Appendix H

Ecological Risk Assessment Calculation Brief

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Environmental Calculation

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H1 Introduction

This appendix provides the support documentation for ecology related information presented in Chapter 7 of this report. The sample locations for the contaminants of potential ecological concern (COPECs) at waste sites are shown in Figures H-1 through H-41. Ecological risk evaluation calculations are presented in Tables H-1 through Table H-12. This appendix also contains a supporting environmental calculation.

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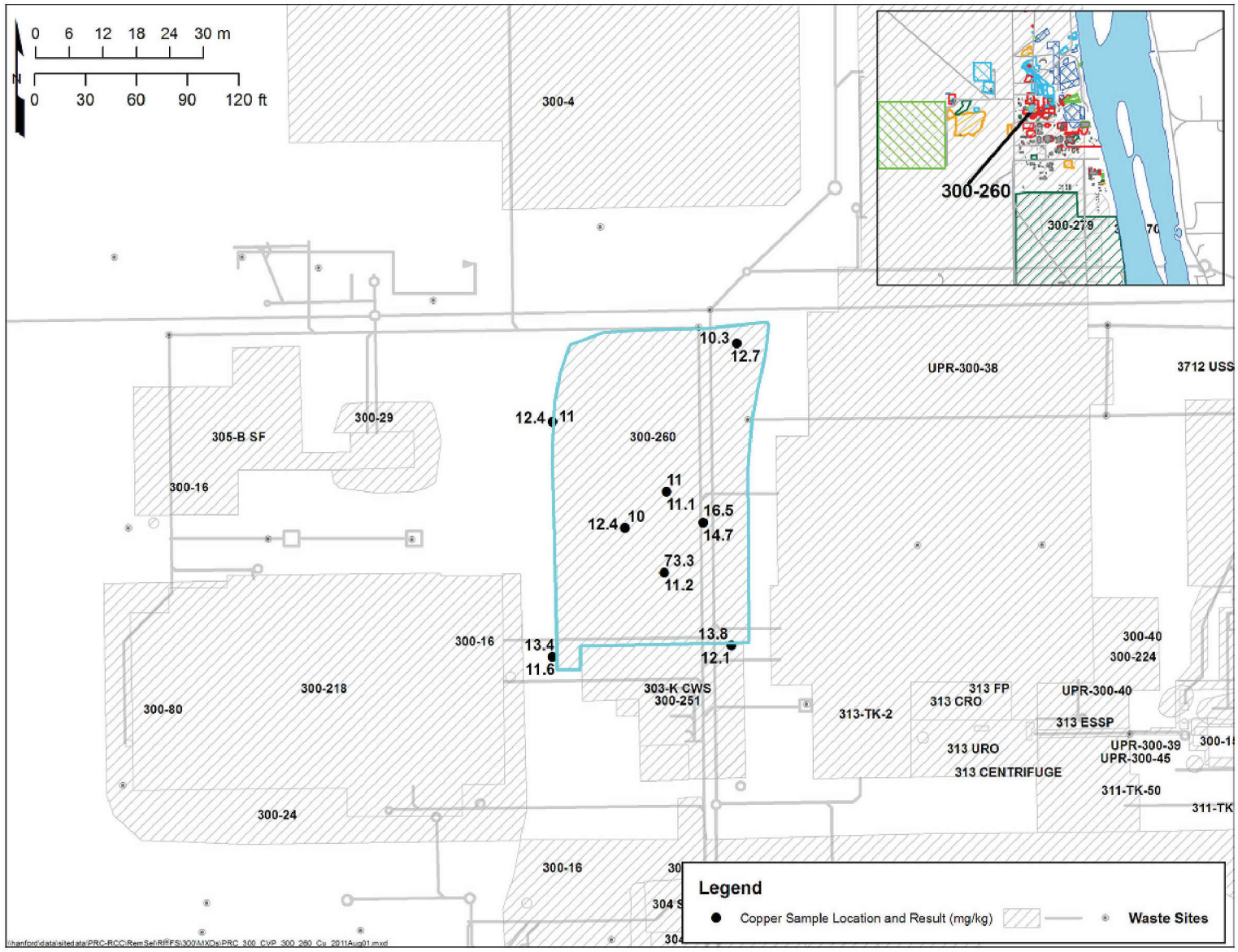


Figure H-1. Contaminated Soil West of the 313 Building (300-260) Sampling Locations and Associated Copper Results

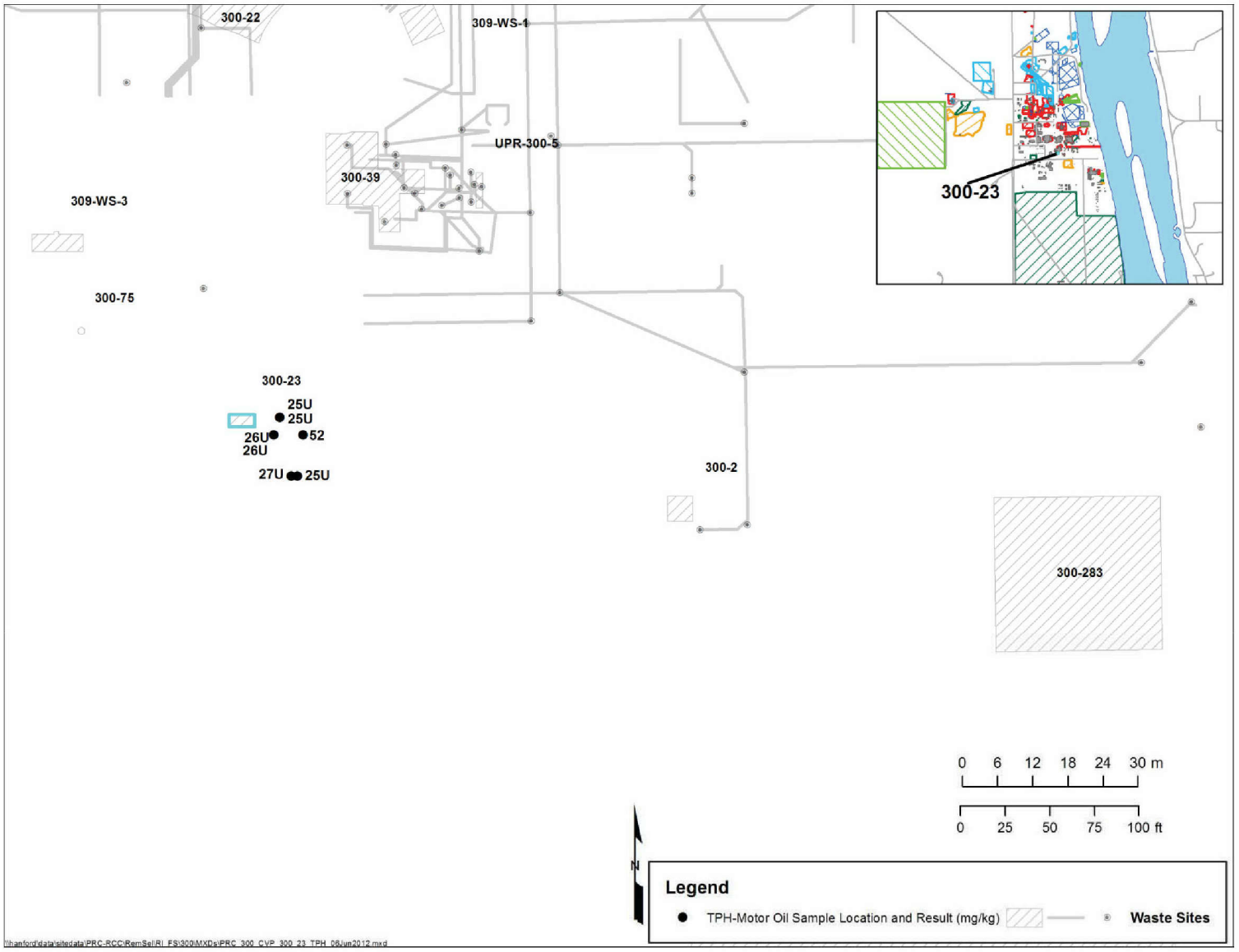


Figure H-2. Underground Storage Tank (300-23) Sampling Locations and Associated TPH-Motor Oil Results

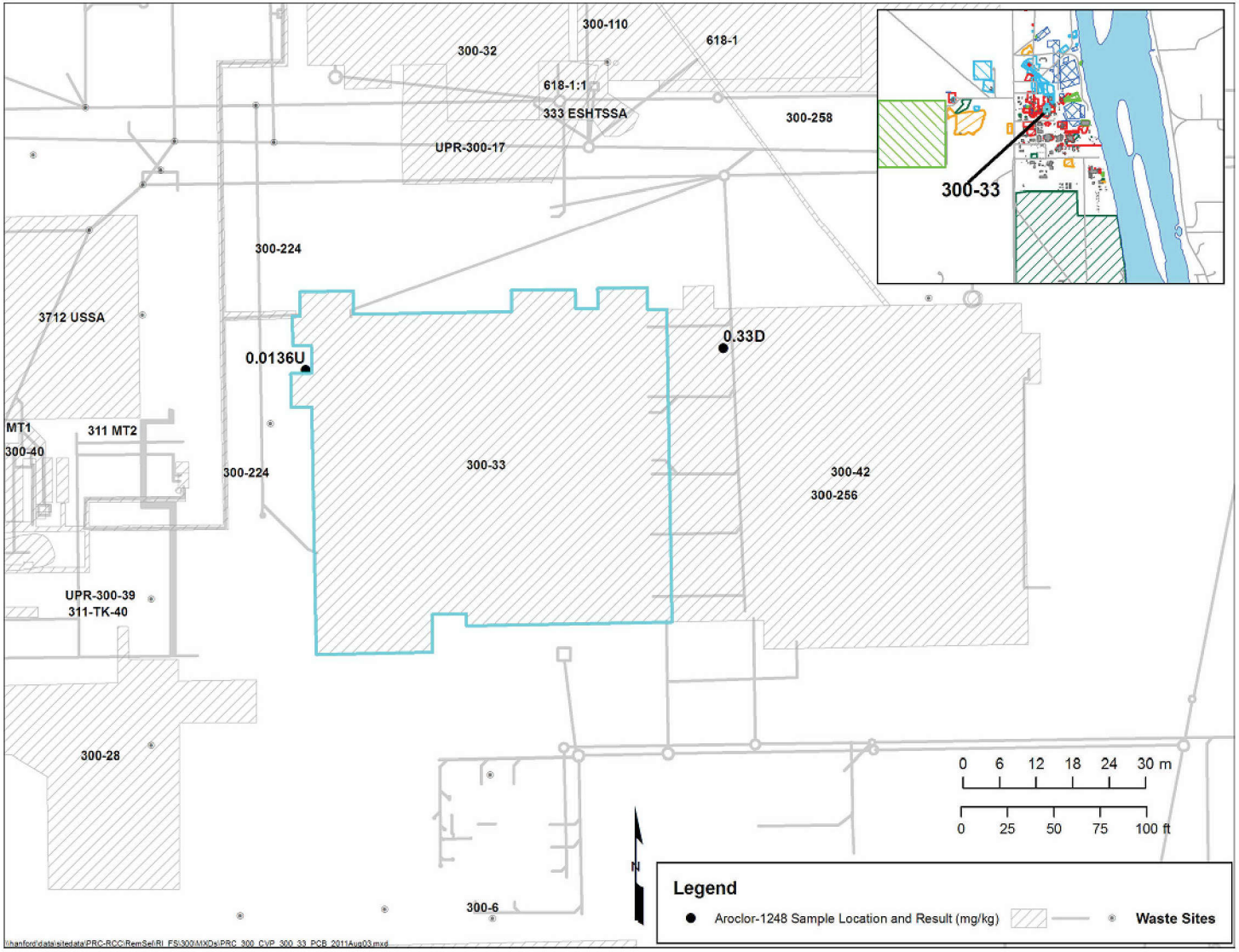
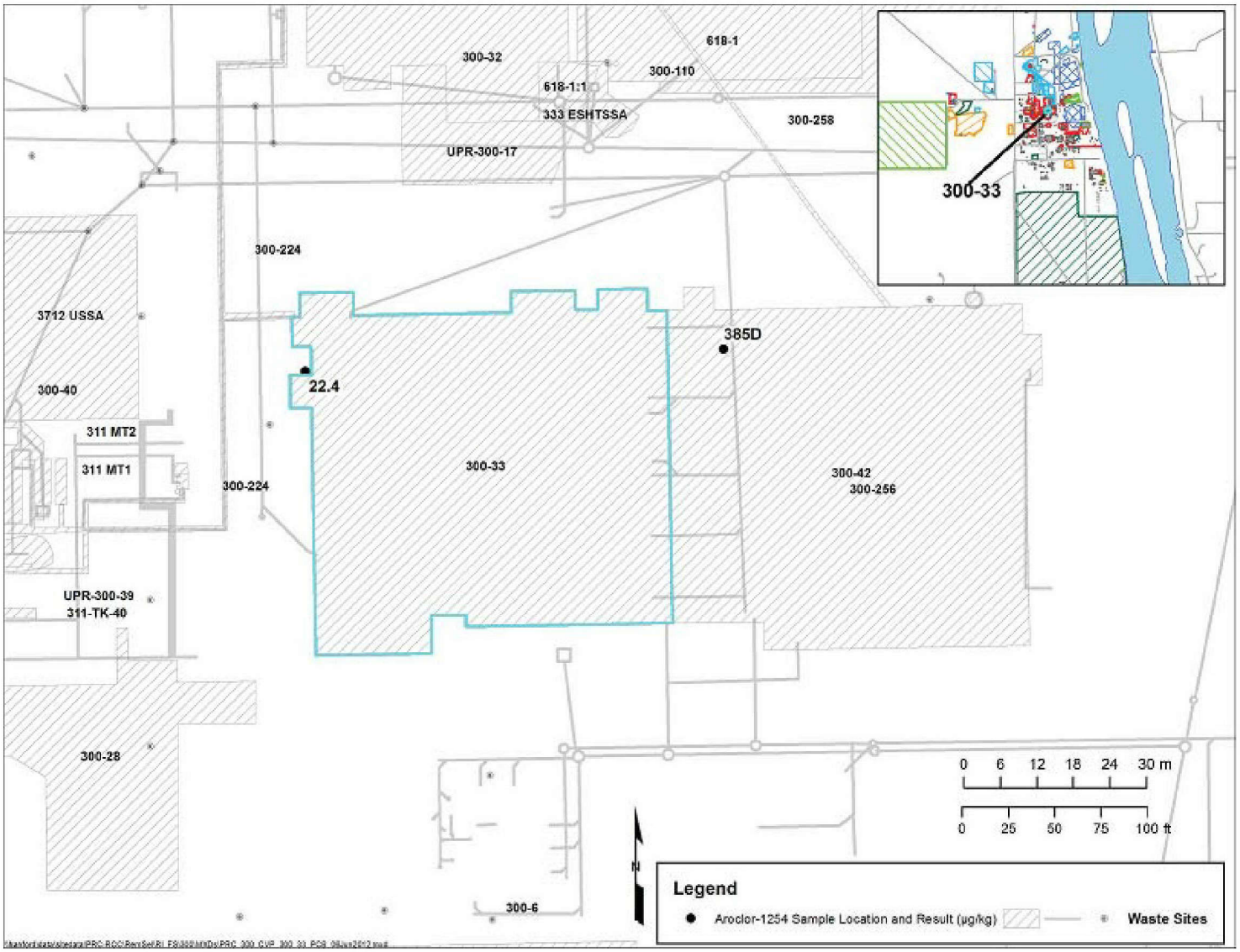


Figure H-3. Unplanned Release and Neutralization Tank (300-33, 300-41, 300-256) Sampling Locations and Associated Aroclor-1248 Results



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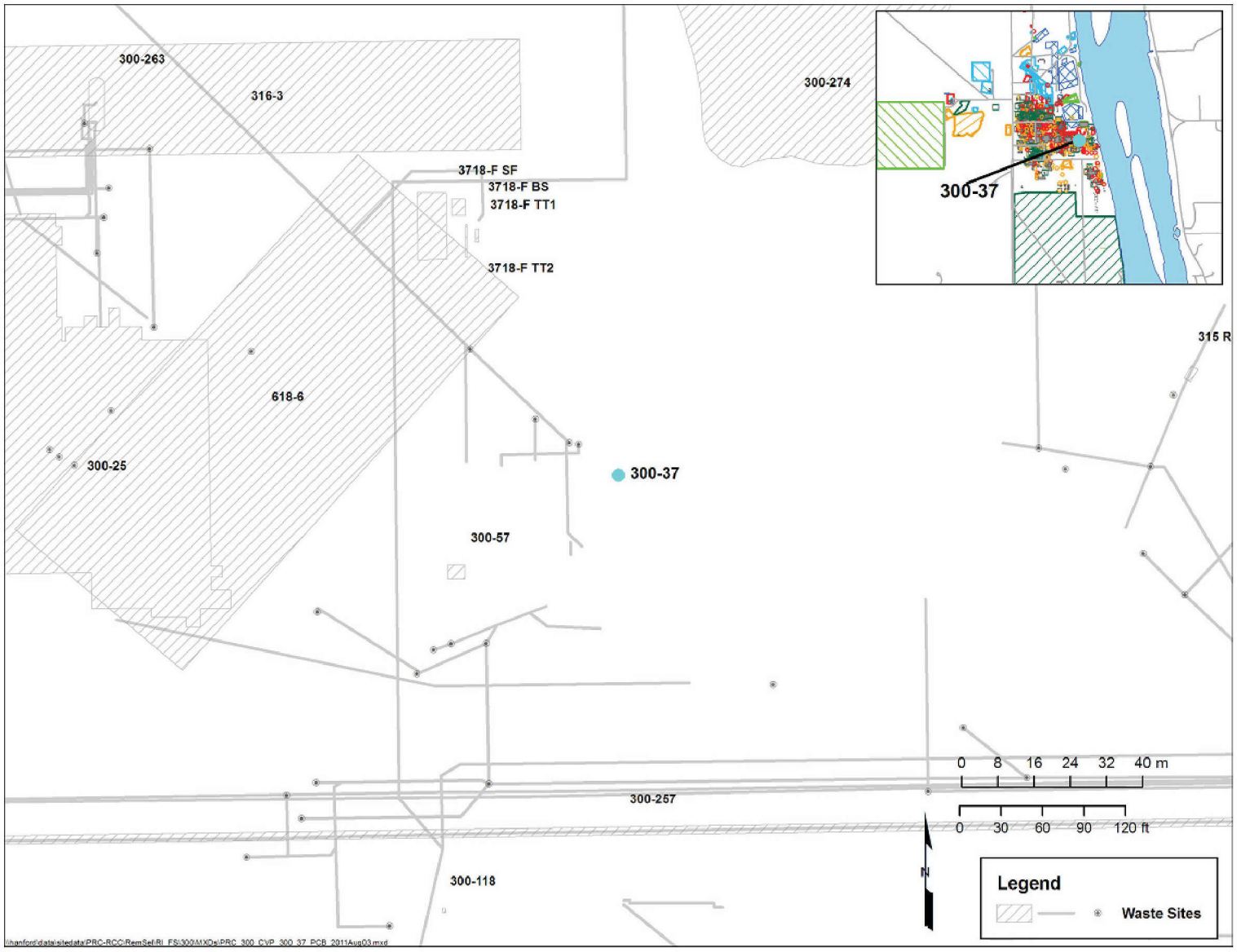


Figure H-5. PCB Leak to Soil (300-37) Sampling Locations and Associated Aroclor-1260 Results

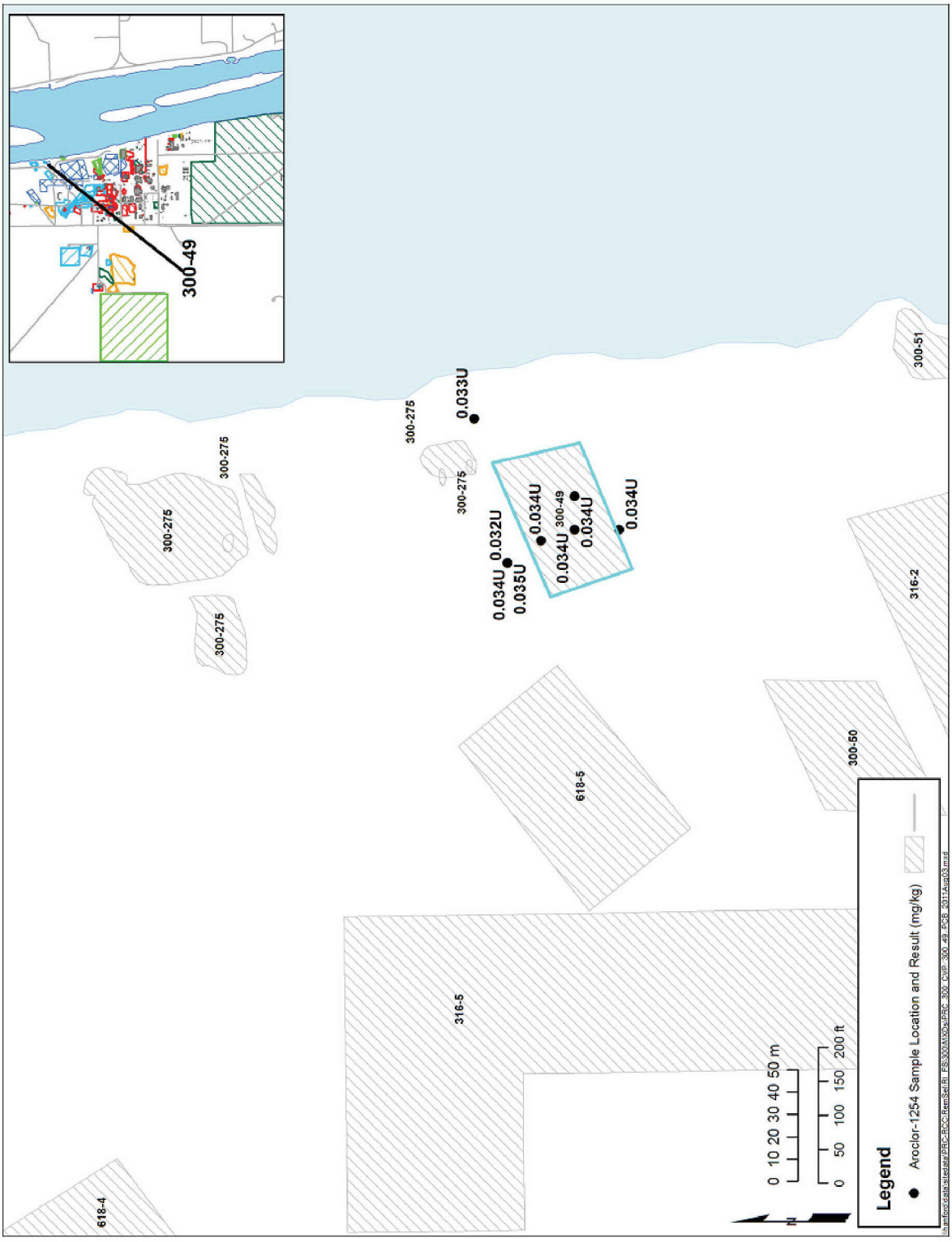


Figure H-6. Landfill 1A (300-49) Sampling Locations and Associated Aroclor-1254 Results

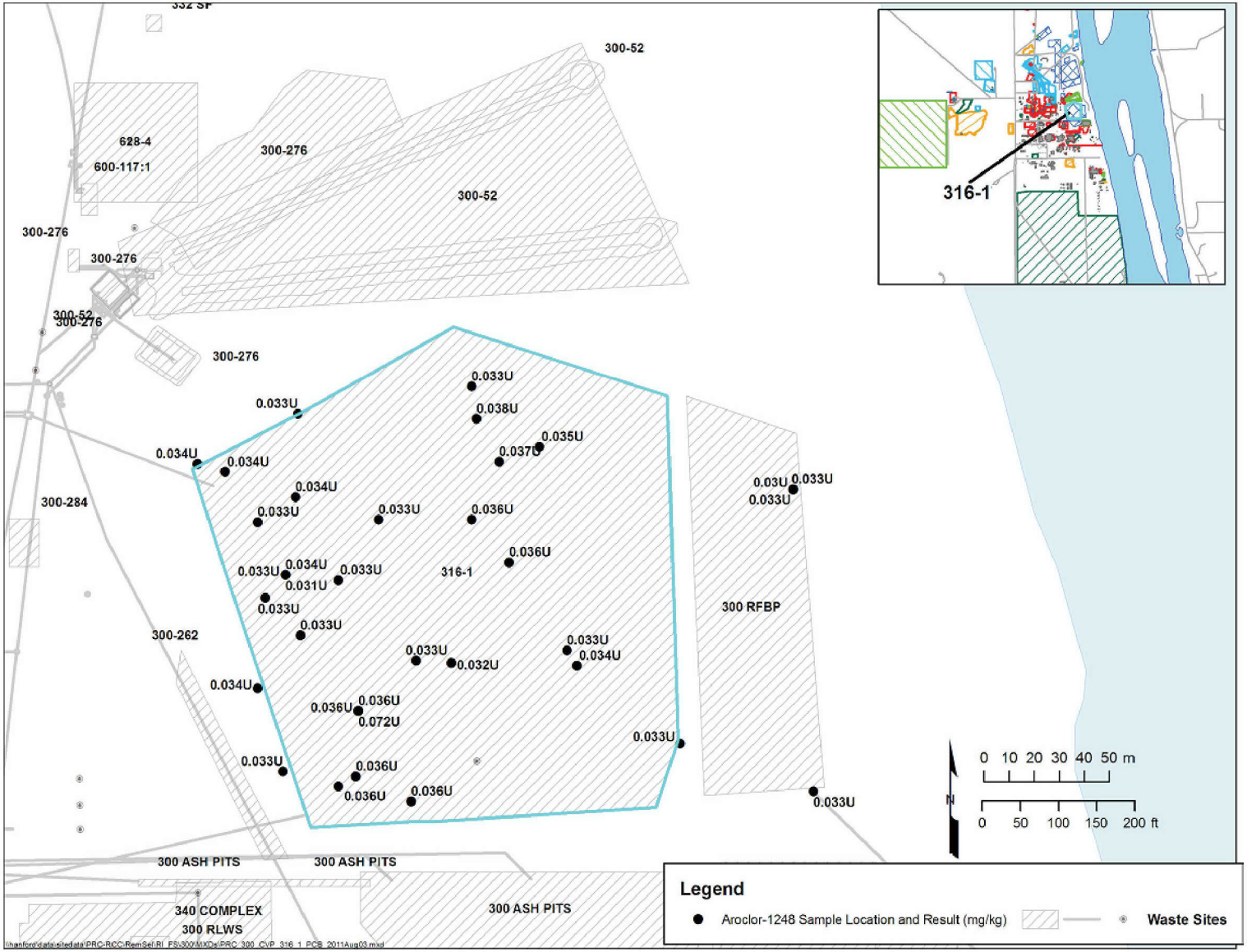
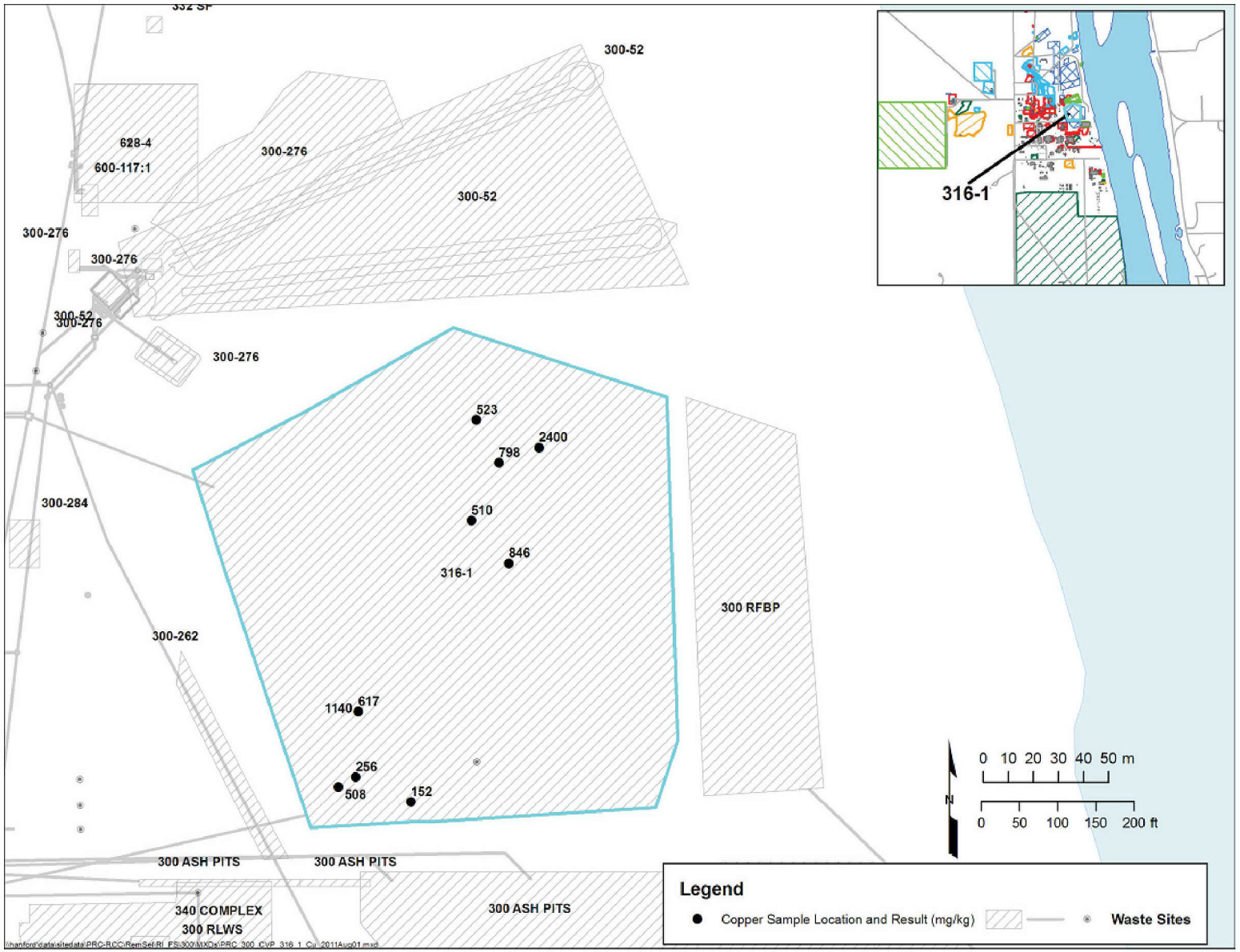


Figure H-7. South Process Pond (316-1) Sampling Locations and Associated Aroclor-1248 Results



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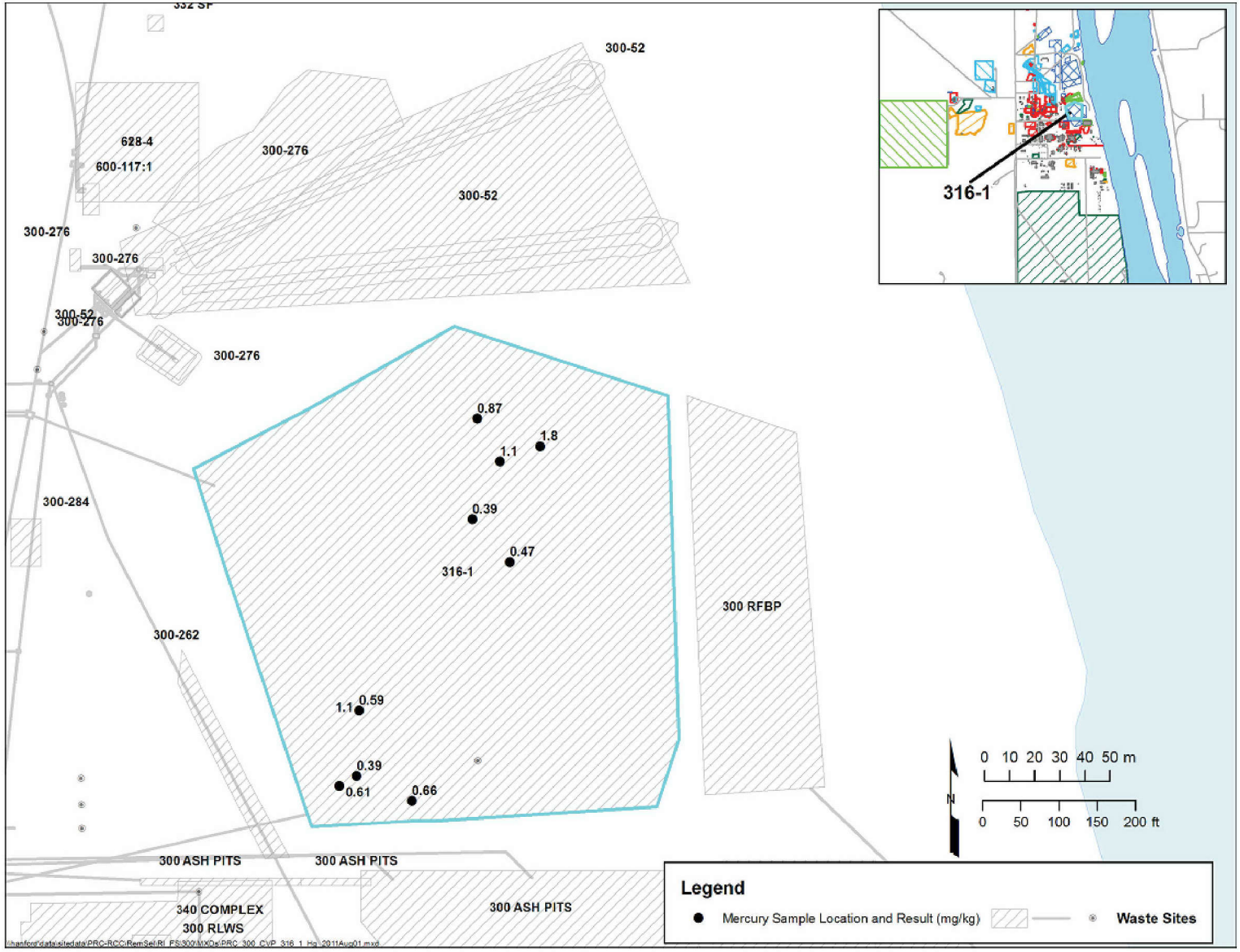


Figure H-9. South Process Pond (316-1) Sampling Locations and Associated Mercury Results

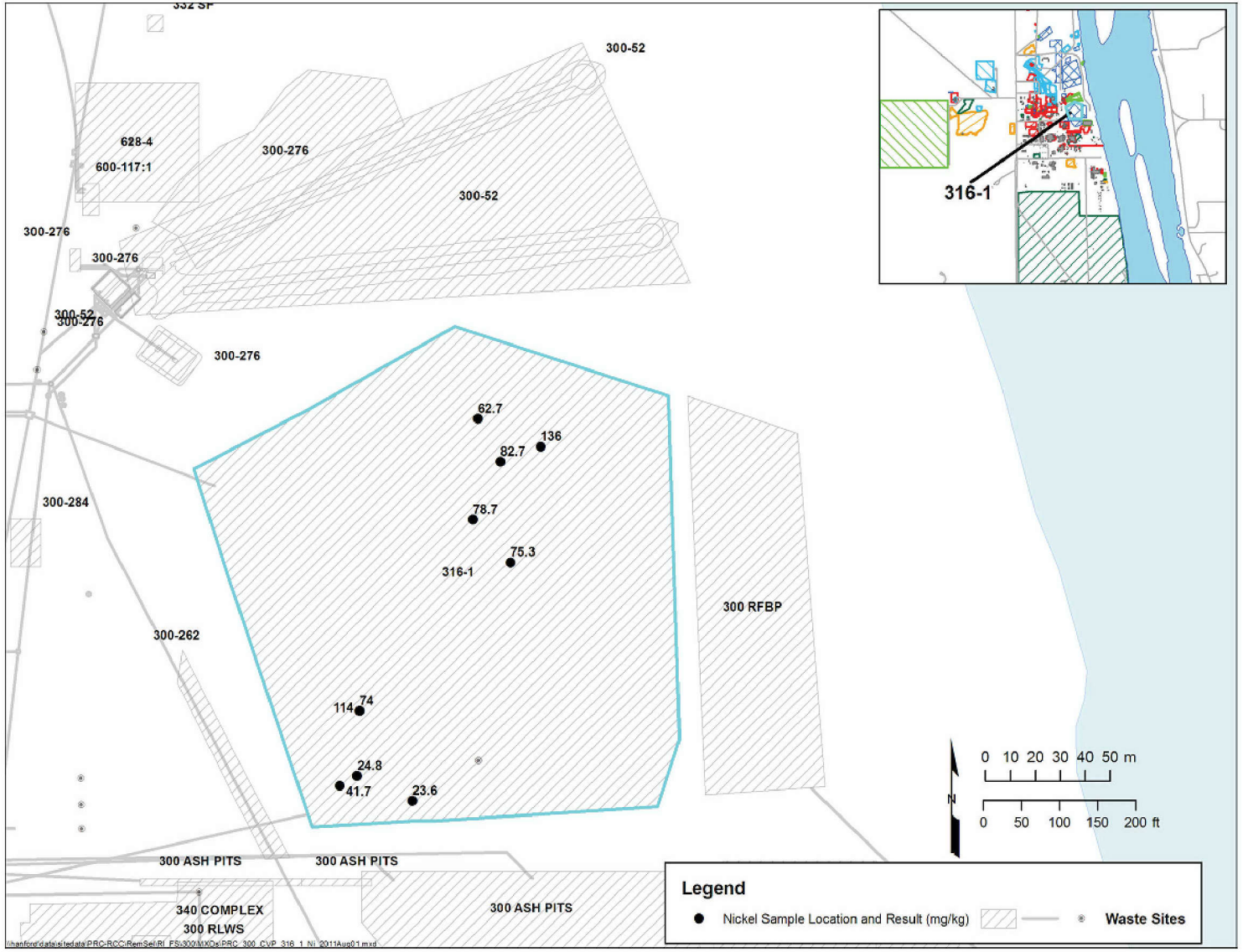
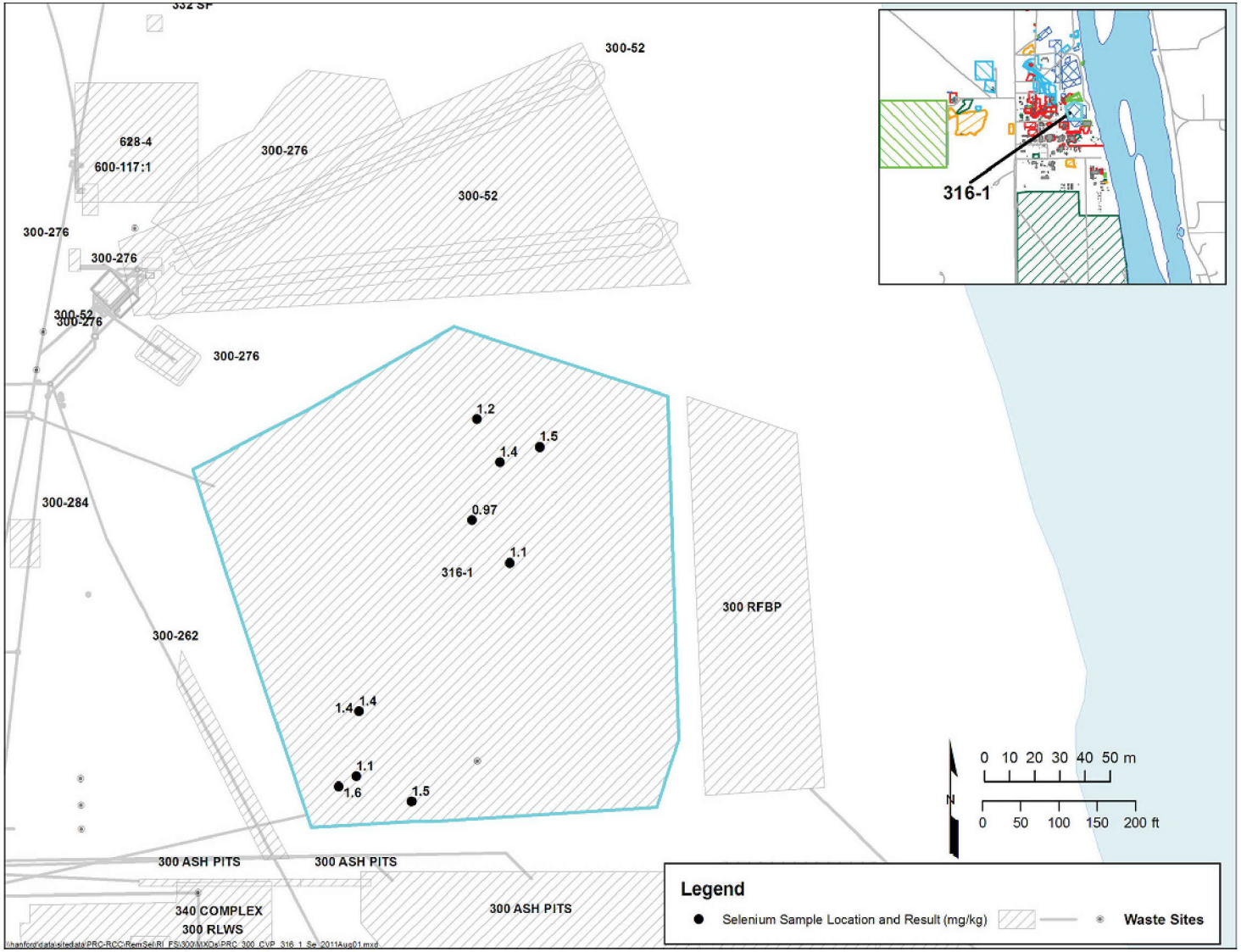


Figure H-10. South Process Pond (316-1) Sampling Locations and Associated Nickel Results



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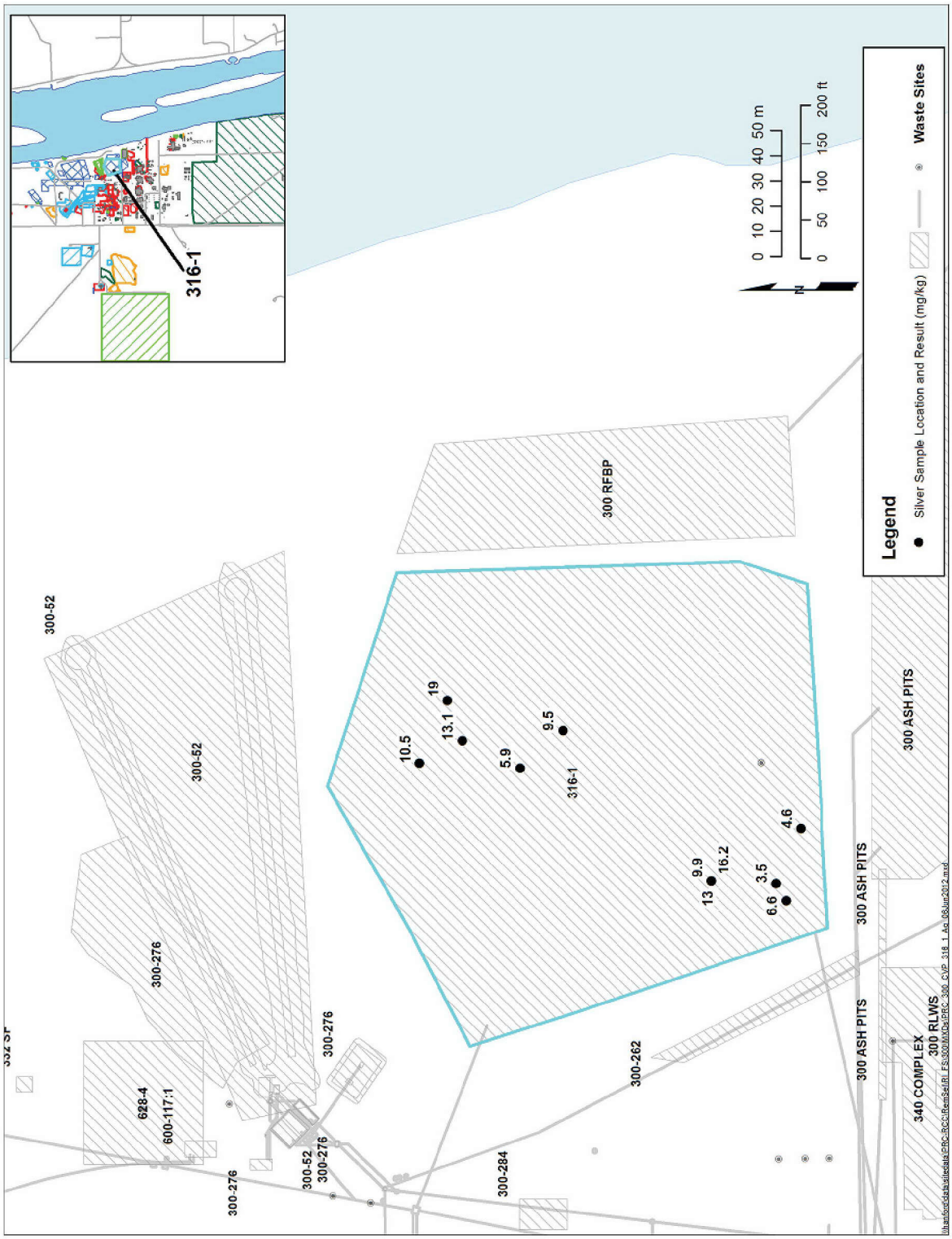

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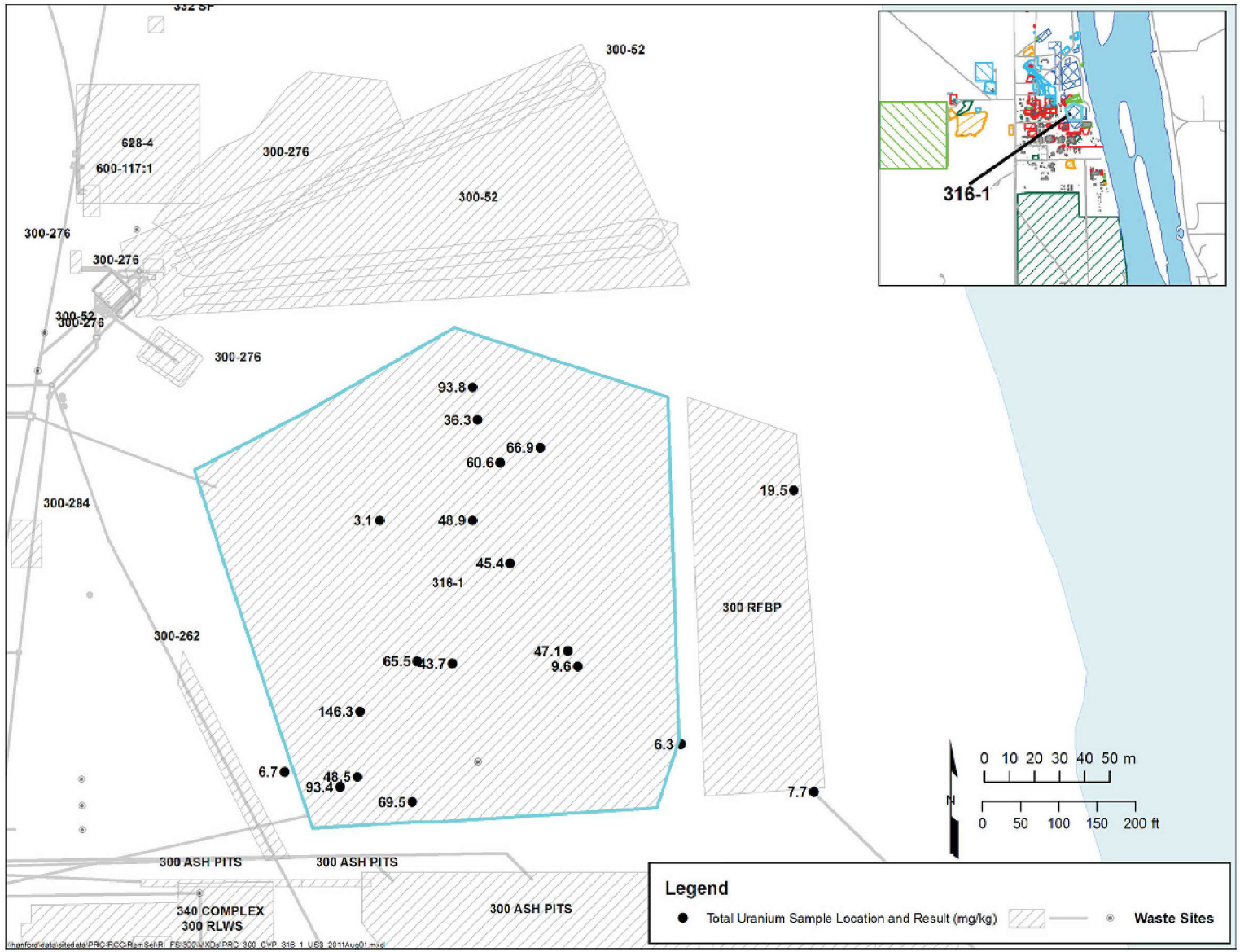

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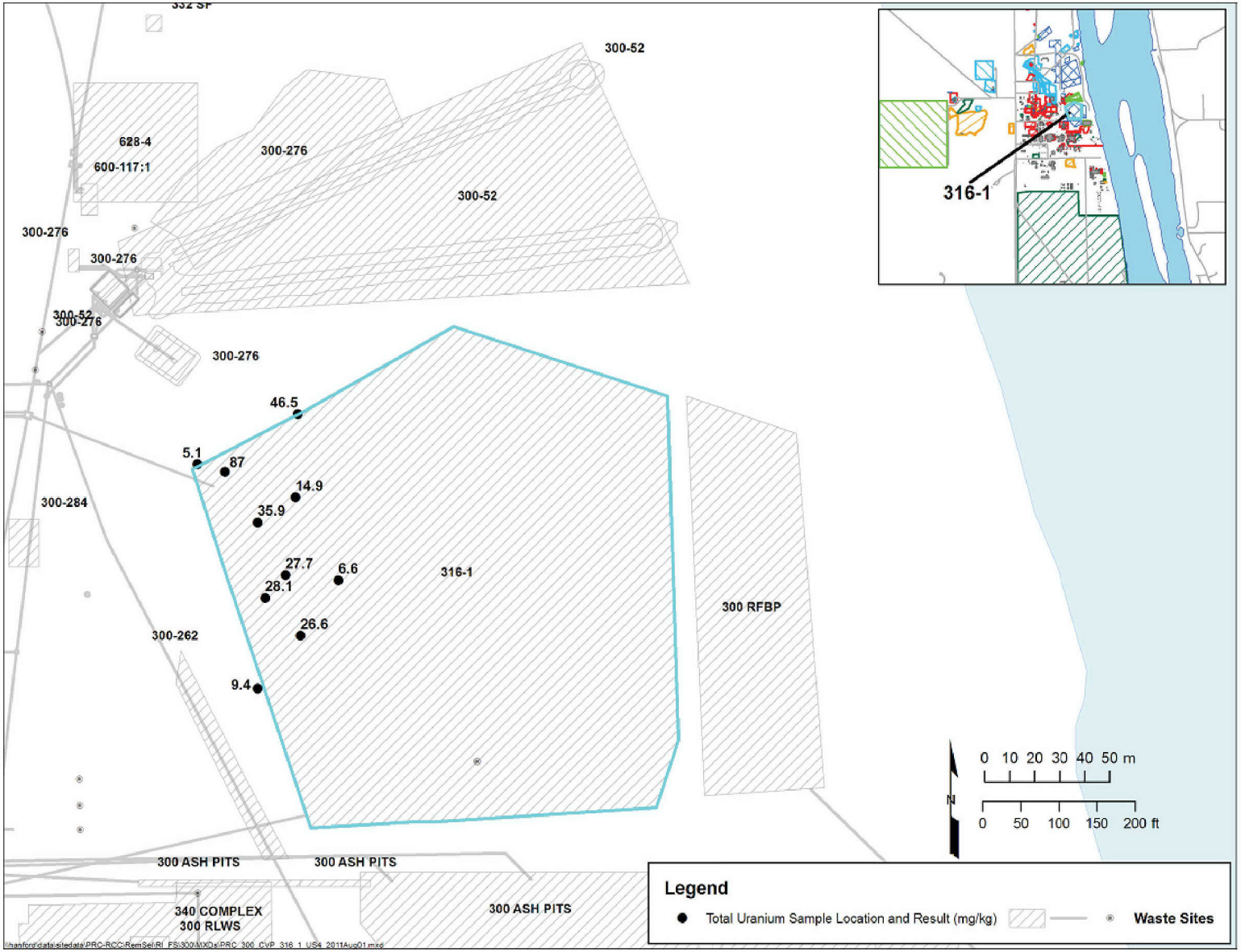

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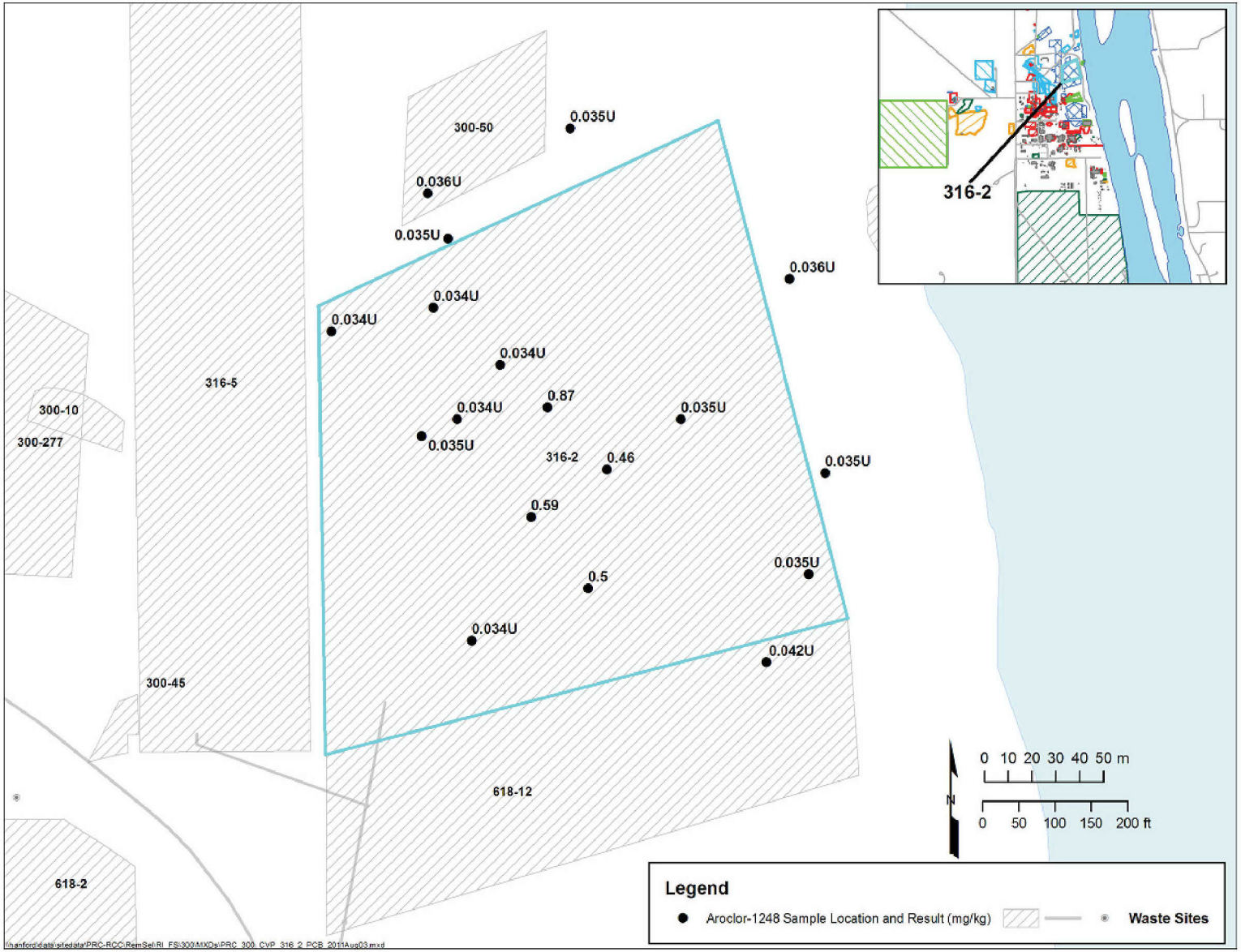


Figure H-15. North Process Pond (316-2) Sampling Locations and Associated Aroclor-1248 Results

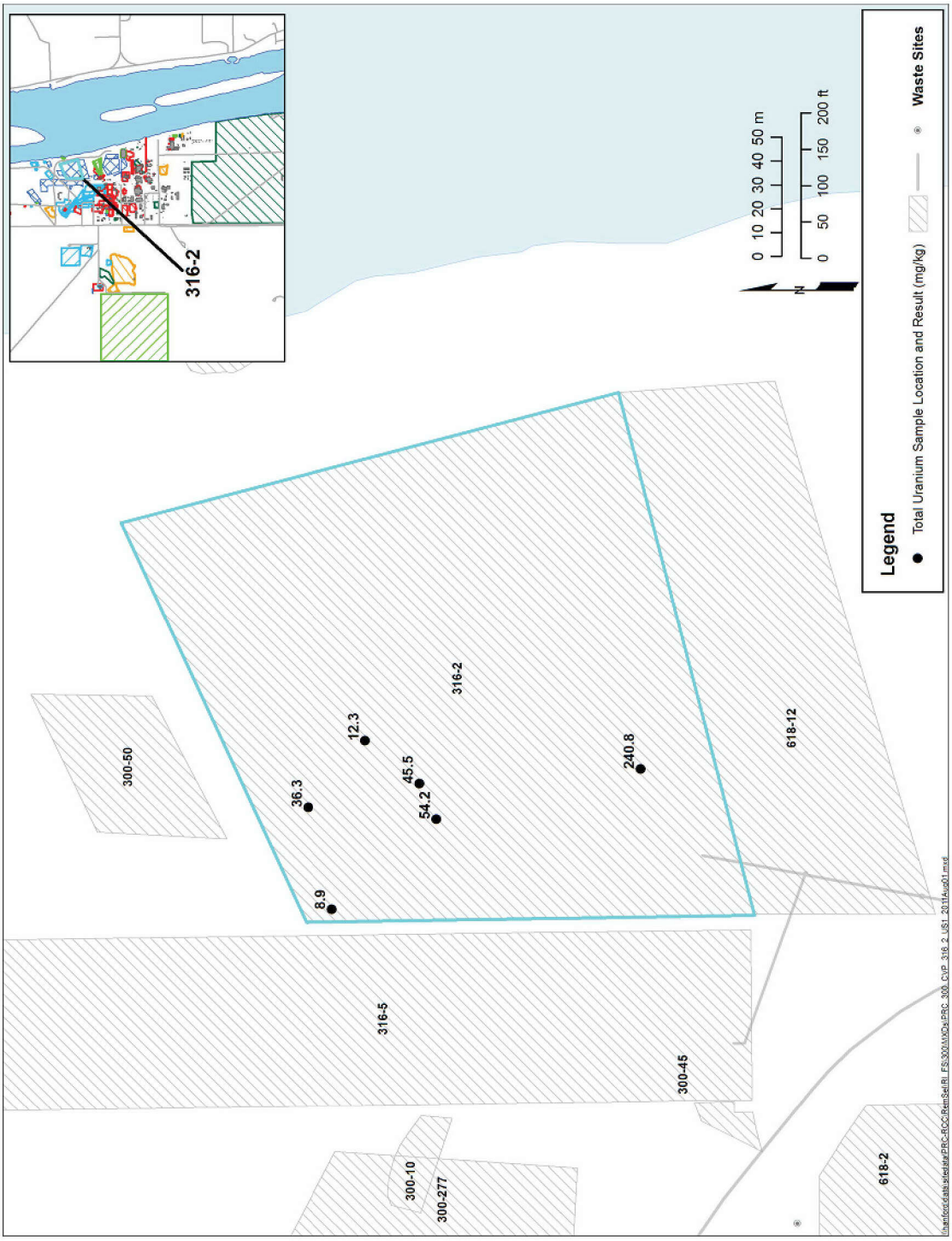
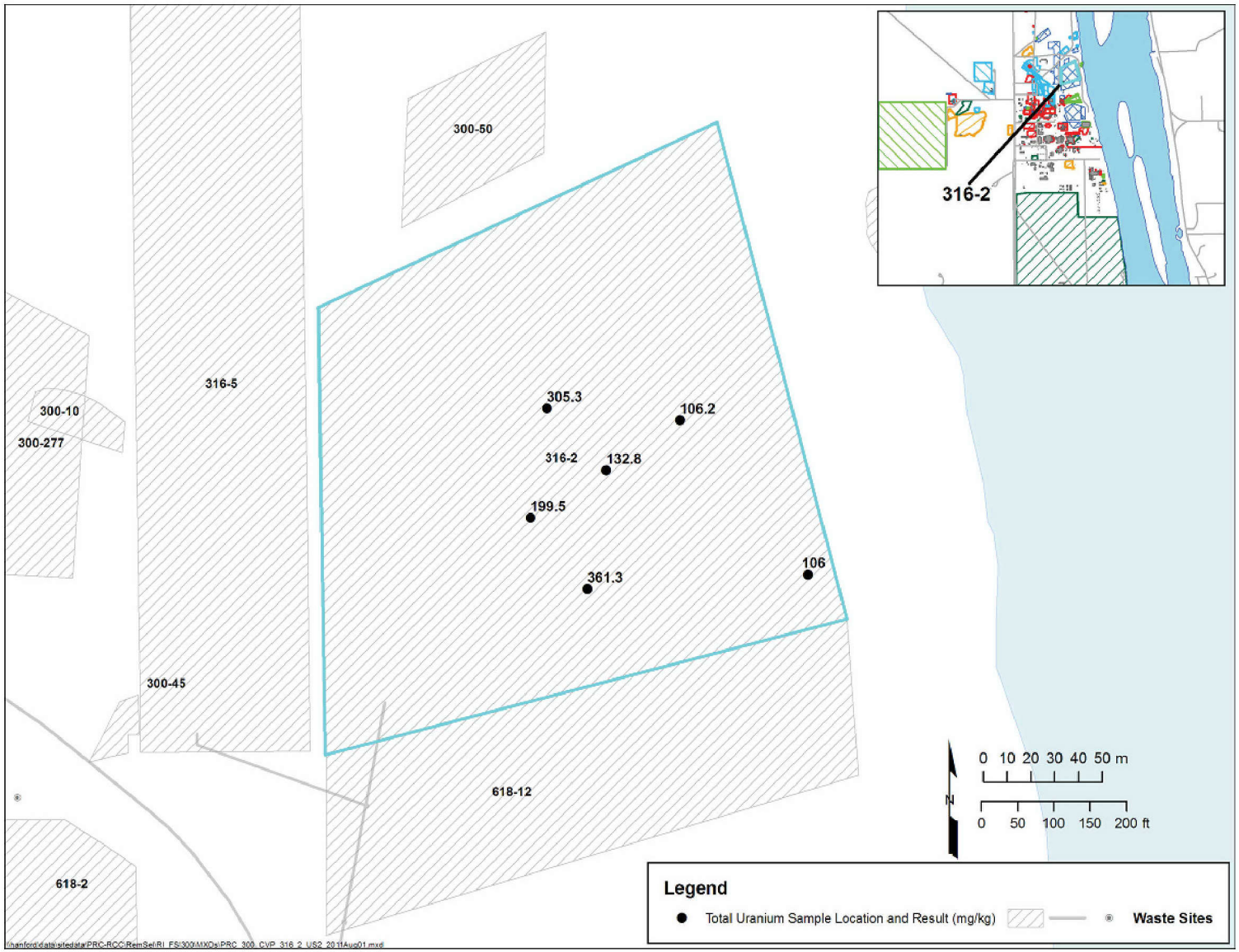


Figure H-16. North Process Pond (316-2 Shallow 1) Sampling Locations and Associated Total Uranium Isotopes Results



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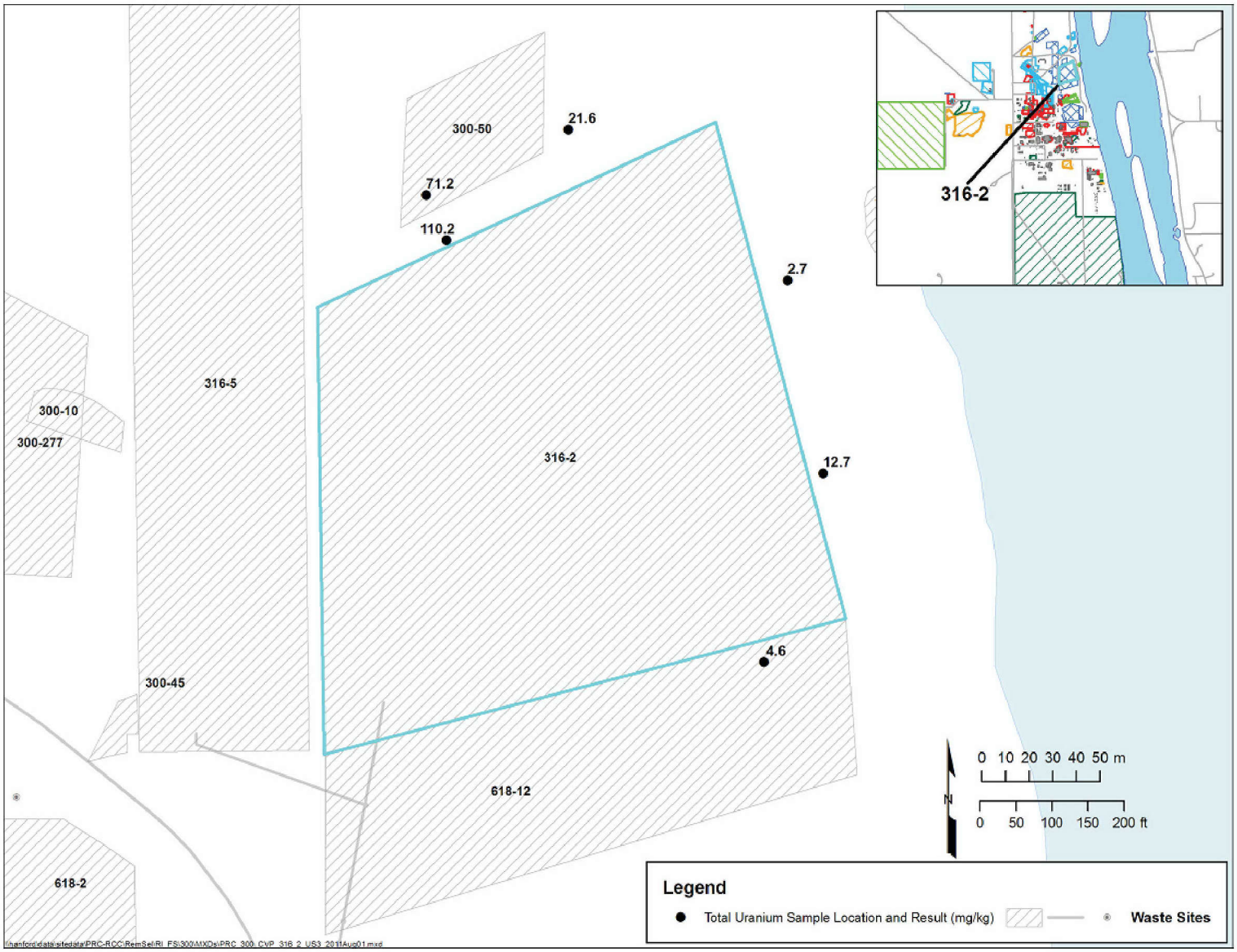

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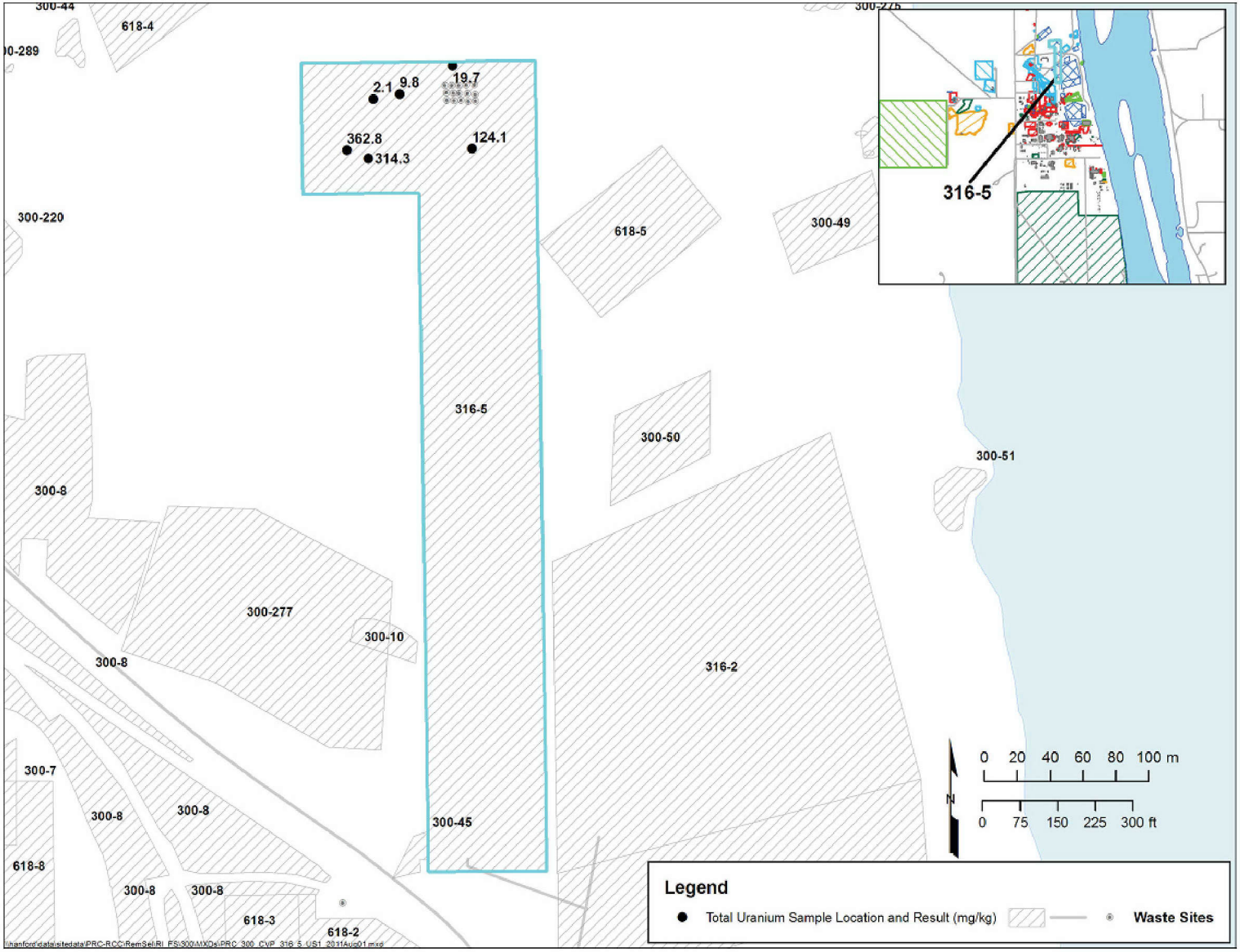
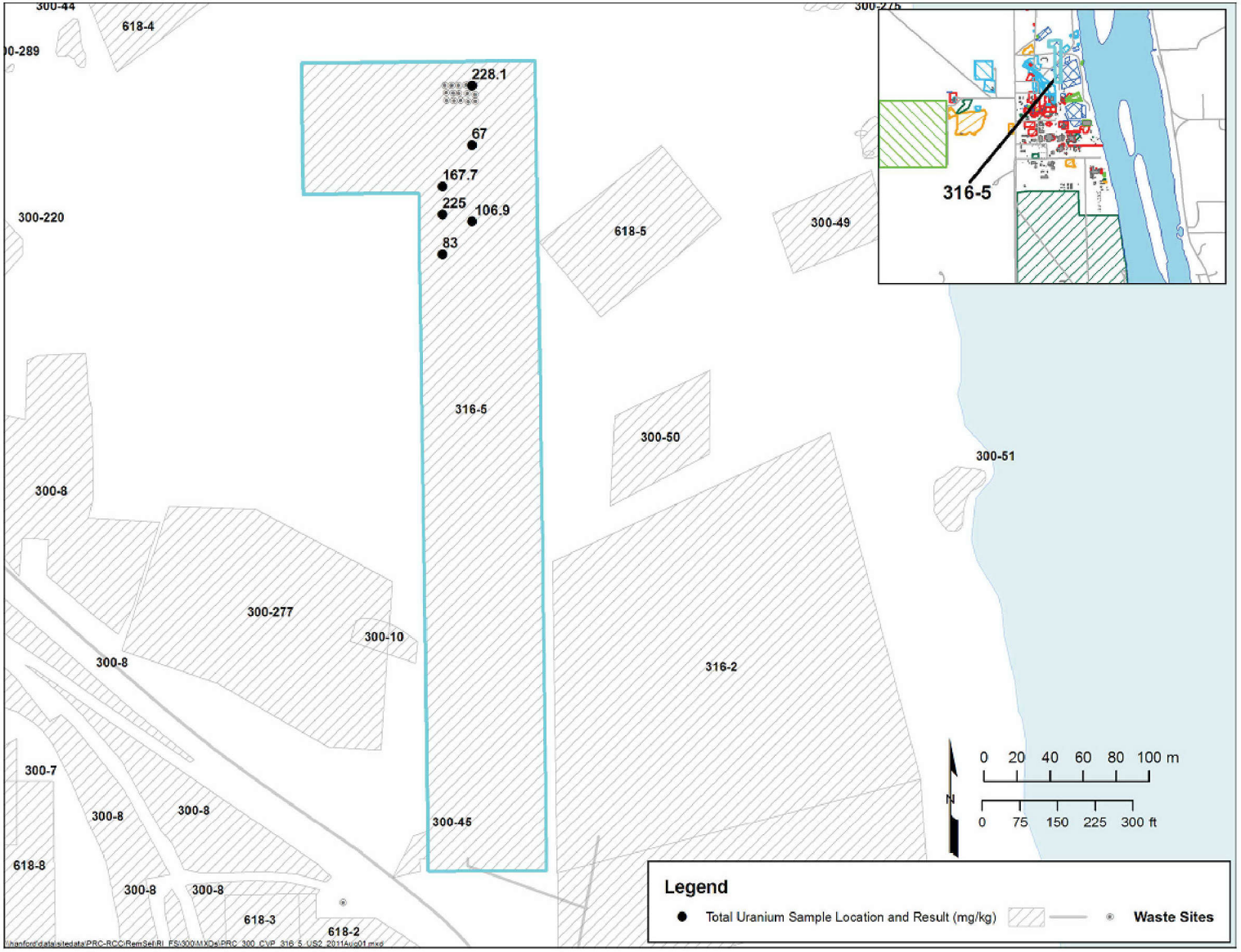


Figure H-19. 3904 Process Waste Trenches (316-5 Shallow 1) Sampling Locations and Associated Total Uranium Isotopes Results



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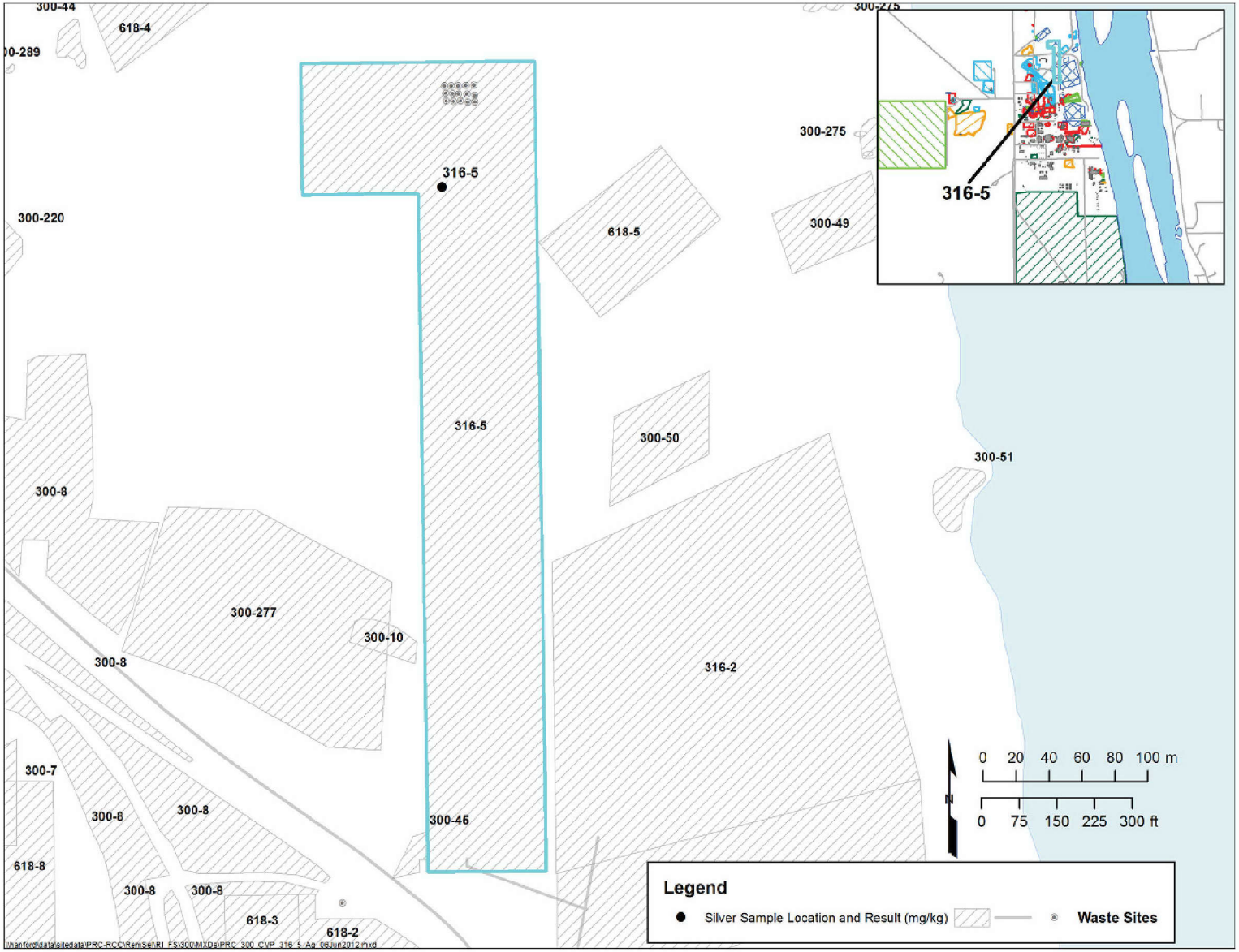
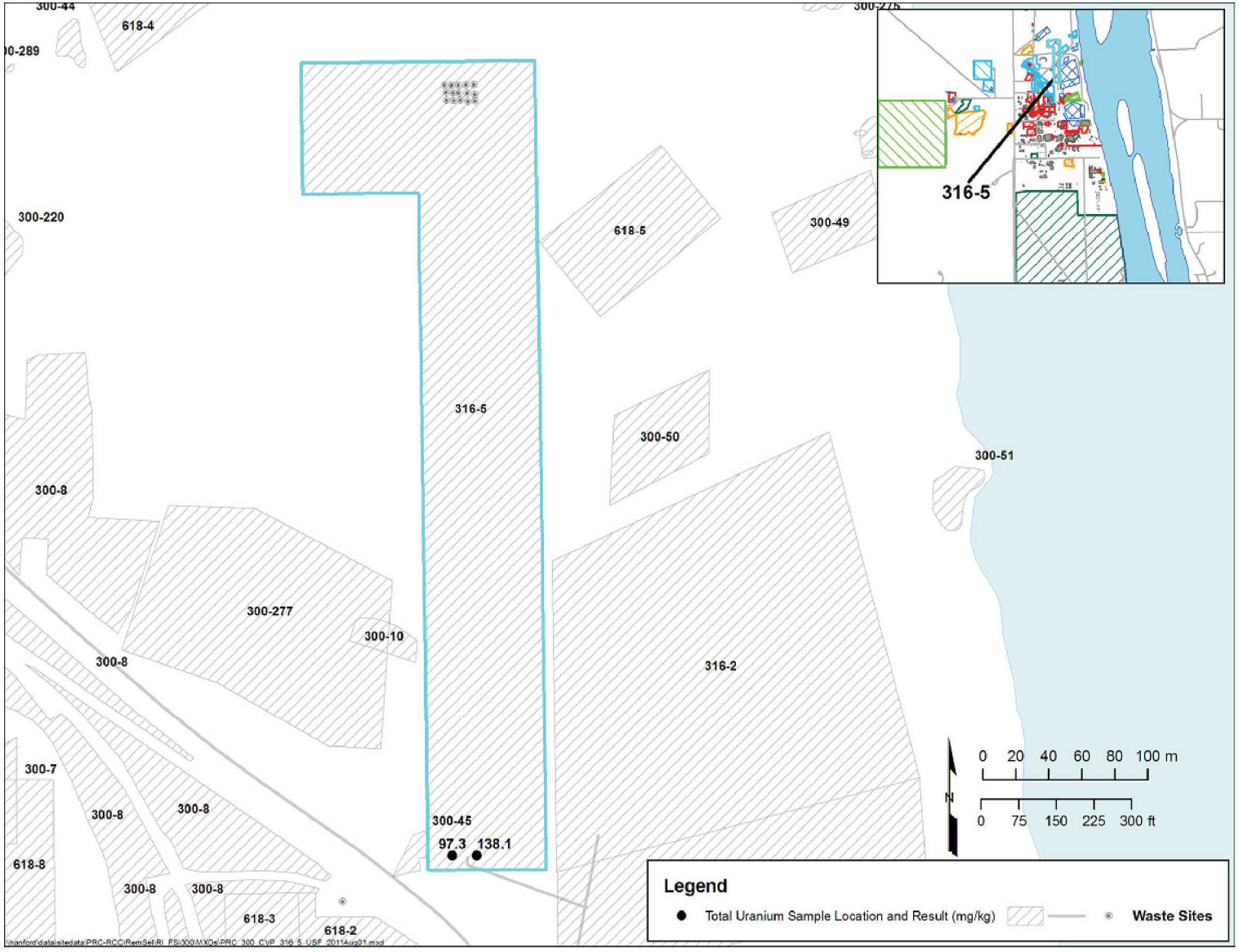


Figure H-21. 3904 Process Waste Trenches (316-5) Sampling Locations and Associated Silver Results



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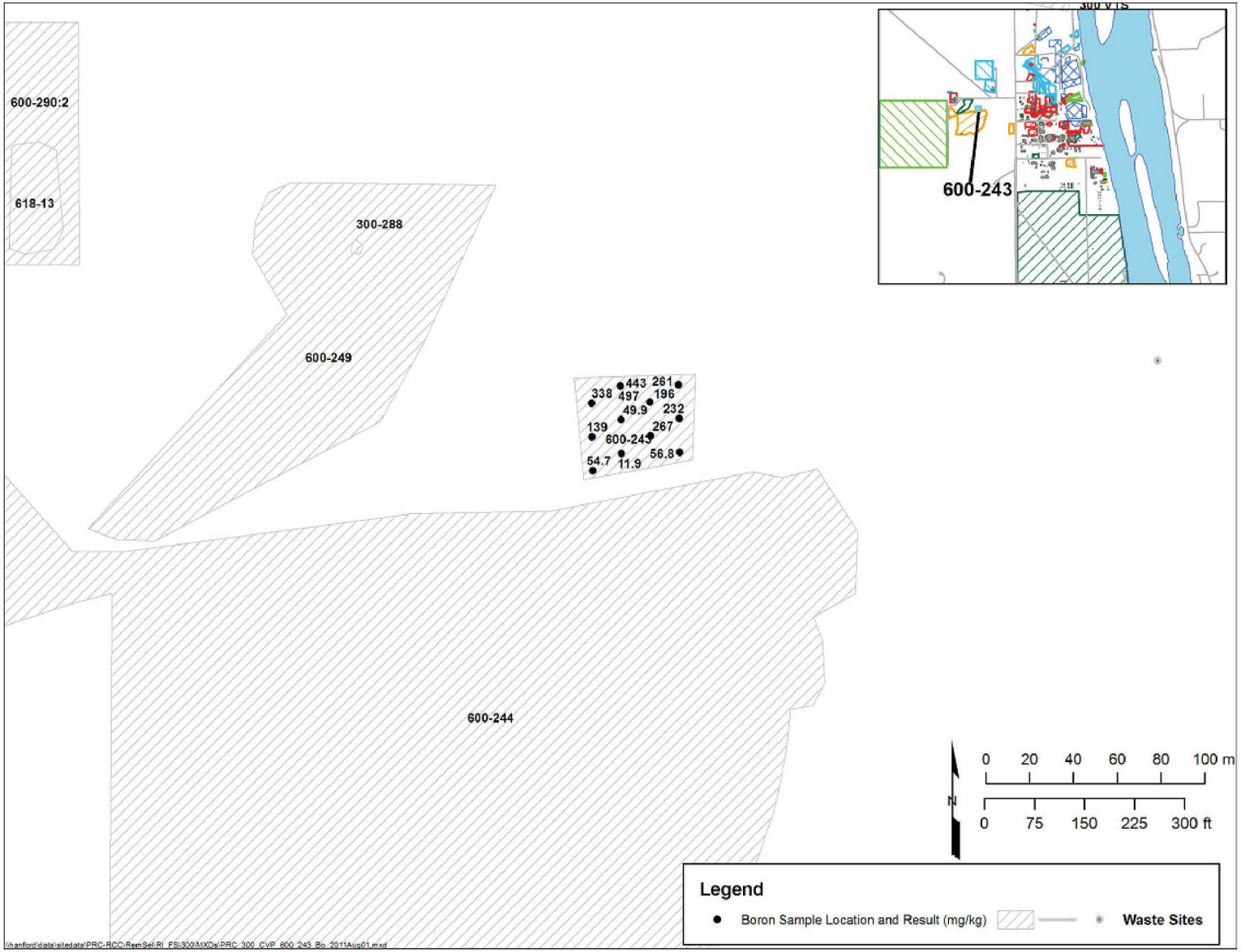


Figure H-23. Petroleum Contaminated Soil Bioremediation Pad (600-243) Sampling Locations and Associated Boron Results

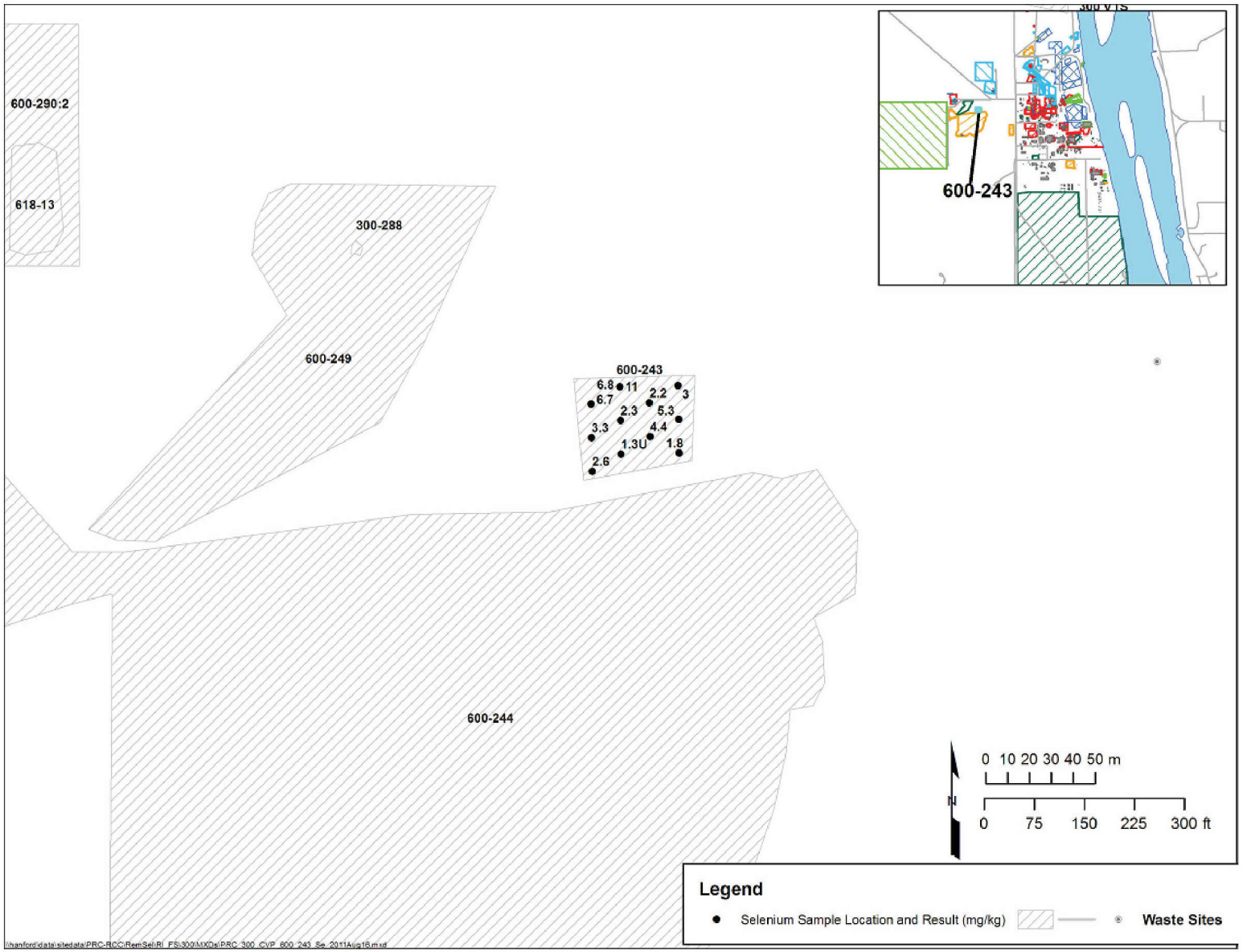


Figure H-24. Petroleum Contaminated Soil Bioremediation Pad (600-243) Sampling Locations and Associated Selenium Results

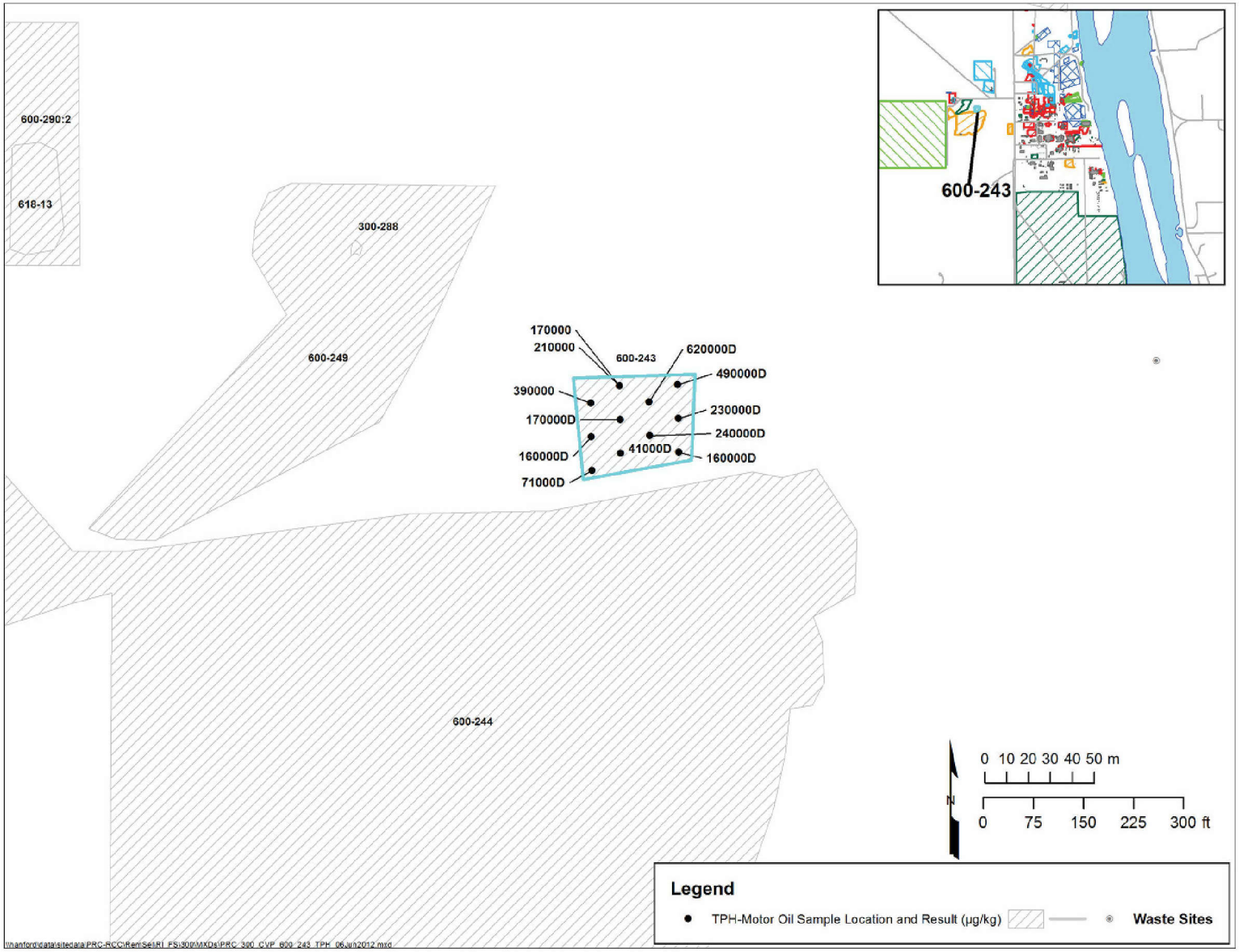


Figure H-25. Petroleum Contaminated Soil Bioremediation Pad (600-243) Sampling Locations and Associated TPH-Motor Oil Results

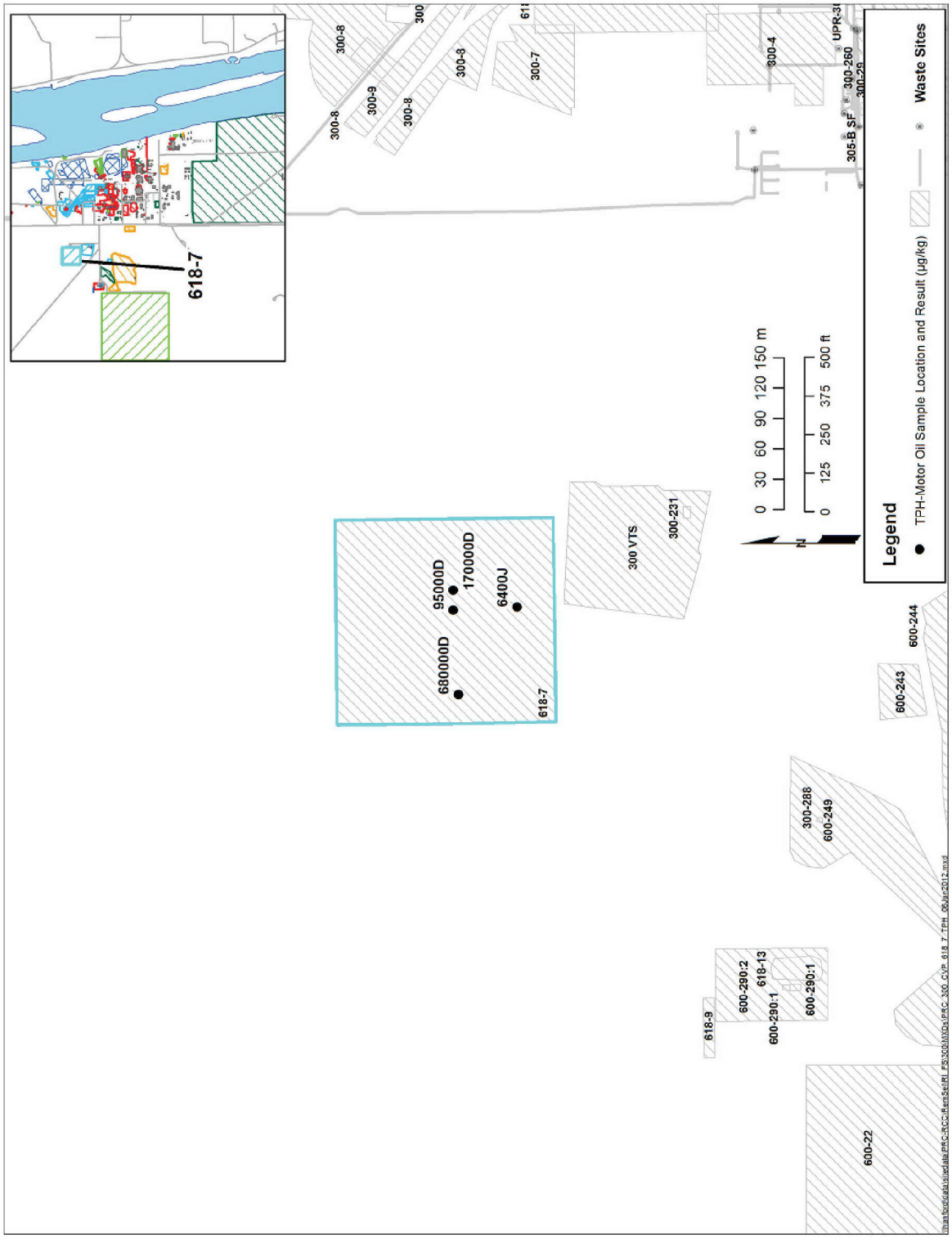


Figure H-26. Burial Ground (618-7) Sampling Locations and Associated TPH-Motor Oil Results

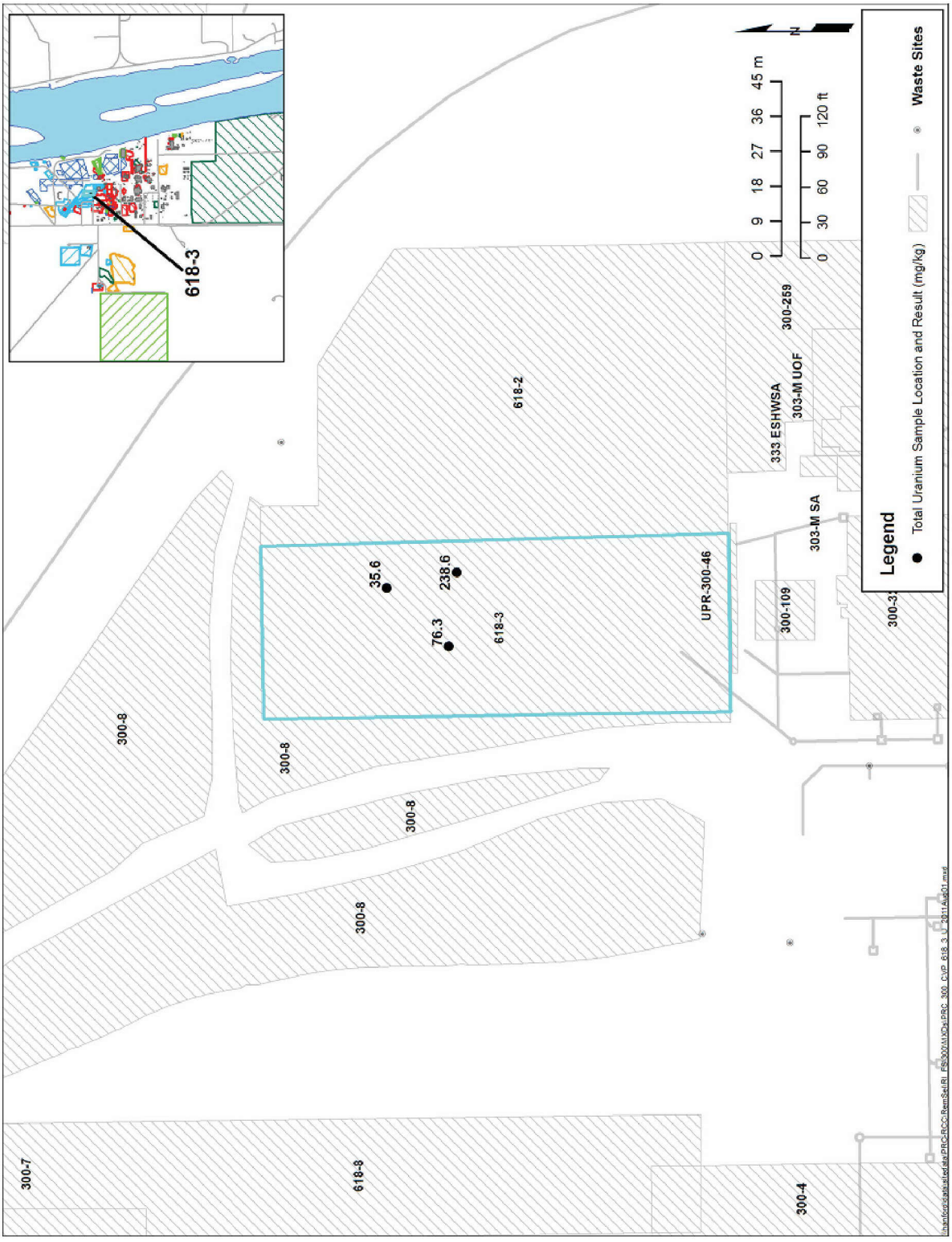


Figure H-27. Burial Ground (618-3) Sampling Locations and Associated Total Uranium Isotopes Results

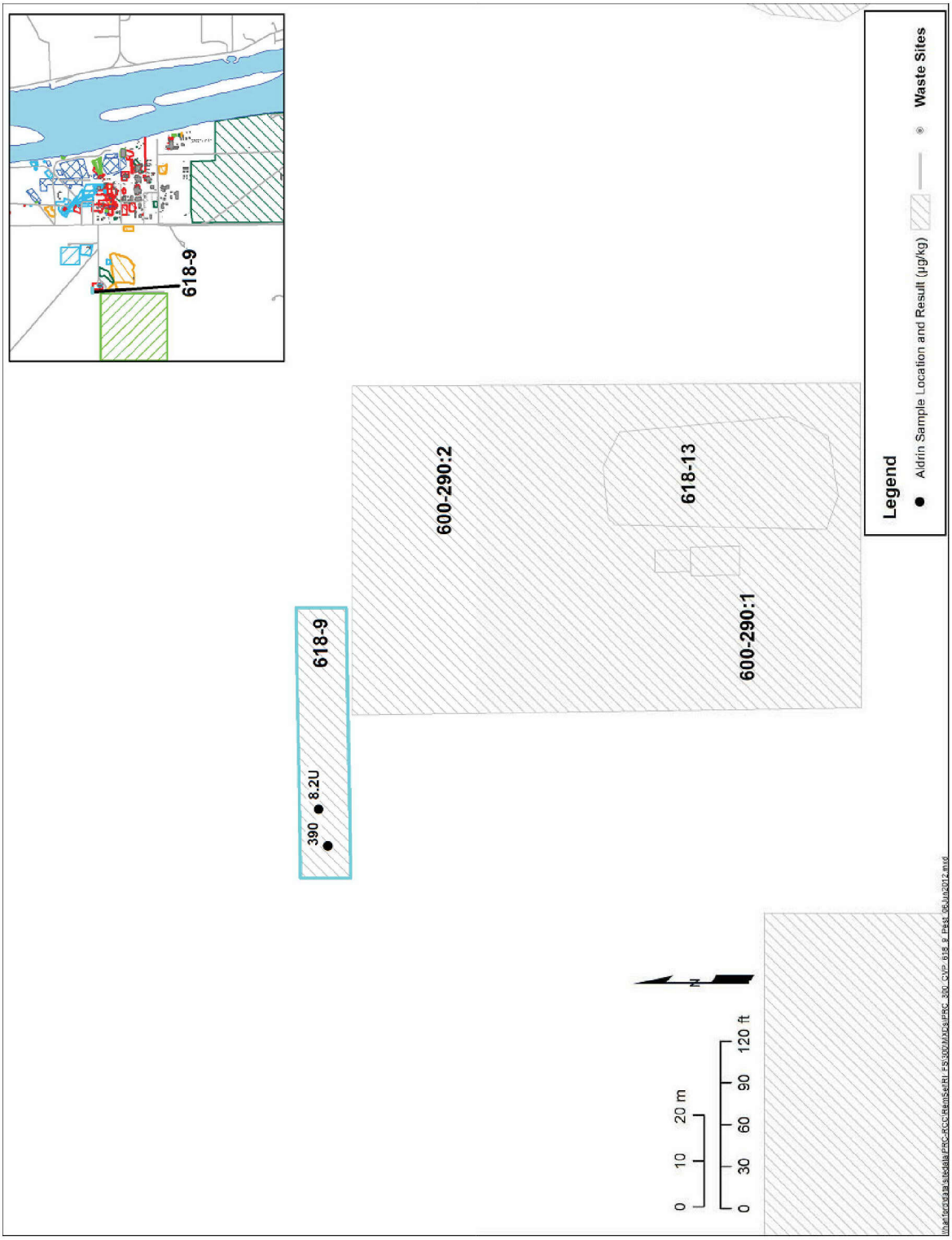


Figure H-28. Burial Ground (618-9) Sampling Locations and Associated Aldrin Results

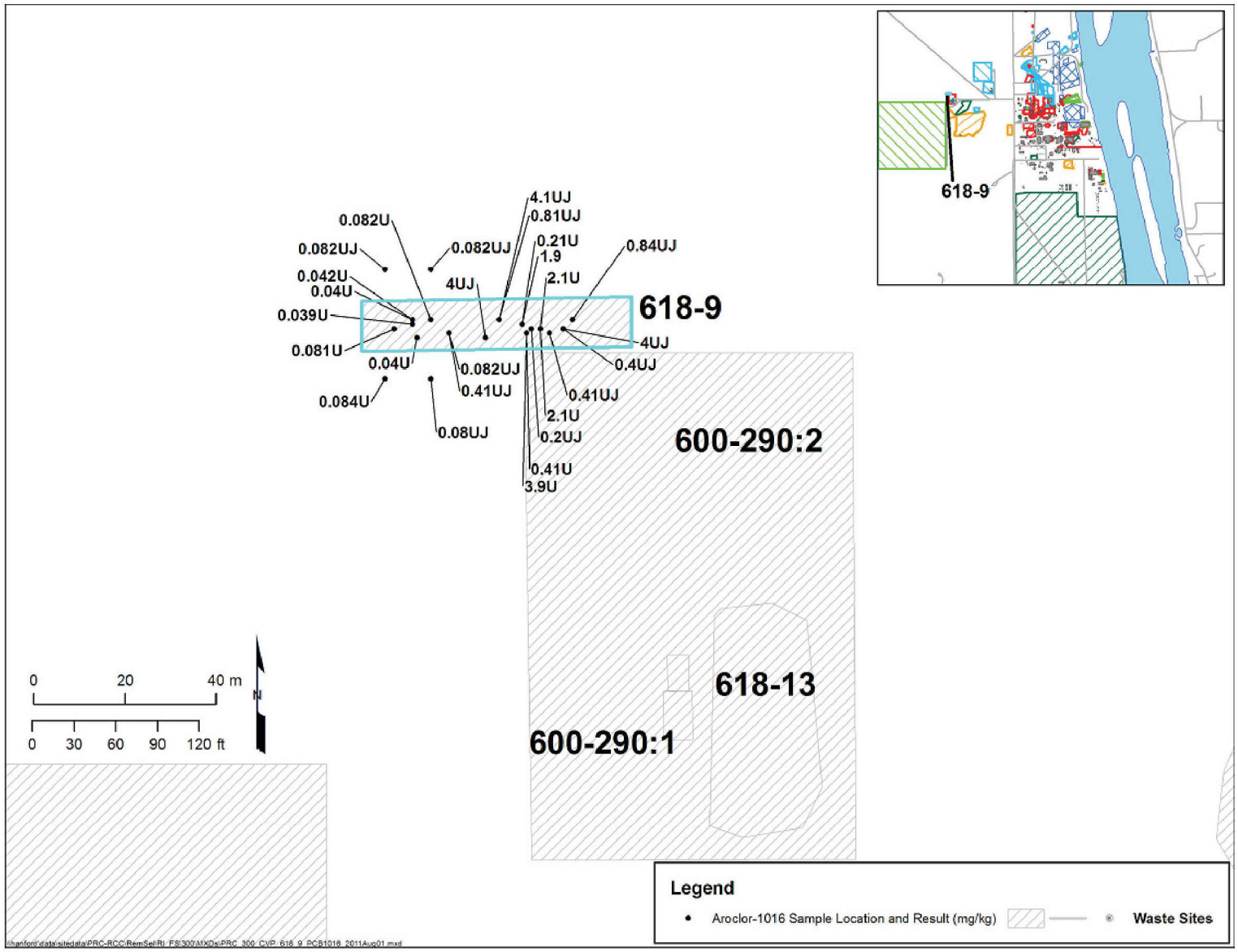


Figure H-29. Burial Ground (618-9) Sampling Locations and Associated Aroclor-1016 Results

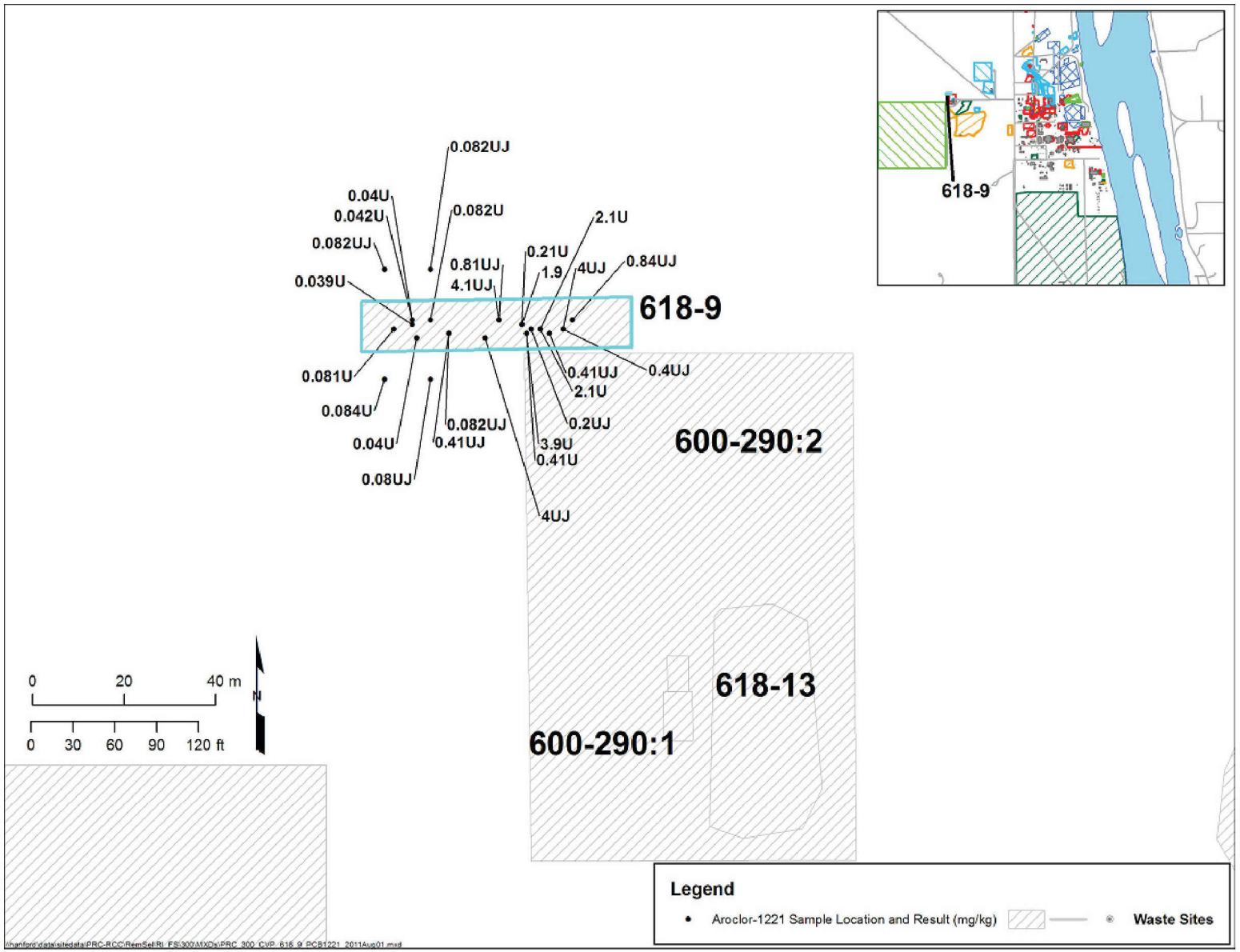


Figure H-30. Burial Ground (618-9) Sampling Locations and Associated Aroclor-1221 Results

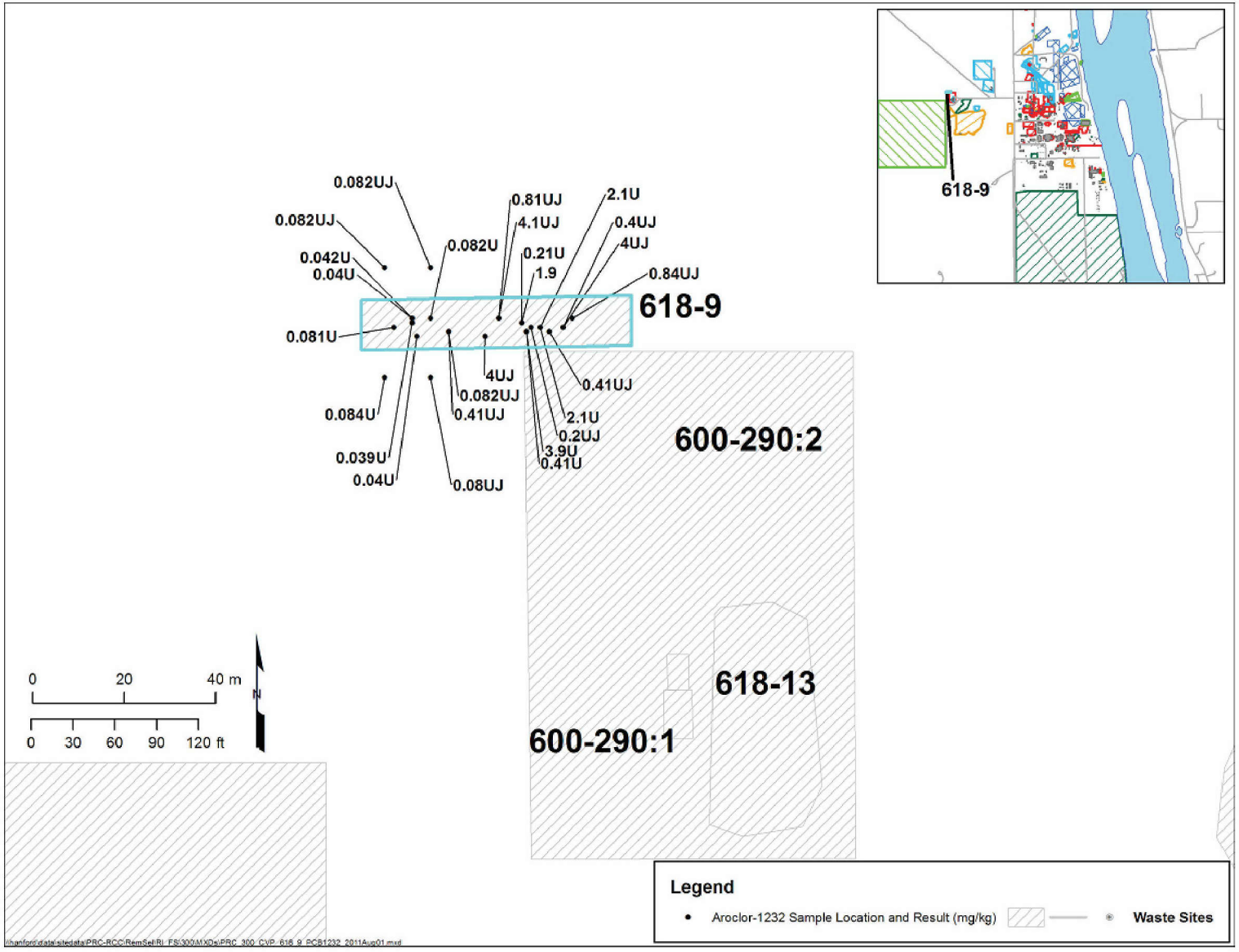


Figure H-31. Burial Ground (618-9) Sampling Locations and Associated Aroclor-1232 Results

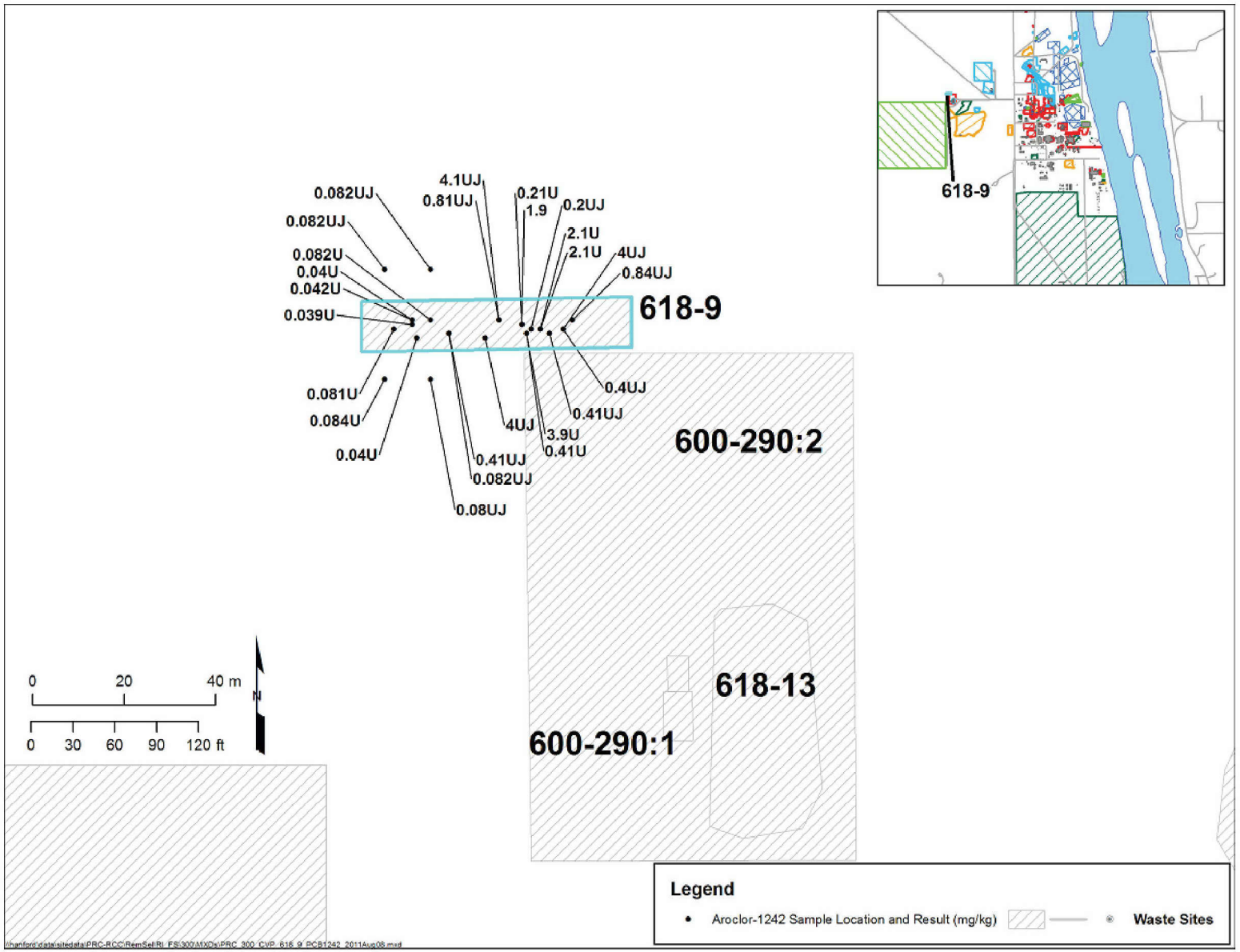


Figure H-32. Burial Ground (618-9) Sampling Locations and Associated Aroclor-1242 Results

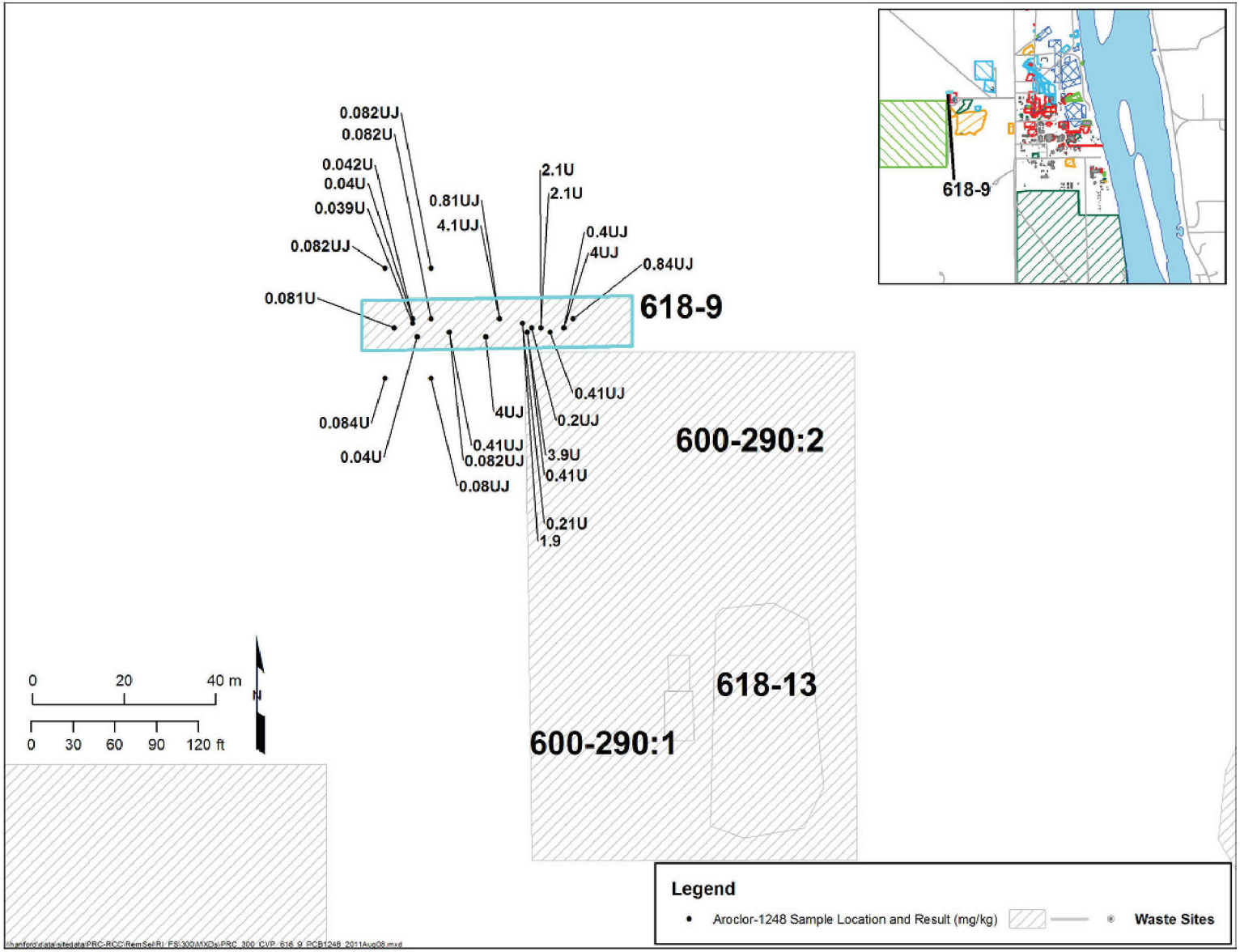


Figure H-33. Burial Ground (618-9) Sampling Locations and Associated Aroclor-1248 Results

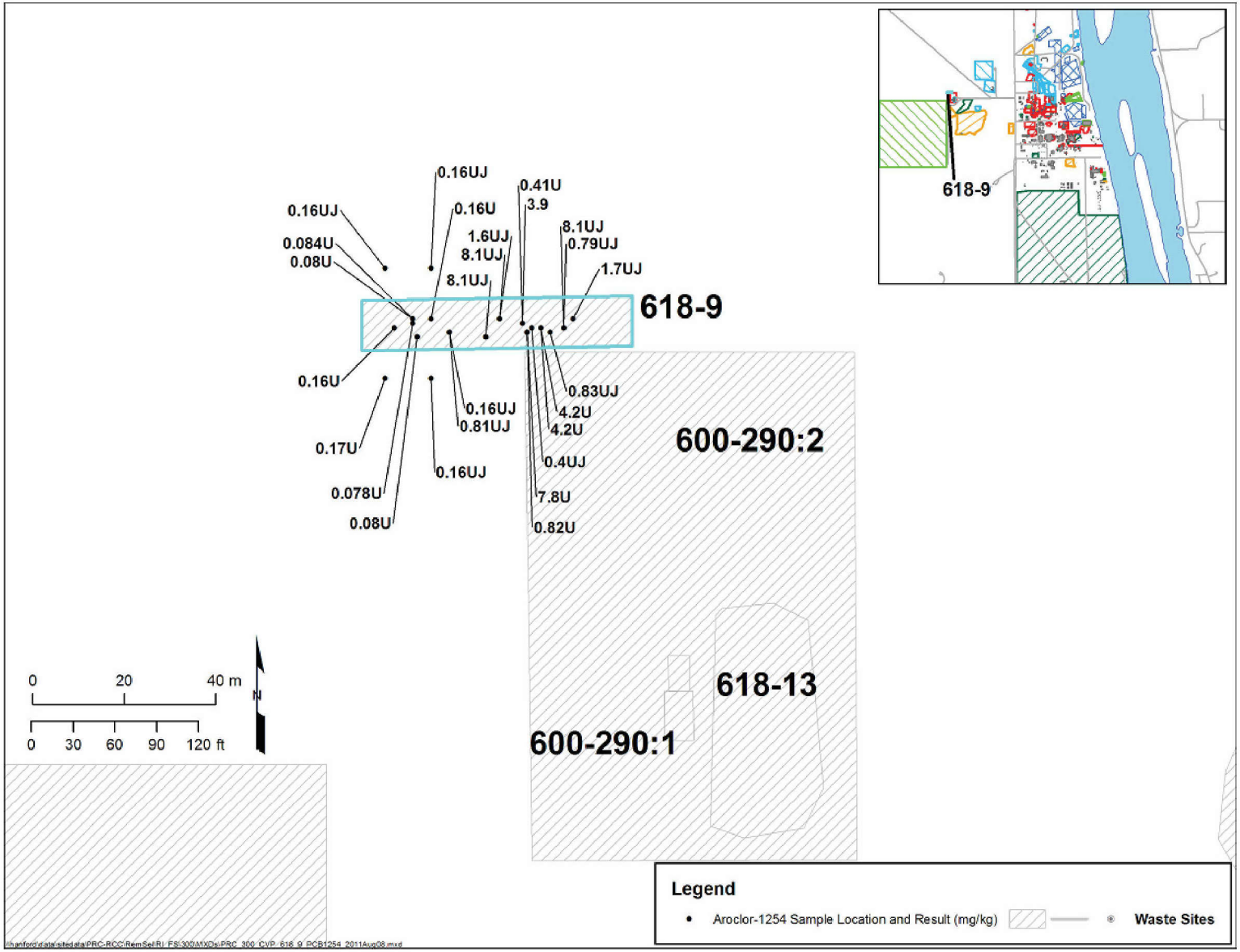
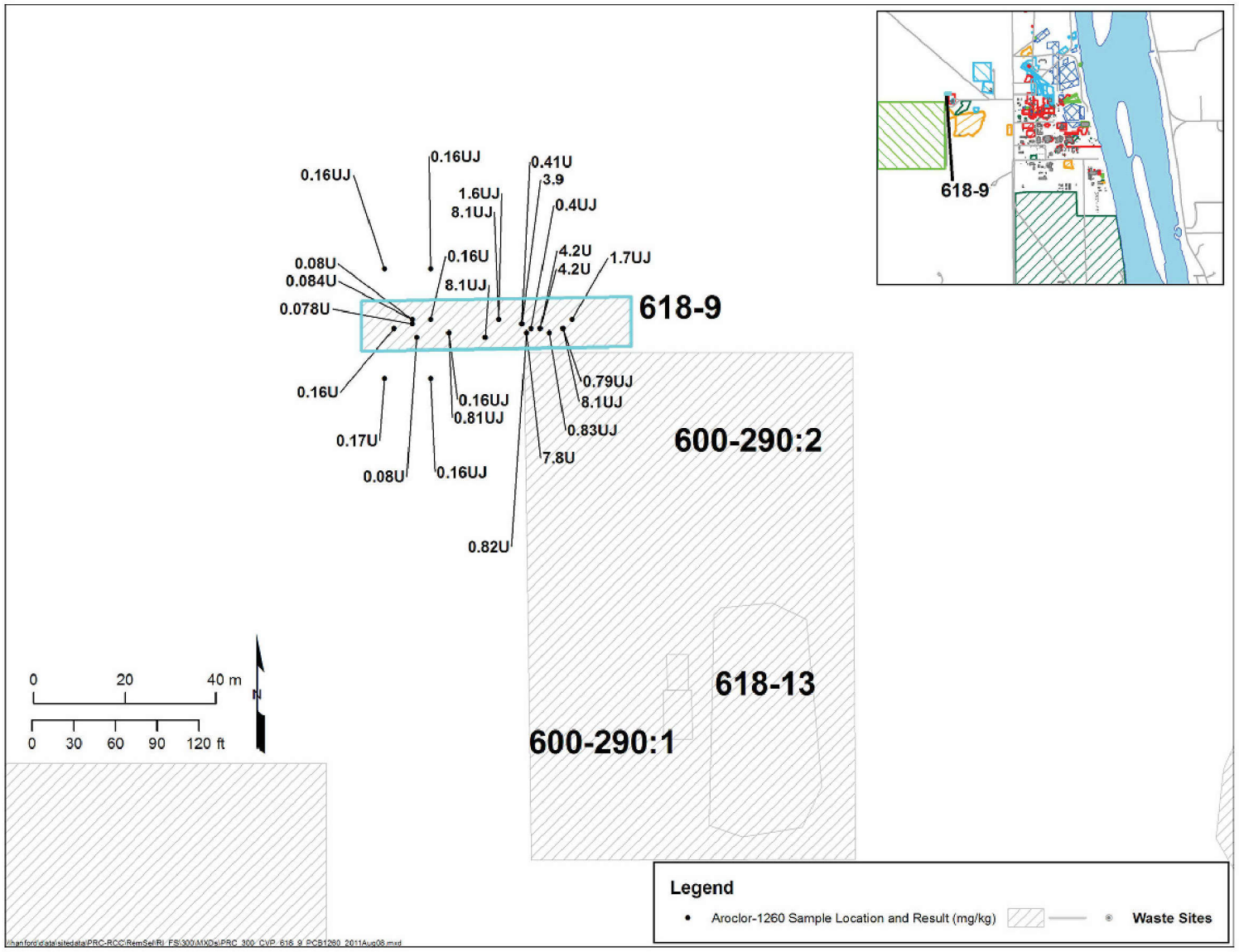


Figure H-34. Burial Ground (618-9) Sampling Locations and Associated Aroclor-1254 Results



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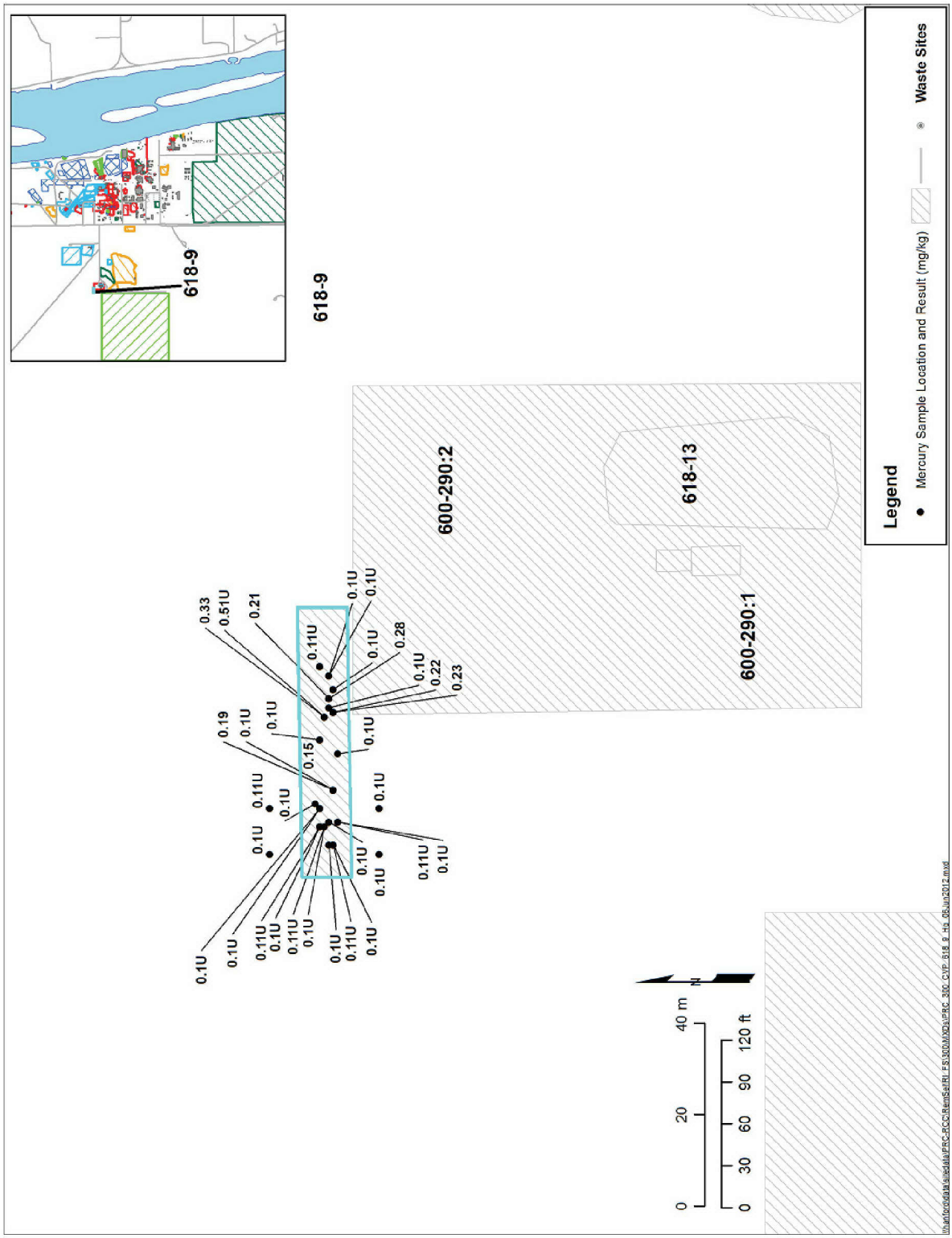

Figure H-36. Burial Ground (618-9) Sampling Locations and Associated Mercury Results

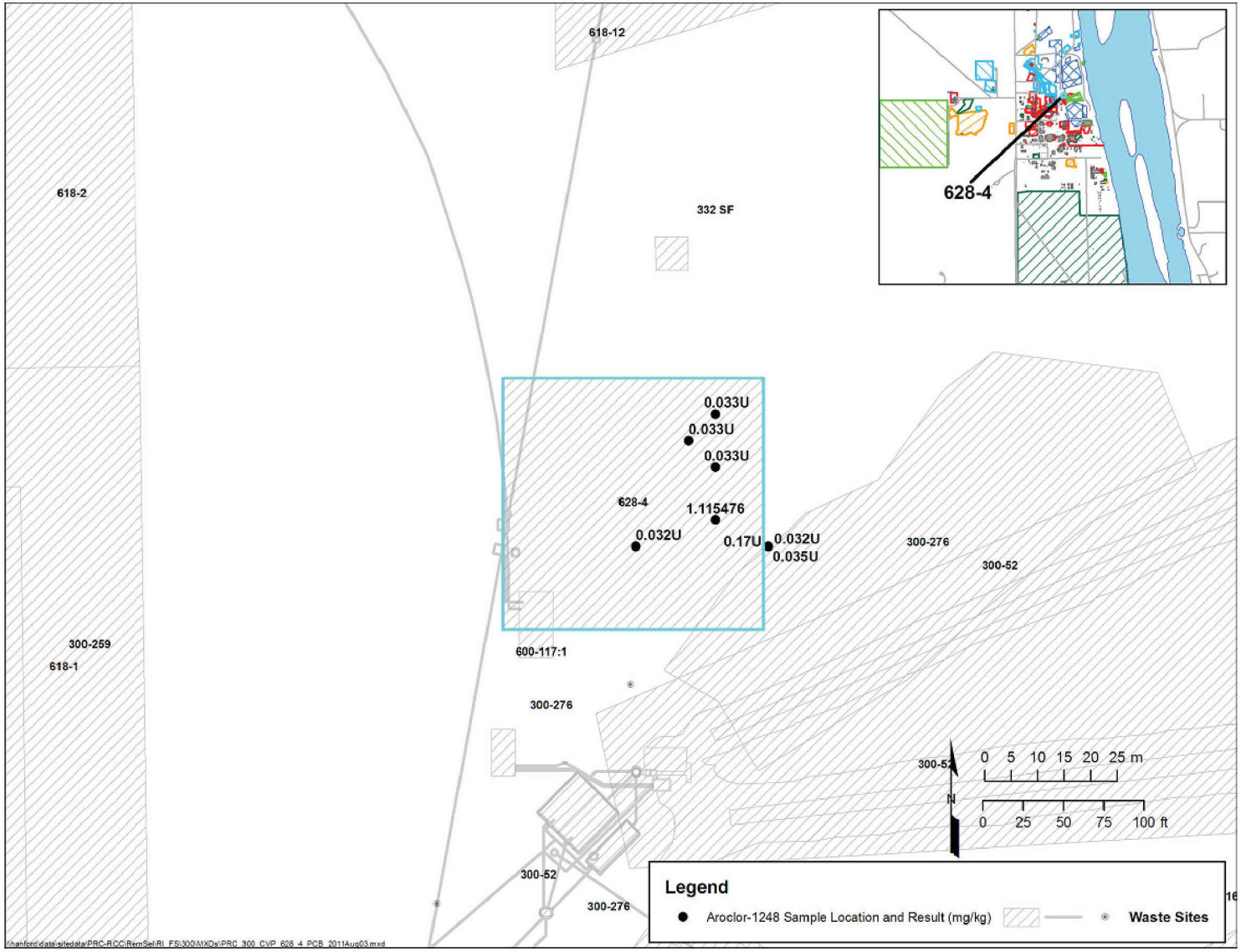

Figure H-37. Landfill 1D (628-4) Sampling Locations and Associated Aroclor-1248 Results

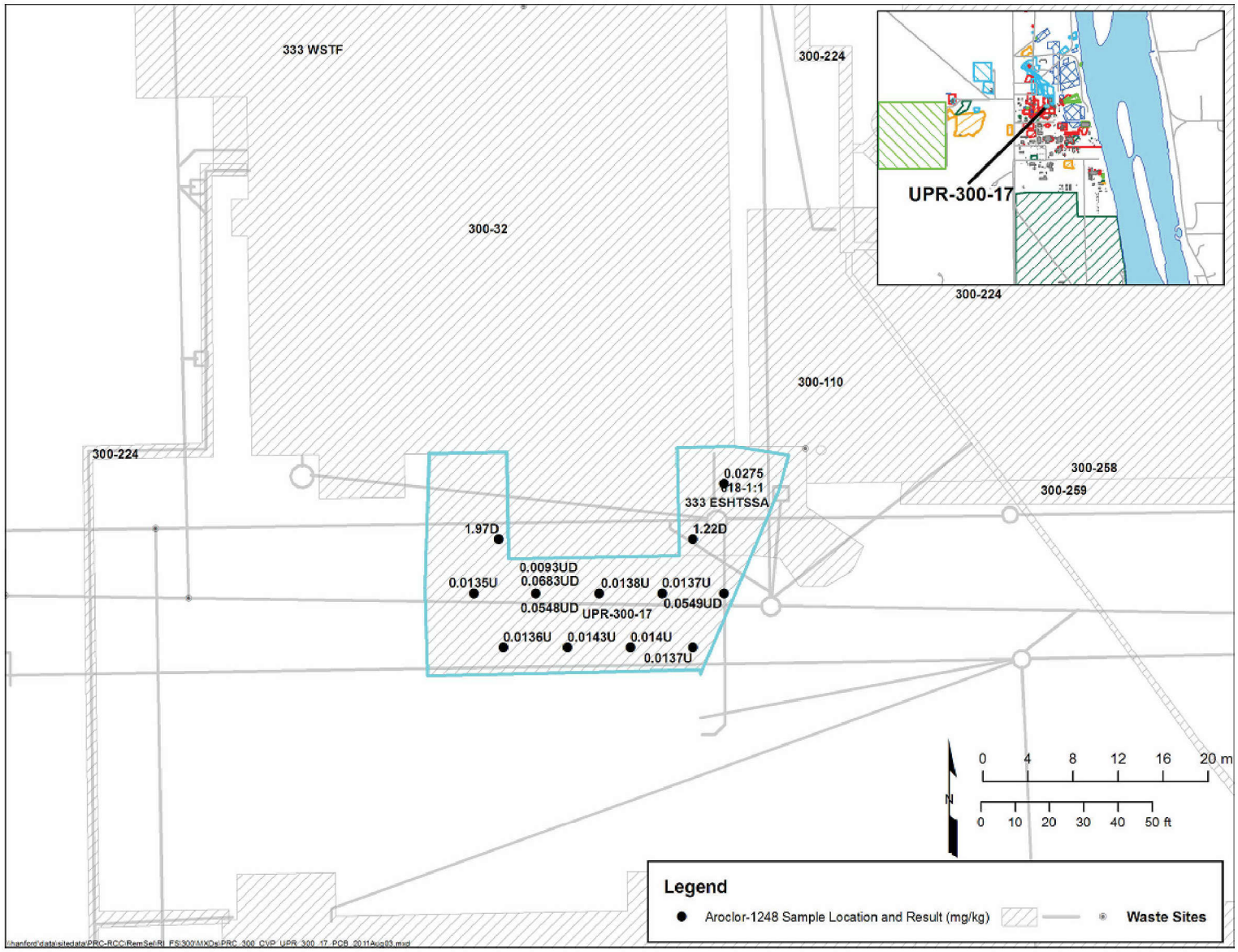

Figure H-38. Metal Shavings Fire Waste Site (UPR-300-17) Sampling Locations and Associated Aroclor-1248 Results

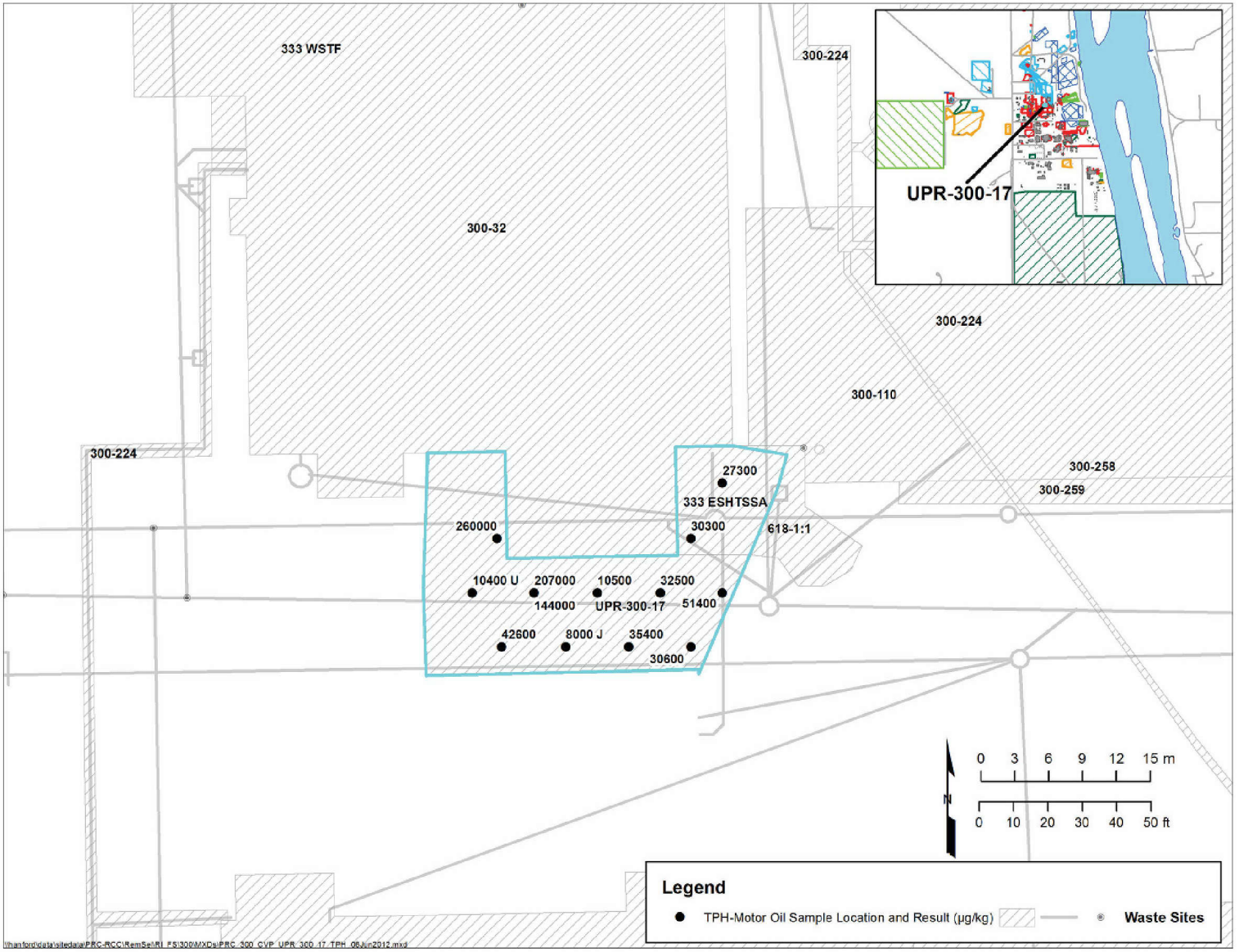

Figure H-39. Metal Shavings Fire Waste Site (UPR-300-17) Sampling Locations and Associated TPH-Motor Oil Results

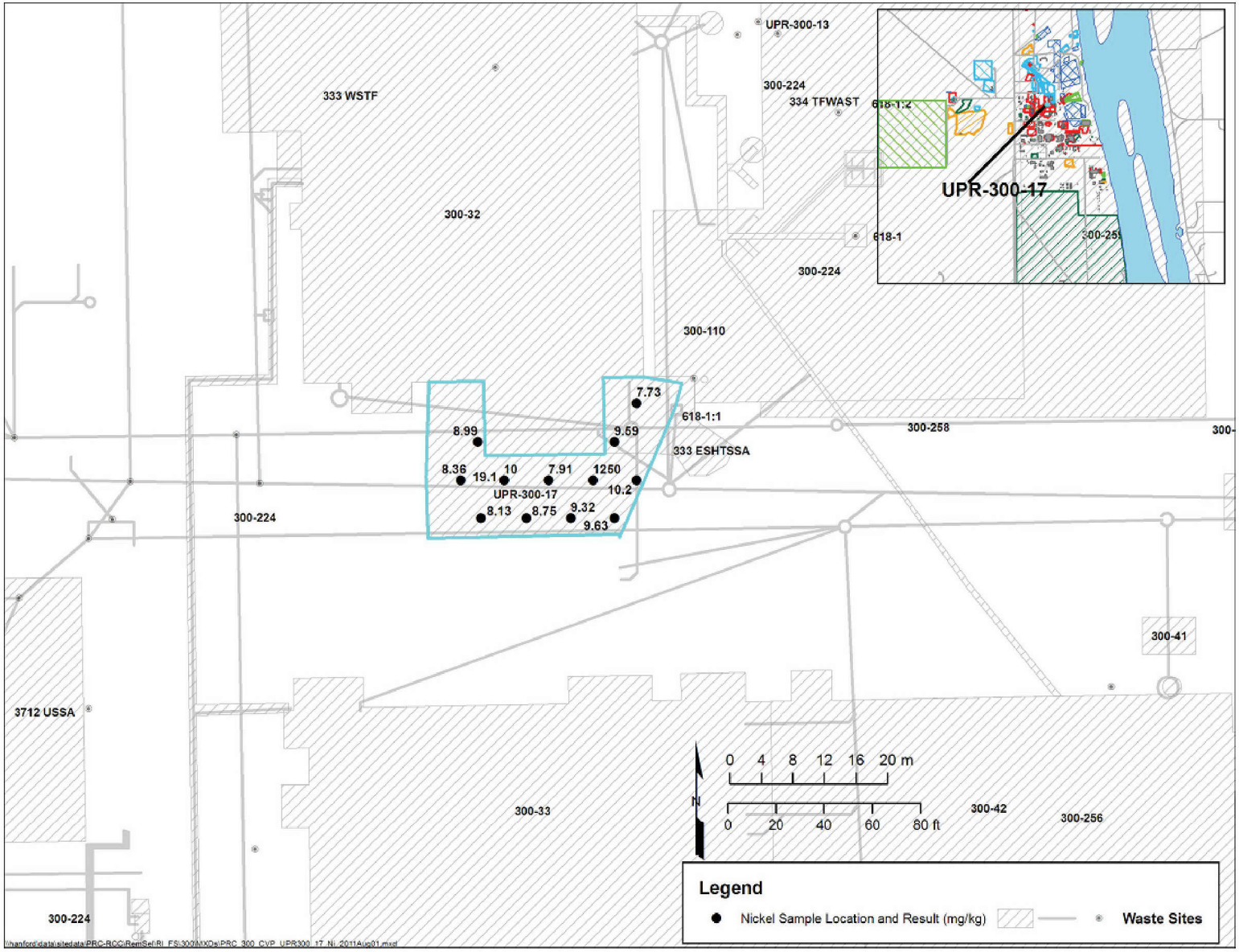

Figure H-40. Metal Shavings Fire Waste Site (UPR-300-17) Sampling Locations and Associated Nickel Results

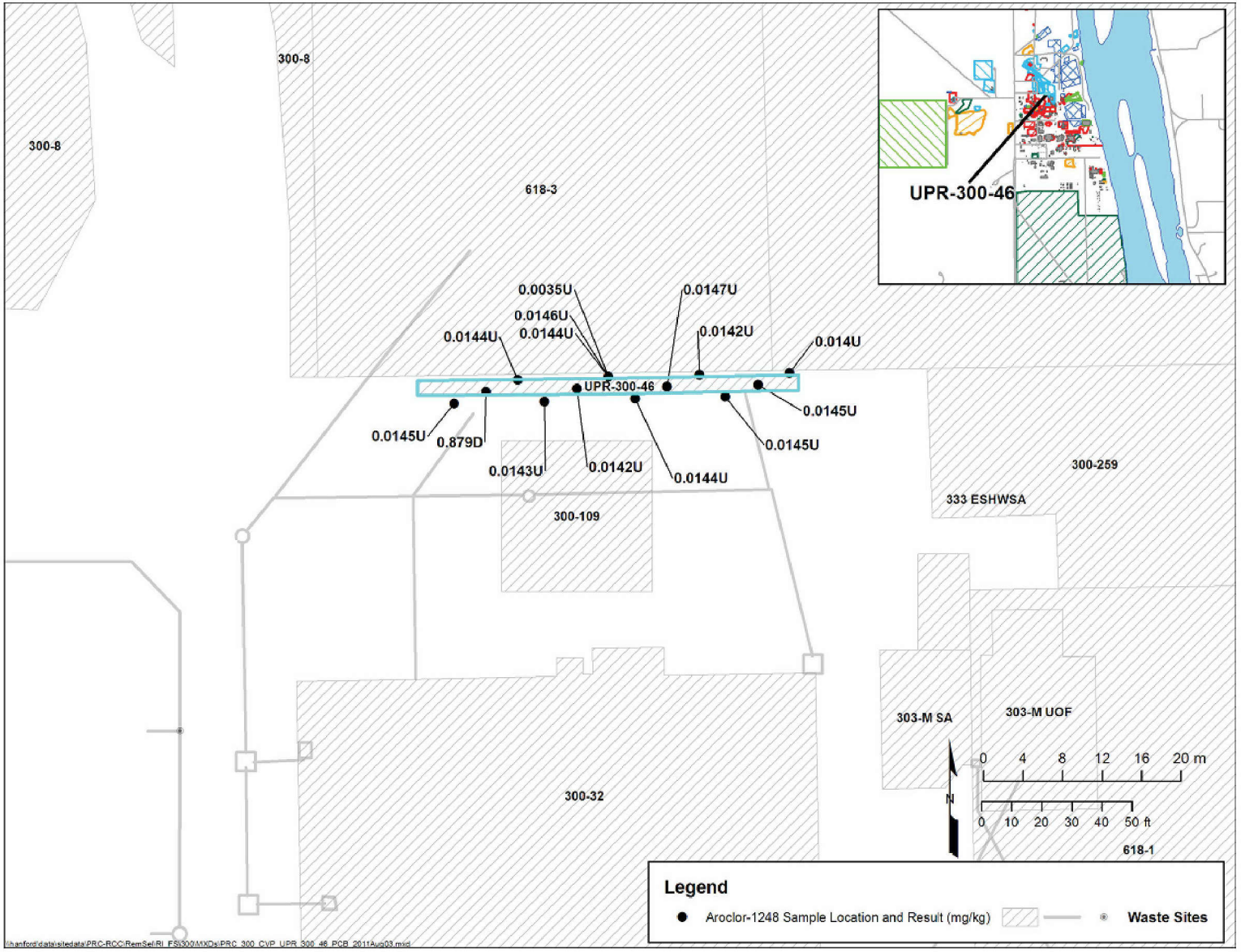

Figure H-41. Contamination North of 333 Building (UPR-300-46) Sampling Locations and Associated Aroclor-1248 Results

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Table H-1. Avian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)
Metals	Aluminum	aluminum sulfate	Carriere et al., 1986	ringed dove	0.155	4 month	oral in diet	reproduction				109.7	---	ES/ER/TM-86/R3		**109.7**	**---**
	Antimony															**---**	**---**
	Arsenic	arsenic oxide	Holcman and Stibilj, 1997*	chicken	1.6	19 days during reproduction	oral in diet	reproduction	progeny count			2.24	---	OSWER Directive 9285.7-62		**---**	**---**
	Arsenic	sodium arsenate	Stanley et al., 1994	mallard	1	>10 weeks	oral in diet	reproduction				9.3	40.3			**9.3**	**40.3**
	Barium	barium hydroxide	Johnson et al., 1960	1-day old chicks	0.121	4 weeks	oral in diet	mortality		0.1	subchronic-chronic	20.8	41.7	ES/ER/TM-86/R3		**20.8**	**41.7**
	Beryllium															**---**	**---**
	Bismuth															**---**	**---**
	Boron	boric acid	Smith and Anders, 1989	mallard	1	3 weeks pre-, during, and 3 weeks post-reproduction	oral in diet	reproduction	egg fertility, duckling growth, embry and duckling mortality			28.8	100	ES/ER/TM-86/R3		**28.8**	**100**
	Cadmium	multiple forms	multiple studies*	multiple species								1.47	---	OSWER Directive 9285.7-65	Geometric mean of NOAELs for reproduction and growth	**1.47**	**---**
	Cadmium	cadmium sulfate	Leach et al., 1979*	chicken	1.6	12 weeks during egg laying	oral in diet	reproduction	egg production, progeny count			0.593	2.37	OSWER Directive 9285.7-65	lowest bounded reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**2.37**
	Chromium (3+)	multiple forms	multiple studies*	chicken				reproduction and growth				2.66	---	OSWER Directive 9285.7-66	Geometric mean of NOAELs for reproduction and growth	**2.66**	**---**
	Chromium (3+)	chrome alum doceahydrate	Haseltine et al., unpublished*	black duck	1.17	180-190 days	oral in diet	reproduction	reproductive success			0.569	2.78	OSWER Directive 9285.7-66	lowest bounded reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**2.78**
	Cobalt	multiple forms	multiple studies*	multiple species				growth	body weight			7.61		OSWER Directive 9285.7-67	Geometric mean of NOAELs for reproduction and growth	**7.61**	
	Cobalt	cobalt chloride	Hill, 1979*	chicken	0.328	5 weeks	oral in diet	growth	body weight			3.89	7.8	OSWER Directive 9285.7-67	lowest bounded reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**7.8**
	Copper	copper	al Ankari et al., 1998*	chicken	1.5161	84 days during egg laying	oral in diet	reproduction	eggs per nest			4.05	12.1	OSWER Directive 9285.7-68	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**4.05**	**12.1**
	Lead	lead acetate	Edens and Garlich, 1983*	chicken	1.81	4 weeks during egg laying	oral in diet	reproduction	progeny count			1.63	3.26	OSWER Directive 9285.7-70	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**1.63**	**3.26**
	Lithium															**---**	**---**
	Manganese	multiple forms	multiple studies*	multiple species				reproduction and growth				179	---	OSWER Directive 9285.7-71	Geometric mean of NOAELs for reproduction and growth	**179**	**---**
	Manganese	manganese chloride tetrahydrate	Southern and Baker, 1983*	chicken	0.316	14 days	oral in diet	growth	body weight			261	348	OSWER Directive 9285.7-71	lowest bounded growth or reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**348**
	Mercury	methyl mercury	Heinz and Hoffman, 1998; Heinz, 1979	mallard	1	2.5 months to two generations	oral in diet	reproduction				0.068	0.37			**0.068**	**0.37**
	Molybdenum	Sodium molybdate	Lepore and Miller, 1965	chicken	1.5	21 days through reproduction	oral in diet	reproduction	embryonic viability	0.1	LOAEL-NOAEL	3.53	35.3	ES/ER/TM-86/R3		**3.53**	**35.3**
	Nickel	multiple forms	multiple studies*	multiple species				reproduction and growth				6.71	---	OSWER Directive 9285.7-76	Geometric mean of reproduction and growth studies	**6.71**	**---**
	Nickel	nickel chloride hexahydrate	Martinez and Diaz, 1996*	chicken	1.8901	42 days	oral in diet	growth	body weight			5.76	11.5	OSWER Directive 9285.7-76	lowest bounded growth or reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**11.5**

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Table H-1. Avian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)
	Selenium	sodium selenite	El-Begearmi and Combs, 1982*	chicken	0.328	2 weeks	oral in diet	survival	mortality			0.29	0.579	OSWER Directive 9285.7-72	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.29**	**0.579**
	Silver	silver acetate	Jensen et al., 1974*	turkey	0.662	5 weeks	oral in diet		growth	0.1	LOAEL-NOAEL	2.02	20.2	OSWER Directive 9285.7-77	lowest growth, reproduction, or survival LOAEL, with NOAEL estimated by application of UF	**2.02**	**20.2**
	Strontium															**---**	**---**
	Thallium											---	---			**---**	**---**
	Tin	bis(Tributyltin) oxide (TBTO)	Schlatterer et al., 1993	Japanese quail	0.15	6 weeks during reproduction	oral in diet	reproduction	egg weight and hatchability			6.8	16.9	ES/ER/TM-86/R3		**6.8**	**16.9**
	Uranium	depleted metallic	Haseltine and Sileo, 1983	black duck	1.25	6 weeks	oral in diet	growth, mortality, organ pathology	mortality, body weight, blood chemistry, liver or kidney effects	0.1	subchronic-chronic	16	---	ES/ER/TM-86/R3		**16**	**---**
	Vanadium	sodium metavanadate	Hill, 1979*	chicken	1.042	5 weeks	oral in diet	growth	body weight			0.344	0.688	OSWER Directive 9285.7-75	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.344**	**0.688**
	Zinc	multiple forms	multiple studies*	multiple species				reproduction and growth				66.1	---	OSWER Directive 9285.7-73	Geometric mean of reproduction and growth studies	**66.1**	**---**
	Zinc	zinc acetate	Gibson et al., 1986*	chicken	2	10 weeks	oral in diet	reproduction	progeny count			57.3	66.5	OSWER Directive 9285.7-73	lowest bounded growth or reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**66.5**
General Inorganics	Ammonia/Ammonium															**---**	**---**
	Chloride															**---**	**---**
	Cyanide															**---**	**---**
	Fluoride		Pattee et al., 1988	screech owl	0.18	1 mo	oral in diet	reproduction	hatching success			7.8	32	ES/ER/TM-86/R3		7.8	32
	Iodine															**---**	**---**
	Nitrate/Nitrite															**---**	**---**
	Phosphate															**---**	**---**
	Sulfate/Sulfite															**---**	**---**
	Total Organic Carbon															**---**	**---**
Volatile Organics	1,1-dichloroethane	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	1,1-dichloroethene	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	1,1,1-trichloroethane	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	1,1,2-trichloroethane	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	1,1,2,2-tetrachloroethane	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	1,2-dichlorobenzene	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	1,2-dichloroethane (DCA)	NA	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	1,3-dichlorobenzene	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	2-butanone (Methyl Ethyl Ketone/MEK)	2-hexanone	Abou-Donia et al., 1982	chicken	1.7	90 days	oral gavage	survival, pathology, neurotoxicity	weight loss and ataxia	0.1	LOAEL-NOAEL	10	100			**10**	**100**

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Table H-1. Avian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)
	2-hexanone	NA	Abou-Donia et al., 1982	chicken	1.7	90 days	oral gavage	survival, pathology, neurotoxicity	weight loss and ataxia	0.1	LOAEL-NOAEL	10	100			**10**	**100**
	Benzene	xylene	Hill and Camardese, 1986	Japanese quail		5 days	oral in diet	growth and mortality		0.01	subacute-chronic	40.7	---		5 day dietary exposure to 4066 mg/kg/d had no effect	**40.7**	**---**
	Butanol															**---**	**---**
	Carbon Tetrachloride	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	Chlorobenzene	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	Chloroform	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	Cis-1,2-dichloroethylene	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	Dichloromethane (Methylene Chloride)	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	Ethyl Benzene	xylene	Hill and Camardese, 1986	Japanese quail		5 days	oral in diet	growth and mortality		0.01	subacute-chronic	40.7	---		5 day dietary exposure to 4066 mg/kg/d had no effect	**40.7**	**---**
	Methyl Isobutyl Ketone	2-hexanone	Abou-Donia et al., 1982	chicken	1.7	90 days	oral gavage	survival, pathology, neurotoxicity	weight loss and ataxia	0.1	LOAEL-NOAEL	10	100			**10**	**100**
	n-butyl Benzene	xylene	Hill and Camardese, 1986	Japanese quail		5 days	oral in diet	growth and mortality		0.01	subacute-chronic	40.7	---		5 day dietary exposure to 4066 mg/kg/d had no effect	**40.7**	**---**
	Tetrachloroethylene	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	Toluene	xylene	Hill and Camardese, 1986	Japanese quail		5 days	oral in diet	growth and mortality		0.01	subacute-chronic	33.3	---		5 day dietary exposure to 4066 mg/kg/d had no effect	**40.7**	**---**
	Trans-1,2-dichloroethylene	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	Trichloroethylene (TCE)	1,2-dichloroethane (DCA)	Alumot et al., 1976	chicken	1.6	2 yr	oral in diet	reproduction	reduced egg production			17.2	34.4	ES/ER/TM-86/R3		**17.2**	**34.4**
	Xylene	NA	Hill and Camardese, 1986	Japanese quail		5 days	oral in diet	growth and mortality		0.01	subacute-chronic	40.7	---		5 day dietary exposure to 4066 mg/kg/d had no effect	**40.7**	**---**
Polycyclic Aromatic Hydrocarbons	Acenaphthene	aromatic hydrocarbon mixture	Patton and Dieter, 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		*Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Acenaphthylene	aromatic hydrocarbon mixture	Patton and Dieter, 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Anthracene	aromatic hydrocarbon mixture	Patton and Dieter, 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Benzo(a)pyrene	benzo(a)anthracene	Beall, 2007	bobwhite quail		60 d	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**

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Table H-1. Avian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)
	Benzo(a)anthracene	NA	Beall, 2007	bobwhite quail		60 d	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Benzo(b)fluoranthene	benzo(a)anthracene	Beall, 2007	bobwhite quail		60 d	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Benzo(ghi)perylene	benzo(a)anthracene	Beall, 2007	bobwhite quail		60 d	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Benzo(k)fluoranthene	benzo(a)anthracene	Beall, 2007	bobwhite quail		60 d	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Chrysene	benzo(a)anthracene	Beall, 2007	bobwhite quail		60 d	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Dibenz(ah)anthracene	benzo(a)anthracene	Beall, 2007	bobwhite quail		60 d	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Fluoranthene	benzo(a)anthracene	Beall, 2007	bobwhite quail		60 d	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	Fluorene	aromatic hydrocarbon mixture	Patton and Dieter, 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Indeno[1,2,3-cd]pyrene	benzo(a)anthracene	Beall, 2007	bobwhite quail		60 d	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
	2-Methylnaphthalene	aromatic hydrocarbon mixture	Patton and Dieter, 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Naphthalene	aromatic hydrocarbon mixture	Patton and Dieter, 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Phenanthrene	aromatic hydrocarbon mixture	Patton and Dieter, 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	Pyrene	Benzo(a)anthracene	Beall 2007	bobwhite quail		60 d	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**

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Table H-1. Avian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)
	Low MW PAHs	aromatic hydrocarbon mixture	Patton and Dieter, 1980	mallard	1.23	7 mo	oral in diet	growth	liver weight			32.5	325		* Mixture of ethylbenzene, 1,2,3,4-tetrahydronaphthalene, dimethylnaphthalene, 2,3,3-trimethylindolenine, acenaphthene, acenaphthylene, phenanthrene, 2-methylbenzothiazole, dibenzothiophene, and 2,6-dimethylquinoline	**32.5**	**325**
	High MW PAHs	benzo(a)anthracene	Beall 2007	bobwhite quail		60 d	oral in diet	growth				0.65	---		NOAEL based on mean exposure over 60-day duration of the study.	**0.65**	**---**
Petroleum	Gasoline Range Organics	No. 2 Fuel	Szaro et al., 1981	mallard	1	18 weeks	oral in diet	mortality and growth	reduced growth			500	5000			**500**	**5000**
	TPH - Diesel	No. 2 Fuel	Szaro et al., 1981	mallard	1	18 weeks	oral in diet	mortality and growth	reduced growth			500	5000			**500**	**5000**
	TPH - Kerosene	No. 2 Fuel	Szaro et al., 1981	mallard	1	18 weeks	oral in diet	mortality and growth	reduced growth			500	5000			**500**	**5000**
Semivolatile Organics	Normal paraffin hydrocarbons	aliphatic hydrocarbon mixture	Patton and Dieter, 1980	mallard	1.23	7 mo	oral in diet	growth				813	---		* Mixture of n-paraffins (tridecane, pentadecane, hexadecane, heptadecane, octadecane, and nonadecane), iso-paraffins (2,2,4,6,6-pentamethylheptane, 2,2,4,4,6,8,8-heptamethylnonane, and 2,6,10,14-tetramethylpentadecane), and 2-ring cyclo-paraffins (decahydronaphthalene)	**813**	**---**
	Phenol															**---**	**---**
	2-methylphenol (ocresol)															**---**	**---**
	4-methylphenol (pcresol)															**---**	**---**
	2,4-dinitrotoluene	NA	Johnson et al., 2005	bobwhite quail		60 d	oral gavage	hematoxicity and mortality	hematoxicity and mortality	0.01(for NOAEL) 0.25 (for LOAEL)	subchronic-chronic, inter-species differences	0.01	1.3	39-EJ-1138-01D	study and value selected based on an extensive review of available literature - documented in USACHPPM	**0.01**	**1.3**
	Bis[2-ethylhexyl] phthalate	NA	Peakall, 1974	ringed dove	0.155	4 wk (during reproduction)	oral in diet	reproduction		NA		1.1		ES/ER/TM-86/R3		**1.1**	**---**
	Total PCBs	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM-86/R3		**0.18**	**1.8**
	Aroclor 1016	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM-86/R3		**0.18**	**1.8**
	Aroclor 1221	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM-86/R3		**0.18**	**1.8**
	Aroclor 1232	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM-86/R3		**0.18**	**1.8**
	Aroclor 1242	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM-86/R3		**0.18**	**1.8**
	Aroclor 1248	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM-86/R3		**0.18**	**1.8**
	Aroclor 1254	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM-86/R3		**0.18**	**1.8**
	Aroclor 1260	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM-86/R3		**0.18**	**1.8**
	Aroclor 1262	aroclor 1254	Dahlgren et al., 1972	ring-necked pheasant	1	17 weeks during egg laying	oral via gelatin capsule	reproduction	reduced egg hatchability	0.1	LOAEL-NOAEL	0.18	1.8	ES/ER/TM-86/R3		**0.18**	**1.8**
Herbicide	Dichloroprop															**---**	**---**

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Table H-1. Avian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)
Pesticide	Aldrin	NA	Hall et al., 1971	ring-necked pheasant		6 weeks	oral via gelatin capsule	growth		0.1(for NOAEL) 0.25 (for LOAEL)	subchronic-chronic	0.007	0.035	39-EJ1138-01J	study and value selected based on an extensive review of available literature - documented in USACHPPM	**0.007**	**0.035**
	beta-1,2,3,4,5,6-Hexachlorocyclohexane	gamma hexachlorobenzene (lindane)	Chakravarty and Lahiri, 1986; Chakravarty et al., 1986	mallard	1	8 wks	oral intubation	reproduction	eggshell thickness, egg number, etc.	0.1	for interspecies uncertainty	0.571	0.857	87-MA02T6-05C	study and value selected based on an extensive review of available literature - documented in USACHPPM	**0.571**	**0.857**
	alpha-Chlordane	chlordane	Stickel et al., 1983	red-winged blackbird	0.064	84 d	oral in diet	mortality				2.14	10.7	ES/ER/TM-86/R3		**2.14**	**10.7**
	gamma-Chlordane	chlordane	Stickel et al., 1983	red-winged blackbird	0.064	84 d	oral in diet	mortality				2.14	10.7	ES/ER/TM-86/R3		**2.14**	**10.7**
	Dichlorodiphenyldichloroethylene	DDT	Cecil et al., 1978	chicken		30 d	oral in diet	growth	body weight			0.227	2.27	OSWER Directive 9285.7-57	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.227**	**---**
	Dichlorodiphenyldichloroethylene	DDT	Heath et al., 1969	mallard		1 yr	oral in diet	reproduction	reproductive success			0.563	1.892	OSWER Directive 9285.7-57	value is lowest reproductive LOAEL above the NOAEL used for the EcoSSL; NOAEL is from same study	**---**	**1.892**
	Dichlorodiphenyltrichloroethane	NA	Cecil et al., 1978	chicken		30 d	oral in diet	growth	body weight			0.227	2.27	OSWER Directive 9285.7-57	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.227**	**---**
	Dichlorodiphenyltrichloroethane	NA	Heath et al., 1969	mallard		1 yr	oral in diet	reproduction	reproductive success			0.563	1.892	OSWER Directive 9285.7-57	value is lowest reproductive LOAEL above the NOAEL used for the EcoSSL; NOAEL is from same study	**---**	**1.892**
	Dieldrin	NA	Nebeker et al., 1992	mallard		24 d	oral in diet	growth	body weight			0.0709	3.78	OSWER Directive 9285.7-56	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.0709**	**---**
	Dieldrin	NA	Wiese et al., 1968	crowned guinea fowl		21 month	oral in diet	reproduction	number of progeny			0.0671	0.223	OSWER Directive 9285.7-56	value is lowest reproductive LOAEL above the NOAEL used for the EcoSSL; NOAEL is from same study	**---**	**0.223**
	Endosulfan I	endosulfan	Abiola, 1992	gray partridge	0.4	4 wk (during reproduction)	oral in diet	reproduction				10	---	ES/ER/TM-86/R3		**10**	**---**
	Endosulfan II	endosulfan	Abiola, 1992	gray partridge	0.4	4 wk (during reproduction)	oral in diet	reproduction				10	---	ES/ER/TM-86/R3		**10**	**---**
	Endosulfan sulfate	endosulfan	Abiola, 1992	gray partridge	0.4	4 wk (during reproduction)	oral in diet	reproduction				10	---	ES/ER/TM-86/R3		**10**	**---**
	Endrin aldehyde	endrin	Spann et al., 1986	mallard	1.15	>200 d	oral in diet	reproduction				0.3	---	ES/ER/TM-86/R3		**0.3**	**---**
	Methoxychlor															**---**	**---**

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Table H-1. Avian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor Type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Avian NOAEL TRV (mg/kg/d)	Selected Avian LOAEL TRV (mg/kg/d)

Notes:

his table are provided in the references section of this appendix.

Uncertainty factors were used to adjust all measured effect concentrations to chronic NOAELS and chronic LOAELs as follows:

LOAEL to NOAEL = 0.1

Subchronic to chronic = 0.1

where:

chronic = >12 weeks or during critical lifestage

subchronic = 4 to 12 weeks

These uncertainty factors are consistent with methods used in development of the EcoSSL Guidance (OSWER Directive 9285.7-55) and are more conservative than uncertainty factors recommended in EPA 540-R-97-006, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments: Interim Final.*

*Study information and calculated NOAELs and LOAELs for these sources were taken directly from the cited EcoSSL report developed by the EPA. All other primary sources were obtained, reviewed, and TRVs were extracted or developed from the study.

EcoSSL = Ecologicla Soil Screenign Level

EPA = United States Evironmental Protection Agency

LOAEL = lowest observable adverse effect level

NOAEL = no observable adverse effect level

mg/kg/d = milligram per kilogram per day

TRV = toxicity reference value

ny Center for Health Promotion and Preventive Medicine

Bold = values selected as the avian TRVs

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Table H-2. Mammalian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Mammalian NOAEL TRV (mg/kg/d)	Selected Mammalian LOAEL TRV (mg/kg/d)
Metals	Aluminum	aluminum chloride	Ondreicka et al., 1966	mouse	0.03	3 generations	oral in water	reproduction	offspring growth	0.1	LOAEL-NOAEL	1.93	19.3	ES/ER/TM-86/R3	Note that soil pH must be <5.5 (EPA, 2003) for Al to be bioavailable.	**1.93**	**19.3**
	Antimony	antimony trichloride	*Rossi et al., 1987	rat	0.33	31 days	oral in water	reproduction	progeny body weight			0.059	0.59	OSWER Directive 9285.7-61	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.059**	**0.59**
	Arsenic	sodium arsenite	*Neiger and Osweiler, 1989	dog	10.1	8 weeks	oral in diet	growth	reduced body weight			1.04	1.66	OSWER Directive 9285.7-62	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**1.04**	**1.66**
	Barium	multiple forms	*multiple studies	multiple species								51.8		OSWER Directive 9285.7-63	geometric mean of NOAELs for reproduction and growth	**---**	**---**
	Barium	barium chloride	NTP, 1994	rat	0.35	105 weeks	oral in water	nephrotoxicity	increased kidney weight			45	75		study selected because NOAEL is similar to EcoSSL, study is of long duration, and a LOAEL was identified.	**45**	**75**
	Beryllium	beryllium sulfate	*Schroeder and Mitchener, 1975	rat	0.486	lifetime	oral in water	longevity				0.532		OSWER Directive 9285.7-64	Same study as ES/E/TM-86/R3, but used different body weight in calculation of NOAEL	**0.532**	**---**
	Bismuth															**---**	**---**
	Boron	boric acid or Borax	Weir and Fischer, 1972	rat	0.35	three generations	oral in diet	reproduction	sterility			28	93.6	ES/ER/TM-86/R3		**28**	**93.6**
	Cadmium	cadmium acetate	*Yuhas et al., 1979	rat	0.43	2 weeks	oral in water	growth	body weight			0.77	7.7	OSWER Directive 9285.7-65	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**---**	**---**
	Cadmium	cadmium chloride	Sutou et al., 1980a and 1980b	rat	0.303	6 weeks during reproduction	oral gavage	reproduction	reduced fetal survival			1	10	ES/ER/TM-86/R3	The ORNL TRV for cadmium was selected as it represents reproductive effects, is a longer study, and is comparable to the TRV used for EcoSSLs	**1**	**10**
	Chromium (6+)	multiple forms	*multiple studies	multiple species				reproduction and growth				9.24		OSWER Directive 9285.7-66	geometric mean of NOAELs for reproduction and growth	**9.24**	**---**
	Chromium (6+)	sodium dichromate	Chowdhury and Mitra, 1995	rat	0.3084	90 days	oral gavage	reproduction	testes weight			20	40	OSWER Directive 9285.7-66	lowest bounded reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**40**
	Chromium (3+)	multiple forms	*multiple studies	multiple species				reproduction and growth				2.4		OSWER Directive 9285.7-66	geometric mean of NOAELs for reproduction and growth	**2.4**	**---**
	Chromium (3+)	chromium sulfate	*Zahid et al., 1990	mouse	0.0249	35 days	oral in diet	reproduction	sperm cell counts	0.1	LOAEL-NOAEL	0.962	9.62	OSWER Directive 9285.7-66	lowest reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**9.62**
	Cobalt	multiple forms	*multiple studies	multiple species				reproduction and growth				7.33		OSWER Directive 9285.7-67	geometric mean of NOAELs for reproduction and growth	**7.33**	**---**
	Cobalt	cobalt chloride	*Domingo et al., 1985	rat	0.3	28 days	gavage	reproduction	progeny body weight			5.45	10.9	OSWER Directive 9285.7-67	lowest bounded reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**10.9**
	Copper	copper sulfate pentahydrate	*Allcroft et al., 1961	pig	100	4 weeks	oral in diet	growth	body weight			5.6	9.34	OSWER Directive 9285.7-68	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**5.6**	**9.34**
	Lead	lead acetate	*Kimmel et al., 1980	rat	0.3	7 weeks during gestation	oral in water	growth	body weight			4.7	8.9	OSWER Directive 9285.7-68	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**4.7**	**8.9**
	Lithium	lithium carbonate	Marathe and Thomas, 1986	rat	0.35	days 6-15 of gestation	oral in diet	reproduction	reduced number of offspring			9.4	18.8	ES/ER/TM-86/R3		**9.4**	**18.8**
	Manganese	multiple forms	*multiple studies	multiple species				reproduction and growth				51.5		OSWER Directive 9285.7-71	geometric mean of NOAELs for reproduction and growth	**51.5**	**---**

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Table H-2. Mammalian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Mammalian NOAEL TRV (mg/kg/d)	Selected Mammalian LOAEL TRV (mg/kg/d)
	Manganese	manganese oxide	*Rehnberg et al., 1980	rat	0.0566	20 days	gavage	reproduction, growth	reproductive organ histology, body weight			21	71	OSWER Directive 9285.7-71	lowest bounded growth or reproductive LOAEL above the geometric mean NOAEL from EcoSSL	---	**71**
	Mercury	methylmercury chloride	Verschuuren et al., 1976a	rat	0.35	three generations	oral in diet	reproduction	pup viability			0.032	0.16	ES/ER/TM-86/R3		**0.032**	**0.16**
	Molybdenum	molybdate (MoO4)	Schroeder and Mitchener, 1971	mouse	0.03	three generations	oral in water	reproduction	reproductive success, number of runts	0.1	LOAEL-NOAEL	0.26	2.6	ES/ER/TM-86/R3		**0.26**	**2.6**
	Nickel	nickelous chloride	*Pandey and Srivastava, 2000	mouse	0.025	35 days	oral (other)	reproduction	sperm cell counts			1.7	3.4	OSWER Directive 9285.7-76	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**1.7**	**3.4**
	Selenium	sodium selenite	*Mahan and Moxon, 1984	pig	17.8	37 days	oral in diet	growth	body weight			0.143	0.215	OSWER Directive 9285.7-72	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.143**	**0.215**
	Silver	silver acetate	*Van Vleet, 1976	pig	8.86	40 days	oral in diet	growth	body weight	0.1	LOAEL-NOAEL	6.02	60.2	OSWER Directive 9285.7-77	lowest growth, reproduction, or survival LOAEL, with NOAEL estimated by application of UF	**6.02**	**60.2**
	Strontium	strontium chloride	Skoryna, 1981	rat	0.35	3 yrs	oral in water	growth	body weight			263		ES/ER/TM-86/R3		**263**	**---**
	Thallium	thallium sulfate	Formigli et al., 1986	rat	0.365	60 days	drinking water	reproduction	sperm motility	0.05 and 0.25	subchronic LOAEL-chronic NOAEL; subchronic LOAEL-chronic LOAEL	0.015	0.075	ES/ER/TM-86/R3; 37-EJ1138-01O	study and value selected based on an extensive review of available literature - documented in USACHPPM	**0.015**	**0.075**
	Tin	bis-tibutyltin-oxide (TBTO)	Davis et al., 1987	mouse	0.03	days 6-15 of gestation	oral intubation	reproduction	reduced fetal weight and fetal survival			23.4	35	ES/ER/TM-86/R3		**23.4**	**35**
	Uranium	uranyl acetate	Paternain et al., 1989	mouse	0.028	60 d prior to gestation, gestation, delivery, lactation	oral intubation	reproduction	pup survival and body weight			3.07	6.13	ES/ER/TM-86/R3	Note that the study selected by ES/ER/TM-86/R3, is one of the studies reviewed by Sheppard et al., 2005. The selected LOAEL approximates the mean of developmental values referenced in Sheppard et al., 2005	**3.07**	**6.13**
	Vanadium	sodium orthovanadate	*Sanchez et al., 1991	mouse	0.047	12 days during gestation	gavage	reproduction	ODVP			4.16	8.31	OSWER Directive 9285.7-75	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**4.16**	**8.31**
	Zinc	various forms	*multiple studies	multiple species				reproduction and growth				75.4		OSWER Directive 9285.7-73	geometric mean of NOAELs for reproduction and growth	**75.4**	**---**
	Zinc	zinc sulfate	*Miller et al., 1989	cattle	580	14 weeks	oral in diet	reproduction	progeny body weight			37.9	75.9	OSWER Directive 9285.7-73	lowest bounded growth or reproductive LOAEL above the geometric mean NOAEL from EcoSSL	**---**	**75.9**
General Inorganics	Ammonia/Ammonium															**---**	**---**
	Chloride															**---**	**---**
	Cyanide	potassium cyanide	Tewe and Maner, 1981	rat	0.273	gestation and lactation	oral in diet	reproduction	juvenile growth			68.7	---	ES/ER/TM-86/R3		**68.7**	**---**
	Fluoride	sodium fluoride	Aulerich et al., 1987	mink	1	382 days	oral in diet	reproduction	kit survival			31.37	52.75	ES/ER/TM-86/R3		**31.37**	**52.75**
	Iodine	potassium iodide	Aulerich et al., 1978	mink	1	breeding through lactation	oral in diet	reproduction	kit survival			1.37	13.7			**1.37**	**13.7**
	Nitrate/Nitrite	potassium nitrate	Sleight and Atallah, 1968	guinea pig	0.86	143-204 days	oral in water	reproduction	number of live births			507	1130	ES/ER/TM-86/R3		**507**	**1130**
	Phosphate															**---**	**---**
	Sulfate/Sulfite															**---**	**---**
	Total Organic Carbon															**---**	**---**

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Table H-2. Mammalian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Mammalian NOAEL TRV (mg/kg/d)	Selected Mammalian LOAEL TRV (mg/kg/d)
Volatile Organics	1,1-dichloroethane	1,2-dichloroethane (DCA)	Lane et al., 1982	mouse	0.035	2 generations	oral in water	reproduction				50	---	ES/ER/TM-86/R3		**50**	**---**
	1,1-dichloroethene	NA	Quast et al., 1983	rat	0.35	2 years	oral in water	mortality, body weight				30	---	ES/ER/TM-86/R3		**30**	**---**
	1,1,1-trichloroethane	NA	Lane et al., 1982	mouse	0.035	2 generations	oral in water	reproduction				1000	---	ES/ER/TM-86/R3		**1000**	**---**
	1,1,2-trichloroethane	1,1,1-trichloroethane	Lane et al., 1982	mouse	0.035	2 generations	oral in water	reproduction				1000	---	ES/ER/TM-86/R3		**1000**	**---**
	1,1,2,2-tetrachloroethane	1,1,1,2-tetrachloroethane	NTP, 1983	rat		103 wks	oral gavage	nephrotoxicity		0.1	LOAEL-NOAEL	8.93	89.3	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0265.htm) Dec 11, 2009	**8.93**	**89.3**
	1,2-dichlorobenzene	NA	NTP, 1985	rat		2 yrs	oral gavage	survival and pathology				85.7	---	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0408.htm) Dec 11, 2009	**85.7**	**---**
	1,2-dichloroethane (DCA)	NA	Lane et al., 1982	mouse	0.035	2 generations	oral in water	reproduction				50	---	ES/ER/TM-86/R3		**50**	**---**
	1,3-dichlorobenzene	1,2-dichlorobenzene	NTP, 1985	rat		2 yrs	oral gavage	survival and pathology				85.7	---	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0408.htm) Dec 11, 2009	**85.7**	**---**
	2-butanone (Methyl Ethyl Ketone/MEK)	NA	Cox et al., 1975	rat	0.35	2 generations	oral in water	reproduction	reduced litter size and pup survival			1771	4571	ES/ER/TM-86/R3		**1771**	**4571**
	2-hexanone	NA	O'Donoghue et al., 1978	rat		13 month	oral in water	neurotoxicity				5	36.1	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/1019.htm) Dec 11, 2009; NOAEL is BMDL10 value; LOAEL is BMD10 value	**5**	**36.1**
	Benzene	NA	Wolf et al., 1956	rat	0.175-0.250	187 days	oral gavage	survival and pathology	hemotoxicity			0.7	7			**0.7**	**7**
	Butanol	NA	EPA, 1986	rat		13 weeks	oral gavage	hypoactivity/ataxia				125	500	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0140.htm) Dec 11, 2009	**125**	**500**
	Carbon Tetrachloride	NA	Alumot et al., 1976a	rat	0.35	2 yrs	oral in diet	reproduction				16	---	ES/ER/TM-86/R3		**16**	**---**
	Chlorobenzene	NA	Monsanto Co., 1967	dog		13 weeks	oral in capsules	liver pathology				19.5	38.7	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0399.htm) Dec 11, 2009	**19.5**	**38.7**
	Chloroform	NA	Palmer et al., 1979	rat	0.35	13 wk	oral intubation	liver, kidney, gonad condition	gonadal atrophy	0.1	subchronic-chronic	15	41	ES/ER/TM-86/R3		**15**	**41**
	Cis-1,2-dichloroethylene	1,2-dichloroethylene	Palmer et al., 1979	mouse	0.03	90 days	oral in water	body and organ weights				45.2	---	ES/ER/TM-86/R3		**45.2**	**---**
	Dichloromethane (Methylene Chloride)	NA	NCA, 1982	rat	0.35	2 yrs	oral in water	liver histology				5.85	50	ES/ER/TM-86/R3		**5.85**	**50**
	Ethyl Benzene	NA	Wolf et al., 1956	rat	0.175-0.250	182 days	oral gavage	survival and pathology	liver and kidney histopathology			136	408			**97.1**	**291**
	Methyl Isobutyl Ketone	2-butanone (Methyl Ethyl Ketone/MEK)	Cox et al., 1975	rat	0.35	2 generations	oral in water	reproduction	reduced litter size and pup survival			1771	4571	ES/ER/TM-86/R3		**1771**	**4571**
	n-butyl Benzene	isopropyl benzene	Wolf et al., 1956	rat	0.175-0.250	194 days	oral gavage	survival and pathology	increased kidney weight			110	330			**110**	**330**
	Tetrachloroethylene	1,1,2,2-tetrachloroethylene	Buben and O'Flaherty, 1985	mouse	0.03	6 weeks	oral gavage	hepatotoxicity		0.1	LOAEL-NOAEL	1.4	7	ES/ER/TM-86/R3		**1.4**	**7**
	Toluene	NA	Gospe et al,. 1994	rat	0.2	gestation days 6-19	oral gavage	reproduction	maternal weight loss			52	520			**52**	**520**
	Trans-1,2-dichloroethylene	1,2-dichloroethylene	Palmer et al., 1979	mouse	0.03	90 days	oral in water	body and organ weights				45.2	---	ES/ER/TM-86/R3		**45.2**	**---**
	Trichloroethylene (TCE)	NA	Buben and O'Flaherty, 1985	mouse	0.03	6 weeks	oral gavage	hepatotoxicity		0.01	LOAEL-NOAEL subchronic-chronic	0.7	7	ES/ER/TM-86/R3		**0.7**	**7**
	Xylene	xylene mixture	NTP, 1986	rat		103 wks	oral gavage	behavior growth mortality				179	350			**179**	**350**

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Table H-2. Mammalian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Mammalian NOAEL TRV (mg/kg/d)	Selected Mammalian LOAEL TRV (mg/kg/d)
Polycyclic Aromatic Hydrocarbons	Acenaphthene	NA	EPA, 1989a	mouse	0.03	90 days	oral gavage	hepatotoxicity	liver weight changes and cellular hypertrophy			175	350	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0442.htm) Dec 9, 2009	**175**	**350**
	Acenaphthylene	acenaphthene	EPA, 1989a	mouse	0.03	90 days	oral gavage	hepatotoxicity	liver weight changes and cellular hypertrophy			175	350	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0442.htm) Dec 9, 2009	**175**	**350**
	Anthracene	NA	EPA, 1989b	mouse	0.03	90 days	oral gavage	survival and pathology	reduced body weight			1000	---	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0434.htm) Dec 9, 2009	**1000**	**---**
	Benzo(a)pyrene	NA	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39-EJ-1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Benzo(a)anthracene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39-EJ-1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Benzo(b)fluoranthene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39-EJ-1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Benzo(ghi)perylene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39-EJ-1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Benzo(k)fluoranthene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39-EJ-1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Chrysene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39-EJ-1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Dibenz(ah)anthracene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39-EJ-1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	Fluoranthene	NA	EPA, 1988	mouse	0.03	13 weeks	oral gavage	nephropathy	increased liver wt and pathology			125	250	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0444.htm) Dec 9, 2009	**125**	**250**
	Fluorene	NA	EPA, 1989c	mouse	0.03	13 weeks	oral gavage	hemotoxicity				125	250	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0435.htm) Dec 9, 2009	**125**	**250**
	Indeno[1,2,3-cd]pyrene	benzo(a)pyrene	Mackenzie and Angevine, 1981	mouse	0.03	gestation days 7-16	oral intubation	reproduction	reduced pregnancy rate and fertility	0.1	LOAEL-NOAEL	1	10	ES/ER/TM-86/R3; 39-EJ-1138-01P	study and value selected based on an extensive review of available literature - documented in USACHPPM	**1**	**10**
	2-Methylnaphthalene	NA	Murata et al., 1997	mouse	0.0425	81 wks	oral in diet	survival and pathology	pulmonary pathology			50.3	113.8			**50.3**	**113.8**
	Naphthalene	NA	NTP, 1992	rat	0.24	days 6-15 of gestation	oral gavage	reproduction	maternal weight loss			50	150			**50**	**150**
	Phenanthrene	anthracene	EPA, 1989b	rat	0.03	90 days	oral gavage	survival and pathology	reduced body weight			1000	---	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0434.htm) Dec 9, 2009	**1000**	**---**
	Pyrene	NA	EPA, 1989d	mouse	0.03	13 weeks	oral gavage	nephropathy				75	125	IRIS	Verified on IRIS (http://www.epa.gov/ncea/iris/subst/0445.htm) Dec 9, 2009	**75**	**125**
	Low MW PAHs	1-naphthaleneacetic acid	*Verschuuren et al., 1976b	rat	0.247	6 weeks	oral in diet	growth	reduced body weight			65.6	328	OSWER Directive 9285.7-78	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**65.6**	**328**

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Table H-2. Mammalian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Mammalian NOAEL TRV (mg/kg/d)	Selected Mammalian LOAEL TRV (mg/kg/d)
	High MW PAHs	benzo(a)pyrene	*Culp et al., 1998	mouse	0.038	55 weeks	oral in diet	survival	reduced survival			0.615	3.07	OSWER Directive 9285.7-78	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.615**	**3.07**
Petroleum	Gasoline Range Organics	JP-8 jet fuel	Cooper and Mattie, 1996	rat	0.35	gestation days 6-15	oral gavage	reproduction	adult and fetal weight; fetal mortality			1000	1500			**1000**	**1500**
	TPH - Diesel	JP-8 jet fuel	Cooper and Mattie, 1996	rat	0.35	gestation days 6-15	oral gavage	reproduction	adult and fetal weight; fetal mortality			1000	1500			**1000**	**1500**
	TPH - Kerosene	JP-8 jet fuel	Cooper and Mattie, 1996	rat	0.35	gestation days 6-15	oral gavage	reproduction	adult and fetal weight; fetal mortality			1000	1500			**1000**	**1500**
Semivolatile Organics	Normal paraffin hydrocarbons	JP-8 jet fuel	Cooper and Mattie, 1996	rat	0.35	gestation days 6-15	oral gavage	reproduction	adult and fetal weight; fetal mortality			1000	1500			**1000**	**1500**
	Phenol	NA	EPAOTS0573686	rat		gestation days 6-15	oral gavage	reproduction	reduced fetal weight	0.1	for interspecies uncertainty	12	36	87-MA02T6-05E	study and value selected based on an extensive review of available literature - documented in USACHPPM	**12**	**36**
	2-methylphenol (ocresol)	NA	Hornshaw et al., 1986	mink	0.958	6 month	oral in diet	reproduction				313	---	ES/ER/TM-86/R3	calculations have been updated to use body weight and ingestion data from primary source	**313**	**---**
	4-methylphenol (pcresol)	2-methylphenol (ocresol)	Hornshaw et al., 1986	mink	0.958	6 month	oral in diet	reproduction				313	---	ES/ER/TM-86/R3	calculations have been updated to use body weight and ingestion data from primary source	**313**	**---**
	2,4-dinitrotoluene	NA	Ellis et al., 1979	dog		24 months	oral in capsules	hemotoxicity and mortality	hemotoxicity and mortality			0.67	1.4	39-EJ-1138-01D	NOAEL and LOAEL are LED10 and ED10 values, respectively calcualted using EPA benchmark dose software. Study for benchmark calculation selected based on an extensive review of available literature - documented in USACHPPM	**0.67**	**1.4**
	Bis[2-ethylhexyl] phthalate	NA	Lamb et al., 1987	mouse	0.03	105 days (during reproduction)	oral in diet	reproduction				18.3	183	ES/ER/TM-86/R3		**18.3**	**183**
	Total PCBs	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**
	Aroclor 1016	aroclor 1016	EPA-600/3-80-033	mink	1	18 months	oral in diet	reproduction	reduced kit growth			1.37	3.43	ES/ER/TM-86/R3		**1.37**	**3.43**
	Aroclor 1221	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**
	Aroclor 1232	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**
	Aroclor 1242	aroclor 1242	Bleavins et al., 1980	mink	1	7 months	oral in diet	reproduction	total reproductive failure	0.1	LOAEL-NOAEL	0.069	0.69	ES/ER/TM-86/R3		**0.069**	**0.69**
	Aroclor 1248	aroclor 1248	Barsotti et al., 1976	Rhesus monkey	5	14 months	oral in diet	reproduction	reduced pregnancy and live birth rates	0.1	LOAEL-NOAEL	0.0087	0.087	ES/ER/TM-86/R3	recalculated: study reports PCB consumption of 0.43 mg PCB/day	**0.0087**	**0.087**
	Aroclor 1254	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**

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Table H-2. Mammalian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Mammalian NOAEL TRV (mg/kg/d)	Selected Mammalian LOAEL TRV (mg/kg/d)
	Aroclor 1260	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**
	Aroclor 1262	aroclor 1254	McCoy et al., 1995	Oldfield mouse	0.014	12 months	oral in diet	reproduction	reduced number of litters, pup body weight, and pup survival	0.1	LOAEL-NOAEL	0.068	0.68	ES/ER/TM-86/R3		**0.068**	**0.68**
Herbicide	Dichloroprop															**---**	**---**
Pesticide	Aldrin	NA	Treon and Cleveland, 1955	rat	0.35	3 generations	oral in diet	reproduction	number of litters and offspring mortality		---	0.2	1	ES/ER/TM-86/R3		**0.2**	**1**
	beta-1,2,3,4,5,6-Hexachlorocyclohexane	NA	Van Velsen et al., 1986	rat	0.35	13 weeks	oral in diet	growth, blood chemistry, organ histology	gonadal atrophy in male and female rats	0.1	chronic-subchronic	0.4	2	ES/ER/TM-86/R3		**0.4**	**2**
	alpha-Chlordane	chlordane	Narotsky and Kavlock, 1995	rat		GD-6-19	oral gavage	reproduction	post natal pup viability	0.1	LOAEL-NOAEL	2.1	21	87-MA02T6-05A	study and value selected based on an extensive review of available literature - documented in USACHPPM	**2.1**	**21**
	gamma-Chlordane	chlordane	Narotsky and Kavlock, 1995	rat		GD-6-19	oral gavage	reproduction	post natal pup viability	0.1	LOAEL-NOAEL	2.1	21	87-MA02T6-05A	study and value selected based on an extensive review of available literature - documented in USACHPPM	**2.1**	**21**
	Dichlorodiphenyldichloroethylene (DDE)	DDT	Wrenn et al., 1970	rat		15 days (during gestation)	oral gavage	reproduction				0.147	0.735	OSWER Directive 9285.7-55	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.147**	**0.735**
	Dichlorodiphenyltrichloroethane (DDT)	NA	Wrenn et al., 1970	rat		15 days (during gestation)	oral gavage	reproduction				0.147	0.735	OSWER Directive 9285.7-55	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.147**	**0.735**
	Dieldrin	NA	Harr et al., 1970	rat		750 days	oral in diet	reproduction			---	0.015	0.03	OSWER Directive 9285.7-56	value is highest bounded NOAEL lower than the lowest bounded LOAEL value for reproduction, growth or survival; LOAEL is from same study	**0.015**	**0.03**
	Endosulfan I	endosulfan	Dikshith et al., 1984	rat	0.35	30 days (not during reproduction)	oral intubation	reproduction and blood chemistry		0.1	chronic-subchronic	0.15	---	ES/ER/TM-86/R3	no effects observed at highest dose	**0.15**	**---**
	Endosulfan II	endosulfan	Dikshith et al., 1984	rat	0.35	30 days (not during reproduction)	oral intubation	reproduction and blood chemistry		0.1	chronic-subchronic	0.15	---	ES/ER/TM-86/R3	no effects observed at highest dose	**0.15**	**---**
	Endosulfan sulfate	endosulfan	Dikshith et al., 1984	rat	0.35	30 days (not during reproduction)	oral intubation	reproduction and blood chemistry		0.1	chronic-subchronic	0.15	---	ES/ER/TM-86/R3	no effects observed at highest dose	**0.15**	**---**
	Endrin aldehyde	endrin	Good and Ware, 1969	mouse	0.03	120 d (during reproduction)	oral in diet	reproduction	reduced parental survival, litter size, and number of young per day	0.1	LOAEL-NOAEL	0.092	0.92	ES/ER/TM-86/R3		**0.092**	**0.92**
	Methoxychlor	NA	Gray et al., 1988	rat	0.35	11 month (during reproduction)	oral in diet	reproduction	fertility and litter size reduced		---	4	8	ES/ER/TM-86/R3		**4**	**8**

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Table H-2. Mammalian Toxicity Reference Values for SSL Calculation

Group	Soil Constituent	Form/Surrogate Analyte	Primary Study	Test Species	Test Species Body Weight (kg)	Duration	Exposure Route	General Effect Endpoint	Specific Effect Endpoint	Uncertainty Factors Applied	Uncertainty Factor type	NOAEL (mg/kg/d)	LOAEL (mg/kg/d)	Secondary Source	Notes	Selected Mammalian NOAEL TRV (mg/kg/d)	Selected Mammalian LOAEL TRV (mg/kg/d)

Notes:

table are provided in the references section of this appendix.

Uncertainty factors were used to adjust all measured effect concentrations to chronic NOAELS and chronic LOAELs as follows:

LOAEL to NOAEL = 0.1

Subchronic to chronic = 0.1

where:

chronic = >12 weeks or during critical lifestage

subchronic = 4 to 12 weeks

These uncertainty factors are consistent with methods used in development of the EcoSSLs (OSWER Directive 9285.7-55) and are more conservative than uncertainty factors recommended in EPA 540-R-97-006, *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments: Interim Final* .

*Study information and calculated NOAELs and LOAELs for these sources were taken directly from the cited EcoSSL report developed by the EPA. All other primary sources were obtained, reviewed, and TRVs were extracted or developed from the study.

Bold = values selected as the mammalian TRVs

Acronyms:

BMD10 = Benchmark dose resulting in observed effects for 10 percent of test species

EcoSSl = ecological soil screening level

EPA = United States Environmental Protection Agency

IRIS = Integrated Risk Information System

LOAEL = lowest observable adverse effect level

NOAEL = no observable adverse effect level

mg/kg/d = milligram per kilogram per day

TRV = toxicity reference value

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Table H-3. Exposure Factors for Bird and Mammal Endpoint Species

Assessment Endpoint Functional Group	Endpoint Species	Body Weight (kg)	Notes	Source	Food Intake (kg/kg-bw/d, dw)	Notes	Source	Diet Composition						Soil Ingestion Site (kg/kg-(bw/d)[b]	Notes	Source
								% of Diet as Mammals/ Birds	% Diet as Invertebrates	% of Diet as Plants	Major Food Items	Source	% of Diet as Soil			
Granivorous bird	California Quail	**0.18**	Median from multiple studies	Robel, 1969 Roseberry and Klimstra, 1971 Guthery et al., 1988	**0.078**	Average of food ingestion rates over 4 seasons from exposure factors handbook for bobwhite (EPA/600/R-93/187). Rate based on diet of commercial game food with only 5 to 10 percent water content; therefore, assumed dry weight.	Koerth and Guthery, 1990	0	0	**100**	Primarily a granivore, but also ingests some animal matter (primarily snails) and green forage. It is assumed this species ingests 100 percent plants (seeds) for screening-level dose calculation purpose.		**6.1**	**0.00476**	Value for mourning dove assumed representative of California Quali. Median soil ingestion rate estimated for mourning dove in Table 3 of the EcoSSL guidance. The median was selected as the best measure of central tendency that is unbiased by outliners.	OSWER Directive 9285.7-55
Omnivorous bird	Meadowlark	**0.0995**	Median from multiple studies	Wiens and Rotenberry, 1980 Maher, 1979	**0.12**	Allometric estimation for 'omnivorous birds' normalized to kg/kg-bw/d using median body weights from multiple studies	Nagy, 2001[a]	0	**63**	**37**	Ground forager that consumes both plant material (primarily seeds) and invertebrates (primarily arthropods). Percentages represent averages for >1900 meadowlarks studied across North America.	Lanyon, 1994	**2.08**	**0.0025**	Data regarding soil ingestion of western meadowlarks are unavailable. For the purposes of this ERA, it was assumed that soil ingestion for meadowlarks is similar to that derived for the American robin.	ES/ER/TM-125
Insectivorous bird	Killdeer	**0.0756**	Median from multiple studies	Purdue and Haines, 1977 Stegeman, 1955 Jackson and Jackson, 2000 Dunning, 1993	**0.192**	Allometric estimation for 'Charadriiformes' normalized to kg/kg-bw/d using median body weights from multiple studies	Nagy, 2001[a]	0	**100**	0	Primarily consume terrestrial invertebrates, especially earthworms, grasshoppers, beetles, and snails. Forages in terrestrial and aquatic habitats.	Jackson and Jackson, 2000	**7.3**	**0.0140**	Data regarding soil ingestion of killdeer are unavailable. For the purposes of this ERA, it was assumed that soil ingestion for killdeer is similar to that of the least sandpiper. However, it should be noted that this value is likely somewhat higher than the actual soil ingestion for killdeer because killdeer do not probe in the soil/sediment. Jackson and Jackson (2000) reported grit to be 4.5% by volume of the esophageal contents in 15 killdeer, which suggests that a value of 7.3% may be a conservative estimate.	Beyer et al., 1994
Carnivorous bird	Red-tailed Hawk	**1.179**	Median from multiple studies	Craighead and Craighead,1956 Steenhof,1983 Springer and Osborne,1983	**0.035**	High end estimate (estimate* 1.25) presented in Table 1 of the EcoSSL guidance (OSWER Directive 9285.7-55). Based on empirical ingestion data from Craighead and Craighead (1956)	OSWER Directive 9285.7-55	**100**	0	0	Primarily eat small mammals such as mice, shrews, voles, rabbits, and squirrels, but also eat birds, lizards, snakes, and large insects, depending on availability. Assumed 100 percent small mammal diet for screening-level dose calculation purposes.	EPA/600/R-93/187	**2.4**	**0.00085**	Median soil ingestion rate estimated for red-tailed hawk in Table 3 of the EcoSSL guidance. The median was selected as the best measure of central tendency that is unbiased by outliners.	OSWER Directive 9285.7-55

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Table H-3. Exposure Factors for Bird and Mammal Endpoint Species

Assessment Endpoint Functional Group	Endpoint Species	Body Weight (kg)	Notes	Source	Food Intake (kg/kg-bw/d, dw)	Notes	Source	Diet Composition						Soil Ingestion Site (kg/kg-(bw/d)[b]	Notes	Source
								% of Diet as Mammals/ Birds	% Diet as Invertebrates	% of Diet as Plants	Major Food Items	Source	% of Diet as Soil			
Granivorous mammal	Great Basin pocket mouse	**0.0175**	Median from multiple studies	Scheffer,1938 O'Farrell et al.,1975 Schreiber,1978	**0.123**	Allometric estimation for 'granivorous mammals' normalized to kg/kg-bw/d using mean weight as reported by Scheffer, 1938, O'Farrell et al., 1975, and Schreiber, 1978	Nagy, 2001[a]	0	0	**100**	Diet consists primarily of seeds; however, insects (e.g., insect larvae reported in pocket mice from eastern Washington; Kritzman, 1974) may be consumed in the spring before seeds become available. Diet assumed to be 100 percent plants (seeds) for screening-level dose calculation purpose.	Kritzman,1974	**2**	**0.00246**	Data regarding soil ingestion of granivorous mammals are unavailable. For the purposes of this ERA, it was assumed that soil ingestion for pocket mice is similar to that of the white-footed mouse.	Beyer et al., 1994
Omnivorous mammal	Deer Mouse	**0.0194**	Median from multiple studies	O'Farrell et al., 1975 Silva and Downing, 1995	**0.166**	Allometric estimation for 'omnivorous mammals' normalized to kg/kg-bw/d using median body weights from multiple studies	Nagy, 2001[a]	0	**50**	**50**	Diet consists of plant material (primarily seeds) and terrestrial invertebrates (mainly insects). Approximation for diet of deer mice in Colorado over all seasons was 50 percent plants and 50 percent invertebrates.	EPA/600/R-93/187	**2**	**0.0033**	Assumed to be similar to the white-footed mouse because of similar dietary and foraging habits.	Beyer et al., 1994
Insectivorous mammal	Grasshopper mouse	**0.0346**	Median from multiple studies	Wied, Maximilian and Prinz zu, 1839 McKinney and Pasley, 1974 BHI-01757	**0.098**	Allometric estimation for 'insectivorous mammals' normalized to kg/kg-bw/d using median body weights from multiple studies	Nagy, 2001[a]	0	**100**	0	Animal material contributed 89 percent of the total food consumed and cultivated grains represented less than 5 percent of the total in the stomach contents of field-trapped grasshopper mice from 90 locations across 13 states. Diet assumed to be 100 percent invertebrates for screening-level dose calculation purposes.	Bailey and Sperry, 1929	**0.9**	**0.00088**	Assumed to be similar to the short-tailed shrew because of similar dietary and foraging habits. Median soil ingestion rate estimated for short-tailed shrew in Table 3 of the EcoSSL guidance. The median was selected as the best measure of central tendency that is unbiased by outliners.	OSWER Directive 9285.7-55
Carnivorous mammal	Badger	**7.6**	Median from multiple studies	Messick and Hornocker, 1981 Silva and Downing, 1995	**0.0347**	Allometric estimation for carnivorous mammals' normalized to kg/kg-bw/d using median body weights from multiple studies	Nagy, 2001[a]	**100**	0	0	Carnivores that primarily eat small rodents (rats, mice, ground squirrels, pocket gophers), thought some reptiles, insects, birds, and carrion are consumed. Assumed 100 percent small mammal diet for screening-level dose calculation purposes.	Long, 1973	**5.2**	**0.00181**	Data regarding soil ingestion of badgers are unavailable. Because the badger is a burrowing mammal, soil ingestion may be similar to that of the prairie dog. It was assumed that the median soil ingestion of the two prairie dog species with available data (2.7 and 7.7 percent) would be representative of the badger.	Beyer et al., 1994

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Table H-3. Exposure Factors for Bird and Mammal Endpoint Species

Assessment Endpoint Functional Group	Endpoint Species	Body Weight (kg)	Notes	Source	Food Intake (kg/kg-bw/d, dw)	Notes	Source	Diet Composition						Soil Ingestion Site (kg/kg-(bw/d)[b]	Notes	Source
								% of Diet as Mammals/ Birds	% Diet as Invertebrates	% of Diet as Plants	Major Food Items	Source	% of Diet as Soil			

Notes:

Complete citations for all references in this table are provided in the references section of this appendix.

Bold and underlined text indicates life-history parameters that were used in the initial screening exposure calculations.

a. Nagy (2001) regression equation format --> dry matter g/day/g body weight = *a* (grams body weight)^{b} /g body weight

b. Soil ingestion is equal to the percent soil in diet multiplied by the food ingestion rate as follows: soil ingestion = (percent soil/100* food ingestion rate)

BW = body weight

DW = dry weight

EPA = United States Environmental Protection Agency

Group	*a*	*b*
Birds		
omnivorous birds	0.670	0.627
Galliformes	0.088	0.891
Charadriiformes	0.522	0.769
Mammals		
carnivorous mammals	0.153	0.834
granivorous mammals	0.659	0.413
insectivorous mammals	0.373	0.622

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Table H-4. Biotransfer Factors and Regression Models Used for SSL Calculations

Group	Analyte	Regression Models[a]				Bioaccumulation Factors		
		B0	B1	Source	Notes[b]	BAF	Source	Notes[b]
Soil to Plants								
Radionuclides	Americium-241					**0.00496**	Beresford et al., 2008	CR review
	Antimony-125					**0.025**	Beresford et al., 2008	From Coughtrey et al., 1983 (A.A. Balkema Vol. 3) suggested value for natural vegetation; Note one CR review value of CR=41
	Carbon-14					**890**	Beresford et al., 2008	Specific activity model; FASSET
	Cesium-134					**0.69342557**	Beresford et al., 2008	CR review
	Cesium 137					**0.69342557**	Beresford et al., 2008	CR review
	Cobalt-60					**0.0135**	Beresford et al., 2008	IAEA TRS364 value for grass
	Curium-244					**0.000275**	Beresford et al., 2008	IAEA TRS364 value for grass
	Europium-152					**0.00519802**	Beresford et al., 2008	Estimated from stable concentrations. in soils & angiosperms values presented Coughtrey and Thorne, 1983 (A.A. Balkema Vol. 1)
	Europium-154					**0.00519802**	Beresford et al., 2008	Estimated from stable concentrations. in soils & angiosperms values presented Coughtrey and Thorne, 1983 (A.A. Balkema Vol. 1)
	Europium-155					**0.00519802**	Beresford et al., 2008	Estimated from stable concentrations. in soils & angiosperms values presented Coughtrey and Thorne, 1983 (A.A. Balkema Vol. 1)
	Hydrogen-3 (tritium)					**150**	Beresford et al., 2008	Specific activity model; FASSET
	Neptunium-237					**0.01725**	Beresford et al., 2008	IAEA TRS363 value for grass
	Nickel-63					**0.1875**	Beresford et al., 2008	CR review
	Plutonium-238					**0.01442538**	Beresford et al., 2008	CR review; note some reviews report values in range 10-2 - 10-8 but present data in manner which cannot be used. Primary source here is Sheppard review of IUR data
	Plutonium-239/240					**0.01442538**	Beresford et al., 2008	CR review; note some reviews report values in range 10-2 - 10-8 but present data in manner which cannot be used. Primary source here is Sheppard review of IUR data
	Radium-226					**0.03944052**	Beresford et al., 2008	CR review
	Radium-228					**0.03944052**	Beresford et al., 2008	CR review
	Strontium 90					**0.20681182**	Beresford et al., 2008	CR review
	Technetium-99					**20.0082961**	Beresford et al., 2008	CR review
	Thorium-232					**0.04374098**	Beresford et al., 2008	CR review
	Uranium-234					**0.0145507**	Beresford et al., 2008	CR review
	Uranium-235					**0.0145507**	Beresford et al., 2008	CR review
	Uranium-238					**0.0145507**	Beresford et al., 2008	CR review
Metals	Aluminum					**0.00287**	BJC/OR-133	Median - Table D-1 validation data
	Antimony	**-3.233**	**0.938**	OSWER Directive 9285.7-55	Derived from measured data in Appendix A	0.0102	BJC/OR-133	Median - Table D-1 validation data
	Arsenic, Total all valence states	**-1.992**	**0.564**	BJC/OR-133	Single variable regression; EcoSSLs used BAF	0.0375	BJC/OR-133	Median - Table 6; cited in OSWER Directive 9285.7-55
	Arsenic (III)	**-1.992**	**0.564**	BJC/OR-133	Single variable regression; EcoSSLs used BAF	0.0375	BJC/OR-133	Median - Table 6; cited in OSWER Directive 9285.7-55
	Arsenic (V)	**-1.992**	**0.564**	BJC/OR-133	Single variable regression; EcoSSLs used BAF	0.0375	BJC/OR-133	Median - Table 6; cited in OSWER Directive 9285.7-55
	Barium					**0.156**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7-55
	Beryllium	**-0.536**	**0.7345**	OSWER Directive 9285.7-55	Derived from measured data in Appendix A			
	Bismuth					**0.005**	ORNL-5786	Figure 2.2
	Boron					**5.714**	USACHPPM, 2004	Median - Table 4-6 leaf tissue
	Cadmium	**-0.476**	**0.546**	BJC/OR-133	Cited in OSWER Directive 9285.7-55 (Table 4a)	0.586	BJC/OR-133	Median - Table 6
	Chromium (total)					**0.041**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7-55
	Chromium (+3)					**0.041**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7-55
	Chromium (+6)					**0.041**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7-55
	Cobalt					**0.00745**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7-55
	Copper	**0.669**	**0.394**	BJC/OR-133	Cited in OSWER Directive 9285.7-55 (Table 4a)	0.124	BJC/OR-133	Median - Table 6
	Lead	**-1.328**	**0.561**		Cited in OSWER Directive 9285.7-55 (Table 4a)	0.0389	BJC/OR-133	Median - Table 6
	Lithium					**0.004**	ORNL-5786	Figure 2.2
	Manganese					**0.0792**	BJC/OR-133	Median - Table D-1 validation data; cited in OSWER Directive 9285.7-55
	Mercury	**-0.996**	**0.544**	BJC/OR-133	Single variable regression	0.0652	BJC/OR-133	Median - Table 6
	Molybdenum					**1.2504**	USACHPPM, 2004	Median - Table 4-6 leaf tissue
	Nickel	**-2.224**	**0.748**	BJC/OR-133	Cited in OSWER Directive 9285.7-55 (Table 4a)	0.018	USACHPPM, 2004	Median - Table 6
	Selenium	**-0.678**	**1.104**	BJC/OR-133	Cited in OSWER Directive 9285.7-55 (Table 4a)	0.672	USACHPPM, 2004	Median - Table 6
	Silver					**0.014**	BJC/OR-133	Median - Table D-1 validation data
	Strontium					**0.207**	Beresford et al., 2008	CR review
	Thallium					**0.004**	ORNL-5786	Figure 2.2
	Tin					**1**	Default	
	Uranium					**0.021**	USACHPPM, 2004	Median - Table 4-6 leaf tissue
	Vanadium					**0.00485**	BJC/OR-133	Median - Table D-1 validation data
	Zinc	**1.575**	**0.555**	BJC/OR-133	Cited in OSWER Directive 9285.7-55 (Table 4a)	0.366	BJC/OR-133	Median - Table 6

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Table H-4. Biotransfer Factors and Regression Models Used for SSL Calculations

Group	Analyte	Regression Models[a]				Bioaccumulation Factors		
		B0	B1	Source	Notes[b]	BAF	Source	Notes[b]
General Inorganics	Ammonia/Ammonium							
	Chloride							
	Cyanide							
	Fluoride					**0.006**	ORNL-5786	Figure 2.2
	Iodine					**0.05**	ORNL-5786	Figure 2.2
	Nitrate/Nitrite							
	Phosphate							
	Sulfate/Sulfite							
	Total Organic Carbon							
Volatile Organics	1,1-dichloroethane						OSWER Directive 9285.7-55	Kow (1.79) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	1,1-dichloroethene						OSWER Directive 9285.7-55	Kow (2.13) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	1,1,1-trichloroethane						OSWER Directive 9285.7-55	Kow (2.48) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	1,1,2-trichloroethane						OSWER Directive 9285.7-55	Kow (2.05) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	1,1,2,2-tetrachloroethane						OSWER Directive 9285.7-55	Kow (2.39) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	1,2-dichlorobenzene					**2.45**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.43 (EPA, 1995)
	1,2-dichloroethane (DCA)						OSWER Directive 9285.7-55	Kow (1.47) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	1,3-dichlorobenzene					**2.23**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.53 (EPI, 2011)c
	2-butanone (Methyl Ethyl Ketone/MEK)						OSWER Directive 9285.7-55	Kow (0.29) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	2-hexanone						OSWER Directive 9285.7-55	Kow (1.38) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Benzene						OSWER Directive 9285.7-55	Kow (2.13) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Butanol						OSWER Directive 9285.7-55	Kow (0.8) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Carbon Tetrachloride						OSWER Directive 9285.7-55	Kow (2.73) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Chlorobenzene						OSWER Directive 9285.7-55	Kow (2.86) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Chloroform						OSWER Directive 9285.7-55	Kow (1.92) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Cis-1,2-dichloroethylene						OSWER Directive 9285.7-55	Kow (1.86) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Dichloromethane (Methylene Chloride)						OSWER Directive 9285.7-55	Kow (1.25) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Ethyl Benzene					**3.21**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.14 (EPA, 1995)
	Methyl Isobutyl Ketone						OSWER Directive 9285.7-55	Kow (1.19) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	n-butyl Benzene					**1.67**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.84 (EPI, 2011)c
	Tetrachloroethylene						OSWER Directive 9285.7-55	Kow (2.67) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Toluene						OSWER Directive 9285.7-55	Kow (2.75) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Trans-1,2-dichloroethylene						OSWER Directive 9285.7-55	Kow (2.07) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Trichloroethylene (TCE)						OSWER Directive 9285.7-55	Kow (2.71) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	Xylene					**3.43**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.07 (EPA, 1995)
Polycyclic Aromatic Hydrocarbons	Acenaphthene	**-5.562**	**-0.856**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
	Acenaphthylene	**-1.144**	**0.791**	OSWER Directive 9285.7-55	Modeled using the rinsed PAH-specific equation			
	Anthracene	**-0.989**	**0.7784**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
	Benzo(a)pyrene	**-2.062**	**0.975**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			

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Table H-4. Biotransfer Factors and Regression Models Used for SSL Calculations

Group	Analyte	Regression Models[a]				Bioaccumulation Factors		
		B0	B1	Source	Notes[b]	BAF	Source	Notes[b]
	Benzo(a)anthracene	**-2.708**	**0.5944**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
	Benzo(b)fluoranthene					**0.31**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
	Benzo(ghi)perylene	**-0.931**	**1.1829**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
	Benzo[k]fluoranthene	**-4.648**	**0.1668**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
	Chrysene	**-2.708**	**0.5944**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
	Dibenz(ah)anthracene					**0.13**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
	Fluoranthene					**0.5**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
	Fluorene	**-5.562**	**-0.856**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
	Indeno[1,2,3-cd]pyrene					**0.11**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
	2-Methylnaphthalene	**-1.321**	**4.544**	OSWER Directive 9285.7-55	Based on LMW PAH rinsed model in Figure 4			
	Naphthalene					**12.2**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
	Phenanthrene	**-0.167**	**0.6203**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
	Pyrene					**0.72**	OSWER Directive 9285.7-55	Median BAF calculated from measured data in Appendix C
	Total PAHs	**0.083**	**0.3015**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
	Low MW PAHs	**-1.321**	**0.4544**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
	High MW PAHs	**-1.703**	**0.9469**	OSWER Directive 9285.7-55	Derived from measured data in Appendix C or Figure 4			
	TPH - Diesel							
	TPH - Kerosene							
	Normal paraffin hydrocarbons							
	Phenol						OSWER Directive 9285.7-55	Kow (1.48) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
Semivolatile Organics	2-methylphenol (ocresol)						OSWER Directive 9285.7-55	Kow (1.99) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	4-methylphenol (pcresol)						OSWER Directive 9285.7-55	Kow (1.95) outside of range of Kow-based models for plants (OSWER Directive 9285.7-55); BAF is undefined.
	2,4-dinitrotoluene	1.873	-0.377	Tsao and Sample, 2005		**0.376**	Tsao and Sample, 2005	Median BAF for foliage, all plants, from Table 3.3-1
	Bis[2-ethylhexyl] phthalate					**0.07**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 7.30 (EPA, 1995)[c]
	Total PCBs					**0.17**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.29 (EPI, 2011)[c]
	Aroclor 1016					**0.30**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 5.69 (ChemIDPlus Lite[c]
	Aroclor 1221					**0.78**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4.65 (ChemIDPlus Lite[c]
	Aroclor 1232					**0.99**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4.4 (ChemIDPlus Lite[c]
	Aroclor 1242					**0.16**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.34 (ChemIDPlus Lite[c]
	Aroclor 1248					**0.18**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.2 (ChemIDPlus Lite[c]
	Aroclor 1254					**0.14**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.5 (ChemIDPlus Lite[c]
	Aroclor 1260					**0.05**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 7.55 (ChemIDPlus Lite[c]
	Aroclor-1262							
Pesticides	Dichloroprop							
	Aldrin					**0.14**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.50 (EPA, 1995)[c]
	beta-1,2,3,4,5,6-Hexachlorocyclohexane					**1.72**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 3.81 (EPA, 1995)[c]
	alpha-Chlordane					**0.16**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.32 (EPA, 1995)[c]
	gamma-Chlordane					**0.16**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 6.32 (EPA, 1995)[c]
	Dichlorodiphenyldichloroethylene	**-2.512**	**0.7524**	OSWER Directive 9285.7-55	Regression model for total DDTs from Table 4b			
	Dichlorodiphenyltrichloroethane	**-2.512**	**0.7524**	OSWER Directive 9285.7-55	Regression model for total DDTs from Table 4b			
	Dieldrin					**0.41**	OSWER Directive 9285.7-55	Empirical BAF from Table 4b

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Table H-4. Biotransfer Factors and Regression Models Used for SSL Calculations

Group	Analyte	Regression Models[a]				Bioaccumulation Factors		
		B0	B1	Source	Notes[b]	BAF	Source	Notes[b]
	Endosulfan I					**1.31**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4.10 (EPA, 1995)[c]
	Endosulfan II					**1.31**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4.10 (EPA, 1995)[c]
	Endosulfan sulfate					**1.98**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4.10 (EPI, 2011)c
	Endrin aldehyde					**1.44**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 4 (EPA, 1995)[c]
	Methoxychlor					**0.52**	OSWER Directive 9285.7-55	Log Kow model for nonionic organics (rinsed plants); log Kow = 5.08 (EPA, 1995)[c]
Soil to Terrestrial Invertebrates								
Radionuclides	Americium-241					**0.1006**	Beresford et al., 2008	CR review
	Antimony-125					**0.2525**	Beresford et al., 2008b	Same as gastropod (most conservative invertebrate CR)
	Carbon-14					**430**	Beresford et al., 2008	Assume same as worm
	Cesium-134					**0.1341**	Beresford et al., 2008	CR review
	Cesium 137					**0.1341**	Beresford et al., 2008	CR review
	Cobalt-60					**0.0035**	Beresford et al., 2008	CR review
	Curium-244					**0.1374**	Beresford et al., 2008	CR review
	Europium-152					**0.0008**	Beresford et al., 2008	Same as soil invertebrate
	Europium-154					**0.0008**	Beresford et al., 2008	Same as soil invertebrate
	Europium-155					**0.0008**	Beresford et al., 2008	Same as soil invertebrate
	Hydrogen-3 (tritium)					**150**	Beresford et al., 2008	Assume same as worm
	Neptunium-237					**0.1006**	Beresford et al., 2008	Same as Am gastropod
	Nickel-63					**0.0086**	Beresford et al., 2008	CR review
	Plutonium-238					**0.0388**	Beresford et al., 2008	CR review
	Plutonium-239/240					**0.0388**	Beresford et al., 2008	CR review
	Radium-226					**0.0900**	Beresford et al., 2008	CR review
	Radium-228					**0.0900**	Beresford et al., 2008	CR review
	Strontium 90					**0.4066**	Beresford et al., 2008	CR review
	Technetium-99					**0.3700**	Beresford et al., 2008	Assume maximum available value in lack of data
	Thorium-232					**0.0088**	Beresford et al., 2008	Assume U Soil invertebrate
	Uranium-234					**0.0088**	Beresford et al., 2008	Same as soil invertebrate
	Uranium-235					**0.0088**	Beresford et al., 2008	Same as soil invertebrate
	Uranium-238					**0.0088**	Beresford et al., 2008	Same as soil invertebrate

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Table H-4. Biotransfer Factors and Regression Models Used for SSL Calculations

Group	Analyte	Regression Models[a]				Bioaccumulation Factors		
		B0	B1	Source	Notes[b]	BAF	Source	Notes[b]
Metals	Aluminum					**0.043**	ES/ER/TM-220	Median - Table C.1
	Antimony					**1**	ORNL-5786 cited in OSWER Directive 9285.7-55	Assumed earthworm concentration = soil concentration according to (Table 4a)
	Arsenic	**-1.421**	**0.706**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)	0.224	ES/ER/TM-220	Median - Table 11
	Arsenic (III)	**-1.421**	**0.706**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)	0.224	ES/ER/TM-220	Median - Table 11
	Arsenic (V)	**-1.421**	**0.706**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)	0.224	ES/ER/TM-220	Median - Table 11
	Barium					**0.091**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7-55
	Beryllium					**0.045**	ES/ER/TM-220	Median - Table C.1; cited in OSWER Directive 9285.7-55
	Bismuth					**1**	Default	
	Boron					**1**	Default	
	Cadmium	**2.114**	**0.795**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)	7.708	ES/ER/TM-220	Median - Table 11
	Chromium					**0.306**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7-55
	Chromium (+3)					**0.306**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7-55
	Chromium (+6)					**0.306**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7-55
	Cobalt					**0.291**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7-55
	Copper	1.675	0.264	ES/ER/TM-220	General regression - low r^2	**0.515**	ES/ER/TM-220	Median - Table 11; cited in OSWER Directive 9285.7-55
	Lead	**-0.218**	**0.807**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)	0.266	ES/ER/TM-220	Median - Table 11
	Lithium					**0.046**	ES/ER/TM-220	Median - Table C.1
	Manganese	**-0.809**	**0.682**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)	0.054	ES/ER/TM-220	Median - Table 11
	Mercury	**0.0781**	**0.3369**	ES/ER/TM-220	General regression, not including validation data	1.693	ES/ER/TM-220	Median - Table 11
	Molybdenum					**0.953**	ES/ER/TM-220	Median - Table C.1
	Nickel	3.677	-0.26	ES/ER/TM-220	regression not significant	**1.059**	ES/ER/TM-220	Median - Table 11
	Selenium	**-0.075**	**0.733**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)	0.985	ES/ER/TM-220	Median - Table 11
	Silver					**2.045**	ES/ER/TM-220	Median - Table C.1; cited in OSWER Directive 9285.7-55
	Strontium					**0.4066**	Beresford et al., 2008	CR review
	Thallium					**0.0541**	USACHPPM, 2004	Median - Table 4-5 (Insecta)
	Tin					**0.08**	ORNL-5786	No data available for invertebrates; assumed to be similar to uptake to small mammals (from Figure 2.25)
	Uranium					**0.033**	ES/ER/TM-220	Median - Table C.1
	Vanadium					**0.042**	ES/ER/TM-220	Median - Table C.1; cited in OSWER Directive 9285.7-55
	Zinc	**4.449**	**0.328**	ES/ER/TM-220	Sample et al., 1999 cited in OSWER Directive 9285.7-55 (Table 4a)			
General Inorganics	Ammonia/Ammonium							
	Chloride							
	Cyanide							
	Fluoride							
	Iodine							
	Nitrate/Nitrite							
	Phosphate							
	Sulfate/Sulfite							
	Total Organic Carbon							

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Table H-4. Biotransfer Factors and Regression Models Used for SSL Calculations

Group	Analyte	Regression Models[a]				Bioaccumulation Factors		
		B0	B1	Source	Notes[b]	BAF	Source	Notes[b]
Volatile Organics	1,1-dichloroethane					1.010	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	1,1-dichloroethene					1.011	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	1,1,1-trichloroethane					1.013	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	1,1,2-trichloroethane					1.010	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	1,1,2,2-tetrachloroethane					1.013	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	1,2-dichlorobenzene					1.018	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	1,2-dichloroethane (DCA)					0.988	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	1,3-dichlorobenzene					1.018	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	2-butanone (Methyl Ethyl Ketone/MEK)					0.094	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	2-hexanone					0.207	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Benzene					1.011	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Butanol					0.478	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Carbon Tetrachloride					1.015	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Chlorobenzene					1.015	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Chloroform					1.011	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Cis-1,2-dichloroethylene					1.011	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Dichloromethane (Methylene Chloride)					1.007	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Ethyl Benzene					1.016	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Methyl Isobutyl Ketone					0.197	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	n-butyl Benzene					1.022	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Tetrachloroethylene					1.018	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Toluene					1.014	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Trans-1,2-dichloroethylene					1.011	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Trichloroethylene (TCE)					1.012	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Xylene					1.016	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
Polycyclic Aromatic Hydrocarbons	Acenaphthene					1.470	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Acenaphthylene					22.9	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Anthracene					2.42	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Benzo(a)pyrene					1.33	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Benzo(a)anthracene					1.59	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Benzo(b)fluoranthene					2.6	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Benzo(ghi)perylene					2.94	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Benzo[k]fluoranthene					2.6	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Chrysene					2.29	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Dibenz(ah)anthracene					2.31	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Fluoranthene					3.04	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Fluorene					9.57	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Indeno[1,2,3-cd]pyrene					2.86	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	2-Methylnaphthalene					1.020	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Naphthalene					4.4	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Phenanthrene					1.72	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Pyrene					1.75	OSWER Directive 9285.7-55	Modeled from Kow based on Jager (1998) [Table 5]
	Total PAHs							
	Low MW PAHs							
	High MW PAHs							
	TPH - Diesel							
	TPH - Kerosene							
	Normal paraffin hydrocarbons							
	Phenol					0.235	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f

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Table H-4. Biotransfer Factors and Regression Models Used for SSL Calculations

Group	Analyte	Regression Models[a]				Bioaccumulation Factors		
		B0	B1	Source	Notes[b]	BAF	Source	Notes[b]
Semivolatile Organics	2-methylphenol (ocresol)					**0.336**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	4-methylphenol (pcresol)					**0.333**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	2,4-dinitrotoluene					**0.184**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Bis[2-ethylhexyl] phthalate					**41.144**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Total PCBs	**1.41**	**1.36**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
	Aroclor 1016	**1.41**	**1.36**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
	Aroclor 1221	**1.41**	**1.36**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
	Aroclor 1232	**1.41**	**1.36**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
	Aroclor 1242	**1.41**	**1.36**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
	Aroclor 1248	**1.41**	**1.36**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
	Aroclor 1254	**1.41**	**1.36**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
	Aroclor 1260	**1.41**	**1.36**	Sample et al., 1999	Combined model and validation data sets, Table 3	**6.67**	Sample et al., 1999	Median, combined model and validation datasets, Table 2
	Aroclor-1262							
Pesticides	Dichloroprop							
	Aldrin					**1.033**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	beta-1,2,3,4,5,6-Hexachlorocyclohexane					**1.021**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	alpha-Chlordane					**1.031**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	gamma-Chlordane					**1.036**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Dichlorodiphenyldichloroethylene	**2.4771**	**0.8804**	OSWER Directive 9285.7-55	Regression derived from measured data			
	Dichlorodiphenyltrichloroethane	**2.1247**	**0.8689**	OSWER Directive 9285.7-55	Regression derived from measured data			
	Dieldrin					**14.70**	OSWER Directive 9285.7-55	Median BAF
	Endosulfan I					**1.184**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Endosulfan II					**1.184**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Endosulfan sulfate					**1.184**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Endrin aldehyde					**6.686**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
	Methoxychlor					**3.739**	OSWER Directive 9285.7-55	Calculated using model from OSWER Directive 9285.7-55 and log Koc and Kow from EPI, 201f
Soil to Small Mammal								
Radionuclides	Americium-241					**0.041**	Beresford et al., 2008	CR review
	Antimony-125					**2.1465E-06**	Beresford et al., 2008	Constant dietary CR [assume shrub diet] Beresford et al., 2004
	Carbon-14					**1340**	Beresford et al., 2008	Specific activity model; FASSET
	Cesium-134					**2.87**	Beresford et al., 2008	CR review - reindeer data not included
	Cesium 137					**2.87**	Beresford et al., 2008	CR review - reindeer data not included
	Cobalt-60					**0.30**	Beresford et al., 2008	CR review
	Curium-244					**0.041**	Beresford et al., 2008	Assume Am mammal
	Europium-152					**0.002**	Beresford et al., 2008	Allometric prediction using DOE (EPIC vole parameters, grass CR of 1E-2)
	Europium-154					**0.002**	Beresford et al., 2008	Allometric prediction using DOE (EPIC vole parameters, grass CR of 1E-2)
	Europium-155					**0.002**	Beresford et al., 2008	Allometric prediction using DOE (EPIC vole parameters, grass CR of 1E-2)
	Hydrogen-3 (tritium)					**150**	Beresford et al., 2008	Specific activity model; FASSET
	Neptunium-237					**0.041**	Beresford et al., 2008	Same as Am mammal
	Nickel-63					**0.072**	Beresford et al., 2008	CR review but based on stable Ni concentrations in mammalian tissues and 'general' soil concentrations FWCR = 3.87e-3 (Coughtrey and Thorne, 1983, A.A. Balkema, Vol. 2). Note 1 study gives high conc. in bone which may increase CR circa 10x)
	Plutonium-238					**0.023**	Beresford et al., 2008	CR review
	Plutonium-239/240					**0.023**	Beresford et al., 2008	CR review
	Radium-226					**0.027**	Beresford et al., 2008	CR review - reindeer data not included
	Radium-228					**0.027**	Beresford et al., 2008	CR review - reindeer data not included
	Strontium 90					**1.74**	Beresford et al., 2008	CR review - reindeer data not included
	Technetium-99					**0.37**	Beresford et al., 2008	FASTer prediction
	Thorium-232					**0.00012**	Beresford et al., 2008	CR review
	Uranium-234					**0.00011**	Beresford et al., 2008	CR review
	Uranium-235					**0.00011**	Beresford et al., 2008	CR review
	Uranium-238					**0.00011**	Beresford et al., 2008	CR review
Metals	Aluminum					**0.0263**	ES/ER/TM-219	Median - Table C.1 (general)
	Antimony						ORNL-5786 cited in OSWER Directive 9285.7-55	**0.001* 50 * Cdiet (from Table 4a)**
	Arsenic	**-4.847**	**0.8188**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0038	ES/ER/TM-219	Median - Table 2 (general)

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Table H-4. Biotransfer Factors and Regression Models Used for SSL Calculations

Group	Analyte	Regression Models[a]				Bioaccumulation Factors		
		B0	B1	Source	Notes[b]	BAF	Source	Notes[b]
	Arsenic (III)	**-4.847**	**0.8188**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0038	ES/ER/TM-219	Median - Table 2 (general)
	Arsenic (V)	**-4.847**	**0.8188**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0038	ES/ER/TM-219	Median - Table 2 (general)
	Barium					**0.0168**	ES/ER/TM-219	Median - Table 2 (general); cited in OSWER Directive 9285.7-55
	Beryllium						ORNL-5786 cited in OSWER Directive 9285.7-55 (table 4a)	**0.001 * 50 * Cdiet (from Table 4a)**
	Bismuth					**1**	Default value	Default Value
	Boron					**1**	Default value	Default Value
	Cadmium	**-1.257**	**0.4723**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - herbivore	0.7568		
	Chromium	**-1.46**	**0.7338**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0605	ES/ER/TM-219	Median - Table 2 (general)
	Chromium (+3)	**-1.46**	**0.7338**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0605	ES/ER/TM-219	Median - Table 2 (general)
	Chromium (+6)	**-1.46**	**0.7338**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.0605	ES/ER/TM-219	Median - Table 2 (general)
	Cobalt	**-4.467**	**1.307**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.1000	ES/ER/TM-219	Median - Table 2 (general)
	Copper	**2.042**	**0.1444**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.5999	ES/ER/TM-219	Median - Table 2 (general)
	Lead	**0.0761**	**0.4422**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.1233	ES/ER/TM-219	Median - Table 2 (general)
	Lithium					**1**	Default value	Default Value
	Manganese					**0.0205**	ES/ER/TM-219	Median - Table C.1 (general)
	Mercury					**0.054**	ES/ER/TM-219	Median - Table 2 (general)
	Molybdenum					**1**	Default value	
	Nickel	**-0.246**	**0.4658**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.3524	ES/ER/TM-219	Median - Table 2 (general)
	Selenium	**-0.416**	**0.3764**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - general	0.2107	ES/ER/TM-219	Median - Table 2 (general)
	Silver					**0.0040**	ES/ER/TM-219	Median - Table C.1 (general)
	Strontium					**1.74**	Beresford et al., 2008	CR review - reindeer data not included
	Thallium					**0.1124**	ES/ER/TM-219	Median - Table 2 (general)
	Tin					**0.08**	ORNL-5786	Figure 2.25
	Uranium					**0.0002**	ORNL-5786	Figure 2.25
	Vanadium					**0.0123**	ES/ER/TM-219	Median - Table C.1 (general)
	Zinc	**4.3632**	**0.0706**	ES/ER/TM-219	cited in OSWER Directive 9285.7-55 (Table 4a) - herbivore	0.8984	ES/ER/TM-219	Median - Table 2 (general)
General Inorganics	Ammonia/Ammonium							
	Chloride							
	Cyanide							
	Fluoride							
	Iodine							
	Nitrate/Nitrite							
	Phosphate							
	Sulfate/Sulfite							
	Total Organic Carbon							

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Table H-4. Biotransfer Factors and Regression Models Used for SSL Calculations

Group	Analyte	Regression Models[a]				Bioaccumulation Factors		
		B0	B1	Source	Notes[b]	BAF	Source	Notes[b]
Volatile Organics	1,1-dichloroethane					**0.0109**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995[d])
	1,1-dichloroethene					**0.0186**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.13 (EPA, 1995[d])
	1,1,1-trichloroethane					**0.0305**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.48 (EPA, 1995[d])
	1,1,2-trichloroethane					**0.0165**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.05 (EPA, 1995[d])
	1,1,2,2-tetrachloroethane					**0.0270**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.39 (EPA, 1995[d])
	1,2-dichlorobenzene					**0.0882**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.43 (EPA, 1995[d])
	1,2-dichloroethane (DCA)					**0.0063**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.47 (EPA, 1995[d])
	1,3-dichlorobenzene					**0.0963**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.53 (EPI, 2011[d])
	2-butanone (Methyl Ethyl Ketone/MEK)					**0.0006**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 0.29 (EPI, 2011[d])
	2-hexanone					**0.0053**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.38 (EP1, 2011[d])
	Benzene					**0.0186**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.13 (EPA, 1995[d])
	Butanol					**0.0017**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 0.8 (EPA, 1995[d])
	Carbon Tetrachloride					**0.0420**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.73 (EPA, 1995[d])
	Chlorobenzene					**0.0490**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.86 (EPA, 1995[d])
	Chloroform					**0.0135**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.92 (EPA, 1995[d])
	Cis-1,2-dichloroethylene					**0.0122**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.86 (EPA, 1995[d])
	Dichloromethane (Methylene Chloride)					**0.0042**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.25 (EPA, 1995[d])
	Ethyl Benzene					**0.0666**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.14 (EPA, 1995[d])
	Methyl Isobutyl Ketone					**0.0037**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.19 (EPA, 1995[d])
	n-butyl Benzene					**0.1227**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.84 (EPI, 2011[d])
	Tetrachloroethylene					**0.0390**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995[d])
	Toluene					**0.0430**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995[d])
	Trans-1,2-dichloroethylene					**0.0170**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995[d])
	Trichloroethylene (TCE)					**0.0410**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995[d])
	Xylene					**0.0619**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.79 (EPA, 1995[d])
Polycyclic Aromatic Hydrocarbons	Acenaphthene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Acenaphthylene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Anthracene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Benzo(a)pyrene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Benzo(a)anthracene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Benzo(b)fluoranthene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Benzo(ghi)perylene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Benzo[k]fluoranthene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Chrysene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Dibenz(ah)anthracene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Fluoranthene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Fluorene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Indeno[1,2,3-cd]pyrene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	2-Methylnaphthalene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Naphthalene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Phenanthrene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Pyrene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Total PAHs					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Low MW PAHs					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	High MW PAHs					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	TPH - Diesel					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	TPH - Kerosene					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Normal paraffin hydrocarbons					**0**	OSWER Directive 9285.7-55	Assumed to be negligible
	Phenol					**0.0064**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.48 (EPA, 1995[d])

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Table H-4. Biotransfer Factors and Regression Models Used for SSL Calculations

Group	Analyte	Regression Models[a]				Bioaccumulation Factors		
		B0	B1	Source	Notes[b]	BAF	Source	Notes[b]
Semivolatile Organics	2-methylphenol (ocresol)					**0.0150**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.99 (EPA, 1995[d])
	4-methylphenol (pcresol)					**0.0141**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 1.95 (EPA, 1995[d])
	2,4-dinitrotoluene					**0.0155**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 2.01 (EPA, 1995[d])
	Bis[2-ethylhexyl] phthalate					**0.0945**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 7.3 (EPA, 1995[d])
	Total PCBs					**0.1792**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.29 (EPI, 2011[d])
	Aroclor 1016					**0.2104**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 5.69 (ChemIDPlus Lite[d])
	Aroclor 1221					**0.1883**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 4.65 (ChemIDPlus Lite[d])
	Aroclor 1232					**0.1704**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 4.4 (ChemIDPlus Lite[d])
	Aroclor 1242					**0.1756**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.34 (ChemIDPlus Lite[d])
	Aroclor 1248					**0.1855**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.2 (ChemIDPlus Lite[d])
	Aroclor 1254					**0.1630**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.5 (ChemIDPlus Lite[d])
	Aroclor 1260					**0.0750**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 7.55 (ChemIDPlus Lite[d])
	Aroclor 1262							
Pesticides	Dichloroprop							
	Aldrin					**0.1630**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.5 (EPA, 1995[d])
	beta-1,2,3,4,5,6-Hexachlorocyclohexane					**0.1201**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.81 (EPA, 1995[d])
	alpha-Chlordane					**0.1771**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.32 (EPA, 1995[d])
	gamma-Chlordane					**0.1771**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.32 (EPA, 1995[d])
	Dichlorodiphenyldichloroethylene	**3.6401**	**0.641**	OSWER Directive 9285.7-55	Regression derived from measured data [Appendix D]	0.1410	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.76 (EPA, 1995)[d]
	Dichlorodiphenyltrichloroethane	**1.1788**	**0.7254**	OSWER Directive 9285.7-55	Regression derived from measured data [Appendix D]	0.1606	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 6.53 (EPA, 1995)[d]
	Dieldrin					**1.20**	OSWER Directive 9285.7-55	Median BAF
	Endosulfan I					**0.1455**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 4.1 (EPA, 1995[d])
	Endosulfan II					**0.1455**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 4.1 (EPA, 1995[d])
	Endosulfan sulfate					**0.1072**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 3.66 (EPI, 2011[d])
	Endrin aldehyde					**0.1368**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 4 (EPA, 1995[d])
	Methoxychlor					**0.2093**	RTI, 2005	logKow model for organics with logKow between -0.67 and 8.2; log Kow = 5.08 (EPA, 1995[d])

a. Regression models are in the form of LN (plant, invertebrate, or small mammal concentration) = B0 + B1(LN (soil concentration).

b. Notes refer to tables and appendices in the cited references, not tables or appendices of this report.

c. BAFs for uptake of organics with log Kows between 3 and 8 to plants were derived using log BAF = -0.4057*(logKow)+1.781 (rinsed plants, OSWER Directive 9285.7-55).

d. BAFs for uptake of organics to small mammals were derived using log BAF = -0.099(logKow^2 + 1.07(logKow) - 3.56; this regression is for uptake to fat and represents the lipid concentration rather than whole body

e. BAFs for uptake of organics to invertebrates were derived using BAF = (0.87*(logKow)/(Koc*foc) (OSWER Directive 9285.7-55), where foc = 0.01.

BAF = Bioaccumulation Factor

Cdiet = concentration in small mammal diet (assumed to be 50 percent plants and 50 percent invertebrates)

EPA = United States Environmental Protection Agency

IAEA = International Atomic Energy Associatior

PCBs = polychlorinated biphenyls

TPH = total petroleum hydrocarbons

USACHPPM = United States Army Center for Health Promotion and Preventive Medicine

Complete citations for all references in this table are provided in the references section of this appendix

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Table H-5. Biotransfer Factors and Regression Models Used for PRG Calculations

Analyte	Partial Site-Specific Bioaccumulation Models[a]								
	Terrestrial Plants			Terrestrial Arthropod			Small Mammal		
	B0	B1	Median BAF	B0	B1	Median BAF	B0	B1	Median BAF
Silver	-3.636	0.340				0.034			0.004
Aluminum			0.012			0.006	-3.636	0.964	
Arsenic			0.047	-0.450	0.544				0.004
Boron			23.481			5.626			1.020
Barium			0.250			0.056			0.122
Beryllium	-0.536	0.735				0.021			b
Cadmium	-0.591	0.547		0.132	0.654		-0.505	0.506	
Cobalt			0.011			0.011	-3.449	0.957	
Chromium			0.124			0.060			0.105
Copper			0.306	2.077	0.332		1.918	0.169	
Mercury	-0.973	0.538				0.889			0.090
Lithium			0.072			0.014			0.031
Manganese			0.154			0.053			0.041
Molybdenum			3.548			1.864			1.916
Nickel	-0.528	0.476				0.093	-0.323	0.445	
Lead	-1.607	0.577		-1.943	0.726		-0.662	0.552	
Antimony	-3.233	0.938				0.0075			b
Selenium	-0.505	1.040				1.161			0.652
Strontium [elemental]			1.744			0.403			0.866
Tin			2.165			0.971			1.403
Thallium			0.050			0.056	-1.936	0.558	
Uranium - Calculated Total			0.041	-1.028	1.078		0.202	1.342	
Vanadium	-9.118	2.383				0.010			0.015
Zinc	1.965	0.479		3.520	0.315				2.056

Notes:

a. Regression models are in the form of LN (plant, invertebrate, or small mammal concentration) = B0 + B1(LN (soil concentration).

b. Concentration in small mammal tissue = 0.001*50* concentration in the diet which was assumed to be arthropods

where:

B0 = Intercept

B1 = Slope

LN = natural log

Acronyms:

BAF = Bioaccumulation Factor

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Table H-6. Home Range Values for Hanford Wildlife

Assessment Endpoint Functional Group	Endpoint Species	Home Range (Square Feet)	Home Range (Acres)	Home Range (Square Meters)	Home Range (Hectares)	Notes	Source
Granivorous bird	California Quail	1132560	26	105218	10.5	4 coveys under various conditions, in California	CWHR, 2012
Omnivorous bird	Meadowlark	236700	7.5	30351	3	varied from 1.2 to 6.1 ha (3-15 ac), and mostly were 2.8 to 3.2 ha (7-8 ac)	Lanyon, 1956 and 1957 as noted in CWHR, 2012
Insectivorous bird	Killdeer	862,488 - 4,303,728	19.8-98.8	80,128 - 399,829	8.0-39.98	adult males and females during breeding season, Minnesota	Mace, 1971
Carnivorous bird	Red-tailed Hawk	10,759,320 - 107,593,200	247-2470	999,574 - 9,995,735	100-1000	depending on location, topography, habitat, and prey availability	CWHR, 2012
Granivorous mammal	Great Basin pocket mouse	5,663 - 24,829	0.13 to 0.57	526 - 2,307	0.05 to 0.25	females in Washington State	O'Farrell et al., 1975
Omnivorous mammal	Deer Mouse	9670	0.222	890	0.09	Idaho dessert	Bowers and Smith, 1979
Insectivorous mammal	Grasshopper mouse	252648	5.8	23472	2.3	The unusually large home range is associated with its predatory life style	cited as Blair, 1953 by McCarty, 1978
Carnivorous mammal	Badger	17,206,200 - 25,831,080	395-593	1,598,508 - 2,399,786	160-240	females:160, males:240	Kurta, 1995; Long, 1999

Notes:
Complete citations for all references in this table are provided in the references section of this appendix.
ADW = Animal Diversity Web
BNA The Birds of North America

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300 ASH PITS_Shallow	non-Rad	Aroclor-1248	12672-29-6	µg/kg	5.20E+01	4.00E+04	1.30E-03	3.25E+02	1.60E-01
300 ASH PITS_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	6.08E+03	1.00E+04	6.08E-01	1.90E+05	3.20E-02
300 ASH PITS_Shallow	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	9.60E+01	1.00E+05	9.60E-04	4.54E+04	2.11E-03
300 ASH PITS_Shallow	non-Rad	Butylbenzylphthalate	85-68-7	µg/kg	76	No Value	--	No Value	--
300 ASH PITS_Shallow	Rad	RADs SOF	--	pCi/g	--	--	5.38E-05	--	1.69E-04
300 ASH PITS_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	3.88E-02	2.74E+04	1.42E-06	4.36E+03	8.89E-06
300 ASH PITS_Shallow	Rad	Uranium-238	U-238	pCi/g	8.23E-01	1.57E+04	5.24E-05	5.15E+03	1.60E-04
300 ASH PITS_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	2.45E+03	5.00E+03	4.90E-01	7.86E+05	3.12E-03
300 VTS_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	2.90E-02	2.21E+03	1.31E-05	9.24E+02	3.14E-05
300-10_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	13500	1.00E+04	**1.35E+00**	1.90E+05	7.11E-02
300-10_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	2.00E+02	1.00E+05	2.00E-03	4.54E+04	4.41E-03
300-10_Shallow_Focused	non-Rad	Butylbenzylphthalate	85-68-7	µg/kg	230	No Value	--	No Value	--
300-10_Shallow_Focused	Rad	Cesium-137	10045-97-3	pCi/g	1.55E-01	2.21E+03	7.01E-05	9.24E+02	1.68E-04
300-10_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	1.59E-04	--	4.43E-04
300-10_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	4.06E-02	2.74E+04	1.48E-06	4.36E+03	9.31E-06
300-10_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	1.37E+00	1.57E+04	8.73E-05	5.15E+03	2.66E-04
300-10_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	4.08E+03	5.00E+03	8.16E-01	7.86E+05	5.19E-03
300-109_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	µg/kg	1.22E+02	4.00E+04	3.05E-03	1.47E+03	8.30E-02
300-109_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	µg/kg	3.97E+01	4.00E+04	9.93E-04	1.47E+03	2.70E-02
300-109_Shallow_Focused	non-Rad	Aroclors HI	--	µg/kg	--	--	4.04E-03	--	1.10E-01
300-109_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	2.42E+03	1.00E+04	2.42E-01	1.90E+05	1.27E-02
300-109_Shallow_Focused	non-Rad	Barium	7440-39-3	µg/kg	6.33E+04	3.30E+05	1.92E-01	1.32E+06	4.80E-02
300-109_Shallow_Focused	non-Rad	Benzo(a)pyrene	50-32-8	µg/kg	1.24E+00	1.80E+04	6.89E-05	7.64E+04	1.62E-05
300-109_Shallow_Focused	non-Rad	Benzo(b)fluoranthene	205-99-2	µg/kg	2.30E+00	1.80E+04	1.28E-04	3.92E+04	5.87E-05
300-109_Shallow_Focused	non-Rad	Beryllium	7440-41-7	µg/kg	1.80E+02	1.00E+04	1.80E-02	1.39E+04	1.29E-02
300-109_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	632	5.00E+02	**1.26E+00**	1.33E+05	4.75E-03
300-109_Shallow_Focused	non-Rad	Cadmium	7440-43-9	µg/kg	5.90E+01	4.00E+03	1.48E-02	1.63E+03	3.62E-02
300-109_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	6950	4.00E+02	**1.74E+01**	3.82E+04	1.82E-01
300-109_Shallow_Focused	non-Rad	Chrysene	218-01-9	µg/kg	1.77E+00	1.80E+04	9.83E-05	4.45E+04	3.98E-05
300-109_Shallow_Focused	non-Rad	Cobalt	7440-48-4	µg/kg	6.42E+03	1.30E+04	4.94E-01	1.11E+05	5.78E-02
300-109_Shallow_Focused	non-Rad	Copper	7440-50-8	µg/kg	1.08E+04	5.00E+04	2.16E-01	1.07E+05	1.01E-01
300-109_Shallow_Focused	non-Rad	Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	1.40E+01	1.80E+04	7.78E-04	3.57E+04	3.92E-04
300-109_Shallow_Focused	non-Rad	Lead	7439-92-1	µg/kg	2.89E+03	5.00E+04	5.78E-02	3.56E+04	8.12E-02
300-109_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	278000	2.20E+05	**1.26E+00**	5.80E+06	4.79E-02
300-109_Shallow_Focused	non-Rad	Mercury	7439-97-6	µg/kg	2.20E+01	1.00E+02	2.20E-01	1.87E+03	1.18E-02
300-109_Shallow_Focused	non-Rad	Molybdenum	7439-98-7	µg/kg	3.41E+02	2.00E+03	1.71E-01	1.40E+04	2.44E-02
300-109_Shallow_Focused	non-Rad	Nickel	7440-02-0	µg/kg	8.49E+03	3.00E+04	2.83E-01	3.26E+04	2.60E-01
300-109_Shallow_Focused	non-Rad	Pyrene	129-00-0	µg/kg	1.56E+00	1.80E+04	8.67E-05	6.00E+05	2.60E-06
300-109_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	1.15E-04	--	4.88E-04
300-109_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	1.40E+00	5.16E+04	2.71E-05	6.37E+03	2.20E-04
300-109_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	1.38E+00	1.57E+04	8.79E-05	5.15E+03	2.68E-04
300-109_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	47600	2.00E+03	**2.38E+01**	3.11E+04	**1.53E+00**
300-109_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	3.47E+04	5.00E+04	6.94E-01	6.78E+04	5.12E-01
300-109_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	4.11E+03	5.00E+03	8.22E-01	7.86E+05	5.23E-03

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-109_Staging Pile Area_Focused	non-Rad	Aroclor-1254	11097-69-1	µg/kg	3.68E+01	4.00E+04	9.20E-04	1.47E+03	2.50E-02
300-109_Staging Pile Area_Focused	non-Rad	Aroclor-1260	11096-82-5	µg/kg	1.94E+01	4.00E+04	4.85E-04	1.47E+03	1.32E-02
300-109_Staging Pile Area_Focused	non-Rad	Aroclors HI	--	µg/kg	--	--	1.41E-03	--	3.82E-02
300-109_Staging Pile Area_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	2.58E+03	1.00E+04	2.58E-01	1.90E+05	1.36E-02
300-109_Staging Pile Area_Focused	non-Rad	Barium	7440-39-3	µg/kg	7.27E+04	3.30E+05	2.20E-01	1.32E+06	5.51E-02
300-109_Staging Pile Area_Focused	non-Rad	Benzo(a)anthracene	56-55-3	µg/kg	2.08E+00	1.80E+04	1.16E-04	6.40E+04	3.25E-05
300-109_Staging Pile Area_Focused	non-Rad	Benzo(a)pyrene	50-32-8	µg/kg	3.30E+00	1.80E+04	1.83E-04	7.64E+04	4.32E-05
300-109_Staging Pile Area_Focused	non-Rad	Benzo(b)fluoranthene	205-99-2	µg/kg	1.31E+00	1.80E+04	7.28E-05	3.92E+04	3.34E-05
300-109_Staging Pile Area_Focused	non-Rad	Beryllium	7440-41-7	µg/kg	2.03E+02	1.00E+04	2.03E-02	1.39E+04	1.46E-02
300-109_Staging Pile Area_Focused	non-Rad	Boron	7440-42-8	µg/kg	1060	5.00E+02	**2.12E+00**	1.33E+05	7.97E-03
300-109_Staging Pile Area_Focused	non-Rad	Cadmium	7440-43-9	µg/kg	6.60E+01	4.00E+03	1.65E-02	1.63E+03	4.05E-02
300-109_Staging Pile Area_Focused	non-Rad	Chromium	7440-47-3	µg/kg	8170	4.00E+02	**2.04E+01**	3.82E+04	2.14E-01
300-109_Staging Pile Area_Focused	non-Rad	Cobalt	7440-48-4	µg/kg	5.95E+03	1.30E+04	4.58E-01	1.11E+05	5.36E-02
300-109_Staging Pile Area_Focused	non-Rad	Copper	7440-50-8	µg/kg	1.16E+04	5.00E+04	2.32E-01	1.07E+05	1.08E-01
300-109_Staging Pile Area_Focused	non-Rad	Fluoranthene	206-44-0	µg/kg	5.14E+00	1.80E+04	2.86E-04	8.39E+05	6.13E-06
300-109_Staging Pile Area_Focused	non-Rad	Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	2.92E+01	1.80E+04	1.62E-03	3.57E+04	8.18E-04
300-109_Staging Pile Area_Focused	non-Rad	Lead	7439-92-1	µg/kg	5.03E+03	5.00E+04	1.01E-01	3.56E+04	1.41E-01
300-109_Staging Pile Area_Focused	non-Rad	Manganese	7439-96-5	µg/kg	286000	2.20E+05	**1.30E+00**	5.80E+06	4.93E-02
300-109_Staging Pile Area_Focused	non-Rad	Molybdenum	7439-98-7	µg/kg	4.08E+02	2.00E+03	2.04E-01	1.40E+04	2.91E-02
300-109_Staging Pile Area_Focused	non-Rad	Nickel	7440-02-0	µg/kg	8.57E+03	3.00E+04	2.86E-01	3.26E+04	2.63E-01
300-109_Staging Pile Area_Focused	non-Rad	Pyrene	129-00-0	µg/kg	6.96E+00	1.80E+04	3.87E-04	6.00E+05	1.16E-05
300-109_Staging Pile Area_Focused	Rad	RADs SOF	--	pCi/g	--	--	1.96E-04	--	8.48E-04
300-109_Staging Pile Area_Focused	non-Rad	Tin	7440-31-5	µg/kg	1.45E+03	5.00E+04	2.90E-02	2.04E+05	7.11E-03
300-109_Staging Pile Area_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	2.54E+00	5.16E+04	4.92E-05	6.37E+03	3.99E-04
300-109_Staging Pile Area_Focused	Rad	Uranium-238	U-238	pCi/g	2.31E+00	1.57E+04	1.47E-04	5.15E+03	4.49E-04
300-109_Staging Pile Area_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	45100	2.00E+03	**2.26E+01**	3.11E+04	**1.45E+00**
300-109_Staging Pile Area_Focused	non-Rad	Zinc	7440-66-6	µg/kg	4.88E+04	5.00E+04	9.76E-01	6.78E+04	7.20E-01
300-109_Staging Pile Area_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	6877	5.00E+03	**1.38E+00**	7.86E+05	8.75E-03
300-18_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	2.20E+03	1.00E+04	2.20E-01	1.90E+05	1.16E-02
300-18_Shallow	non-Rad	Barium	7440-39-3	µg/kg	6.34E+04	3.30E+05	1.92E-01	1.32E+06	4.80E-02
300-18_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	6.50E+02	1.00E+04	6.50E-02	1.39E+04	4.68E-02
300-18_Shallow	non-Rad	Cadmium	7440-43-9	µg/kg	4.00E+01	4.00E+03	1.00E-02	1.63E+03	2.45E-02
300-18_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	6900	4.00E+02	**1.73E+01**	3.82E+04	1.81E-01
300-18_Shallow	non-Rad	Lead	7439-92-1	µg/kg	3.60E+03	5.00E+04	7.20E-02	3.56E+04	1.01E-01
300-18_Shallow	Rad	RADs SOF	--	pCi/g	--	--	3.88E-05	--	1.82E-04
300-18_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	6.49E-01	5.16E+04	1.26E-05	6.37E+03	1.02E-04
300-18_Shallow	Rad	Uranium-238	U-238	pCi/g	4.11E-01	1.57E+04	2.62E-05	5.15E+03	7.98E-05
300-18_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	1.14E+03	5.00E+03	2.27E-01	7.86E+05	1.45E-03
300-223_Shallow_Focused	non-Rad	Total petroleum hydrocarbons - diesel range	TPHDIESEL	µg/kg	1.20E+05	2.00E+05	6.00E-01	3.56E+08	3.37E-04
300-223_Shallow_Focused	non-Rad	Total petroleum hydrocarbons - motor oil (high boiling)	TPH/OILH	µg/kg	230000	No Value	--	No Value	--
300-23_Shallow_Focused	non-Rad	Total petroleum hydrocarbons - motor oil (high boiling)	TPH/OILH	µg/kg	52000	No Value	--	No Value	--
300-259_Shallow	non-Rad	Antimony	7440-36-0	µg/kg	3.22E+02	5.00E+03	6.45E-02	5.98E+03	5.39E-02
300-259_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	2.10E+03	1.00E+04	2.10E-01	1.90E+05	1.10E-02
300-259_Shallow	non-Rad	Barium	7440-39-3	µg/kg	7.52E+04	3.30E+05	2.28E-01	1.32E+06	5.70E-02

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-259_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	2.26E+02	1.00E+04	2.26E-02	1.39E+04	1.62E-02
300-259_Shallow	non-Rad	Boron	7440-42-8	µg/kg	1302.923	5.00E+02	**2.61E+00**	1.33E+05	9.80E-03
300-259_Shallow	non-Rad	Cadmium	7440-43-9	µg/kg	2.52E+02	4.00E+03	6.29E-02	1.63E+03	1.54E-01
300-259_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	7901.1621	4.00E+02	**1.98E+01**	3.82E+04	2.07E-01
300-259_Shallow	non-Rad	Cobalt	7440-48-4	µg/kg	5.83E+03	1.30E+04	4.49E-01	1.11E+05	5.25E-02
300-259_Shallow	non-Rad	Copper	7440-50-8	µg/kg	1.07E+04	5.00E+04	2.14E-01	1.07E+05	9.99E-02
300-259_Shallow	non-Rad	Lead	7439-92-1	µg/kg	4.62E+03	5.00E+04	9.25E-02	3.56E+04	1.30E-01
300-259_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	318873.58	2.20E+05	**1.45E+00**	5.80E+06	5.50E-02
300-259_Shallow	non-Rad	Mercury	7439-97-6	µg/kg	1.00E+01	1.00E+02	1.00E-01	1.87E+03	5.35E-03
300-259_Shallow	non-Rad	Molybdenum	7439-98-7	µg/kg	3.03E+02	2.00E+03	1.51E-01	1.40E+04	2.16E-02
300-259_Shallow	non-Rad	Nickel	7440-02-0	µg/kg	8.75E+03	3.00E+04	2.92E-01	3.26E+04	2.68E-01
300-259_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.17E-04	--	5.12E-04
300-259_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.59E+00	5.16E+04	3.09E-05	6.37E+03	2.50E-04
300-259_Shallow	Rad	Uranium-238	U-238	pCi/g	1.35E+00	1.57E+04	8.58E-05	5.15E+03	2.62E-04
300-259_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	42625.614	2.00E+03	**2.13E+01**	3.11E+04	**1.37E+00**
300-259_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	479584.29	5.00E+04	**9.59E+00**	6.78E+04	**7.07E+00**
300-259_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	3.88E+03	5.00E+03	7.75E-01	7.86E+05	4.93E-03
300-260_Shallow_Focused	non-Rad	Antimony	7440-36-0	µg/kg	9.22E+02	5.00E+03	1.84E-01	5.98E+03	1.54E-01
300-260_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	3.16E+03	1.00E+04	3.16E-01	1.90E+05	1.66E-02
300-260_Shallow_Focused	non-Rad	Barium	7440-39-3	µg/kg	1.22E+05	3.30E+05	3.70E-01	1.32E+06	9.24E-02
300-260_Shallow_Focused	non-Rad	Beryllium	7440-41-7	µg/kg	2.39E+02	1.00E+04	2.39E-02	1.39E+04	1.72E-02
300-260_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	8360	5.00E+02	**1.67E+01**	1.33E+05	6.29E-02
300-260_Shallow_Focused	non-Rad	Cadmium	7440-43-9	µg/kg	1.10E+02	4.00E+03	2.75E-02	1.63E+03	6.75E-02
300-260_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	9890	4.00E+02	**2.47E+01**	3.82E+04	2.59E-01
300-260_Shallow_Focused	non-Rad	Cobalt	7440-48-4	µg/kg	7.43E+03	1.30E+04	5.72E-01	1.11E+05	6.69E-02
300-260_Shallow_Focused	non-Rad	Copper	7440-50-8	µg/kg	73300	5.00E+04	**1.47E+00**	1.07E+05	6.85E-01
300-260_Shallow_Focused	non-Rad	Lead	7439-92-1	µg/kg	1.83E+04	5.00E+04	3.66E-01	3.56E+04	5.14E-01
300-260_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	328000	2.20E+05	**1.49E+00**	5.80E+06	5.66E-02
300-260_Shallow_Focused	non-Rad	Mercury	7439-97-6	µg/kg	1.20E+01	1.00E+02	1.20E-01	1.87E+03	6.42E-03
300-260_Shallow_Focused	non-Rad	Molybdenum	7439-98-7	µg/kg	5.37E+02	2.00E+03	2.69E-01	1.40E+04	3.84E-02
300-260_Shallow_Focused	non-Rad	Nickel	7440-02-0	µg/kg	1.02E+04	3.00E+04	3.40E-01	3.26E+04	3.13E-01
300-260_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	2.83E-04	--	8.93E-04
300-260_Shallow_Focused	non-Rad	Silver	7440-22-4	µg/kg	2.06E+02	2.00E+03	1.03E-01	4.96E+04	4.15E-03
300-260_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	2.51E-01	2.74E+04	9.16E-06	4.36E+03	5.76E-05
300-260_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	4.30E+00	1.57E+04	2.74E-04	5.15E+03	8.35E-04
300-260_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	59000	2.00E+03	**2.95E+01**	3.11E+04	**1.90E+00**
300-260_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	77400	5.00E+04	**1.55E+00**	6.78E+04	**1.14E+00**
300-260_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	12800	5.00E+03	**2.56E+00**	7.86E+05	1.63E-02
300-272_Overburden_Focused	non-Rad	Total petroleum hydrocarbons - diesel range	TPHDIESEL	µg/kg	1.31E+04	2.00E+05	6.55E-02	3.56E+08	3.68E-05
300-272_Shallow_Focused	non-Rad	Total petroleum hydrocarbons - diesel range	TPHDIESEL	µg/kg	4.31E+04	2.00E+05	2.16E-01	3.56E+08	1.21E-04
300-275_Shallow_1	non-Rad	Acenaphthene	83-32-9	µg/kg	9.60E+02	2.00E+04	4.80E-02	1.10E+06	8.73E-04
300-275_Shallow_1	non-Rad	Antimony	7440-36-0	µg/kg	2.60E+02	5.00E+03	5.20E-02	5.98E+03	4.35E-02
300-275_Shallow_1	non-Rad	Arsenic	7440-38-2	µg/kg	2.21E+03	1.00E+04	2.21E-01	1.90E+05	1.16E-02
300-275_Shallow_1	non-Rad	Barium	7440-39-3	µg/kg	7.53E+04	3.30E+05	2.28E-01	1.32E+06	5.70E-02

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-275_Shallow_1	non-Rad	Benzo(a)pyrene	50-32-8	µg/kg	1.30E+00	1.80E+04	7.22E-05	7.64E+04	1.70E-05
300-275_Shallow_1	non-Rad	Benzo(b)fluoranthene	205-99-2	µg/kg	1.86E+00	1.80E+04	1.03E-04	3.92E+04	4.73E-05
300-275_Shallow_1	non-Rad	Beryllium	7440-41-7	µg/kg	4.52E+02	1.00E+04	4.52E-02	1.39E+04	3.25E-02
300-275_Shallow_1	non-Rad	Boron	7440-42-8	µg/kg	1466.2284	5.00E+02	**2.93E+00**	1.33E+05	1.10E-02
300-275_Shallow_1	non-Rad	Cadmium	7440-43-9	µg/kg	8.33E+01	4.00E+03	2.08E-02	1.63E+03	5.11E-02
300-275_Shallow_1	Rad	Cesium-137	10045-97-3	pCi/g	8.20E-02	2.21E+03	3.71E-05	9.24E+02	8.87E-05
300-275_Shallow_1	non-Rad	Chromium	7440-47-3	µg/kg	8021.7632	4.00E+02	**2.01E+01**	3.82E+04	2.10E-01
300-275_Shallow_1	non-Rad	Chrysene	218-01-9	µg/kg	2.20E+00	1.80E+04	1.22E-04	4.45E+04	4.94E-05
300-275_Shallow_1	non-Rad	Cobalt	7440-48-4	µg/kg	5.85E+03	1.30E+04	4.50E-01	1.11E+05	5.27E-02
300-275_Shallow_1	non-Rad	Copper	7440-50-8	µg/kg	4.29E+04	5.00E+04	8.58E-01	1.07E+05	4.01E-01
300-275_Shallow_1	non-Rad	Fluoranthene	206-44-0	µg/kg	2.30E+03	1.80E+04	1.28E-01	8.39E+05	2.74E-03
300-275_Shallow_1	non-Rad	Fluorene	86-73-7	µg/kg	8.11E+01	2.90E+04	2.80E-03	1.75E+05	4.64E-04
300-275_Shallow_1	non-Rad	Lead	7439-92-1	µg/kg	7.19E+03	5.00E+04	1.44E-01	3.56E+04	2.02E-01
300-275_Shallow_1	non-Rad	Lithium	7439-93-2	µg/kg	6686.355	2.00E+03	**3.34E+00**	5.15E+05	1.30E-02
300-275_Shallow_1	non-Rad	Manganese	7439-96-5	µg/kg	276815.49	2.20E+05	**1.26E+00**	5.80E+06	4.77E-02
300-275_Shallow_1	non-Rad	Mercury	7439-97-6	µg/kg	1.67E+01	1.00E+02	1.67E-01	1.87E+03	8.91E-03
300-275_Shallow_1	non-Rad	Molybdenum	7439-98-7	µg/kg	3.78E+02	2.00E+03	1.89E-01	1.40E+04	2.70E-02
300-275_Shallow_1	non-Rad	Nickel	7440-02-0	µg/kg	9.46E+03	3.00E+04	3.15E-01	3.26E+04	2.90E-01
300-275_Shallow_1	Rad	RADs SOF	--	pCi/g	--	--	6.96E-04	--	2.97E-03
300-275_Shallow_1	non-Rad	Silver	7440-22-4	µg/kg	1.21E+02	2.00E+03	6.04E-02	4.96E+04	2.44E-03
300-275_Shallow_1	non-Rad	Strontium	7440-24-6	µg/kg	20195.541	No Value	--	4.23E+06	4.77E-03
300-275_Shallow_1	non-Rad	Tin	7440-31-5	µg/kg	1.47E+03	5.00E+04	2.93E-02	2.04E+05	7.18E-03
300-275_Shallow_1	non-Rad	Uranium	7440-61-1	µg/kg	2.50E+03	5.00E+03	5.00E-01	7.86E+05	3.18E-03
300-275_Shallow_1	Rad	Uranium-233/234	U-233/234	pCi/g	7.72E+00	5.16E+04	1.50E-04	6.37E+03	1.21E-03
300-275_Shallow_1	Rad	Uranium-235	15117-96-1	pCi/g	1.00E+00	2.74E+04	3.65E-05	4.36E+03	2.29E-04
300-275_Shallow_1	Rad	Uranium-238	U-238	pCi/g	7.41E+00	1.57E+04	4.72E-04	5.15E+03	1.44E-03
300-275_Shallow_1	non-Rad	Vanadium	7440-62-2	µg/kg	45127.74	2.00E+03	**2.26E+01**	3.11E+04	**1.45E+00**
300-275_Shallow_1	non-Rad	Zinc	7440-66-6	µg/kg	4.10E+04	5.00E+04	8.20E-01	6.78E+04	6.05E-01
300-275_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	22251	5.00E+03	**4.45E+00**	7.86E+05	2.83E-02
300-275_Shallow_2	non-Rad	Acenaphthene	83-32-9	µg/kg	3.60E+00	2.00E+04	1.80E-04	1.10E+06	3.27E-06
300-275_Shallow_2	non-Rad	Arsenic	7440-38-2	µg/kg	2.76E+03	1.00E+04	2.76E-01	1.90E+05	1.45E-02
300-275_Shallow_2	non-Rad	Barium	7440-39-3	µg/kg	6.86E+04	3.30E+05	2.08E-01	1.32E+06	5.20E-02
300-275_Shallow_2	non-Rad	Beryllium	7440-41-7	µg/kg	2.54E+02	1.00E+04	2.54E-02	1.39E+04	1.83E-02
300-275_Shallow_2	non-Rad	Boron	7440-42-8	µg/kg	1146.5781	5.00E+02	**2.29E+00**	1.33E+05	8.62E-03
300-275_Shallow_2	non-Rad	Cadmium	7440-43-9	µg/kg	1.44E+02	4.00E+03	3.60E-02	1.63E+03	8.83E-02
300-275_Shallow_2	non-Rad	Chromium	7440-47-3	µg/kg	8993.6377	4.00E+02	**2.25E+01**	3.82E+04	2.35E-01
300-275_Shallow_2	non-Rad	Cobalt	7440-48-4	µg/kg	5.98E+03	1.30E+04	4.60E-01	1.11E+05	5.38E-02
300-275_Shallow_2	non-Rad	Copper	7440-50-8	µg/kg	1.16E+04	5.00E+04	2.32E-01	1.07E+05	1.08E-01
300-275_Shallow_2	non-Rad	Fluoranthene	206-44-0	µg/kg	5.60E+01	1.80E+04	3.11E-03	8.39E+05	6.67E-05
300-275_Shallow_2	non-Rad	Fluorene	86-73-7	µg/kg	2.60E+00	2.90E+04	8.97E-05	1.75E+05	1.49E-05
300-275_Shallow_2	non-Rad	Lead	7439-92-1	µg/kg	4.10E+03	5.00E+04	8.20E-02	3.56E+04	1.15E-01
300-275_Shallow_2	non-Rad	Lithium	7439-93-2	µg/kg	7066.6688	2.00E+03	**3.53E+00**	5.15E+05	1.37E-02
300-275_Shallow_2	non-Rad	Manganese	7439-96-5	µg/kg	292731.34	2.20E+05	**1.33E+00**	5.80E+06	5.05E-02
300-275_Shallow_2	non-Rad	Mercury	7439-97-6	µg/kg	2.73E+01	1.00E+02	2.73E-01	1.87E+03	1.46E-02

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-275_Shallow_2	non-Rad	Molybdenum	7439-98-7	µg/kg	4.04E+02	2.00E+03	2.02E-01	1.40E+04	2.88E-02
300-275_Shallow_2	non-Rad	Nickel	7440-02-0	µg/kg	9.59E+03	3.00E+04	3.20E-01	3.26E+04	2.94E-01
300-275_Shallow_2	Rad	RADs SOF	--	pCi/g	--	--	1.13E-04	--	5.01E-04
300-275_Shallow_2	non-Rad	Strontium	7440-24-6	µg/kg	27080.652	No Value	--	4.23E+06	6.40E-03
300-275_Shallow_2	non-Rad	Tin	7440-31-5	µg/kg	1.15E+03	5.00E+04	2.30E-02	2.04E+05	5.63E-03
300-275_Shallow_2	Rad	Uranium-233/234	U-233/234	pCi/g	1.31E+00	5.16E+04	2.53E-05	6.37E+03	2.05E-04
300-275_Shallow_2	Rad	Uranium-235	15117-96-1	pCi/g	2.37E-01	2.74E+04	8.65E-06	4.36E+03	5.44E-05
300-275_Shallow_2	Rad	Uranium-238	U-238	pCi/g	1.24E+00	1.57E+04	7.93E-05	5.15E+03	2.42E-04
300-275_Shallow_2	non-Rad	Vanadium	7440-62-2	µg/kg	51631.53	2.00E+03	**2.58E+01**	3.11E+04	**1.66E+00**
300-275_Shallow_2	non-Rad	Zinc	7440-66-6	µg/kg	4.12E+04	5.00E+04	8.25E-01	6.78E+04	6.08E-01
300-275_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	3.73E+03	5.00E+03	7.45E-01	7.86E+05	4.74E-03
300-33, 300-41, 300-256_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	5349	5.00E+03	**1.07E+00**	7.86E+05	6.81E-03
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclor-1016	12674-11-2	µg/kg	1.03E+01	4.00E+04	2.58E-04	1.82E+03	5.66E-03
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclor-1242	53469-21-9	µg/kg	1.64E+01	4.00E+04	4.10E-04	1.49E+03	1.10E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclor-1248	12672-29-6	µg/kg	1.90E+02	4.00E+04	4.75E-03	3.25E+02	5.85E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclor-1254	11097-69-1	µg/kg	8.49E+01	4.00E+04	2.12E-03	1.47E+03	5.78E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclor-1260	11096-82-5	µg/kg	1.75E+01	4.00E+04	4.36E-04	1.47E+03	1.19E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclors HI	--	µg/kg	--	--	7.97E-03	--	6.71E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	2.64E+03	1.00E+04	2.64E-01	1.90E+05	1.39E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Barium	7440-39-3	µg/kg	7.24E+04	3.30E+05	2.19E-01	1.32E+06	5.49E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	2.56E+02	1.00E+04	2.56E-02	1.39E+04	1.84E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Boron	7440-42-8	µg/kg	1483.9168	5.00E+02	**2.97E+00**	1.33E+05	1.12E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Butylbenzylphthalate	85-68-7	µg/kg	228	No Value	--	No Value	--
300-33, 300-41, 300-256_Shallow	non-Rad	Cadmium	7440-43-9	µg/kg	9.37E+01	4.00E+03	2.34E-02	1.63E+03	5.75E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	8781.1801	4.00E+02	**2.20E+01**	3.82E+04	2.30E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Cobalt	7440-48-4	µg/kg	6.27E+03	1.30E+04	4.83E-01	1.11E+05	5.65E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Copper	7440-50-8	µg/kg	1.37E+04	5.00E+04	2.73E-01	1.07E+05	1.28E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Fluoride	16984-48-8	µg/kg	1651.3546	No Value	--	2.28E+06	7.24E-04
300-33, 300-41, 300-256_Shallow	non-Rad	Lead	7439-92-1	µg/kg	4.27E+03	5.00E+04	8.54E-02	3.56E+04	1.20E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Lithium	7439-93-2	µg/kg	5495.0169	2.00E+03	**2.75E+00**	5.15E+05	1.07E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	314762.37	2.20E+05	**1.43E+00**	5.80E+06	5.43E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Mercury	7439-97-6	µg/kg	1.60E+01	1.00E+02	1.60E-01	1.87E+03	8.56E-03
300-33, 300-41, 300-256_Shallow	non-Rad	Methylene chloride	75-09-2	µg/kg	2.913436	No Value	--	1.66E+05	1.76E-05
300-33, 300-41, 300-256_Shallow	non-Rad	Molybdenum	7439-98-7	µg/kg	4.86E+02	2.00E+03	2.43E-01	1.40E+04	3.47E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Nickel	7440-02-0	µg/kg	8.88E+03	3.00E+04	2.96E-01	3.26E+04	2.72E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Nitrate	14797-55-8	µg/kg	8866.6667	No Value	--	3.40E+08	2.61E-05
300-33, 300-41, 300-256_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.85E-04	--	8.14E-04
300-33, 300-41, 300-256_Shallow	non-Rad	Silver	7440-22-4	µg/kg	7.82E+02	2.00E+03	3.91E-01	4.96E+04	1.58E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Uranium	7440-61-1	µg/kg	7260	5.00E+03	**1.45E+00**	7.86E+05	9.24E-03
300-33, 300-41, 300-256_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	2.14E+00	5.16E+04	4.14E-05	6.37E+03	3.36E-04
300-33, 300-41, 300-256_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	3.38E-01	2.74E+04	1.23E-05	4.36E+03	7.75E-05
300-33, 300-41, 300-256_Shallow	Rad	Uranium-238	U-238	pCi/g	2.06E+00	1.57E+04	1.31E-04	5.15E+03	4.00E-04
300-33, 300-41, 300-256_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	52694.189	2.00E+03	**2.63E+01**	3.11E+04	**1.69E+00**
300-33, 300-41, 300-256_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	4.15E+04	5.00E+04	8.29E-01	6.78E+04	6.12E-01

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	µg/kg	3.30E+02	4.00E+04	8.25E-03	3.25E+02	**1.02E+00**
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	µg/kg	3.85E+02	4.00E+04	9.63E-03	1.47E+03	2.62E-01
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	µg/kg	5.20E+01	4.00E+04	1.30E-03	1.47E+03	3.54E-02
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclors HI	--	µg/kg	--	--	1.92E-02	--	**1.32E+00**
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	3.24E+03	1.00E+04	3.24E-01	1.90E+05	1.71E-02
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Barium	7440-39-3	µg/kg	6.46E+04	3.30E+05	1.96E-01	1.32E+06	4.89E-02
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Beryllium	7440-41-7	µg/kg	1.69E+02	1.00E+04	1.69E-02	1.39E+04	1.22E-02
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	1030	5.00E+02	**2.06E+00**	1.33E+05	7.74E-03
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Cadmium	7440-43-9	µg/kg	1.00E+02	4.00E+03	2.50E-02	1.63E+03	6.13E-02
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	8080	4.00E+02	**2.02E+01**	3.82E+04	2.12E-01
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Cobalt	7440-48-4	µg/kg	5.64E+03	1.30E+04	4.34E-01	1.11E+05	5.08E-02
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Copper	7440-50-8	µg/kg	1.04E+04	5.00E+04	2.08E-01	1.07E+05	9.72E-02
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Fluoride	16984-48-8	µg/kg	1300	No Value	**--**	2.28E+06	5.70E-04
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Lead	7439-92-1	µg/kg	3.16E+03	5.00E+04	6.32E-02	3.56E+04	8.88E-02
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Lithium	7439-93-2	µg/kg	6580	2.00E+03	**3.29E+00**	5.15E+05	1.28E-02
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	259000	2.20E+05	**1.18E+00**	5.80E+06	4.47E-02
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Methylene chloride	75-09-2	µg/kg	2.21	No Value	**--**	1.66E+05	1.33E-05
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Molybdenum	7439-98-7	µg/kg	2.75E+02	2.00E+03	1.38E-01	1.40E+04	1.96E-02
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Nickel	7440-02-0	µg/kg	8.04E+03	3.00E+04	2.68E-01	3.26E+04	2.47E-01
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Nitrate	14797-55-8	µg/kg	17900	No Value	**--**	3.40E+08	5.26E-05
300-33, 300-41, 300-256_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	1.97E-04	--	8.95E-04
300-33, 300-41, 300-256_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	3.02E+00	5.16E+04	5.85E-05	6.37E+03	4.74E-04
300-33, 300-41, 300-256_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	2.17E+00	1.57E+04	1.38E-04	5.15E+03	4.21E-04
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	51400	2.00E+03	**2.57E+01**	3.11E+04	**1.65E+00**
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	3.89E+04	5.00E+04	7.78E-01	6.78E+04	5.74E-01
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	6460	5.00E+03	**1.29E+00**	7.86E+05	8.22E-03
300-37_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	µg/kg	1.00E+02	4.00E+04	2.50E-03	1.47E+03	6.80E-02
300-37_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	µg/kg	3.20E+03	4.00E+04	8.00E-02	1.47E+03	**2.18E+00**
300-37_Shallow_Focused	non-Rad	Aroclors HI	--	µg/kg	--	--	8.25E-02	--	**2.25E+00**
300-44_Overburden_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	9.10E+03	1.00E+04	9.10E-01	1.90E+05	4.79E-02
300-44_Overburden_Focused	Rad	Uranium-238	U-238	pCi/g	3.45E-01	1.57E+04	2.20E-05	5.15E+03	6.70E-05
300-44_Overburden_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	1.03E+03	5.00E+03	2.05E-01	7.86E+05	1.31E-03
300-44_Shallow_Focused	non-Rad	Antimony	7440-36-0	µg/kg	4.10E+03	5.00E+03	8.20E-01	5.98E+03	6.86E-01
300-44_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	16900	1.00E+04	**1.69E+00**	1.90E+05	8.89E-02
300-44_Shallow_Focused	non-Rad	Barium	7440-39-3	µg/kg	7.52E+04	3.30E+05	2.28E-01	1.32E+06	5.70E-02
300-44_Shallow_Focused	non-Rad	Beryllium	7440-41-7	µg/kg	4.80E+02	1.00E+04	4.80E-02	1.39E+04	3.45E-02
300-44_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	9300	4.00E+02	**2.33E+01**	3.82E+04	2.43E-01
300-44_Shallow_Focused	non-Rad	Cobalt	7440-48-4	µg/kg	8.20E+03	1.30E+04	6.31E-01	1.11E+05	7.39E-02
300-44_Shallow_Focused	non-Rad	Copper	7440-50-8	µg/kg	7.80E+03	5.00E+04	1.56E-01	1.07E+05	7.29E-02
300-44_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	303000	2.20E+05	**1.38E+00**	5.80E+06	5.22E-02
300-44_Shallow_Focused	non-Rad	Nickel	7440-02-0	µg/kg	8.60E+03	3.00E+04	2.87E-01	3.26E+04	2.64E-01
300-44_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	2.93E-01	1.57E+04	1.87E-05	5.15E+03	5.69E-05
300-44_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	43200	2.00E+03	**2.16E+01**	3.11E+04	**1.39E+00**
300-44_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	3.78E+04	5.00E+04	7.56E-01	6.78E+04	5.58E-01

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-44_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	8.72E+02	5.00E+03	1.74E-01	7.86E+05	1.11E-03
300-45_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	µg/kg	8.60E+01	4.00E+04	2.15E-03	1.47E+03	5.85E-02
300-45_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	2.90E+02	1.00E+05	2.90E-03	4.54E+04	6.39E-03
300-45_Shallow_Focused	Rad	Cesium-137	10045-97-3	pCi/g	2.28E-02	2.21E+03	1.03E-05	9.24E+02	2.47E-05
300-45_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	8.89E-05	--	2.72E-04
300-45_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	6.06E-02	2.74E+04	2.21E-06	4.36E+03	1.39E-05
300-45_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	1.20E+00	1.57E+04	7.64E-05	5.15E+03	2.33E-04
300-45_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	3.60E+03	5.00E+03	7.20E-01	7.86E+05	4.58E-03
300-49_Overburden	non-Rad	1,2,4-Trichlorobenzene	120-82-1	µg/kg	30.521	No Value	--	No Value	--
300-49_Overburden	non-Rad	1,4-Dichlorobenzene	106-46-7	µg/kg	28.761	No Value	--	No Value	--
300-49_Overburden	non-Rad	2,4-Dinitrotoluene	121-14-2	µg/kg	18.933	No Value	--	2.64E+04	7.17E-04
300-49_Overburden	non-Rad	2-Chlorophenol	95-57-8	µg/kg	51.333	No Value	--	No Value	--
300-49_Overburden	non-Rad	4-Chloro-3-methylphenol	59-50-7	µg/kg	45.95	No Value	--	No Value	--
300-49_Overburden	non-Rad	Acenaphthene	83-32-9	µg/kg	3.07E+01	2.00E+04	1.54E-03	1.10E+06	2.79E-05
300-49_Overburden	non-Rad	Antimony	7440-36-0	µg/kg	2.32E+02	5.00E+03	4.64E-02	5.98E+03	3.88E-02
300-49_Overburden	non-Rad	Aroclor-1254	11097-69-1	µg/kg	3.01E+03	4.00E+04	7.52E-02	1.47E+03	**2.05E+00**
300-49_Overburden	non-Rad	Arsenic	7440-38-2	µg/kg	3.29E+03	1.00E+04	3.29E-01	1.90E+05	1.73E-02
300-49_Overburden	non-Rad	Barium	7440-39-3	µg/kg	7.61E+04	3.30E+05	2.31E-01	1.32E+06	5.76E-02
300-49_Overburden	non-Rad	Beryllium	7440-41-7	µg/kg	2.01E+02	1.00E+04	2.01E-02	1.39E+04	1.45E-02
300-49_Overburden	non-Rad	Cadmium	7440-43-9	µg/kg	1.74E+02	4.00E+03	4.36E-02	1.63E+03	1.07E-01
300-49_Overburden	non-Rad	Chromium	7440-47-3	µg/kg	18105.752	4.00E+02	**4.53E+01**	3.82E+04	4.74E-01
300-49_Overburden	non-Rad	Cobalt	7440-48-4	µg/kg	7.13E+03	1.30E+04	5.48E-01	1.11E+05	6.42E-02
300-49_Overburden	non-Rad	Copper	7440-50-8	µg/kg	536000	5.00E+04	**1.07E+01**	1.07E+05	**5.01E+00**
300-49_Overburden	non-Rad	Di-n-butylphthalate	84-74-2	µg/kg	51.612	No Value	--	No Value	--
300-49_Overburden	non-Rad	Lead	7439-92-1	µg/kg	3.70E+04	5.00E+04	7.39E-01	3.56E+04	**1.04E+00**
300-49_Overburden	non-Rad	Manganese	7439-96-5	µg/kg	316668.7	2.20E+05	**1.44E+00**	5.80E+06	5.46E-02
300-49_Overburden	non-Rad	Nickel	7440-02-0	µg/kg	1.30E+04	3.00E+04	4.35E-01	3.26E+04	4.00E-01
300-49_Overburden	non-Rad	n-Nitrosodi-n-dipropylamine	621-64-7	µg/kg	39.728	No Value	--	No Value	--
300-49_Overburden	non-Rad	Pentachlorophenol	87-86-5	µg/kg	49.824	No Value	--	No Value	--
300-49_Overburden	non-Rad	Phenol	108-95-2	µg/kg	5.00E+01	3.00E+04	1.67E-03	1.51E+06	3.31E-05
300-49_Overburden	non-Rad	Pyrene	129-00-0	µg/kg	4.01E+01	1.80E+04	2.23E-03	6.00E+05	6.69E-05
300-49_Overburden	Rad	RADs SOF	--	pCi/g	--	--	8.70E-05	--	3.70E-04
300-49_Overburden	non-Rad	Silver	7440-22-4	µg/kg	7.03E+02	2.00E+03	3.51E-01	4.96E+04	1.42E-02
300-49_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	1.01E+00	5.16E+04	1.95E-05	6.37E+03	1.58E-04
300-49_Overburden	Rad	Uranium-235	15117-96-1	pCi/g	5.70E-02	2.74E+04	2.08E-06	4.36E+03	1.31E-05
300-49_Overburden	Rad	Uranium-238	U-238	pCi/g	1.03E+00	1.57E+04	6.54E-05	5.15E+03	1.99E-04
300-49_Overburden	non-Rad	Vanadium	7440-62-2	µg/kg	50379.9	2.00E+03	**2.52E+01**	3.11E+04	**1.62E+00**
300-49_Overburden	non-Rad	Zinc	7440-66-6	µg/kg	141984.11	5.00E+04	**2.84E+00**	6.78E+04	**2.09E+00**
300-49_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	3.07E+03	5.00E+03	6.13E-01	7.86E+05	3.90E-03
300-49_Shallow	non-Rad	Antimony	7440-36-0	µg/kg	1.76E+02	5.00E+03	3.52E-02	5.98E+03	2.94E-02
300-49_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	4.43E+03	1.00E+04	4.43E-01	1.90E+05	2.33E-02
300-49_Shallow	non-Rad	Barium	7440-39-3	µg/kg	8.99E+04	3.30E+05	2.72E-01	1.32E+06	6.81E-02
300-49_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	3.03E+02	1.00E+04	3.03E-02	1.39E+04	2.18E-02
300-49_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	1.51E-01	2.21E+03	6.83E-05	9.24E+02	1.63E-04

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-49_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	9170.4553	4.00E+02	**2.29E+01**	3.82E+04	2.40E-01
300-49_Shallow	non-Rad	Cobalt	7440-48-4	µg/kg	9.32E+03	1.30E+04	7.17E-01	1.11E+05	8.40E-02
300-49_Shallow	non-Rad	Copper	7440-50-8	µg/kg	1.49E+04	5.00E+04	2.97E-01	1.07E+05	1.39E-01
300-49_Shallow	non-Rad	Lead	7439-92-1	µg/kg	6.63E+03	5.00E+04	1.33E-01	3.56E+04	1.86E-01
300-49_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	361805.31	2.20E+05	**1.64E+00**	5.80E+06	6.24E-02
300-49_Shallow	non-Rad	Nickel	7440-02-0	µg/kg	1.07E+04	3.00E+04	3.55E-01	3.26E+04	3.27E-01
300-49_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.70E-04	--	6.32E-04
300-49_Shallow	non-Rad	Silver	7440-22-4	µg/kg	3.82E+02	2.00E+03	1.91E-01	4.96E+04	7.71E-03
300-49_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.32E+00	5.16E+04	2.55E-05	6.37E+03	2.07E-04
300-49_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	2.40E-01	2.74E+04	8.76E-06	4.36E+03	5.50E-05
300-49_Shallow	Rad	Uranium-238	U-238	pCi/g	1.06E+00	1.57E+04	6.78E-05	5.15E+03	2.07E-04
300-49_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	58672.352	2.00E+03	**2.93E+01**	3.11E+04	**1.89E+00**
300-49_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	54650.548	5.00E+04	**1.09E+00**	6.78E+04	8.06E-01
300-49_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	2.98E+03	5.00E+03	5.97E-01	7.86E+05	3.80E-03
300-50_Overburden	non-Rad	Aroclor-1254	11097-69-1	µg/kg	3.34E+01	4.00E+04	8.36E-04	1.47E+03	2.28E-02
300-50_Overburden	non-Rad	Aroclor-1260	11096-82-5	µg/kg	2.29E+02	4.00E+04	5.73E-03	1.47E+03	1.56E-01
300-50_Overburden	non-Rad	Aroclors HI	--	µg/kg	--	--	6.57E-03	--	1.79E-01
300-50_Overburden	non-Rad	Arsenic	7440-38-2	µg/kg	6.90E+03	1.00E+04	6.90E-01	1.90E+05	3.63E-02
300-50_Overburden	non-Rad	Barium	7440-39-3	µg/kg	1.18E+05	3.30E+05	3.57E-01	1.32E+06	8.92E-02
300-50_Overburden	non-Rad	Beryllium	7440-41-7	µg/kg	3.25E+02	1.00E+04	3.25E-02	1.39E+04	2.34E-02
300-50_Overburden	non-Rad	Cadmium	7440-43-9	µg/kg	5.63E+02	4.00E+03	1.41E-01	1.63E+03	3.45E-01
300-50_Overburden	Rad	Cesium-137	10045-97-3	pCi/g	5.60E-02	2.21E+03	2.53E-05	9.24E+02	6.06E-05
300-50_Overburden	non-Rad	Chromium	7440-47-3	µg/kg	12197.473	4.00E+02	**3.05E+01**	3.82E+04	3.19E-01
300-50_Overburden	non-Rad	Cobalt	7440-48-4	µg/kg	9.39E+03	1.30E+04	7.22E-01	1.11E+05	8.46E-02
300-50_Overburden	non-Rad	Copper	7440-50-8	µg/kg	64526.564	5.00E+04	**1.29E+00**	1.07E+05	6.03E-01
300-50_Overburden	non-Rad	Lead	7439-92-1	µg/kg	5.90E+03	5.00E+04	1.18E-01	3.56E+04	1.66E-01
300-50_Overburden	non-Rad	Manganese	7439-96-5	µg/kg	314270.52	2.20E+05	**1.43E+00**	5.80E+06	5.42E-02
300-50_Overburden	non-Rad	Nickel	7440-02-0	µg/kg	1.52E+04	3.00E+04	5.08E-01	3.26E+04	4.67E-01
300-50_Overburden	Rad	RADs SOF	--	pCi/g	--	--	5.38E-04	--	2.27E-03
300-50_Overburden	non-Rad	Silver	7440-22-4	µg/kg	1.20E+03	2.00E+03	6.01E-01	4.96E+04	2.42E-02
300-50_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	6.03E+00	5.16E+04	1.17E-04	6.37E+03	9.46E-04
300-50_Overburden	Rad	Uranium-235	15117-96-1	pCi/g	4.49E-01	2.74E+04	1.64E-05	4.36E+03	1.03E-04
300-50_Overburden	Rad	Uranium-238	U-238	pCi/g	5.95E+00	1.57E+04	3.79E-04	5.15E+03	1.16E-03
300-50_Overburden	non-Rad	Vanadium	7440-62-2	µg/kg	45242.833	2.00E+03	**2.26E+01**	3.11E+04	**1.45E+00**
300-50_Overburden	non-Rad	Zinc	7440-66-6	µg/kg	4.59E+04	5.00E+04	9.18E-01	6.78E+04	6.77E-01
300-50_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	17919	5.00E+03	**3.58E+00**	7.86E+05	2.28E-02
300-50_Shallow	non-Rad	Antimony	7440-36-0	µg/kg	3.00E+03	5.00E+03	6.00E-01	5.98E+03	5.02E-01
300-50_Shallow	non-Rad	Aroclor-1254	11097-69-1	µg/kg	1.26E+02	4.00E+04	3.16E-03	1.47E+03	8.59E-02
300-50_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	6.40E+03	1.00E+04	6.40E-01	1.90E+05	3.37E-02
300-50_Shallow	non-Rad	Barium	7440-39-3	µg/kg	1.03E+05	3.30E+05	3.12E-01	1.32E+06	7.81E-02
300-50_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	2.82E+02	1.00E+04	2.82E-02	1.39E+04	2.03E-02
300-50_Shallow	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	1.93E+01	1.00E+05	1.93E-04	4.54E+04	4.25E-04
300-50_Shallow	non-Rad	Cadmium	7440-43-9	µg/kg	4.63E+02	4.00E+03	1.16E-01	1.63E+03	2.84E-01
300-50_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	5.60E-02	2.21E+03	2.53E-05	9.24E+02	6.06E-05

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-50_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	16841.216	4.00E+02	**4.21E+01**	3.82E+04	4.41E-01
300-50_Shallow	non-Rad	Cobalt	7440-48-4	µg/kg	9.11E+03	1.30E+04	7.01E-01	1.11E+05	8.21E-02
300-50_Shallow	non-Rad	Copper	7440-50-8	µg/kg	1.68E+04	5.00E+04	3.36E-01	1.07E+05	1.57E-01
300-50_Shallow	non-Rad	Lead	7439-92-1	µg/kg	6.38E+03	5.00E+04	1.28E-01	3.56E+04	1.79E-01
300-50_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	318119.94	2.20E+05	**1.45E+00**	5.80E+06	5.48E-02
300-50_Shallow	non-Rad	Nickel	7440-02-0	µg/kg	1.24E+04	3.00E+04	4.14E-01	3.26E+04	3.81E-01
300-50_Shallow	Rad	RADs SOF	--	pCi/g	--	--	7.39E-04	--	3.08E-03
300-50_Shallow	non-Rad	Silver	7440-22-4	µg/kg	2991.6221	2.00E+03	**1.50E+00**	4.96E+04	6.03E-02
300-50_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	7.89E+00	5.16E+04	1.53E-04	6.37E+03	1.24E-03
300-50_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	6.64E-01	2.74E+04	2.42E-05	4.36E+03	1.52E-04
300-50_Shallow	Rad	Uranium-238	U-238	pCi/g	8.41E+00	1.57E+04	5.36E-04	5.15E+03	1.63E-03
300-50_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	46964.326	2.00E+03	**2.35E+01**	3.11E+04	**1.51E+00**
300-50_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	4.13E+04	5.00E+04	8.27E-01	6.78E+04	6.10E-01
300-50_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	22938	5.00E+03	**4.59E+00**	7.86E+05	2.92E-02
300-8_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	5.74E+02	1.00E+04	5.74E-02	1.39E+04	4.13E-02
300-8_Shallow	Rad	RADs SOF	--	pCi/g	--	--	6.75E-05	--	2.83E-04
300-8_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	7.86E-01	5.16E+04	1.52E-05	6.37E+03	1.23E-04
300-8_Shallow	Rad	Uranium-238	U-238	pCi/g	8.21E-01	1.57E+04	5.23E-05	5.15E+03	1.60E-04
300-8_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	2.37E+03	5.00E+03	4.75E-01	7.86E+05	3.02E-03
316-1_Overburden	Rad	Cesium-137	10045-97-3	pCi/g	1.01E-01	2.21E+03	4.57E-05	9.24E+02	1.09E-04
316-1_Overburden	Rad	Cobalt-60	10198-40-0	pCi/g	3.18E-01	6.13E+03	5.19E-05	8.05E+02	3.95E-04
316-1_Overburden	Rad	RADs SOF	--	pCi/g	--	--	1.25E-03	--	5.39E-03
316-1_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	1.30E+01	5.16E+04	2.51E-04	6.37E+03	2.03E-03
316-1_Overburden	Rad	Uranium-235	15117-96-1	pCi/g	1.08E+00	2.74E+04	3.94E-05	4.36E+03	2.48E-04
316-1_Overburden	Rad	Uranium-238	U-238	pCi/g	1.35E+01	1.57E+04	8.57E-04	5.15E+03	2.61E-03
316-1_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	40572	5.00E+03	**8.11E+00**	7.86E+05	5.16E-02
316-1_Shallow_1	non-Rad	Aroclor-1248	12672-29-6	µg/kg	3.00E+03	4.00E+04	7.50E-02	3.25E+02	**9.23E+00**
316-1_Shallow_1	non-Rad	Arsenic	7440-38-2	µg/kg	19014.394	1.00E+04	**1.90E+00**	1.90E+05	1.00E-01
316-1_Shallow_1	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	6.86E+01	1.00E+05	6.86E-04	4.54E+04	1.51E-03
316-1_Shallow_1	non-Rad	Butylbenzylphthalate	85-68-7	µg/kg	97.692869	No Value	**--**	No Value	**--**
316-1_Shallow_1	Rad	Cesium-137	10045-97-3	pCi/g	3.18E-02	2.21E+03	1.44E-05	9.24E+02	3.44E-05
316-1_Shallow_1	Rad	RADs SOF	--	pCi/g	--	--	1.82E-03	--	5.69E-03
316-1_Shallow_1	Rad	Uranium-235	15117-96-1	pCi/g	1.21E+00	2.74E+04	4.43E-05	4.36E+03	2.78E-04
316-1_Shallow_1	Rad	Uranium-238	U-238	pCi/g	2.77E+01	1.57E+04	1.76E-03	5.15E+03	5.38E-03
316-1_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	83027	5.00E+03	**1.66E+01**	7.86E+05	1.06E-01
316-1_Shallow_3	non-Rad	Antimony	7440-36-0	µg/kg	4.90E+02	5.00E+03	9.80E-02	5.98E+03	8.19E-02
316-1_Shallow_3	non-Rad	Aroclor-1254	11097-69-1	µg/kg	9.99E+01	4.00E+04	2.50E-03	1.47E+03	6.79E-02
316-1_Shallow_3	non-Rad	Arsenic	7440-38-2	µg/kg	5.14E+03	1.00E+04	5.14E-01	1.90E+05	2.70E-02
316-1_Shallow_3	non-Rad	Barium	7440-39-3	µg/kg	1.29E+05	3.30E+05	3.91E-01	1.32E+06	9.78E-02
316-1_Shallow_3	non-Rad	Beryllium	7440-41-7	µg/kg	4.16E+02	1.00E+04	4.16E-02	1.39E+04	2.99E-02
316-1_Shallow_3	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	3.42E+02	1.00E+05	3.42E-03	4.54E+04	7.54E-03
316-1_Shallow_3	non-Rad	Cadmium	7440-43-9	µg/kg	4.70E+02	4.00E+03	1.18E-01	1.63E+03	2.88E-01
316-1_Shallow_3	Rad	Cesium-137	10045-97-3	pCi/g	3.77E-01	2.21E+03	1.71E-04	9.24E+02	4.08E-04
316-1_Shallow_3	non-Rad	Chromium	7440-47-3	µg/kg	50455.279	4.00E+02	**1.26E+02**	3.82E+04	**1.32E+00**

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
316-1_Shallow_3	non-Rad	Cobalt	7440-48-4	µg/kg	9.70E+03	1.30E+04	7.46E-01	1.11E+05	8.74E-02
316-1_Shallow_3	Rad	Cobalt-60	10198-40-0	pCi/g	2.28E+00	6.13E+03	3.72E-04	8.05E+02	2.83E-03
316-1_Shallow_3	non-Rad	Copper	7440-50-8	µg/kg	1366370.3	5.00E+04	**2.73E+01**	1.07E+05	**1.28E+01**
316-1_Shallow_3	non-Rad	Heptachlor epoxide	1024-57-3	µg/kg	2.6479397	No Value	--	No Value	--
316-1_Shallow_3	non-Rad	Lead	7439-92-1	µg/kg	1.44E+04	5.00E+04	2.88E-01	3.56E+04	4.05E-01
316-1_Shallow_3	non-Rad	Manganese	7439-96-5	µg/kg	392825.12	2.20E+05	**1.79E+00**	5.80E+06	6.77E-02
316-1_Shallow_3	non-Rad	Mercury	7439-97-6	µg/kg	1105.3045	1.00E+02	**1.11E+01**	1.87E+03	5.91E-01
316-1_Shallow_3	non-Rad	Nickel	7440-02-0	µg/kg	94655.889	3.00E+04	**3.16E+00**	3.26E+04	**2.90E+00**
316-1_Shallow_3	non-Rad	Phenol	108-95-2	µg/kg	2.80E+01	3.00E+04	9.33E-04	1.51E+06	1.85E-05
316-1_Shallow_3	Rad	RADs SOF	--	pCi/g	--	--	2.41E-03	--	1.14E-02
316-1_Shallow_3	non-Rad	Selenium	7782-49-2	µg/kg	1444.348	5.20E+02	**2.78E+00**	1.90E+03	7.60E-01
316-1_Shallow_3	non-Rad	Silver	7440-22-4	µg/kg	13195.532	2.00E+03	**6.60E+00**	4.96E+04	2.66E-01
316-1_Shallow_3	Rad	Uranium-233/234	U-233/234	pCi/g	2.27E+01	5.16E+04	4.40E-04	6.37E+03	3.57E-03
316-1_Shallow_3	Rad	Uranium-235	15117-96-1	pCi/g	2.55E+00	2.74E+04	9.30E-05	4.36E+03	5.84E-04
316-1_Shallow_3	Rad	Uranium-238	U-238	pCi/g	2.08E+01	1.57E+04	1.33E-03	5.15E+03	4.04E-03
316-1_Shallow_3	non-Rad	Vanadium	7440-62-2	µg/kg	56706.602	2.00E+03	**2.84E+01**	3.11E+04	**1.82E+00**
316-1_Shallow_3	non-Rad	Zinc	7440-66-6	µg/kg	82015.898	5.00E+04	**1.64E+00**	6.78E+04	**1.21E+00**
316-1_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	63074	5.00E+03	**1.26E+01**	7.86E+05	8.02E-02
316-1_Shallow_4	non-Rad	Aroclor-1254	11097-69-1	µg/kg	6.20E+01	4.00E+04	1.55E-03	1.47E+03	4.22E-02
316-1_Shallow_4	Rad	Cobalt-60	10198-40-0	pCi/g	1.20E-01	6.13E+03	1.96E-05	8.05E+02	1.49E-04
316-1_Shallow_4	Rad	RADs SOF	--	pCi/g	--	--	1.28E-03	--	5.69E-03
316-1_Shallow_4	Rad	Uranium-233/234	U-233/234	pCi/g	1.61E+01	5.16E+04	3.13E-04	6.37E+03	2.53E-03
316-1_Shallow_4	Rad	Uranium-235	15117-96-1	pCi/g	1.07E+00	2.74E+04	3.90E-05	4.36E+03	2.45E-04
316-1_Shallow_4	Rad	Uranium-238	U-238	pCi/g	1.43E+01	1.57E+04	9.09E-04	5.15E+03	2.77E-03
316-1_Shallow_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	42963	5.00E+03	**8.59E+00**	7.86E+05	5.47E-02
316-2_Shallow_1	Rad	Cesium-137	10045-97-3	pCi/g	3.10E-02	2.21E+03	1.40E-05	9.24E+02	3.35E-05
316-2_Shallow_1	Rad	Cobalt-60	10198-40-0	pCi/g	9.22E-02	6.13E+03	1.50E-05	8.05E+02	1.14E-04
316-2_Shallow_1	Rad	RADs SOF	--	pCi/g	--	--	6.53E-03	--	2.99E-02
316-2_Shallow_1	Rad	Uranium-233/234	U-233/234	pCi/g	8.64E+01	5.16E+04	1.67E-03	6.37E+03	1.36E-02
316-2_Shallow_1	Rad	Uranium-235	15117-96-1	pCi/g	1.22E+01	2.74E+04	4.45E-04	4.36E+03	2.80E-03
316-2_Shallow_1	Rad	Uranium-238	U-238	pCi/g	6.88E+01	1.57E+04	4.39E-03	5.15E+03	1.34E-02
316-2_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	210452	5.00E+03	**4.21E+01**	7.86E+05	2.68E-01
316-2_Shallow_2	non-Rad	Aroclor-1248	12672-29-6	µg/kg	6.97E+02	4.00E+04	1.74E-02	3.25E+02	**2.14E+00**
316-2_Shallow_2	non-Rad	Aroclor-1254	11097-69-1	µg/kg	4.20E+01	4.00E+04	1.05E-03	1.47E+03	2.86E-02
316-2_Shallow_2	non-Rad	Aroclor-1260	11096-82-5	µg/kg	1.10E+02	4.00E+04	2.75E-03	1.47E+03	7.48E-02
316-2_Shallow_2	non-Rad	Aroclors HI	--	µg/kg	--	--	2.12E-02	--	**2.24E+00**
316-2_Shallow_2	Rad	Cesium-137	10045-97-3	pCi/g	4.48E-01	2.21E+03	2.03E-04	9.24E+02	4.85E-04
316-2_Shallow_2	Rad	Cobalt-60	10198-40-0	pCi/g	4.53E-01	6.13E+03	7.38E-05	8.05E+02	5.62E-04
316-2_Shallow_2	Rad	RADs SOF	--	pCi/g	--	--	9.03E-03	--	4.03E-02
316-2_Shallow_2	Rad	Uranium-233/234	U-233/234	pCi/g	1.15E+02	5.16E+04	2.22E-03	6.37E+03	1.80E-02
316-2_Shallow_2	Rad	Uranium-235	15117-96-1	pCi/g	1.11E+01	2.74E+04	4.05E-04	4.36E+03	2.55E-03
316-2_Shallow_2	Rad	Uranium-238	U-238	pCi/g	9.62E+01	1.57E+04	6.13E-03	5.15E+03	1.87E-02
316-2_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	291369	5.00E+03	**5.83E+01**	7.86E+05	3.71E-01
316-2_Shallow_3	non-Rad	Arsenic	7440-38-2	µg/kg	8.00E+03	1.00E+04	8.00E-01	1.90E+05	4.21E-02

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
316-2_Shallow_3	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	2.60E+02	1.00E+05	2.60E-03	4.54E+04	5.73E-03
316-2_Shallow_3	non-Rad	Butylbenzylphthalate	85-68-7	µg/kg	180	No Value	--	No Value	--
316-2_Shallow_3	Rad	RADs SOF	--	pCi/g	--	--	1.59E-03	--	4.96E-03
316-2_Shallow_3	Rad	Uranium-235	15117-96-1	pCi/g	9.09E-01	2.74E+04	3.32E-05	4.36E+03	2.08E-04
316-2_Shallow_3	Rad	Uranium-238	U-238	pCi/g	2.44E+01	1.57E+04	1.56E-03	5.15E+03	4.75E-03
316-2_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	73174	5.00E+03	**1.46E+01**	7.86E+05	9.31E-02
316-5_Shallow_1	Rad	Americium-241	14596-10-2	pCi/g	4.79E-01	2.15E+04	2.23E-05	4.84E+03	9.90E-05
316-5_Shallow_1	non-Rad	Arsenic	7440-38-2	µg/kg	3.07E+03	1.00E+04	3.07E-01	1.90E+05	1.62E-02
316-5_Shallow_1	non-Rad	Benzo(a)anthracene	56-55-3	µg/kg	3.80E+01	1.80E+04	2.11E-03	6.40E+04	5.94E-04
316-5_Shallow_1	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	1.46E+02	1.00E+05	1.46E-03	4.54E+04	3.21E-03
316-5_Shallow_1	non-Rad	Butylbenzylphthalate	85-68-7	µg/kg	100	No Value	--	No Value	--
316-5_Shallow_1	Rad	Cesium-137	10045-97-3	pCi/g	2.29E+00	2.21E+03	1.04E-03	9.24E+02	2.48E-03
316-5_Shallow_1	Rad	RADs SOF	--	pCi/g	--	--	7.42E-03	--	2.41E-02
316-5_Shallow_1	Rad	Uranium-235	15117-96-1	pCi/g	1.86E+01	2.74E+04	6.79E-04	4.36E+03	4.27E-03
316-5_Shallow_1	Rad	Uranium-238	U-238	pCi/g	8.92E+01	1.57E+04	5.68E-03	5.15E+03	1.73E-02
316-5_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	271835	5.00E+03	**5.44E+01**	7.86E+05	3.46E-01
316-5_Shallow_2	non-Rad	1,1,2,2-Tetrachloroethane	79-34-5	µg/kg	140	No Value	--	1.65E+05	8.48E-04
316-5_Shallow_2	non-Rad	2-Butoxyethanol	111-76-2	µg/kg	240	No Value	--	No Value	--
316-5_Shallow_2	Rad	Americium-241	14596-10-2	pCi/g	1.24E-01	2.15E+04	5.77E-06	4.84E+03	2.56E-05
316-5_Shallow_2	non-Rad	Arsenic	7440-38-2	µg/kg	3.18E+03	1.00E+04	3.18E-01	1.90E+05	1.67E-02
316-5_Shallow_2	non-Rad	Barium	7440-39-3	µg/kg	7.67E+04	3.30E+05	2.32E-01	1.32E+06	5.81E-02
316-5_Shallow_2	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	1.80E+02	1.00E+05	1.80E-03	4.54E+04	3.97E-03
316-5_Shallow_2	non-Rad	Butylbenzylphthalate	85-68-7	µg/kg	110	No Value	--	No Value	--
316-5_Shallow_2	Rad	Cesium-137	10045-97-3	pCi/g	1.71E+00	2.21E+03	7.76E-04	9.24E+02	1.85E-03
316-5_Shallow_2	non-Rad	Chromium	7440-47-3	µg/kg	6900	4.00E+02	**1.73E+01**	3.82E+04	1.81E-01
316-5_Shallow_2	non-Rad	Chrysene	218-01-9	µg/kg	3.80E+01	1.80E+04	2.11E-03	4.45E+04	8.54E-04
316-5_Shallow_2	Rad	Cobalt-60	10198-40-0	pCi/g	1.18E-01	6.13E+03	1.92E-05	8.05E+02	1.47E-04
316-5_Shallow_2	non-Rad	Di-n-butylphthalate	84-74-2	µg/kg	146.4259	No Value	--	No Value	--
316-5_Shallow_2	non-Rad	Lead	7439-92-1	µg/kg	3.20E+03	5.00E+04	6.40E-02	3.56E+04	8.99E-02
316-5_Shallow_2	Rad	RADs SOF	--	pCi/g	--	--	5.43E-03	--	1.72E-02
316-5_Shallow_2	non-Rad	Selenium	7782-49-2	µg/kg	4.90E+02	5.20E+02	9.42E-01	1.90E+03	2.58E-01
316-5_Shallow_2	non-Rad	Silver	7440-22-4	µg/kg	3600	2.00E+03	**1.80E+00**	4.96E+04	7.26E-02
316-5_Shallow_2	Rad	Uranium-235	15117-96-1	pCi/g	9.04E+00	2.74E+04	3.30E-04	4.36E+03	2.07E-03
316-5_Shallow_2	Rad	Uranium-238	U-238	pCi/g	6.75E+01	1.57E+04	4.30E-03	5.15E+03	1.31E-02
316-5_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	204701	5.00E+03	**4.09E+01**	7.86E+05	2.60E-01
316-5_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	µg/kg	5.70E+01	4.00E+04	1.43E-03	3.25E+02	1.75E-01
316-5_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	µg/kg	7.00E+01	4.00E+04	1.75E-03	1.47E+03	4.76E-02
316-5_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	µg/kg	5.20E+01	4.00E+04	1.30E-03	1.47E+03	3.54E-02
316-5_Shallow_Focused	non-Rad	Aroclors HI	--	µg/kg	--	--	4.48E-03	--	2.58E-01
316-5_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	4.30E+03	1.00E+04	4.30E-01	1.90E+05	2.26E-02
316-5_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	1.90E+02	1.00E+05	1.90E-03	4.54E+04	4.19E-03
316-5_Shallow_Focused	Rad	Cesium-137	10045-97-3	pCi/g	1.83E+00	2.21E+03	8.28E-04	9.24E+02	1.98E-03
316-5_Shallow_Focused	non-Rad	Di-n-butylphthalate	84-74-2	µg/kg	1500	No Value	--	No Value	--
316-5_Shallow_Focused	Rad	Europium-155	14391-16-3	pCi/g	7.19E-02	1.53E+05	4.70E-07	3.34E+04	2.15E-06

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
316-5_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	3.99E-03	--	1.25E-02
316-5_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	7.67E+00	2.74E+04	2.80E-04	4.36E+03	1.76E-03
316-5_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	4.52E+01	1.57E+04	2.88E-03	5.15E+03	8.78E-03
316-5_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	138095	5.00E+03	**2.76E+01**	7.86E+05	1.76E-01
331 LSLDF_Shallow_Focused	non-Rad	4,4'-DDE (Dichlorodiphenyldichloroethylene)	72-55-9	µg/kg	25	No Value	--	4.00E+02	6.25E-02
331 LSLDF_Shallow_Focused	non-Rad	Acetone	67-64-1	µg/kg	590	No Value	--	No Value	--
331 LSLDF_Shallow_Focused	non-Rad	Aldrin	309-00-2	µg/kg	0.56	No Value	--	1.65E+02	3.39E-03
331 LSLDF_Shallow_Focused	non-Rad	Alpha-BHC	319-84-6	µg/kg	0.39	No Value	--	No Value	--
331 LSLDF_Shallow_Focused	non-Rad	Antimony	7440-36-0	µg/kg	3.60E+02	5.00E+03	7.20E-02	5.98E+03	6.02E-02
331 LSLDF_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	µg/kg	8.50E+02	4.00E+04	2.13E-02	1.47E+03	5.78E-01
331 LSLDF_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	2.40E+03	1.00E+04	2.40E-01	1.90E+05	1.26E-02
331 LSLDF_Shallow_Focused	non-Rad	Barium	7440-39-3	µg/kg	7.86E+04	3.30E+05	2.38E-01	1.32E+06	5.95E-02
331 LSLDF_Shallow_Focused	non-Rad	Beryllium	7440-41-7	µg/kg	5.70E+02	1.00E+04	5.70E-02	1.39E+04	4.10E-02
331 LSLDF_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	9.10E+02	1.00E+05	9.10E-03	4.54E+04	2.00E-02
331 LSLDF_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	1700	5.00E+02	**3.40E+00**	1.33E+05	1.28E-02
331 LSLDF_Shallow_Focused	non-Rad	Butylbenzylphthalate	85-68-7	µg/kg	340	No Value	--	No Value	--
331 LSLDF_Shallow_Focused	non-Rad	Cadmium	7440-43-9	µg/kg	1.40E+02	4.00E+03	3.50E-02	1.63E+03	8.59E-02
331 LSLDF_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	10300	4.00E+02	**2.58E+01**	3.82E+04	2.70E-01
331 LSLDF_Shallow_Focused	non-Rad	Cobalt	7440-48-4	µg/kg	8.60E+03	1.30E+04	6.62E-01	1.11E+05	7.75E-02
331 LSLDF_Shallow_Focused	non-Rad	Copper	7440-50-8	µg/kg	1.54E+04	5.00E+04	3.08E-01	1.07E+05	1.44E-01
331 LSLDF_Shallow_Focused	non-Rad	Dieldrin	60-57-1	µg/kg	13	No Value	--	2.09E+01	6.22E-01
331 LSLDF_Shallow_Focused	non-Rad	Di-n-butylphthalate	84-74-2	µg/kg	98	No Value	--	No Value	--
331 LSLDF_Shallow_Focused	non-Rad	Endosulfan I	959-98-8	µg/kg	1.9	No Value	--	7.10E+02	2.68E-03
331 LSLDF_Shallow_Focused	non-Rad	Endosulfan II	33213-65-9	µg/kg	3.1	No Value	--	7.10E+02	4.37E-03
331 LSLDF_Shallow_Focused	non-Rad	Lead	7439-92-1	µg/kg	9.00E+03	5.00E+04	1.80E-01	3.56E+04	2.53E-01
331 LSLDF_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	349000	2.20E+05	**1.59E+00**	5.80E+06	6.02E-02
331 LSLDF_Shallow_Focused	non-Rad	Mercury	7439-97-6	µg/kg	110	1.00E+02	**1.10E+00**	1.87E+03	5.88E-02
331 LSLDF_Shallow_Focused	non-Rad	Methoxychlor	72-43-5	µg/kg	3.3	No Value	--	2.18E+04	1.51E-04
331 LSLDF_Shallow_Focused	non-Rad	Methylene chloride	75-09-2	µg/kg	11	No Value	--	1.66E+05	6.63E-05
331 LSLDF_Shallow_Focused	non-Rad	Molybdenum	7439-98-7	µg/kg	5.90E+02	2.00E+03	2.95E-01	1.40E+04	4.21E-02
331 LSLDF_Shallow_Focused	non-Rad	Nickel	7440-02-0	µg/kg	1.00E+04	3.00E+04	3.33E-01	3.26E+04	3.07E-01
331 LSLDF_Shallow_Focused	non-Rad	Nitrate	14797-55-8	µg/kg	41700	No Value	--	3.40E+08	1.23E-04
331 LSLDF_Shallow_Focused	non-Rad	Nitrogen in Nitrite and Nitrate	NO2+NO3-N	µg/kg	9500	No Value	--	No Value	--
331 LSLDF_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	4.05E-05	--	1.76E-04
331 LSLDF_Shallow_Focused	non-Rad	Silver	7440-22-4	µg/kg	1.10E+03	2.00E+03	5.50E-01	4.96E+04	2.22E-02
331 LSLDF_Shallow_Focused	non-Rad	Uranium	7440-61-1	µg/kg	2.30E+03	5.00E+03	4.60E-01	7.86E+05	2.93E-03
331 LSLDF_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	5.40E-01	5.16E+04	1.05E-05	6.37E+03	8.48E-05
331 LSLDF_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	4.71E-01	1.57E+04	3.00E-05	5.15E+03	9.15E-05
331 LSLDF_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	53100	2.00E+03	**2.66E+01**	3.11E+04	**1.71E+00**
331 LSLDF_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	137000	5.00E+04	**2.74E+00**	6.78E+04	**2.02E+00**
331 LSLDF_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	1.40E+03	5.00E+03	2.80E-01	7.86E+05	1.78E-03
600-243_Shallow	non-Rad	2-Methylnaphthalene	91-57-6	µg/kg	2.79E+02	2.90E+04	9.61E-03	6.01E+03	4.64E-02
600-243_Shallow	non-Rad	Anthracene	120-12-7	µg/kg	3.13E+01	2.90E+04	1.08E-03	6.78E+05	4.61E-05
600-243_Shallow	non-Rad	Antimony	7440-36-0	µg/kg	1.30E+03	5.00E+03	2.60E-01	5.98E+03	2.17E-01

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
600-243_Shallow	non-Rad	Aroclor-1254	11097-69-1	µg/kg	2.70E+01	4.00E+04	6.75E-04	1.47E+03	1.84E-02
600-243_Shallow	non-Rad	Aroclor-1260	11096-82-5	µg/kg	1.85E+01	4.00E+04	4.63E-04	1.47E+03	1.26E-02
600-243_Shallow	non-Rad	Aroclors HI	--	µg/kg	--	--	1.14E-03	--	3.10E-02
600-243_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	6.16E+03	1.00E+04	6.16E-01	1.90E+05	3.24E-02
600-243_Shallow	non-Rad	Barium	7440-39-3	µg/kg	2.92E+05	3.30E+05	8.85E-01	1.32E+06	2.21E-01
600-243_Shallow	non-Rad	Benzo(a)anthracene	56-55-3	µg/kg	4.33E+01	1.80E+04	2.40E-03	6.40E+04	6.76E-04
600-243_Shallow	non-Rad	Benzo(a)pyrene	50-32-8	µg/kg	4.27E+01	1.80E+04	2.37E-03	7.64E+04	5.59E-04
600-243_Shallow	non-Rad	Benzo(b)fluoranthene	205-99-2	µg/kg	4.63E+01	1.80E+04	2.57E-03	3.92E+04	1.18E-03
600-243_Shallow	non-Rad	Benzo(k)fluoranthene	207-08-9	µg/kg	3.18E+01	1.80E+04	1.76E-03	3.92E+04	8.10E-04
600-243_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	2.08E+03	1.00E+04	2.08E-01	1.39E+04	1.50E-01
600-243_Shallow	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	4.32E+02	1.00E+05	4.32E-03	4.54E+04	9.52E-03
600-243_Shallow	non-Rad	Boron	7440-42-8	µg/kg	294462.62	5.00E+02	**5.89E+02**	1.33E+05	**2.21E+00**
600-243_Shallow	non-Rad	Cadmium	7440-43-9	µg/kg	7.96E+02	4.00E+03	1.99E-01	1.63E+03	4.88E-01
600-243_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	18006.452	4.00E+02	**4.50E+01**	3.82E+04	4.71E-01
600-243_Shallow	non-Rad	Chrysene	218-01-9	µg/kg	6.26E+01	1.80E+04	3.48E-03	4.45E+04	1.41E-03
600-243_Shallow	non-Rad	Cobalt	7440-48-4	µg/kg	6.21E+03	1.30E+04	4.77E-01	1.11E+05	5.59E-02
600-243_Shallow	non-Rad	Copper	7440-50-8	µg/kg	53981.061	5.00E+04	**1.08E+00**	1.07E+05	5.04E-01
600-243_Shallow	non-Rad	Dibenzofuran	132-64-9	µg/kg	78.499839	No Value	--	No Value	--
600-243_Shallow	non-Rad	Di-n-butylphthalate	84-74-2	µg/kg	37.233317	No Value	--	No Value	--
600-243_Shallow	non-Rad	Fluoranthene	206-44-0	µg/kg	7.91E+01	1.80E+04	4.39E-03	8.39E+05	9.43E-05
600-243_Shallow	non-Rad	Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	2.80E+01	1.80E+04	1.56E-03	3.57E+04	7.84E-04
600-243_Shallow	non-Rad	Lead	7439-92-1	µg/kg	4.01E+04	5.00E+04	8.03E-01	3.56E+04	**1.13E+00**
600-243_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	2.08E+05	2.20E+05	9.47E-01	5.80E+06	3.59E-02
600-243_Shallow	non-Rad	Molybdenum	7439-98-7	µg/kg	1.87E+03	2.00E+03	9.35E-01	1.40E+04	1.34E-01
600-243_Shallow	non-Rad	Naphthalene	91-20-3	µg/kg	2.04E+02	2.90E+04	7.02E-03	1.00E+05	2.04E-03
600-243_Shallow	non-Rad	Nickel	7440-02-0	µg/kg	2.14E+04	3.00E+04	7.13E-01	3.26E+04	6.56E-01
600-243_Shallow	non-Rad	Pyrene	129-00-0	µg/kg	7.00E+01	1.80E+04	3.89E-03	6.00E+05	1.17E-04
600-243_Shallow	non-Rad	Selenium	7782-49-2	µg/kg	5708.5512	5.20E+02	**1.10E+01**	1.90E+03	**3.00E+00**
600-243_Shallow	non-Rad	Silver	7440-22-4	µg/kg	5.00E+02	2.00E+03	2.50E-01	4.96E+04	1.01E-02
600-243_Shallow	non-Rad	Total petroleum hydrocarbons - diesel range	TPHDIESEL	µg/kg	9.53E+04	2.00E+05	4.77E-01	3.56E+08	2.68E-04
600-243_Shallow	non-Rad	Total petroleum hydrocarbons - motor oil (high boiling)	TPH/OILH	µg/kg	334524.06	No Value	--	No Value	--
600-243_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	46986.305	2.00E+03	**2.35E+01**	3.11E+04	**1.51E+00**
600-243_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	84099.429	5.00E+04	**1.68E+00**	6.78E+04	**1.24E+00**
600-259_Overburden	Rad	Cesium-137	10045-97-3	pCi/g	3.40E-02	2.21E+03	1.54E-05	9.24E+02	3.68E-05
600-259_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	6.80E-02	2.21E+03	3.08E-05	9.24E+02	7.36E-05
600-259_Shallow_Focused	Rad	Cesium-137	10045-97-3	pCi/g	3.80E-02	2.21E+03	1.72E-05	9.24E+02	4.11E-05
600-47_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	2.30E+03	1.00E+04	2.30E-01	1.90E+05	1.21E-02
600-47_Shallow	non-Rad	Barium	7440-39-3	µg/kg	6.70E+04	3.30E+05	2.03E-01	1.32E+06	5.08E-02
600-47_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	5.00E+02	1.00E+04	5.00E-02	1.39E+04	3.60E-02
600-47_Shallow	non-Rad	Cadmium	7440-43-9	µg/kg	9.00E+01	4.00E+03	2.25E-02	1.63E+03	5.52E-02
600-47_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	5500	4.00E+02	**1.38E+01**	3.82E+04	1.44E-01
600-47_Shallow	non-Rad	Lead	7439-92-1	µg/kg	3.50E+03	5.00E+04	7.00E-02	3.56E+04	9.83E-02
600-47_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.27E-04	--	5.21E-04
600-47_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.36E+00	5.16E+04	2.64E-05	6.37E+03	2.14E-04

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
600-47_Shallow	Rad	Uranium-238	U-238	pCi/g	1.58E+00	1.57E+04	1.01E-04	5.15E+03	3.07E-04
600-47_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	4.30E+03	5.00E+03	8.61E-01	7.86E+05	5.47E-03
618-1_Shallow	non-Rad	Aroclor-1254	11097-69-1	µg/kg	2.64E+02	4.00E+04	6.60E-03	1.47E+03	1.80E-01
618-1_Shallow	non-Rad	Aroclor-1260	11096-82-5	µg/kg	5.35E+01	4.00E+04	1.34E-03	1.47E+03	3.64E-02
618-1_Shallow	non-Rad	Aroclors HI	--	µg/kg	--	--	7.94E-03	--	2.16E-01
618-1_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	2.28E+03	1.00E+04	2.28E-01	1.90E+05	1.20E-02
618-1_Shallow	non-Rad	Barium	7440-39-3	µg/kg	9.72E+04	3.30E+05	2.95E-01	1.32E+06	7.36E-02
618-1_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	1.88E+02	1.00E+04	1.88E-02	1.39E+04	1.35E-02
618-1_Shallow	non-Rad	Boron	7440-42-8	µg/kg	1190	5.00E+02	**2.38E+00**	1.33E+05	8.95E-03
618-1_Shallow	non-Rad	Cadmium	7440-43-9	µg/kg	6.80E+01	4.00E+03	1.70E-02	1.63E+03	4.17E-02
618-1_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	7930	4.00E+02	**1.98E+01**	3.82E+04	2.08E-01
618-1_Shallow	non-Rad	Cobalt	7440-48-4	µg/kg	6.36E+03	1.30E+04	4.89E-01	1.11E+05	5.73E-02
618-1_Shallow	non-Rad	Copper	7440-50-8	µg/kg	1.14E+04	5.00E+04	2.28E-01	1.07E+05	1.07E-01
618-1_Shallow	non-Rad	Fluoride	16984-48-8	µg/kg	400	No Value	**--**	2.28E+06	1.75E-04
618-1_Shallow	non-Rad	Lead	7439-92-1	µg/kg	3.10E+03	5.00E+04	6.20E-02	3.56E+04	8.71E-02
618-1_Shallow	non-Rad	Lithium	7439-93-2	µg/kg	6380	2.00E+03	**3.19E+00**	5.15E+05	1.24E-02
618-1_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	300000	2.20E+05	**1.36E+00**	5.80E+06	5.17E-02
618-1_Shallow	non-Rad	Mercury	7439-97-6	µg/kg	3.10E+01	1.00E+02	3.10E-01	1.87E+03	1.66E-02
618-1_Shallow	non-Rad	Molybdenum	7439-98-7	µg/kg	3.36E+02	2.00E+03	1.68E-01	1.40E+04	2.40E-02
618-1_Shallow	non-Rad	Nickel	7440-02-0	µg/kg	8.15E+03	3.00E+04	2.72E-01	3.26E+04	2.50E-01
618-1_Shallow	non-Rad	Nitrate	14797-55-8	µg/kg	1600	No Value	**--**	3.40E+08	4.71E-06
618-1_Shallow	non-Rad	Nitrogen in Nitrite and Nitrate	NO2+NO3-N	µg/kg	300	No Value	**--**	No Value	**--**
618-1_Shallow	Rad	RADs SOF	--	pCi/g	--	--	2.67E-04	--	1.19E-03
618-1_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.34E-04	--	5.96E-04
618-1_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.93E+00	5.16E+04	3.74E-05	6.37E+03	3.03E-04
618-1_Shallow	Rad	Uranium-238	U-238	pCi/g	1.51E+00	1.57E+04	9.62E-05	5.15E+03	2.93E-04
618-1_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	56300	2.00E+03	**2.82E+01**	3.11E+04	**1.81E+00**
618-1_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	4.21E+04	5.00E+04	8.42E-01	6.78E+04	6.21E-01
618-1_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	4.22E+03	5.00E+03	8.45E-01	7.86E+05	5.37E-03
618-1_Shallow_Focused	non-Rad	Antimony	7440-36-0	µg/kg	4.55E+02	5.00E+03	9.10E-02	5.98E+03	7.61E-02
618-1_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	µg/kg	3.51E+01	4.00E+04	8.78E-04	3.25E+02	1.08E-01
618-1_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	µg/kg	9.81E+02	4.00E+04	2.45E-02	1.47E+03	6.67E-01
618-1_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	µg/kg	5.60E+01	4.00E+04	1.40E-03	1.47E+03	3.81E-02
618-1_Shallow_Focused	non-Rad	Aroclors HI	--	µg/kg	--	--	2.68E-02	--	8.13E-01
618-1_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	6.09E+03	1.00E+04	6.09E-01	1.90E+05	3.21E-02
618-1_Shallow_Focused	non-Rad	Barium	7440-39-3	µg/kg	1.02E+05	3.30E+05	3.09E-01	1.32E+06	7.73E-02
618-1_Shallow_Focused	non-Rad	Beryllium	7440-41-7	µg/kg	3.71E+02	1.00E+04	3.71E-02	1.39E+04	2.67E-02
618-1_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	3740	5.00E+02	**7.48E+00**	1.33E+05	2.81E-02
618-1_Shallow_Focused	non-Rad	Cadmium	7440-43-9	µg/kg	2.66E+02	4.00E+03	6.65E-02	1.63E+03	1.63E-01
618-1_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	19500	4.00E+02	**4.88E+01**	3.82E+04	5.10E-01
618-1_Shallow_Focused	non-Rad	Cobalt	7440-48-4	µg/kg	8.60E+03	1.30E+04	6.62E-01	1.11E+05	7.75E-02
618-1_Shallow_Focused	non-Rad	Copper	7440-50-8	µg/kg	2.38E+04	5.00E+04	4.76E-01	1.07E+05	2.22E-01
618-1_Shallow_Focused	non-Rad	Fluoride	16984-48-8	µg/kg	900	No Value	**--**	2.28E+06	3.95E-04
618-1_Shallow_Focused	non-Rad	Lead	7439-92-1	µg/kg	6.21E+03	5.00E+04	1.24E-01	3.56E+04	1.74E-01

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-1_Shallow_Focused	non-Rad	Lithium	7439-93-2	µg/kg	13300	2.00E+03	**6.65E+00**	5.15E+05	2.58E-02
618-1_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	403000	2.20E+05	**1.83E+00**	5.80E+06	6.95E-02
618-1_Shallow_Focused	non-Rad	Mercury	7439-97-6	µg/kg	198	1.00E+02	**1.98E+00**	1.87E+03	1.06E-01
618-1_Shallow_Focused	non-Rad	Molybdenum	7439-98-7	µg/kg	3.56E+02	2.00E+03	1.78E-01	1.40E+04	2.54E-02
618-1_Shallow_Focused	non-Rad	Nickel	7440-02-0	µg/kg	1.68E+04	3.00E+04	5.60E-01	3.26E+04	5.15E-01
618-1_Shallow_Focused	non-Rad	Nitrate	14797-55-8	µg/kg	3800	No Value	--	3.40E+08	1.12E-05
618-1_Shallow_Focused	non-Rad	Nitrogen in Nitrite and Nitrate	NO2+NO3-N	µg/kg	260	No Value	--	No Value	--
618-1_Shallow_Focused	non-Rad	Silver	7440-22-4	µg/kg	1.12E+03	2.00E+03	5.60E-01	4.96E+04	2.26E-02
618-1_Shallow_Focused	non-Rad	Uranium	7440-61-1	µg/kg	7080	5.00E+03	**1.42E+00**	7.86E+05	9.01E-03
618-1_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	1.13E+01	5.16E+04	2.19E-04	6.37E+03	1.77E-03
618-1_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	9.87E-01	2.74E+04	3.60E-05	4.36E+03	2.26E-04
618-1_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	8.23E+00	1.57E+04	5.24E-04	5.15E+03	1.60E-03
618-1_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	64700	2.00E+03	**3.24E+01**	3.11E+04	**2.08E+00**
618-1_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	68100	5.00E+04	**1.36E+00**	6.78E+04	**1.00E+00**
618-1_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	24957	5.00E+03	**4.99E+00**	7.86E+05	3.18E-02
618-12_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	8.52E+03	1.00E+04	8.52E-01	1.90E+05	4.49E-02
618-12_Shallow	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	6.30E+01	1.00E+05	6.30E-04	4.54E+04	1.39E-03
618-12_Shallow	non-Rad	Butylbenzylphthalate	85-68-7	µg/kg	60	No Value	--	No Value	--
618-12_Shallow	Rad	RADs SOF	--	pCi/g	--	--	6.99E-04	--	2.19E-03
618-12_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	4.71E-01	2.74E+04	1.72E-05	4.36E+03	1.08E-04
618-12_Shallow	Rad	Uranium-238	U-238	pCi/g	1.07E+01	1.57E+04	6.82E-04	5.15E+03	2.08E-03
618-12_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	32092	5.00E+03	**6.42E+00**	7.86E+05	4.08E-02
618-13_Shallow	non-Rad	Acetone	67-64-1	µg/kg	8.64	No Value	--	No Value	--
618-13_Shallow	non-Rad	Antimony	7440-36-0	µg/kg	3.12E+02	5.00E+03	6.24E-02	5.98E+03	5.22E-02
618-13_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	3.50E+03	1.00E+04	3.50E-01	1.90E+05	1.84E-02
618-13_Shallow	non-Rad	Barium	7440-39-3	µg/kg	7.40E+04	3.30E+05	2.24E-01	1.32E+06	5.61E-02
618-13_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	2.12E+02	1.00E+04	2.12E-02	1.39E+04	1.53E-02
618-13_Shallow	non-Rad	Boron	7440-42-8	µg/kg	1050	5.00E+02	**2.10E+00**	1.33E+05	7.89E-03
618-13_Shallow	non-Rad	Cadmium	7440-43-9	µg/kg	6.30E+01	4.00E+03	1.58E-02	1.63E+03	3.87E-02
618-13_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	3.80E-02	2.21E+03	1.72E-05	9.24E+02	4.11E-05
618-13_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	10700	4.00E+02	**2.68E+01**	3.82E+04	2.80E-01
618-13_Shallow	non-Rad	Cobalt	7440-48-4	µg/kg	6.29E+03	1.30E+04	4.84E-01	1.11E+05	5.67E-02
618-13_Shallow	non-Rad	Copper	7440-50-8	µg/kg	1.15E+04	5.00E+04	2.30E-01	1.07E+05	1.07E-01
618-13_Shallow	non-Rad	Lead	7439-92-1	µg/kg	3.62E+03	5.00E+04	7.24E-02	3.56E+04	1.02E-01
618-13_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	344000	2.20E+05	**1.56E+00**	5.80E+06	5.93E-02
618-13_Shallow	non-Rad	Methylene chloride	75-09-2	µg/kg	5.12	No Value	--	1.66E+05	3.08E-05
618-13_Shallow	non-Rad	Molybdenum	7439-98-7	µg/kg	4.20E+02	2.00E+03	2.10E-01	1.40E+04	3.00E-02
618-13_Shallow	non-Rad	Nickel	7440-02-0	µg/kg	1.24E+04	3.00E+04	4.13E-01	3.26E+04	3.80E-01
618-13_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.62E-04	--	6.72E-04
618-13_Shallow	non-Rad	Tin	7440-31-5	µg/kg	1.05E+03	5.00E+04	2.10E-02	2.04E+05	5.15E-03
618-13_Shallow	non-Rad	Uranium	7440-61-1	µg/kg	1.75E+03	5.00E+03	3.50E-01	7.86E+05	2.23E-03
618-13_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.92E+00	5.16E+04	3.72E-05	6.37E+03	3.01E-04
618-13_Shallow	Rad	Uranium-238	U-238	pCi/g	1.70E+00	1.57E+04	1.08E-04	5.15E+03	3.30E-04
618-13_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	55800	2.00E+03	**2.79E+01**	3.11E+04	**1.79E+00**

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-13_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	4.14E+04	5.00E+04	8.28E-01	6.78E+04	6.11E-01
618-13_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	5061	5.00E+03	**1.01E+00**	7.86E+05	6.44E-03
618-13_Shallow_Focused	non-Rad	Acetone	67-64-1	µg/kg	5.9	No Value	--	No Value	--
618-13_Shallow_Focused	non-Rad	Antimony	7440-36-0	µg/kg	2.33E+02	5.00E+03	4.66E-02	5.98E+03	3.90E-02
618-13_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	3.39E+03	1.00E+04	3.39E-01	1.90E+05	1.78E-02
618-13_Shallow_Focused	non-Rad	Barium	7440-39-3	µg/kg	5.77E+04	3.30E+05	1.75E-01	1.32E+06	4.37E-02
618-13_Shallow_Focused	non-Rad	Beryllium	7440-41-7	µg/kg	1.84E+02	1.00E+04	1.84E-02	1.39E+04	1.32E-02
618-13_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	960	5.00E+02	**1.92E+00**	1.33E+05	7.22E-03
618-13_Shallow_Focused	non-Rad	Cadmium	7440-43-9	µg/kg	4.70E+01	4.00E+03	1.18E-02	1.63E+03	2.88E-02
618-13_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	8740	4.00E+02	**2.19E+01**	3.82E+04	2.29E-01
618-13_Shallow_Focused	non-Rad	Cobalt	7440-48-4	µg/kg	5.71E+03	1.30E+04	4.39E-01	1.11E+05	5.14E-02
618-13_Shallow_Focused	non-Rad	Copper	7440-50-8	µg/kg	1.01E+04	5.00E+04	2.02E-01	1.07E+05	9.44E-02
618-13_Shallow_Focused	non-Rad	Hexavalent Chromium	18540-29-9	µg/kg	150	No Value	--	1.25E+06	1.20E-04
618-13_Shallow_Focused	non-Rad	Lead	7439-92-1	µg/kg	4.94E+03	5.00E+04	9.88E-02	3.56E+04	1.39E-01
618-13_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	268000	2.20E+05	**1.22E+00**	5.80E+06	4.62E-02
618-13_Shallow_Focused	non-Rad	Methylene chloride	75-09-2	µg/kg	5.03	No Value	--	1.66E+05	3.03E-05
618-13_Shallow_Focused	non-Rad	Molybdenum	7439-98-7	µg/kg	2.97E+02	2.00E+03	1.49E-01	1.40E+04	2.12E-02
618-13_Shallow_Focused	non-Rad	Nickel	7440-02-0	µg/kg	1.00E+04	3.00E+04	3.33E-01	3.26E+04	3.07E-01
618-13_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	8.32E-05	--	3.65E-04
618-13_Shallow_Focused	non-Rad	Tin	7440-31-5	µg/kg	7.45E+02	5.00E+04	1.49E-02	2.04E+05	3.65E-03
618-13_Shallow_Focused	non-Rad	Uranium	7440-61-1	µg/kg	1.50E+03	5.00E+03	3.00E-01	7.86E+05	1.91E-03
618-13_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	1.14E+00	5.16E+04	2.21E-05	6.37E+03	1.79E-04
618-13_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	9.59E-01	1.57E+04	6.11E-05	5.15E+03	1.86E-04
618-13_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	48600	2.00E+03	**2.43E+01**	3.11E+04	**1.56E+00**
618-13_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	3.71E+04	5.00E+04	7.42E-01	6.78E+04	5.47E-01
618-13_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	2.85E+03	5.00E+03	5.71E-01	7.86E+05	3.63E-03
618-2_Overburden	non-Rad	Arsenic	7440-38-2	µg/kg	2.70E+03	1.00E+04	2.70E-01	1.90E+05	1.42E-02
618-2_Overburden	non-Rad	Barium	7440-39-3	µg/kg	7.47E+04	3.30E+05	2.26E-01	1.32E+06	5.66E-02
618-2_Overburden	Rad	Cesium-137	10045-97-3	pCi/g	5.80E-02	2.21E+03	2.62E-05	9.24E+02	6.28E-05
618-2_Overburden	non-Rad	Chromium	7440-47-3	µg/kg	6600	4.00E+02	**1.65E+01**	3.82E+04	1.73E-01
618-2_Overburden	non-Rad	Lead	7439-92-1	µg/kg	4.30E+03	5.00E+04	8.60E-02	3.56E+04	1.21E-01
618-2_Overburden	Rad	RADs SOF	--	pCi/g	--	--	7.63E-05	--	2.79E-04
618-2_Overburden	non-Rad	Selenium	7782-49-2	µg/kg	1000	5.20E+02	**1.92E+00**	1.90E+03	5.26E-01
618-2_Overburden	non-Rad	Tin	7440-31-5	µg/kg	2.70E+03	5.00E+04	5.40E-02	2.04E+05	1.32E-02
618-2_Overburden	non-Rad	Uranium	7440-61-1	µg/kg	1.14E+00	5.00E+03	2.28E-04	7.86E+05	1.45E-06
618-2_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	6.44E-01	5.16E+04	1.25E-05	6.37E+03	1.01E-04
618-2_Overburden	Rad	Uranium-238	U-238	pCi/g	5.91E-01	1.57E+04	3.76E-05	5.15E+03	1.15E-04
618-2_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	1.75E+03	5.00E+03	3.50E-01	7.86E+05	2.23E-03
618-2_Shallow	Rad	Americium-241	14596-10-2	pCi/g	8.13E-01	2.15E+04	3.78E-05	4.84E+03	1.68E-04
618-2_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	1.90E+03	1.00E+04	1.90E-01	1.90E+05	1.00E-02
618-2_Shallow	non-Rad	Barium	7440-39-3	µg/kg	7.91E+04	3.30E+05	2.40E-01	1.32E+06	5.99E-02
618-2_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	2.24E+00	2.21E+03	1.01E-03	9.24E+02	2.42E-03
618-2_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	7100	4.00E+02	**1.78E+01**	3.82E+04	1.86E-01
618-2_Shallow	non-Rad	Lead	7439-92-1	µg/kg	5.60E+03	5.00E+04	1.12E-01	3.56E+04	1.57E-01

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-2_Shallow	Rad	Plutonium-239/240	PU-239/240	pCi/g	7.67E+00	1.27E+04	6.04E-04	6.27E+03	1.22E-03
618-2_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.84E-03	--	4.63E-03
618-2_Shallow	non-Rad	Selenium	7782-49-2	µg/kg	760	5.20E+02	**1.46E+00**	1.90E+03	4.00E-01
618-2_Shallow	non-Rad	Tin	7440-31-5	µg/kg	2.40E+03	5.00E+04	4.80E-02	2.04E+05	1.18E-02
618-2_Shallow	non-Rad	Uranium	7440-61-1	µg/kg	4.53E+03	5.00E+03	9.06E-01	7.86E+05	5.76E-03
618-2_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	2.20E+00	5.16E+04	4.26E-05	6.37E+03	3.45E-04
618-2_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	2.14E-01	2.74E+04	7.81E-06	4.36E+03	4.91E-05
618-2_Shallow	Rad	Uranium-238	U-238	pCi/g	2.20E+00	1.57E+04	1.40E-04	5.15E+03	4.27E-04
618-2_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	5852	5.00E+03	**1.17E+00**	7.86E+05	7.45E-03
618-2_Staging Pile	Rad	Americium-241	14596-10-2	pCi/g	8.18E-01	2.15E+04	3.80E-05	4.84E+03	1.69E-04
618-2_Staging Pile	non-Rad	Arsenic	7440-38-2	µg/kg	3.06E+03	1.00E+04	3.06E-01	1.90E+05	1.61E-02
618-2_Staging Pile	non-Rad	Barium	7440-39-3	µg/kg	6.77E+04	3.30E+05	2.05E-01	1.32E+06	5.13E-02
618-2_Staging Pile	Rad	Cesium-137	10045-97-3	pCi/g	9.50E-02	2.21E+03	4.30E-05	9.24E+02	1.03E-04
618-2_Staging Pile	non-Rad	Chromium	7440-47-3	µg/kg	6424.1864	4.00E+02	**1.61E+01**	3.82E+04	1.68E-01
618-2_Staging Pile	non-Rad	Lead	7439-92-1	µg/kg	4.01E+03	5.00E+04	8.02E-02	3.56E+04	1.13E-01
618-2_Staging Pile	Rad	Plutonium-239/240	PU-239/240	pCi/g	1.00E+01	1.27E+04	7.87E-04	6.27E+03	1.59E-03
618-2_Staging Pile	Rad	RADs SOF	--	pCi/g	--	--	1.04E-03	--	8.14E-03
618-2_Staging Pile	Rad	Tritium	10028-17-8	pCi/g	2.33E+00	1.68E+06	1.39E-06	4.20E+02	5.55E-03
618-2_Staging Pile	non-Rad	Uranium	7440-61-1	µg/kg	5022	5.00E+03	**1.00E+00**	7.86E+05	6.39E-03
618-2_Staging Pile	Rad	Uranium-233/234	U-233/234	pCi/g	2.04E+00	5.16E+04	3.95E-05	6.37E+03	3.20E-04
618-2_Staging Pile	Rad	Uranium-235	15117-96-1	pCi/g	1.23E-01	2.74E+04	4.50E-06	4.36E+03	2.83E-05
618-2_Staging Pile	Rad	Uranium-238	U-238	pCi/g	1.97E+00	1.57E+04	1.26E-04	5.15E+03	3.83E-04
618-2_Staging Pile	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	9201	5.00E+03	**1.84E+00**	7.86E+05	1.17E-02
618-3_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	2.80E+03	1.00E+04	2.80E-01	1.90E+05	1.47E-02
618-3_Shallow	non-Rad	Barium	7440-39-3	µg/kg	7.65E+04	3.30E+05	2.32E-01	1.32E+06	5.80E-02
618-3_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	9700	4.00E+02	**2.43E+01**	3.82E+04	2.54E-01
618-3_Shallow	non-Rad	Lead	7439-92-1	µg/kg	3.90E+03	5.00E+04	7.80E-02	3.56E+04	1.10E-01
618-3_Shallow	Rad	RADs SOF	--	pCi/g	--	--	6.07E-05	--	2.51E-04
618-3_Shallow	non-Rad	Selenium	7782-49-2	µg/kg	659	5.20E+02	**1.27E+00**	1.90E+03	3.47E-01
618-3_Shallow	non-Rad	Uranium	7440-61-1	µg/kg	1.61E+03	5.00E+03	3.22E-01	7.86E+05	2.05E-03
618-3_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	6.77E-01	5.16E+04	1.31E-05	6.37E+03	1.06E-04
618-3_Shallow	Rad	Uranium-238	U-238	pCi/g	7.47E-01	1.57E+04	4.76E-05	5.15E+03	1.45E-04
618-3_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	2.22E+03	5.00E+03	4.45E-01	7.86E+05	2.83E-03
618-3_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	6.78E-03	--	2.90E-02
618-3_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	7.96E+01	5.16E+04	1.54E-03	6.37E+03	1.25E-02
618-3_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	4.79E+00	2.74E+04	1.75E-04	4.36E+03	1.10E-03
618-3_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	7.94E+01	1.57E+04	5.06E-03	5.15E+03	1.54E-02
618-3_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	238577	5.00E+03	**4.77E+01**	7.86E+05	3.04E-01
618-4_Overburden_2	non-Rad	Arsenic	7440-38-2	µg/kg	2.50E+03	1.00E+04	2.50E-01	1.90E+05	1.32E-02
618-4_Overburden_2	non-Rad	Lead	7439-92-1	µg/kg	4.70E+03	5.00E+04	9.40E-02	3.56E+04	1.32E-01
618-4_Overburden_2	Rad	RADs SOF	--	pCi/g	--	--	1.15E-04	--	4.78E-04
618-4_Overburden_2	Rad	Uranium-233/234	U-233/234	pCi/g	1.30E+00	5.16E+04	2.52E-05	6.37E+03	2.04E-04
618-4_Overburden_2	Rad	Uranium-238	U-238	pCi/g	1.41E+00	1.57E+04	8.98E-05	5.15E+03	2.74E-04
618-4_Overburden_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	4.20E+03	5.00E+03	8.39E-01	7.86E+05	5.34E-03

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-4_Overburden_3	non-Rad	Lead	7439-92-1	µg/kg	5.00E+03	5.00E+04	1.00E-01	3.56E+04	1.40E-01
618-4_Overburden_3	Rad	RADs SOF	--	pCi/g	--	--	3.73E-05	--	1.59E-04
618-4_Overburden_3	Rad	Uranium-233/234	U-233/234	pCi/g	4.24E-01	5.16E+04	8.22E-06	6.37E+03	6.66E-05
618-4_Overburden_3	Rad	Uranium-235	15117-96-1	pCi/g	3.20E-02	2.74E+04	1.17E-06	4.36E+03	7.34E-06
618-4_Overburden_3	Rad	Uranium-238	U-238	pCi/g	4.38E-01	1.57E+04	2.79E-05	5.15E+03	8.50E-05
618-4_Overburden_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	1.17E+03	5.00E+03	2.34E-01	7.86E+05	1.49E-03
618-4_Overburden_4	non-Rad	Lead	7439-92-1	µg/kg	4.80E+03	5.00E+04	9.60E-02	3.56E+04	1.35E-01
618-4_Overburden_4	Rad	RADs SOF	--	pCi/g	--	--	7.83E-05	--	3.31E-04
618-4_Overburden_4	Rad	Uranium-233/234	U-233/234	pCi/g	9.42E-01	5.16E+04	1.83E-05	6.37E+03	1.48E-04
618-4_Overburden_4	Rad	Uranium-238	U-238	pCi/g	9.42E-01	1.57E+04	6.00E-05	5.15E+03	1.83E-04
618-4_Overburden_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	2.32E+03	5.00E+03	4.65E-01	7.86E+05	2.96E-03
618-4_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	3.20E+03	1.00E+04	3.20E-01	1.90E+05	1.68E-02
618-4_Shallow	non-Rad	Lead	7439-92-1	µg/kg	4.90E+04	5.00E+04	9.80E-01	3.56E+04	**1.38E+00**
618-4_Shallow	Rad	RADs SOF	--	pCi/g	--	--	2.58E-04	--	1.10E-03
618-4_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	3.22E+00	5.16E+04	6.24E-05	6.37E+03	5.05E-04
618-4_Shallow	Rad	Uranium-238	U-238	pCi/g	3.07E+00	1.57E+04	1.96E-04	5.15E+03	5.96E-04
618-4_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	7456	5.00E+03	**1.49E+00**	7.86E+05	9.49E-03
618-5_Overburden	non-Rad	Arsenic	7440-38-2	µg/kg	3.40E+03	1.00E+04	3.40E-01	1.90E+05	1.79E-02
618-5_Overburden	non-Rad	Cadmium	7440-43-9	µg/kg	1.70E+02	4.00E+03	4.25E-02	1.63E+03	1.04E-01
618-5_Overburden	non-Rad	Chromium	7440-47-3	µg/kg	9700	4.00E+02	**2.43E+01**	3.82E+04	2.54E-01
618-5_Overburden	non-Rad	Lead	7439-92-1	µg/kg	7.50E+03	5.00E+04	1.50E-01	3.56E+04	2.11E-01
618-5_Overburden	Rad	RADs SOF	--	pCi/g	--	--	3.70E-04	--	1.54E-03
618-5_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	4.14E+00	5.16E+04	8.02E-05	6.37E+03	6.50E-04
618-5_Overburden	Rad	Uranium-238	U-238	pCi/g	4.56E+00	1.57E+04	2.90E-04	5.15E+03	8.85E-04
618-5_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	9773	5.00E+03	**1.95E+00**	7.86E+05	1.24E-02
618-5_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	4.30E+03	1.00E+04	4.30E-01	1.90E+05	2.26E-02
618-5_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	11300	4.00E+02	**2.83E+01**	3.82E+04	2.96E-01
618-5_Shallow	non-Rad	Lead	7439-92-1	µg/kg	6.10E+03	5.00E+04	1.22E-01	3.56E+04	1.71E-01
618-5_Shallow	Rad	RADs SOF	--	pCi/g	--	--	8.51E-05	--	3.51E-04
618-5_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	9.38E-01	5.16E+04	1.82E-05	6.37E+03	1.47E-04
618-5_Shallow	Rad	Uranium-238	U-238	pCi/g	1.05E+00	1.57E+04	6.69E-05	5.15E+03	2.04E-04
618-5_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	2.85E+03	5.00E+03	5.70E-01	7.86E+05	3.62E-03
618-5_Staging Pile_4	non-Rad	Arsenic	7440-38-2	µg/kg	3.30E+03	1.00E+04	3.30E-01	1.90E+05	1.74E-02
618-5_Staging Pile_4	non-Rad	Cadmium	7440-43-9	µg/kg	5.00E+01	4.00E+03	1.25E-02	1.63E+03	3.07E-02
618-5_Staging Pile_4	non-Rad	Chromium	7440-47-3	µg/kg	11800	4.00E+02	**2.95E+01**	3.82E+04	3.09E-01
618-5_Staging Pile_4	non-Rad	Lead	7439-92-1	µg/kg	5.30E+03	5.00E+04	1.06E-01	3.56E+04	1.49E-01
618-5_Staging Pile_4	Rad	RADs SOF	--	pCi/g	--	--	9.43E-05	--	4.00E-04
618-5_Staging Pile_4	Rad	Uranium-233/234	U-233/234	pCi/g	1.15E+00	5.16E+04	2.23E-05	6.37E+03	1.81E-04
618-5_Staging Pile_4	Rad	Uranium-238	U-238	pCi/g	1.13E+00	1.57E+04	7.20E-05	5.15E+03	2.19E-04
618-5_Staging Pile_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	3.36E+03	5.00E+03	6.73E-01	7.86E+05	4.28E-03
618-5_Staging Pile_5	non-Rad	Arsenic	7440-38-2	µg/kg	2.70E+03	1.00E+04	2.70E-01	1.90E+05	1.42E-02
618-5_Staging Pile_5	non-Rad	Chromium	7440-47-3	µg/kg	10300	4.00E+02	**2.58E+01**	3.82E+04	2.70E-01
618-5_Staging Pile_5	non-Rad	Lead	7439-92-1	µg/kg	3.90E+03	5.00E+04	7.80E-02	3.56E+04	1.10E-01
618-5_Staging Pile_5	Rad	RADs SOF	--	pCi/g	--	--	1.45E-04	--	6.10E-04

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-5_Staging Pile_5	Rad	Uranium-233/234	U-233/234	pCi/g	1.52E+00	5.16E+04	2.95E-05	6.37E+03	2.39E-04
618-5_Staging Pile_5	Rad	Uranium-235	15117-96-1	pCi/g	1.68E-01	2.74E+04	6.13E-06	4.36E+03	3.85E-05
618-5_Staging Pile_5	Rad	Uranium-238	U-238	pCi/g	1.71E+00	1.57E+04	1.09E-04	5.15E+03	3.32E-04
618-5_Staging Pile_5	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	4.33E+03	5.00E+03	8.65E-01	7.86E+05	5.50E-03
618-7_Shallow_1	non-Rad	Antimony	7440-36-0	µg/kg	5.59E+02	5.00E+03	1.12E-01	5.98E+03	9.34E-02
618-7_Shallow_1	non-Rad	Arsenic	7440-38-2	µg/kg	1.89E+03	1.00E+04	1.89E-01	1.90E+05	9.95E-03
618-7_Shallow_1	non-Rad	Barium	7440-39-3	µg/kg	6.89E+04	3.30E+05	2.09E-01	1.32E+06	5.22E-02
618-7_Shallow_1	non-Rad	Beryllium	7440-41-7	µg/kg	2.77E+02	1.00E+04	2.77E-02	1.39E+04	1.99E-02
618-7_Shallow_1	non-Rad	Cadmium	7440-43-9	µg/kg	6.54E+01	4.00E+03	1.63E-02	1.63E+03	4.01E-02
618-7_Shallow_1	Rad	Cesium-137	10045-97-3	pCi/g	8.20E-02	2.21E+03	3.71E-05	9.24E+02	8.87E-05
618-7_Shallow_1	non-Rad	Chromium	7440-47-3	µg/kg	10227.486	4.00E+02	**2.56E+01**	3.82E+04	2.68E-01
618-7_Shallow_1	non-Rad	Cobalt	7440-48-4	µg/kg	9.15E+03	1.30E+04	7.04E-01	1.11E+05	8.25E-02
618-7_Shallow_1	non-Rad	Copper	7440-50-8	µg/kg	1.61E+04	5.00E+04	3.22E-01	1.07E+05	1.51E-01
618-7_Shallow_1	non-Rad	Lead	7439-92-1	µg/kg	1.46E+04	5.00E+04	2.91E-01	3.56E+04	4.09E-01
618-7_Shallow_1	non-Rad	Manganese	7439-96-5	µg/kg	326067.08	2.20E+05	**1.48E+00**	5.80E+06	5.62E-02
618-7_Shallow_1	non-Rad	Mercury	7439-97-6	µg/kg	4.43E+01	1.00E+02	4.43E-01	1.87E+03	2.37E-02
618-7_Shallow_1	non-Rad	Nickel	7440-02-0	µg/kg	2.10E+04	3.00E+04	6.99E-01	3.26E+04	6.43E-01
618-7_Shallow_1	Rad	RADs SOF	--	pCi/g	--	--	3.49E-04	--	1.43E-03
618-7_Shallow_1	non-Rad	Tin	7440-31-5	µg/kg	1.55E+03	5.00E+04	3.09E-02	2.04E+05	7.58E-03
618-7_Shallow_1	Rad	Uranium-233/234	U-233/234	pCi/g	3.61E+00	5.16E+04	7.01E-05	6.37E+03	5.67E-04
618-7_Shallow_1	Rad	Uranium-235	15117-96-1	pCi/g	3.64E-01	2.74E+04	1.33E-05	4.36E+03	8.34E-05
618-7_Shallow_1	Rad	Uranium-238	U-238	pCi/g	3.57E+00	1.57E+04	2.28E-04	5.15E+03	6.94E-04
618-7_Shallow_1	non-Rad	Vanadium	7440-62-2	µg/kg	74575.766	2.00E+03	**3.73E+01**	3.11E+04	**2.40E+00**
618-7_Shallow_1	non-Rad	Zinc	7440-66-6	µg/kg	4.92E+04	5.00E+04	9.84E-01	6.78E+04	7.25E-01
618-7_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	10814	5.00E+03	**2.16E+00**	7.86E+05	1.38E-02
618-7_Shallow_2	non-Rad	Antimony	7440-36-0	µg/kg	6.60E+02	5.00E+03	1.32E-01	5.98E+03	1.10E-01
618-7_Shallow_2	non-Rad	Arsenic	7440-38-2	µg/kg	2.50E+03	1.00E+04	2.50E-01	1.90E+05	1.32E-02
618-7_Shallow_2	non-Rad	Barium	7440-39-3	µg/kg	7.38E+04	3.30E+05	2.24E-01	1.32E+06	5.59E-02
618-7_Shallow_2	non-Rad	Beryllium	7440-41-7	µg/kg	4.40E+02	1.00E+04	4.40E-02	1.39E+04	3.17E-02
618-7_Shallow_2	non-Rad	Chromium	7440-47-3	µg/kg	6800	4.00E+02	**1.70E+01**	3.82E+04	1.78E-01
618-7_Shallow_2	non-Rad	Cobalt	7440-48-4	µg/kg	9.30E+03	1.30E+04	7.15E-01	1.11E+05	8.38E-02
618-7_Shallow_2	non-Rad	Copper	7440-50-8	µg/kg	1.36E+04	5.00E+04	2.72E-01	1.07E+05	1.27E-01
618-7_Shallow_2	non-Rad	Lead	7439-92-1	µg/kg	2.80E+03	5.00E+04	5.60E-02	3.56E+04	7.87E-02
618-7_Shallow_2	non-Rad	Manganese	7439-96-5	µg/kg	364000	2.20E+05	**1.65E+00**	5.80E+06	6.28E-02
618-7_Shallow_2	non-Rad	Mercury	7439-97-6	µg/kg	2.00E+01	1.00E+02	2.00E-01	1.87E+03	1.07E-02
618-7_Shallow_2	non-Rad	Nickel	7440-02-0	µg/kg	9.70E+03	3.00E+04	3.23E-01	3.26E+04	2.98E-01
618-7_Shallow_2	Rad	RADs SOF	--	pCi/g	--	--	4.50E-05	--	1.93E-04
618-7_Shallow_2	non-Rad	Tin	7440-31-5	µg/kg	1.50E+03	5.00E+04	3.00E-02	2.04E+05	7.35E-03
618-7_Shallow_2	Rad	Uranium-233/234	U-233/234	pCi/g	5.66E-01	5.16E+04	1.10E-05	6.37E+03	8.89E-05
618-7_Shallow_2	Rad	Uranium-238	U-238	pCi/g	5.34E-01	1.57E+04	3.40E-05	5.15E+03	1.04E-04
618-7_Shallow_2	non-Rad	Vanadium	7440-62-2	µg/kg	74700	2.00E+03	**3.74E+01**	3.11E+04	**2.40E+00**
618-7_Shallow_2	non-Rad	Zinc	7440-66-6	µg/kg	4.62E+04	5.00E+04	9.24E-01	6.78E+04	6.81E-01
618-7_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	1.57E+03	5.00E+03	3.15E-01	7.86E+05	2.00E-03
618-7_Shallow_3	non-Rad	Antimony	7440-36-0	µg/kg	4.50E+02	5.00E+03	9.00E-02	5.98E+03	7.53E-02

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-7_Shallow_3	non-Rad	Arsenic	7440-38-2	µg/kg	2.80E+03	1.00E+04	2.80E-01	1.90E+05	1.47E-02
618-7_Shallow_3	non-Rad	Barium	7440-39-3	µg/kg	8.25E+04	3.30E+05	2.50E-01	1.32E+06	6.25E-02
618-7_Shallow_3	non-Rad	Beryllium	7440-41-7	µg/kg	3.10E+02	1.00E+04	3.10E-02	1.39E+04	2.23E-02
618-7_Shallow_3	non-Rad	Cadmium	7440-43-9	µg/kg	1.90E+02	4.00E+03	4.75E-02	1.63E+03	1.17E-01
618-7_Shallow_3	non-Rad	Chromium	7440-47-3	µg/kg	10100	4.00E+02	**2.53E+01**	3.82E+04	2.64E-01
618-7_Shallow_3	non-Rad	Cobalt	7440-48-4	µg/kg	8.60E+03	1.30E+04	6.62E-01	1.11E+05	7.75E-02
618-7_Shallow_3	non-Rad	Copper	7440-50-8	µg/kg	1.36E+04	5.00E+04	2.72E-01	1.07E+05	1.27E-01
618-7_Shallow_3	non-Rad	Lead	7439-92-1	µg/kg	4.30E+03	5.00E+04	8.60E-02	3.56E+04	1.21E-01
618-7_Shallow_3	non-Rad	Manganese	7439-96-5	µg/kg	357000	2.20E+05	**1.62E+00**	5.80E+06	6.16E-02
618-7_Shallow_3	non-Rad	Mercury	7439-97-6	µg/kg	2.00E+01	1.00E+02	2.00E-01	1.87E+03	1.07E-02
618-7_Shallow_3	non-Rad	Nickel	7440-02-0	µg/kg	1.01E+04	3.00E+04	3.37E-01	3.26E+04	3.10E-01
618-7_Shallow_3	Rad	RADs SOF	--	pCi/g	--	--	8.40E-05	--	3.71E-04
618-7_Shallow_3	non-Rad	Tin	7440-31-5	µg/kg	1.80E+03	5.00E+04	3.60E-02	2.04E+05	8.82E-03
618-7_Shallow_3	Rad	Uranium-233/234	U-233/234	pCi/g	1.07E+00	5.16E+04	2.07E-05	6.37E+03	1.68E-04
618-7_Shallow_3	Rad	Uranium-235	15117-96-1	pCi/g	8.50E-02	2.74E+04	3.10E-06	4.36E+03	1.95E-05
618-7_Shallow_3	Rad	Uranium-238	U-238	pCi/g	9.45E-01	1.57E+04	6.02E-05	5.15E+03	1.83E-04
618-7_Shallow_3	non-Rad	Vanadium	7440-62-2	µg/kg	68200	2.00E+03	**3.41E+01**	3.11E+04	**2.19E+00**
618-7_Shallow_3	non-Rad	Zinc	7440-66-6	µg/kg	4.45E+04	5.00E+04	8.90E-01	6.78E+04	6.56E-01
618-7_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	2.85E+03	5.00E+03	5.70E-01	7.86E+05	3.63E-03
618-7_Shallow_4	non-Rad	Antimony	7440-36-0	µg/kg	2.50E+02	5.00E+03	5.00E-02	5.98E+03	4.18E-02
618-7_Shallow_4	non-Rad	Arsenic	7440-38-2	µg/kg	5.20E+03	1.00E+04	5.20E-01	1.90E+05	2.74E-02
618-7_Shallow_4	non-Rad	Barium	7440-39-3	µg/kg	5.79E+04	3.30E+05	1.75E-01	1.32E+06	4.39E-02
618-7_Shallow_4	non-Rad	Beryllium	7440-41-7	µg/kg	2.20E+02	1.00E+04	2.20E-02	1.39E+04	1.58E-02
618-7_Shallow_4	non-Rad	Cadmium	7440-43-9	µg/kg	9.00E+01	4.00E+03	2.25E-02	1.63E+03	5.52E-02
618-7_Shallow_4	non-Rad	Chromium	7440-47-3	µg/kg	11400	4.00E+02	**2.85E+01**	3.82E+04	2.98E-01
618-7_Shallow_4	non-Rad	Cobalt	7440-48-4	µg/kg	6.70E+03	1.30E+04	5.15E-01	1.11E+05	6.04E-02
618-7_Shallow_4	non-Rad	Copper	7440-50-8	µg/kg	1.32E+04	5.00E+04	2.64E-01	1.07E+05	1.23E-01
618-7_Shallow_4	non-Rad	Lead	7439-92-1	µg/kg	3.00E+03	5.00E+04	6.00E-02	3.56E+04	8.43E-02
618-7_Shallow_4	non-Rad	Manganese	7439-96-5	µg/kg	285000	2.20E+05	**1.30E+00**	5.80E+06	4.91E-02
618-7_Shallow_4	non-Rad	Nickel	7440-02-0	µg/kg	1.29E+04	3.00E+04	4.30E-01	3.26E+04	3.96E-01
618-7_Shallow_4	Rad	RADs SOF	--	pCi/g	--	--	6.20E-05	--	2.56E-04
618-7_Shallow_4	non-Rad	Tin	7440-31-5	µg/kg	7.10E+02	5.00E+04	1.42E-02	2.04E+05	3.48E-03
618-7_Shallow_4	Rad	Uranium-233/234	U-233/234	pCi/g	6.89E-01	5.16E+04	1.34E-05	6.37E+03	1.08E-04
618-7_Shallow_4	Rad	Uranium-238	U-238	pCi/g	7.63E-01	1.57E+04	4.86E-05	5.15E+03	1.48E-04
618-7_Shallow_4	non-Rad	Vanadium	7440-62-2	µg/kg	54800	2.00E+03	**2.74E+01**	3.11E+04	**1.76E+00**
618-7_Shallow_4	non-Rad	Zinc	7440-66-6	µg/kg	3.70E+04	5.00E+04	7.40E-01	6.78E+04	5.46E-01
618-7_Shallow_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	2.06E+03	5.00E+03	4.13E-01	7.86E+05	2.63E-03
618-7_Shallow_Focused	non-Rad	Acenaphthene	83-32-9	µg/kg	1.50E+02	2.00E+04	7.50E-03	1.10E+06	1.36E-04
618-7_Shallow_Focused	non-Rad	Antimony	7440-36-0	µg/kg	9.80E+02	5.00E+03	1.96E-01	5.98E+03	1.64E-01
618-7_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	µg/kg	6.70E+00	4.00E+04	1.68E-04	3.25E+02	2.06E-02
618-7_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	4.20E+03	1.00E+04	4.20E-01	1.90E+05	2.21E-02
618-7_Shallow_Focused	non-Rad	Barium	7440-39-3	µg/kg	9.28E+04	3.30E+05	2.81E-01	1.32E+06	7.03E-02
618-7_Shallow_Focused	non-Rad	Benzo(a)anthracene	56-55-3	µg/kg	8.80E+01	1.80E+04	4.89E-03	6.40E+04	1.38E-03
618-7_Shallow_Focused	non-Rad	Benzo(a)pyrene	50-32-8	µg/kg	6.60E+01	1.80E+04	3.67E-03	7.64E+04	8.64E-04

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-7_Shallow_Focused	non-Rad	Benzo(b)fluoranthene	205-99-2	µg/kg	5.20E+01	1.80E+04	2.89E-03	3.92E+04	1.33E-03
618-7_Shallow_Focused	non-Rad	Benzo(k)fluoranthene	207-08-9	µg/kg	1.10E+01	1.80E+04	6.11E-04	3.92E+04	2.81E-04
618-7_Shallow_Focused	non-Rad	Beryllium	7440-41-7	µg/kg	3.70E+02	1.00E+04	3.70E-02	1.39E+04	2.66E-02
618-7_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	4.70E+02	1.00E+05	4.70E-03	4.54E+04	1.04E-02
618-7_Shallow_Focused	non-Rad	Cadmium	7440-43-9	µg/kg	6200	4.00E+03	**1.55E+00**	1.63E+03	**3.80E+00**
618-7_Shallow_Focused	Rad	Cesium-137	10045-97-3	pCi/g	1.00E-02	2.21E+03	4.52E-06	9.24E+02	1.08E-05
618-7_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	65900	4.00E+02	**1.65E+02**	3.82E+04	**1.73E+00**
618-7_Shallow_Focused	non-Rad	Chrysene	218-01-9	µg/kg	6.90E+01	1.80E+04	3.83E-03	4.45E+04	1.55E-03
618-7_Shallow_Focused	non-Rad	Cobalt	7440-48-4	µg/kg	1.10E+04	1.30E+04	8.46E-01	1.11E+05	9.91E-02
618-7_Shallow_Focused	non-Rad	Copper	7440-50-8	µg/kg	2.50E+04	5.00E+04	5.00E-01	1.07E+05	2.34E-01
618-7_Shallow_Focused	non-Rad	Dibenz[a,h]anthracene	53-70-3	µg/kg	4.50E+01	1.80E+04	2.50E-03	4.41E+04	1.02E-03
618-7_Shallow_Focused	non-Rad	Di-n-butylphthalate	84-74-2	µg/kg	33	No Value	--	No Value	--
618-7_Shallow_Focused	non-Rad	Fluoranthene	206-44-0	µg/kg	4.80E+01	1.80E+04	2.67E-03	8.39E+05	5.72E-05
618-7_Shallow_Focused	non-Rad	Lead	7439-92-1	µg/kg	6.50E+03	5.00E+04	1.30E-01	3.56E+04	1.83E-01
618-7_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	425000	2.20E+05	**1.93E+00**	5.80E+06	7.33E-02
618-7_Shallow_Focused	non-Rad	Mercury	7439-97-6	µg/kg	2.00E+01	1.00E+02	2.00E-01	1.87E+03	1.07E-02
618-7_Shallow_Focused	non-Rad	Nickel	7440-02-0	µg/kg	1.72E+04	3.00E+04	5.73E-01	3.26E+04	5.28E-01
618-7_Shallow_Focused	non-Rad	Pyrene	129-00-0	µg/kg	4.10E+02	1.80E+04	2.28E-02	6.00E+05	6.83E-04
618-7_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	6.60E-04	--	3.19E-03
618-7_Shallow_Focused	non-Rad	Tin	7440-31-5	µg/kg	1.20E+03	5.00E+04	2.40E-02	2.04E+05	5.88E-03
618-7_Shallow_Focused	non-Rad	Total petroleum hydrocarbons - motor oil (high boiling)	TPH/OILH	µg/kg	680000	No Value	--	No Value	--
618-7_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	1.09E+01	5.16E+04	2.11E-04	6.37E+03	1.71E-03
618-7_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	9.74E-01	2.74E+04	3.55E-05	4.36E+03	2.23E-04
618-7_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	6.42E+00	1.57E+04	4.09E-04	5.15E+03	1.25E-03
618-7_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	80500	2.00E+03	**4.03E+01**	3.11E+04	**2.59E+00**
618-7_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	52400	5.00E+04	**1.05E+00**	6.78E+04	7.73E-01
618-7_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	19563	5.00E+03	**3.91E+00**	7.86E+05	2.49E-02
618-8_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	4.10E+03	1.00E+04	4.10E-01	1.90E+05	2.16E-02
618-8_Shallow	non-Rad	Barium	7440-39-3	µg/kg	9.76E+04	3.30E+05	2.96E-01	1.32E+06	7.39E-02
618-8_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	12400	4.00E+02	**3.10E+01**	3.82E+04	3.25E-01
618-8_Shallow	non-Rad	Lead	7439-92-1	µg/kg	5.10E+03	5.00E+04	1.02E-01	3.56E+04	1.43E-01
618-8_Shallow	Rad	RADs SOF	--	pCi/g	--	--	6.99E-05	--	3.30E-04
618-8_Shallow	non-Rad	Selenium	7782-49-2	µg/kg	846	5.20E+02	**1.63E+00**	1.90E+03	4.45E-01
618-8_Shallow	non-Rad	Uranium	7440-61-1	µg/kg	1.72E+03	5.00E+03	3.44E-01	7.86E+05	2.19E-03
618-8_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.19E+00	5.16E+04	2.31E-05	6.37E+03	1.87E-04
618-8_Shallow	Rad	Uranium-238	U-238	pCi/g	7.34E-01	1.57E+04	4.68E-05	5.15E+03	1.43E-04
618-8_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	1.94E+03	5.00E+03	3.87E-01	7.86E+05	2.46E-03
618-9_Shallow_Focused	non-Rad	1,1,2,2-Tetrachloroethane	79-34-5	µg/kg	110	No Value	--	1.65E+05	6.67E-04
618-9_Shallow_Focused	non-Rad	Acetone	67-64-1	µg/kg	680	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aldrin	309-00-2	µg/kg	390	No Value	--	1.65E+02	**2.36E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1016	12674-11-2	µg/kg	1.90E+03	4.00E+04	4.75E-02	1.82E+03	**1.04E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1221	11104-28-2	µg/kg	1.90E+03	4.00E+04	4.75E-02	1.47E+03	**1.29E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1232	11141-16-5	µg/kg	1.90E+03	4.00E+04	4.75E-02	1.44E+03	**1.32E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1242	53469-21-9	µg/kg	1.90E+03	4.00E+04	4.75E-02	1.49E+03	**1.28E+00**

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-9_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	µg/kg	1.90E+03	4.00E+04	4.75E-02	3.25E+02	**5.85E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	µg/kg	3.90E+03	4.00E+04	9.75E-02	1.47E+03	**2.65E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	µg/kg	3.90E+03	4.00E+04	9.75E-02	1.47E+03	**2.65E+00**
618-9_Shallow_Focused	non-Rad	Aroclors HI	--	µg/kg	--	--	4.33E-01	--	**1.61E+01**
618-9_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	11600	1.00E+04	**1.16E+00**	1.90E+05	6.11E-02
618-9_Shallow_Focused	non-Rad	Barium	7440-39-3	µg/kg	9.02E+04	3.30E+05	2.73E-01	1.32E+06	6.83E-02
618-9_Shallow_Focused	non-Rad	Beryllium	7440-41-7	µg/kg	3.30E+02	1.00E+04	3.30E-02	1.39E+04	2.37E-02
618-9_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	5.20E+03	1.00E+05	5.20E-02	4.54E+04	1.15E-01
618-9_Shallow_Focused	non-Rad	Butylbenzylphthalate	85-68-7	µg/kg	2700	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Chlordane	57-74-9	µg/kg	6.90E+01	1.00E+03	6.90E-02	5.04E+04	1.37E-03
618-9_Shallow_Focused	non-Rad	Chloroform	67-66-3	µg/kg	9	No Value	--	1.65E+05	5.45E-05
618-9_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	9700	4.00E+02	**2.43E+01**	3.82E+04	2.54E-01
618-9_Shallow_Focused	non-Rad	Cobalt	7440-48-4	µg/kg	1.14E+04	1.30E+04	8.77E-01	1.11E+05	1.03E-01
618-9_Shallow_Focused	non-Rad	Copper	7440-50-8	µg/kg	1.67E+04	5.00E+04	3.34E-01	1.07E+05	1.56E-01
618-9_Shallow_Focused	non-Rad	Di-n-butylphthalate	84-74-2	µg/kg	7200	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Heptachlor epoxide	1024-57-3	µg/kg	44	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Hexachlorobutadiene	87-68-3	µg/kg	760	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Hexachloroethane	67-72-1	µg/kg	17000	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Lead	7439-92-1	µg/kg	7.70E+03	5.00E+04	1.54E-01	3.56E+04	2.16E-01
618-9_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	359000	2.20E+05	**1.63E+00**	5.80E+06	6.19E-02
618-9_Shallow_Focused	non-Rad	Mercury	7439-97-6	µg/kg	330	1.00E+02	**3.30E+00**	1.87E+03	1.76E-01
618-9_Shallow_Focused	non-Rad	Methylene chloride	75-09-2	µg/kg	2300	No Value	--	1.66E+05	1.39E-02
618-9_Shallow_Focused	non-Rad	Nickel	7440-02-0	µg/kg	1.06E+04	3.00E+04	3.53E-01	3.26E+04	3.25E-01
618-9_Shallow_Focused	non-Rad	Nitrate	14797-55-8	µg/kg	1670000	No Value	--	3.40E+08	4.91E-03
618-9_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	1.94E-04	--	5.99E-04
618-9_Shallow_Focused	non-Rad	Tetrachloroethene	127-18-4	µg/kg	920	No Value	--	6.98E+04	1.32E-02
618-9_Shallow_Focused	non-Rad	Toluene	108-88-3	µg/kg	9.00E+00	2.00E+05	4.50E-05	5.20E+06	1.73E-06
618-9_Shallow_Focused	non-Rad	Trichloroethene	79-01-6	µg/kg	2	No Value	--	7.01E+04	2.85E-05
618-9_Shallow_Focused	non-Rad	Uranium	7440-61-1	µg/kg	3.10E+03	5.00E+03	6.20E-01	7.86E+05	3.94E-03
618-9_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	7.10E-02	2.74E+04	2.59E-06	4.36E+03	1.63E-05
618-9_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	3.00E+00	1.57E+04	1.91E-04	5.15E+03	5.83E-04
618-9_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	59300	2.00E+03	**2.97E+01**	3.11E+04	**1.91E+00**
618-9_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	52300	5.00E+04	**1.05E+00**	6.78E+04	7.71E-01
618-9_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	8963	5.00E+03	**1.79E+00**	7.86E+05	1.14E-02
628-4_Overburden	non-Rad	Arsenic	7440-38-2	µg/kg	3.37E+03	1.00E+04	3.37E-01	1.90E+05	1.78E-02
628-4_Overburden	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	µg/kg	6.09E+01	1.00E+05	6.09E-04	4.54E+04	1.34E-03
628-4_Overburden	Rad	Cesium-137	10045-97-3	pCi/g	3.30E-02	2.21E+03	1.49E-05	9.24E+02	3.57E-05
628-4_Overburden	non-Rad	Lead	7439-92-1	µg/kg	7.28E+03	5.00E+04	1.46E-01	3.56E+04	2.05E-01
628-4_Overburden	Rad	RADs SOF	--	pCi/g	--	--	8.12E-05	--	3.24E-04
628-4_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	8.70E-01	5.16E+04	1.69E-05	6.37E+03	1.37E-04
628-4_Overburden	Rad	Uranium-238	U-238	pCi/g	7.75E-01	1.57E+04	4.94E-05	5.15E+03	1.51E-04
628-4_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	2.31E+03	5.00E+03	4.62E-01	7.86E+05	2.94E-03
628-4_Shallow	non-Rad	Aroclor-1242	53469-21-9	µg/kg	4.24E+01	4.00E+04	1.06E-03	1.49E+03	2.84E-02
628-4_Shallow	non-Rad	Aroclor-1248	12672-29-6	µg/kg	1.12E+03	4.00E+04	2.79E-02	3.25E+02	**3.43E+00**

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
628-4_Shallow	non-Rad	Aroclor-1254	11097-69-1	µg/kg	4.05E+02	4.00E+04	1.01E-02	1.47E+03	2.75E-01
628-4_Shallow	non-Rad	Aroclor-1260	11096-82-5	µg/kg	3.78E+01	4.00E+04	9.44E-04	1.47E+03	2.57E-02
628-4_Shallow	non-Rad	Aroclors HI	--	µg/kg	--	--	4.00E-02	--	**3.76E+00**
628-4_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	3.86E+03	1.00E+04	3.86E-01	1.90E+05	2.03E-02
628-4_Shallow	non-Rad	Lead	7439-92-1	µg/kg	99167.457	5.00E+04	**1.98E+00**	3.56E+04	**2.79E+00**
628-4_Shallow	Rad	RADs SOF	--	pCi/g	--	--	9.28E-05	--	4.07E-04
628-4_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.13E+00	5.16E+04	2.19E-05	6.37E+03	1.77E-04
628-4_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	1.12E-01	2.74E+04	4.08E-06	4.36E+03	2.57E-05
628-4_Shallow	Rad	Uranium-238	U-238	pCi/g	1.05E+00	1.57E+04	6.68E-05	5.15E+03	2.04E-04
628-4_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	3.16E+03	5.00E+03	6.33E-01	7.86E+05	4.02E-03
UPR-300-17_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	12420	5.00E+03	**2.48E+00**	7.86E+05	1.58E-02
UPR-300-17_Shallow	non-Rad	Acenaphthene	83-32-9	µg/kg	1.17E+02	2.00E+04	5.85E-03	1.10E+06	1.06E-04
UPR-300-17_Shallow	non-Rad	Anthracene	120-12-7	µg/kg	7.01E+00	2.90E+04	2.42E-04	6.78E+05	1.03E-05
UPR-300-17_Shallow	non-Rad	Antimony	7440-36-0	µg/kg	3.59E+02	5.00E+03	7.17E-02	5.98E+03	6.00E-02
UPR-300-17_Shallow	non-Rad	Aroclor-1248	12672-29-6	µg/kg	1.97E+03	4.00E+04	4.93E-02	3.25E+02	**6.06E+00**
UPR-300-17_Shallow	non-Rad	Aroclor-1254	11097-69-1	µg/kg	4.50E+02	4.00E+04	1.13E-02	1.47E+03	3.06E-01
UPR-300-17_Shallow	non-Rad	Aroclor-1260	11096-82-5	µg/kg	1.13E+02	4.00E+04	2.83E-03	1.47E+03	7.71E-02
UPR-300-17_Shallow	non-Rad	Aroclors HI	--	µg/kg	--	--	6.34E-02	--	**6.44E+00**
UPR-300-17_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	2.57E+03	1.00E+04	2.57E-01	1.90E+05	1.35E-02
UPR-300-17_Shallow	non-Rad	Barium	7440-39-3	µg/kg	8.10E+04	3.30E+05	2.45E-01	1.32E+06	6.14E-02
UPR-300-17_Shallow	non-Rad	Benzo(a)anthracene	56-55-3	µg/kg	5.92E+01	1.80E+04	3.29E-03	6.40E+04	9.26E-04
UPR-300-17_Shallow	non-Rad	Benzo(a)pyrene	50-32-8	µg/kg	4.38E+01	1.80E+04	2.43E-03	7.64E+04	5.73E-04
UPR-300-17_Shallow	non-Rad	Benzo(b)fluoranthene	205-99-2	µg/kg	3.27E+01	1.80E+04	1.82E-03	3.92E+04	8.34E-04
UPR-300-17_Shallow	non-Rad	Benzo(k)fluoranthene	207-08-9	µg/kg	1.00E+01	1.80E+04	5.57E-04	3.92E+04	2.56E-04
UPR-300-17_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	2.40E+02	1.00E+04	2.40E-02	1.39E+04	1.73E-02
UPR-300-17_Shallow	non-Rad	Boron	7440-42-8	µg/kg	3902.7336	5.00E+02	**7.81E+00**	1.33E+05	2.93E-02
UPR-300-17_Shallow	non-Rad	Cadmium	7440-43-9	µg/kg	1.73E+02	4.00E+03	4.31E-02	1.63E+03	1.06E-01
UPR-300-17_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	13794.625	4.00E+02	**3.45E+01**	3.82E+04	3.61E-01
UPR-300-17_Shallow	non-Rad	Chrysene	218-01-9	µg/kg	3.93E+01	1.80E+04	2.18E-03	4.45E+04	8.82E-04
UPR-300-17_Shallow	non-Rad	Cobalt	7440-48-4	µg/kg	6.69E+03	1.30E+04	5.14E-01	1.11E+05	6.02E-02
UPR-300-17_Shallow	non-Rad	Copper	7440-50-8	µg/kg	1.51E+04	5.00E+04	3.03E-01	1.07E+05	1.41E-01
UPR-300-17_Shallow	non-Rad	Fluoranthene	206-44-0	µg/kg	3.53E+01	1.80E+04	1.96E-03	8.39E+05	4.21E-05
UPR-300-17_Shallow	non-Rad	Fluorene	86-73-7	µg/kg	2.93E+00	2.90E+04	1.01E-04	1.75E+05	1.67E-05
UPR-300-17_Shallow	non-Rad	Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	5.85E+00	1.80E+04	3.25E-04	3.57E+04	1.64E-04
UPR-300-17_Shallow	non-Rad	Lead	7439-92-1	µg/kg	1.12E+04	5.00E+04	2.25E-01	3.56E+04	3.16E-01
UPR-300-17_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	285159.32	2.20E+05	**1.30E+00**	5.80E+06	4.92E-02
UPR-300-17_Shallow	non-Rad	Mercury	7439-97-6	µg/kg	6.90E+01	1.00E+02	6.90E-01	1.87E+03	3.69E-02
UPR-300-17_Shallow	non-Rad	Molybdenum	7439-98-7	µg/kg	4.12E+02	2.00E+03	2.06E-01	1.40E+04	2.95E-02
UPR-300-17_Shallow	non-Rad	Naphthalene	91-20-3	µg/kg	4.79E+01	2.90E+04	1.65E-03	1.00E+05	4.79E-04
UPR-300-17_Shallow	non-Rad	Nickel	7440-02-0	µg/kg	563653.88	3.00E+04	**1.88E+01**	3.26E+04	**1.73E+01**
UPR-300-17_Shallow	non-Rad	Pyrene	129-00-0	µg/kg	3.41E+01	1.80E+04	1.90E-03	6.00E+05	5.69E-05
UPR-300-17_Shallow	Rad	RADs SOF	--	pCi/g	--	--	4.09E-04	--	1.96E-03
UPR-300-17_Shallow	non-Rad	Silver	7440-22-4	µg/kg	3.40E+02	2.00E+03	1.70E-01	4.96E+04	6.85E-03
UPR-300-17_Shallow	non-Rad	Total petroleum hydrocarbons - diesel range	TPHDIESEL	µg/kg	2.95E+03	2.00E+05	1.48E-02	3.56E+08	8.29E-06

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
UPR-300-17_Shallow	non-Rad	Total petroleum hydrocarbons - motor oil (high boiling)	TPH/OILH	µg/kg	210419.68	No Value	--	No Value	--
UPR-300-17_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	6.15E+00	5.16E+04	1.19E-04	6.37E+03	9.65E-04
UPR-300-17_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	9.14E-01	2.74E+04	3.34E-05	4.36E+03	2.10E-04
UPR-300-17_Shallow	Rad	Uranium-238	U-238	pCi/g	4.04E+00	1.57E+04	2.57E-04	5.15E+03	7.85E-04
UPR-300-17_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	52149.755	2.00E+03	**2.61E+01**	3.11E+04	**1.68E+00**
UPR-300-17_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	157172	5.00E+04	**3.14E+00**	6.78E+04	**2.32E+00**
UPR-300-46_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	4.90E+03	5.00E+03	9.79E-01	7.86E+05	6.23E-03
UPR-300-46_Shallow	non-Rad	Acenaphthene	83-32-9	µg/kg	1.31E+01	2.00E+04	6.54E-04	1.10E+06	1.19E-05
UPR-300-46_Shallow	non-Rad	Antimony	7440-36-0	µg/kg	3.81E+02	5.00E+03	7.61E-02	5.98E+03	6.37E-02
UPR-300-46_Shallow	non-Rad	Aroclor-1248	12672-29-6	µg/kg	8.79E+02	4.00E+04	2.20E-02	3.25E+02	**2.70E+00**
UPR-300-46_Shallow	non-Rad	Aroclor-1254	11097-69-1	µg/kg	4.90E+02	4.00E+04	1.22E-02	1.47E+03	3.33E-01
UPR-300-46_Shallow	non-Rad	Aroclor-1260	11096-82-5	µg/kg	8.44E+01	4.00E+04	2.11E-03	1.47E+03	5.74E-02
UPR-300-46_Shallow	non-Rad	Aroclors HI	--	µg/kg	--	--	3.63E-02	--	**3.09E+00**
UPR-300-46_Shallow	non-Rad	Arsenic	7440-38-2	µg/kg	2.85E+03	1.00E+04	2.85E-01	1.90E+05	1.50E-02
UPR-300-46_Shallow	non-Rad	Barium	7440-39-3	µg/kg	8.21E+04	3.30E+05	2.49E-01	1.32E+06	6.22E-02
UPR-300-46_Shallow	non-Rad	Benzo(a)anthracene	56-55-3	µg/kg	3.88E+00	1.80E+04	2.15E-04	6.40E+04	6.06E-05
UPR-300-46_Shallow	non-Rad	Benzo(a)pyrene	50-32-8	µg/kg	3.40E+00	1.80E+04	1.89E-04	7.64E+04	4.46E-05
UPR-300-46_Shallow	non-Rad	Benzo(b)fluoranthene	205-99-2	µg/kg	5.30E+00	1.80E+04	2.95E-04	3.92E+04	1.35E-04
UPR-300-46_Shallow	non-Rad	Benzo(k)fluoranthene	207-08-9	µg/kg	2.78E+00	1.80E+04	1.55E-04	3.92E+04	7.10E-05
UPR-300-46_Shallow	non-Rad	Beryllium	7440-41-7	µg/kg	2.22E+02	1.00E+04	2.22E-02	1.39E+04	1.60E-02
UPR-300-46_Shallow	non-Rad	Boron	7440-42-8	µg/kg	1713.9346	5.00E+02	**3.43E+00**	1.33E+05	1.29E-02
UPR-300-46_Shallow	non-Rad	Cadmium	7440-43-9	µg/kg	9.47E+01	4.00E+03	2.37E-02	1.63E+03	5.81E-02
UPR-300-46_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	7.00E-02	2.21E+03	3.17E-05	9.24E+02	7.58E-05
UPR-300-46_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	10173.082	4.00E+02	**2.54E+01**	3.82E+04	2.66E-01
UPR-300-46_Shallow	non-Rad	Chrysene	218-01-9	µg/kg	5.58E+00	1.80E+04	3.10E-04	4.45E+04	1.25E-04
UPR-300-46_Shallow	non-Rad	Cobalt	7440-48-4	µg/kg	6.36E+03	1.30E+04	4.89E-01	1.11E+05	5.73E-02
UPR-300-46_Shallow	non-Rad	Copper	7440-50-8	µg/kg	1.32E+04	5.00E+04	2.63E-01	1.07E+05	1.23E-01
UPR-300-46_Shallow	non-Rad	Dibenz[a,h]anthracene	53-70-3	µg/kg	1.25E+00	1.80E+04	6.94E-05	4.41E+04	2.83E-05
UPR-300-46_Shallow	non-Rad	Fluoranthene	206-44-0	µg/kg	9.55E+00	1.80E+04	5.31E-04	8.39E+05	1.14E-05
UPR-300-46_Shallow	non-Rad	Fluorene	86-73-7	µg/kg	2.15E+00	2.90E+04	7.41E-05	1.75E+05	1.23E-05
UPR-300-46_Shallow	non-Rad	Indeno(1,2,3-cd)pyrene	193-39-5	µg/kg	7.80E+00	1.80E+04	4.33E-04	3.57E+04	2.18E-04
UPR-300-46_Shallow	non-Rad	Lead	7439-92-1	µg/kg	7.11E+03	5.00E+04	1.42E-01	3.56E+04	2.00E-01
UPR-300-46_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	311000.56	2.20E+05	**1.41E+00**	5.80E+06	5.36E-02
UPR-300-46_Shallow	non-Rad	Mercury	7439-97-6	µg/kg	2.92E+01	1.00E+02	2.92E-01	1.87E+03	1.56E-02
UPR-300-46_Shallow	non-Rad	Molybdenum	7439-98-7	µg/kg	4.56E+02	2.00E+03	2.28E-01	1.40E+04	3.26E-02
UPR-300-46_Shallow	non-Rad	Naphthalene	91-20-3	µg/kg	3.57E+01	2.90E+04	1.23E-03	1.00E+05	3.57E-04
UPR-300-46_Shallow	non-Rad	Nickel	7440-02-0	µg/kg	9.23E+03	3.00E+04	3.08E-01	3.26E+04	2.83E-01
UPR-300-46_Shallow	non-Rad	Pyrene	129-00-0	µg/kg	4.44E+00	1.80E+04	2.46E-04	6.00E+05	7.39E-06
UPR-300-46_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.85E-04	--	7.45E-04
UPR-300-46_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.77E+00	5.16E+04	3.43E-05	6.37E+03	2.78E-04
UPR-300-46_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	2.43E-01	2.74E+04	8.87E-06	4.36E+03	5.57E-05
UPR-300-46_Shallow	Rad	Uranium-238	U-238	pCi/g	1.73E+00	1.57E+04	1.10E-04	5.15E+03	3.35E-04
UPR-300-46_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	53808.248	2.00E+03	**2.69E+01**	3.11E+04	**1.73E+00**
UPR-300-46_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	4.79E+04	5.00E+04	9.59E-01	6.78E+04	7.07E-01

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Table H-7. 300 Area Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient

Notes:

Bolded HQ values are greater than or equal to 1.

1 Plant/Invertebrate SSLs are the lowest NOAEL based values found in *Tier 1 Risk-Based Soil Concentrations Protective of Ecological Receptors at the Hanford Site* [CHPRC-00784] located in Appendix H of *Remedial Investigation/Feasibility Study for the 100-KR-1, 100-KR, and 100-KR-4 Operable Units* (DOE/RL-2010-97).

2 Avian/mammal SSLs are the lowest NOAEL based values found in *Tier 1 Risk-Based Soil Concentrations Protective of Ecological Receptors at the Hanford Site* [CHPRC-00784] located in Appendix H of *Remedial Investigation/Feasibility Study for the 100-KR-1, 100-KR, and 100-KR-4 Operable Units* (DOE/RL-2010-97).

All data represent detected concentrations of the chemicals.

µg/kg = Microgram per kilogram
Aroclors HI - Sum of HQs within each decisional unit
Hazard Quotients greater than one are in bold font.
pCi/g = pico Curie per gram

Rad = Radionuclide

RADs SOF = Sum of HQs for radionuclide isotopes within each decisional unit

SOF = Sum of fractions

SSL = Soil screening level

Uranium 234 SSLs were used as surrogates for Uranium 233/234.

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Table H-8. Comparison of 300 Area Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Lognormal 90th Percentile Background Value	EPC > 90th Percentile Background Value
300-10_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	13,500	6.47E+03	**Yes**
300-109_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	632	3.89E+03	No
300-109_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	6,950	1.85E+04	No
300-109_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	278,000	5.12E+05	No
300-109_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	47,600	8.51E+04	No
300-109_Staging Pile Area_Focused	non-Rad	Boron	7440-42-8	µg/kg	1,060	3.89E+03	No
300-109_Staging Pile Area_Focused	non-Rad	Chromium	7440-47-3	µg/kg	8,170	1.85E+04	No
300-109_Staging Pile Area_Focused	non-Rad	Manganese	7439-96-5	µg/kg	286,000	5.12E+05	No
300-109_Staging Pile Area_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	45,100	8.51E+04	No
300-109_Staging Pile Area_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	6877	3.21E+03	**Yes**
300-18_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	6,900	1.85E+04	No
300-259_Shallow	non-Rad	Boron	7440-42-8	µg/kg	1,303	3.89E+03	No
300-259_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	7,901	1.85E+04	No
300-259_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	318,874	5.12E+05	No
300-259_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	42,626	8.51E+04	No
300-259_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	479,584	6.78E+04	**Yes**
300-260_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	8,360	3.89E+03	**Yes**
300-260_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	9,890	1.85E+04	No
300-260_Shallow_Focused	non-Rad	Copper	7440-50-8	µg/kg	73,300	2.20E+04	**Yes**
300-260_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	328,000	5.12E+05	No
300-260_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	59,000	8.51E+04	No
300-260_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	77,400	6.78E+04	**Yes**
300-260_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	12800	3.21E+03	**Yes**
300-275_Shallow_1	non-Rad	Boron	7440-42-8	µg/kg	1,466	3.89E+03	No
300-275_Shallow_1	non-Rad	Chromium	7440-47-3	µg/kg	8,022	1.85E+04	No
300-275_Shallow_1	non-Rad	Lithium	7439-93-2	µg/kg	6,686	1.33E+04	No
300-275_Shallow_1	non-Rad	Manganese	7439-96-5	µg/kg	276,815	5.12E+05	No
300-275_Shallow_1	non-Rad	Vanadium	7440-62-2	µg/kg	45,128	8.51E+04	No
300-275_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	22251	3.21E+03	**Yes**

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Table H-8. Comparison of 300 Area Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Lognormal 90th Percentile Background Value	EPC > 90th Percentile Background Value
300-275_Shallow_2	non-Rad	Boron	7440-42-8	µg/kg	1,147	3.89E+03	No
300-275_Shallow_2	non-Rad	Chromium	7440-47-3	µg/kg	8,994	1.85E+04	No
300-275_Shallow_2	non-Rad	Lithium	7439-93-2	µg/kg	7,067	1.33E+04	No
300-275_Shallow_2	non-Rad	Manganese	7439-96-5	µg/kg	292,731	5.12E+05	No
300-275_Shallow_2	non-Rad	Vanadium	7440-62-2	µg/kg	51,632	8.51E+04	No
300-33, 300-41, 300-256_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	5349	3.21E+03	**Yes**
300-33, 300-41, 300-256_Shallow	non-Rad	Boron	7440-42-8	µg/kg	1,484	3.89E+03	No
300-33, 300-41, 300-256_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	8,781	1.85E+04	No
300-33, 300-41, 300-256_Shallow	non-Rad	Lithium	7439-93-2	µg/kg	5,495	1.33E+04	No
300-33, 300-41, 300-256_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	314,762	5.12E+05	No
300-33, 300-41, 300-256_Shallow	non-Rad	Uranium	7440-61-1	µg/kg	7,260	3.21E+03	**Yes**
300-33, 300-41, 300-256_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	52,694	8.51E+04	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	µg/kg	330	--	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	µg/kg	385	--	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	µg/kg	52	--	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	1,030	3.89E+03	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	8,080	1.85E+04	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Lithium	7439-93-2	µg/kg	6,580	1.33E+04	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	259,000	5.12E+05	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	51,400	8.51E+04	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	6460	3.21E+03	**Yes**
300-37_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	µg/kg	100	--	--
300-37_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	µg/kg	3200	--	--
300-44_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	16,900	6.47E+03	**Yes**
300-44_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	9,300	1.85E+04	No
300-44_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	303,000	5.12E+05	No
300-44_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	43,200	8.51E+04	No
300-49_Overburden	non-Rad	Aroclor-1254	11097-69-1	µg/kg	3007.72	--	--
300-49_Overburden	non-Rad	Chromium	7440-47-3	µg/kg	18,106	1.85E+04	No

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Table H-8. Comparison of 300 Area Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Lognormal 90th Percentile Background Value	EPC > 90th Percentile Background Value
300-49_Overburden	non-Rad	Copper	7440-50-8	µg/kg	536,000	2.20E+04	**Yes**
300-49_Overburden	non-Rad	Lead	7439-92-1	µg/kg	36,964	1.02E+04	**Yes**
300-49_Overburden	non-Rad	Manganese	7439-96-5	µg/kg	316,669	5.12E+05	No
300-49_Overburden	non-Rad	Vanadium	7440-62-2	µg/kg	50,380	8.51E+04	No
300-49_Overburden	non-Rad	Zinc	7440-66-6	µg/kg	141,984	6.78E+04	**Yes**
300-49_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	9,170	1.85E+04	No
300-49_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	361,805	5.12E+05	No
300-49_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	58,672	8.51E+04	No
300-49_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	54,651	6.78E+04	No
300-50_Overburden	non-Rad	Chromium	7440-47-3	µg/kg	12,197	1.85E+04	No
300-50_Overburden	non-Rad	Copper	7440-50-8	µg/kg	64,527	2.20E+04	**Yes**
300-50_Overburden	non-Rad	Manganese	7439-96-5	µg/kg	314,271	5.12E+05	No
300-50_Overburden	non-Rad	Vanadium	7440-62-2	µg/kg	45,243	8.51E+04	No
300-50_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	17919	3.21E+03	**Yes**
300-50_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	16,841	1.85E+04	No
300-50_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	318,120	5.12E+05	No
300-50_Shallow	non-Rad	Silver	7440-22-4	µg/kg	2,992	1.67E+02	**Yes**
300-50_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	46,964	8.51E+04	No
300-50_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	22938	3.21E+03	**Yes**
316-1_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	40572	3.21E+03	**Yes**
316-1_Shallow_1	non-Rad	Aroclor-1248	12672-29-6	µg/kg	3000	--	--
316-1_Shallow_1	non-Rad	Arsenic	7440-38-2	µg/kg	19,014	6.47E+03	**Yes**
316-1_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	83027	3.21E+03	**Yes**
316-1_Shallow_3	non-Rad	Chromium	7440-47-3	µg/kg	50,455	1.85E+04	**Yes**
316-1_Shallow_3	non-Rad	Copper	7440-50-8	µg/kg	1.37E+06	2.20E+04	**Yes**
316-1_Shallow_3	non-Rad	Manganese	7439-96-5	µg/kg	392,825	5.12E+05	No
316-1_Shallow_3	non-Rad	Mercury	7439-97-6	µg/kg	1,105	1.31E+01	**Yes**
316-1_Shallow_3	non-Rad	Nickel	7440-02-0	µg/kg	94,656	1.91E+04	**Yes**
316-1_Shallow_3	non-Rad	Selenium	7782-49-2	µg/kg	1,444	7.80E+02	**Yes**

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Table H-8. Comparison of 300 Area Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Lognormal 90th Percentile Background Value	EPC > 90th Percentile Background Value
316-1_Shallow_3	non-Rad	Silver	7440-22-4	µg/kg	13,196	1.67E+02	**Yes**
316-1_Shallow_3	non-Rad	Vanadium	7440-62-2	µg/kg	56,707	8.51E+04	No
316-1_Shallow_3	non-Rad	Zinc	7440-66-6	µg/kg	82,016	6.78E+04	**Yes**
316-1_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	63074	3.21E+03	**Yes**
316-1_Shallow_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	42963	3.21E+03	**Yes**
316-2_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	210452	3.21E+03	**Yes**
316-2_Shallow_2	non-Rad	Aroclor-1248	12672-29-6	µg/kg	696.77511	--	--
316-2_Shallow_2	non-Rad	Aroclor-1254	11097-69-1	µg/kg	42	--	--
316-2_Shallow_2	non-Rad	Aroclor-1260	11096-82-5	µg/kg	110	--	--
316-2_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	291369	3.21E+03	**Yes**
316-2_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	73174	3.21E+03	**Yes**
316-5_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	271835	3.21E+03	**Yes**
316-5_Shallow_2	non-Rad	Chromium	7440-47-3	µg/kg	6,900	1.85E+04	No
316-5_Shallow_2	non-Rad	Silver	7440-22-4	µg/kg	3,600	1.67E+02	**Yes**
316-5_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	204701	3.21E+03	**Yes**
316-5_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	138095	3.21E+03	**Yes**
331 LSLDF_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	1,700	3.89E+03	No
331 LSLDF_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	10,300	1.85E+04	No
331 LSLDF_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	349,000	5.12E+05	No
331 LSLDF_Shallow_Focused	non-Rad	Mercury	7439-97-6	µg/kg	110	1.31E+01	**Yes**
331 LSLDF_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	53,100	8.51E+04	No
331 LSLDF_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	137,000	6.78E+04	**Yes**
600-243_Shallow	non-Rad	Boron	7440-42-8	µg/kg	294,463	3.89E+03	**Yes**
600-243_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	18,006	1.85E+04	No
600-243_Shallow	non-Rad	Copper	7440-50-8	µg/kg	53,981	2.20E+04	**Yes**
600-243_Shallow	non-Rad	Lead	7439-92-1	µg/kg	40,139	1.02E+04	**Yes**
600-243_Shallow	non-Rad	Selenium	7782-49-2	µg/kg	5,709	7.80E+02	**Yes**
600-243_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	46,986	8.51E+04	No
600-243_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	84,099	6.78E+04	**Yes**

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Table H-8. Comparison of 300 Area Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Lognormal 90th Percentile Background Value	EPC > 90th Percentile Background Value
600-47_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	5,500	1.85E+04	No
618-1_Shallow	non-Rad	Boron	7440-42-8	µg/kg	1,190	3.89E+03	No
618-1_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	7,930	1.85E+04	No
618-1_Shallow	non-Rad	Lithium	7439-93-2	µg/kg	6,380	1.33E+04	No
618-1_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	300,000	5.12E+05	No
618-1_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	56,300	8.51E+04	No
618-1_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	3,740	3.89E+03	**Yes**
618-1_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	19,500	1.85E+04	**Yes**
618-1_Shallow_Focused	non-Rad	Lithium	7439-93-2	µg/kg	13,300	1.33E+04	No
618-1_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	403,000	5.12E+05	No
618-1_Shallow_Focused	non-Rad	Mercury	7439-97-6	µg/kg	198	1.31E+01	**Yes**
618-1_Shallow_Focused	non-Rad	Uranium	7440-61-1	µg/kg	7,080	3.21E+03	**Yes**
618-1_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	64,700	8.51E+04	No
618-1_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	68,100	6.78E+04	**Yes**
618-1_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	24957	3.21E+03	**Yes**
618-12_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	32092	3.21E+03	**Yes**
618-13_Shallow	non-Rad	Boron	7440-42-8	µg/kg	1,050	3.89E+03	No
618-13_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	10,700	1.85E+04	No
618-13_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	344,000	5.12E+05	No
618-13_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	55,800	8.51E+04	No
618-13_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	5061	3.21E+03	**Yes**
618-13_Shallow_Focused	non-Rad	Boron	7440-42-8	µg/kg	960	3.89E+03	No
618-13_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	8,740	1.85E+04	No
618-13_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	268,000	5.12E+05	No
618-13_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	48,600	8.51E+04	No
618-2_Overburden	non-Rad	Chromium	7440-47-3	µg/kg	6,600	1.85E+04	No
618-2_Overburden	non-Rad	Selenium	7782-49-2	µg/kg	1,000	7.80E+02	**Yes**
618-2_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	7,100	1.85E+04	No
618-2_Shallow	non-Rad	Selenium	7782-49-2	µg/kg	760	7.80E+02	No

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Table H-8. Comparison of 300 Area Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Lognormal 90th Percentile Background Value	EPC > 90th Percentile Background Value
618-2_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	5852	3.21E+03	**Yes**
618-2_Staging Pile	non-Rad	Chromium	7440-47-3	µg/kg	6,424	1.85E+04	No
618-2_Staging Pile	non-Rad	Uranium	7440-61-1	µg/kg	5,022	3.21E+03	**Yes**
618-2_Staging Pile	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	9201	3.21E+03	**Yes**
618-3_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	9,700	1.85E+04	No
618-3_Shallow	non-Rad	Selenium	7782-49-2	µg/kg	659	7.80E+02	No
618-3_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	238577	3.21E+03	**Yes**
618-4_Shallow	non-Rad	Lead	7439-92-1	µg/kg	49,000	1.02E+04	**Yes**
618-4_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	7456	3.21E+03	**Yes**
618-5_Overburden	non-Rad	Chromium	7440-47-3	µg/kg	9,700	1.85E+04	No
618-5_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	9773	3.21E+03	**Yes**
618-5_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	11,300	1.85E+04	No
618-5_Staging Pile_4	non-Rad	Chromium	7440-47-3	µg/kg	11,800	1.85E+04	No
618-5_Staging Pile_5	non-Rad	Chromium	7440-47-3	µg/kg	10,300	1.85E+04	No
618-7_Shallow_1	non-Rad	Chromium	7440-47-3	µg/kg	10,227	1.85E+04	No
618-7_Shallow_1	non-Rad	Manganese	7439-96-5	µg/kg	326,067	5.12E+05	No
618-7_Shallow_1	non-Rad	Vanadium	7440-62-2	µg/kg	74,576	8.51E+04	No
618-7_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	10814	3.21E+03	**Yes**
618-7_Shallow_2	non-Rad	Chromium	7440-47-3	µg/kg	6,800	1.85E+04	No
618-7_Shallow_2	non-Rad	Manganese	7439-96-5	µg/kg	364,000	5.12E+05	No
618-7_Shallow_2	non-Rad	Vanadium	7440-62-2	µg/kg	74,700	8.51E+04	No
618-7_Shallow_3	non-Rad	Chromium	7440-47-3	µg/kg	10,100	1.85E+04	No
618-7_Shallow_3	non-Rad	Manganese	7439-96-5	µg/kg	357,000	5.12E+05	No
618-7_Shallow_3	non-Rad	Vanadium	7440-62-2	µg/kg	68,200	8.51E+04	No
618-7_Shallow_4	non-Rad	Chromium	7440-47-3	µg/kg	11,400	1.85E+04	No
618-7_Shallow_4	non-Rad	Manganese	7439-96-5	µg/kg	285,000	5.12E+05	No
618-7_Shallow_4	non-Rad	Vanadium	7440-62-2	µg/kg	54,800	8.51E+04	No
618-7_Shallow_Focused	non-Rad	Cadmium	7440-43-9	µg/kg	6,200	5.63E+02	**Yes**
618-7_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	65,900	1.85E+04	**Yes**

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Table H-8. Comparison of 300 Area Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Lognormal 90th Percentile Background Value	EPC > 90th Percentile Background Value
618-7_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	425,000	5.12E+05	No
618-7_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	80,500	8.51E+04	No
618-7_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	52,400	6.78E+04	No
618-7_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	19563	3.21E+03	**Yes**
618-8_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	12,400	1.85E+04	No
618-8_Shallow	non-Rad	Selenium	7782-49-2	µg/kg	846	7.80E+02	**Yes**
618-9_Shallow_Focused	non-Rad	Aldrin	309-00-2	µg/kg	390	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1016	12674-11-2	µg/kg	1900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1221	11104-28-2	µg/kg	1900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1232	11141-16-5	µg/kg	1900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1242	53469-21-9	µg/kg	1900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	µg/kg	1900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	µg/kg	3900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	µg/kg	3900	--	--
618-9_Shallow_Focused	non-Rad	Arsenic	7440-38-2	µg/kg	11,600	6.47E+03	**Yes**
618-9_Shallow_Focused	non-Rad	Chromium	7440-47-3	µg/kg	9,700	1.85E+04	**No**
618-9_Shallow_Focused	non-Rad	Manganese	7439-96-5	µg/kg	359,000	5.12E+05	**No**
618-9_Shallow_Focused	non-Rad	Mercury	7439-97-6	µg/kg	330	1.31E+01	**Yes**
618-9_Shallow_Focused	non-Rad	Vanadium	7440-62-2	µg/kg	59,300	8.51E+04	**No**
618-9_Shallow_Focused	non-Rad	Zinc	7440-66-6	µg/kg	52,300	6.78E+04	**No**
618-9_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	8963	3.21E+03	**Yes**
628-4_Shallow	non-Rad	Aroclor-1242	53469-21-9	µg/kg	42.354	--	--
628-4_Shallow	non-Rad	Aroclor-1248	12672-29-6	µg/kg	1115.476	--	--
628-4_Shallow	non-Rad	Aroclor-1254	11097-69-1	µg/kg	404.954	--	--
628-4_Shallow	non-Rad	Aroclor-1260	11096-82-5	µg/kg	37.768	--	--
628-4_Shallow	non-Rad	Lead	7439-92-1	µg/kg	99,167	1.02E+04	**Yes**
UPR-300-17_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	µg/kg	12420	3.21E+03	**Yes**
UPR-300-17_Shallow	non-Rad	Aroclor-1248	12672-29-6	µg/kg	1970	--	--
UPR-300-17_Shallow	non-Rad	Aroclor-1254	11097-69-1	µg/kg	450.00081	--	--

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Table H-8. Comparison of 300 Area Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Lognormal 90th Percentile Background Value	EPC > 90th Percentile Background Value
UPR-300-17_Shallow	non-Rad	Aroclor-1260	11096-82-5	µg/kg	113.2752	--	--
UPR-300-17_Shallow	non-Rad	Boron	7440-42-8	µg/kg	3,903	3.89E+03	Yes
UPR-300-17_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	13,795	1.85E+04	No
UPR-300-17_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	285,159	5.12E+05	No
UPR-300-17_Shallow	non-Rad	Nickel	7440-02-0	µg/kg	563,654	1.91E+04	Yes
UPR-300-17_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	52,150	8.51E+04	No
UPR-300-17_Shallow	non-Rad	Zinc	7440-66-6	µg/kg	157,172	6.78E+04	Yes
UPR-300-46_Shallow	non-Rad	Aroclor-1248	12672-29-6	µg/kg	8.79E+02	--	--
UPR-300-46_Shallow	non-Rad	Aroclor-1254	11097-69-1	µg/kg	4.90E+02	--	--
UPR-300-46_Shallow	non-Rad	Aroclor-1260	11096-82-5	µg/kg	8.44E+01	--	--
UPR-300-46_Shallow	non-Rad	Boron	7440-42-8	µg/kg	1.71E+03	3.89E+03	No
UPR-300-46_Shallow	non-Rad	Chromium	7440-47-3	µg/kg	1.02E+04	1.85E+04	No
UPR-300-46_Shallow	non-Rad	Manganese	7439-96-5	µg/kg	3.11E+05	5.12E+05	No
UPR-300-46_Shallow	non-Rad	Vanadium	7440-62-2	µg/kg	5.38E+04	8.51E+04	No

Notes-

EPC = Exposure point concentration

pCi/g = picocuries per gram

SSL = Soil screening level

ug/kg - microgram per kilogram

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Table H-9. Ecological PRG Comparisons for 300 Area Waste Site Decision Units

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/ Invertebrate PRG (µg/kg)	Hazard Quotient	Wildlife PRG (µg/kg)	Hazard Quotient
300-10_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	1.35E+04	1.28E+05	1.05E-01	1.27E+05	1.06E-01
300-109_Staging Pile Area_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	6.88E+03	1.00E+05	6.88E-02	4.03E+04	1.71E-01
300-259_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	4.80E+05	6.21E+05	7.72E-01	8.56E+05	5.60E-01
300-260_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	8.36E+03	2.86E+04	2.92E-01	3.20E+04	2.61E-01
300-260_Shallow_Focused	non-Rad	Copper	7440-50-8	ug/kg	7.33E+04	5.80E+04	**1.26E+00**	1.93E+05	3.80E-01
300-260_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.28E+04	1.00E+05	1.28E-01	4.03E+04	3.18E-01
300-260_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	7.74E+04	6.21E+05	1.25E-01	8.56E+05	9.04E-02
300-275_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.23E+04	1.00E+05	2.23E-01	4.03E+04	5.52E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5.35E+03	1.00E+05	5.35E-02	4.03E+04	1.33E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Uranium	7440-61-1	ug/kg	7.26E+03	1.00E+05	7.26E-02	4.03E+04	1.80E-01
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	ug/kg	3.30E+02	No Value	--	No Value	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3.85E+02	No Value	--	No Value	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	5.20E+01	No Value	--	No Value	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	6.46E+03	1.00E+05	6.46E-02	4.03E+04	1.60E-01
300-37_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	1.00E+02	No Value	--	No Value	--
300-37_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3.20E+03	No Value	--	No Value	--
300-44_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	1.69E+04	1.28E+05	1.32E-01	1.27E+05	1.33E-01
300-49_Overburden	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3.01E+03	No Value	--	No Value	--
300-49_Overburden	non-Rad	Copper	7440-50-8	ug/kg	5.36E+05	5.80E+04	**9.24E+00**	1.93E+05	**2.78E+00**
300-49_Overburden	non-Rad	Lead	7439-92-1	ug/kg	3.70E+04	1.70E+06	2.17E-02	1.56E+05	2.37E-01
300-49_Overburden	non-Rad	Zinc	7440-66-6	ug/kg	1.42E+05	6.21E+05	2.29E-01	8.56E+05	1.66E-01
300-50_Overburden	non-Rad	Copper	7440-50-8	ug/kg	6.45E+04	5.80E+04	**1.11E+00**	1.93E+05	3.34E-01
300-50_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.79E+04	1.00E+05	1.79E-01	4.03E+04	4.45E-01
300-50_Shallow	non-Rad	Silver	7440-22-4	ug/kg	2.99E+03	2.99E+03	**1.00E+00**	9.83E+05	3.04E-03
300-50_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.29E+04	1.00E+05	2.29E-01	4.03E+04	5.69E-01
316-1_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	4.06E+04	1.00E+05	4.06E-01	4.03E+04	**1.01E+00**
316-1_Shallow_1	non-Rad	Aroclor-1248	12672-29-6	ug/kg	3.00E+03	No Value	--	No Value	--
316-1_Shallow_1	non-Rad	Arsenic	7440-38-2	ug/kg	1.90E+04	1.28E+05	1.49E-01	1.27E+05	1.50E-01
316-1_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	8.30E+04	1.00E+05	8.30E-01	4.03E+04	**2.06E+00**
316-1_Shallow_3	non-Rad	Chromium	7440-47-3	ug/kg	5.05E+04	1.49E+05	3.39E-01	1.09E+05	4.63E-01
316-1_Shallow_3	non-Rad	Copper	7440-50-8	ug/kg	1.37E+06	5.80E+04	**2.36E+01**	1.93E+05	**7.08E+00**
316-1_Shallow_3	non-Rad	Mercury	7439-97-6	ug/kg	1.11E+03	3.00E+02	**3.68E+00**	1.56E+03	7.09E-01
316-1_Shallow_3	non-Rad	Nickel	7440-02-0	ug/kg	9.47E+04	3.80E+04	**2.49E+00**	2.47E+05	3.83E-01
316-1_Shallow_3	non-Rad	Selenium	7782-49-2	ug/kg	1.44E+03	2.02E+03	7.15E-01	1.43E+03	**1.01E+00**
316-1_Shallow_3	non-Rad	Silver	7440-22-4	ug/kg	1.32E+04	2.99E+03	**4.41E+00**	9.83E+05	1.34E-02
316-1_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	6.31E+04	1.00E+05	6.31E-01	4.03E+04	**1.56E+00**
316-1_Shallow_3	non-Rad	Zinc	7440-66-6	ug/kg	8.20E+04	6.21E+05	1.32E-01	8.56E+05	9.58E-02
316-1_Shallow_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	4.30E+04	1.00E+05	4.30E-01	4.03E+04	**1.07E+00**
316-2_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.10E+05	1.00E+05	**2.10E+00**	4.03E+04	**5.22E+00**
316-2_Shallow_2	non-Rad	Aroclor-1248	12672-29-6	ug/kg	6.97E+02	No Value	--	No Value	--
316-2_Shallow_2	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.20E+01	No Value	--	No Value	--

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Table H-9. Ecological PRG Comparisons for 300 Area Waste Site Decision Units

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/ Invertebrate PRG (µg/kg)	Hazard Quotient	Wildlife PRG (µg/kg)	Hazard Quotient
316-2_Shallow_2	non-Rad	Aroclor-1260	11096-82-5	ug/kg	1.10E+02	No Value	--	No Value	--
316-2_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.91E+05	1.00E+05	**2.91E+00**	4.03E+04	**7.23E+00**
316-2_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	7.32E+04	1.00E+05	7.32E-01	4.03E+04	**1.82E+00**
316-5_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.72E+05	1.00E+05	**2.72E+00**	4.03E+04	**6.74E+00**
316-5_Shallow_2	non-Rad	Silver	7440-22-4	ug/kg	3.60E+03	2.99E+03	**1.20E+00**	9.83E+05	3.66E-03
316-5_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.05E+05	1.00E+05	**2.05E+00**	4.03E+04	**5.08E+00**
316-5_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.38E+05	1.00E+05	**1.38E+00**	4.03E+04	**3.43E+00**
331 LSLDF_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	1.10E+02	3.00E+02	3.67E-01	1.56E+03	7.05E-02
331 LSLDF_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	1.37E+05	6.21E+05	2.21E-01	8.56E+05	1.60E-01
600-243_Shallow	non-Rad	Boron	7440-42-8	ug/kg	2.94E+05	2.86E+04	**1.03E+01**	3.20E+04	**9.20E+00**
600-243_Shallow	non-Rad	Copper	7440-50-8	ug/kg	5.40E+04	5.80E+04	9.31E-01	1.93E+05	2.80E-01
600-243_Shallow	non-Rad	Lead	7439-92-1	ug/kg	4.01E+04	1.70E+06	2.36E-02	1.56E+05	2.57E-01
600-243_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	5.71E+03	2.02E+03	**2.83E+00**	1.43E+03	**3.99E+00**
600-243_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	8.41E+04	6.21E+05	1.35E-01	8.56E+05	9.82E-02
618-1_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	3.74E+03	2.86E+04	1.31E-01	3.20E+04	1.17E-01
618-1_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	1.95E+04	1.49E+05	1.31E-01	1.09E+05	1.79E-01
618-1_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	1.98E+02	3.00E+02	6.60E-01	1.56E+03	1.27E-01
618-1_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.50E+04	1.00E+05	2.50E-01	4.03E+04	6.19E-01
618-1_Shallow_Focused	non-Rad	Uranium	7440-61-1	ug/kg	7.08E+03	1.00E+05	7.08E-02	4.03E+04	1.76E-01
618-1_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	6.81E+04	6.21E+05	1.10E-01	8.56E+05	7.96E-02
618-12_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	3.21E+04	1.00E+05	3.21E-01	4.03E+04	7.96E-01
618-13_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5.06E+03	1.00E+05	5.06E-02	4.03E+04	1.26E-01
618-2_Overburden	non-Rad	Selenium	7782-49-2	ug/kg	1.00E+03	2.02E+03	4.95E-01	1.43E+03	6.99E-01
618-2_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5.85E+03	1.00E+05	5.85E-02	4.03E+04	1.45E-01
618-2_Staging Pile	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	9.20E+03	1.00E+05	9.20E-02	4.03E+04	2.28E-01
618-2_Staging Pile	non-Rad	Uranium	7440-61-1	ug/kg	5.02E+03	1.00E+05	5.02E-02	4.03E+04	1.25E-01
618-3_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.39E+05	1.00E+05	**2.39E+00**	4.03E+04	**5.92E+00**
618-4_Shallow	non-Rad	Lead	7439-92-1	ug/kg	4.90E+04	1.70E+06	2.88E-02	1.56E+05	3.14E-01
618-4_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	7.46E+03	1.00E+05	7.46E-02	4.03E+04	1.85E-01
618-5_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	9.77E+03	1.00E+05	9.77E-02	4.03E+04	2.42E-01
618-7_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.08E+04	1.00E+05	1.08E-01	4.03E+04	2.68E-01
618-7_Shallow_Focused	non-Rad	Cadmium	7440-43-9	ug/kg	6.20E+03	9.84E+03	6.30E-01	2.86E+04	2.17E-01
618-7_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	6.59E+04	1.49E+05	4.42E-01	1.09E+05	6.05E-01

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Table H-9. Ecological PRG Comparisons for 300 Area Waste Site Decision Units

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/ Invertebrate PRG (µg/kg)	Hazard Quotient	Wildlife PRG (µg/kg)	Hazard Quotient
618-7_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.96E+04	1.00E+05	1.96E-01	4.03E+04	4.85E-01
618-8_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	8.46E+02	2.02E+03	4.19E-01	1.43E+03	5.92E-01
618-9_Shallow_Focused	non-Rad	Aldrin	309-00-2	ug/kg	3.90E+02	No Value	--	9.90E+00	**3.94E+01**
618-9_Shallow_Focused	non-Rad	Aroclor-1016	12674-11-2	ug/kg	1.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1221	11104-28-2	ug/kg	1.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1232	11141-16-5	ug/kg	1.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1242	53469-21-9	ug/kg	1.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	1.16E+04	1.28E+05	9.06E-02	1.27E+05	9.13E-02
618-9_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	3.30E+02	3.00E+02	**1.10E+00**	1.56E+03	2.12E-01
618-9_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	8.96E+03	1.00E+05	8.96E-02	4.03E+04	2.22E-01
628-4_Shallow	non-Rad	Aroclor-1242	53469-21-9	ug/kg	4.24E+01	No Value	--	No Value	--
628-4_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1.12E+03	No Value	--	No Value	--
628-4_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.05E+02	No Value	--	No Value	--
628-4_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3.78E+01	No Value	--	No Value	--
628-4_Shallow	non-Rad	Lead	7439-92-1	ug/kg	9.92E+04	1.70E+06	5.83E-02	1.56E+05	6.36E-01
UPR-300-17_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1.97E+03	No Value	--	No Value	--
UPR-300-17_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.50E+02	No Value	--	No Value	--
UPR-300-17_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	1.13E+02	No Value	--	No Value	--
UPR-300-17_Shallow	non-Rad	Boron	7440-42-8	ug/kg	3.90E+03	2.86E+04	1.36E-01	3.20E+04	1.22E-01
UPR-300-17_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	5.64E+05	3.80E+04	**1.48E+01**	2.47E+05	**2.28E+00**
UPR-300-17_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.24E+04	1.00E+05	1.24E-01	4.03E+04	3.08E-01
UPR-300-17_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	1.57E+05	6.21E+05	2.53E-01	8.56E+05	1.84E-01
UPR-300-46_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	8.79E+02	No Value	--	No Value	--
UPR-300-46_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.90E+02	No Value	--	No Value	--
UPR-300-46_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	8.44E+01	No Value	--	No Value	--

Acronyms:

PRG = Preliminary remediation goal

Table H-10. Summary of 300 Area Waste Sites Ecological Evaluation Based on PRGs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Plant/Invertebrate HQ	Wildlife HQ
300-223_Shallow_Focused	TPH-Motor Oil (uncertainty)	--
300-23_Shallow_Focused	TPH-Motor Oil (uncertainty)	--
300-260_Shallow_Focused	Copper (1.3)	--
300-49_Overburden	Copper (9.2)	Copper (2.8)
300-50_Overburden	Copper (1.1)	--
316-1_Overburden	--	Total Uranium Isotopes (1.0)
316-1_Shallow_1	--	Aroclor-1248 (NoPRG) Total Uranium Isotopes (2.1)
316-1_Shallow_3	Copper (23.6) Mercury (3.7) Nickel (2.5) Silver (4.4)	Copper (7.1) Selenium (1.0) Total Uranium Isotopes (1.6)
316-1_Shallow_4	--	Total Uranium Isotopes (1.1)
316-2_Shallow_1	Total Uranium Isotopes (2.1)	Total Uranium Isotopes (5.2)
316-2_Shallow_2	Total Uranium Isotopes (2.9)	Aroclor-1248 (NoPRG) Aroclors HI (No PRGs) Total Uranium Isotopes (7.2)
316-2_Shallow_3	--	Total Uranium Isotopes (1.8)
316-5_Shallow_1	Total Uranium Isotopes (2.7)	Total Uranium Isotopes (6.7)
316-5_Shallow_2	Silver (1.2) Total Uranium Isotopes (2.1)	Total Uranium Isotopes (5.1)
316-5_Shallow_Focused	Total Uranium Isotopes (1.4)	Total Uranium Isotopes (3.4)
300-33, 300-41, 300-256_Shallow_Focused	--	Aroclor-1248 (NoPRG) Aroclors HI (No PRGs)
300-37_Shallow_Focused	--	Aroclor-1260 (NoPRG) Aroclors HI (No PRGs)
600-243_Shallow	Boron (10.3) Selenium (2.8) TPH-Motor Oil (uncertainty)	Boron (9.2) Selenium (4.0)
618-3_Shallow_Focused	Total Uranium Isotopes (2.4)	Total Uranium Isotopes (5.9)
618-7_Shallow_Focused	TPH-Motor Oil (uncertainty)	--
618-9_Shallow_Focused	Mercury (1.1)	Aldrin (39) Aroclor-1016 (NoPRG) Aroclor-1221 (NoPRG) Aroclor-1232 (NoPRG) Aroclor-1242 (NoPRG) Aroclor-1248 (NoPRG) Aroclor-1254 (NoPRG) Aroclor-1260 (NoPRG) Aroclors HI (No PRGs)
628-4_Shallow	--	Aroclor-1248 (NoPRG) Aroclors HI (No PRGs)
UPR-300-17_Shallow	Nickel (15) TPH-Motor Oil (uncertainty)	Aroclor-1248 (NoPRG) Aroclors HI (No PRGs) Nickel (2.3)
UPR-300-46_Shallow	--	Aroclor-1248 (NoPRG) Aroclors HI (No PRGs)

PRG = Preliminary remediation goal
HQ = Hazard Quotient

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Table H-11. Wildlife Exposure to Non-Radionuclide Chemicals through Drinking from Seeps in the 300 Area Riparian Area

Chemical	Seep EPC (mg/L)	Mammal LOAEL TRV (mg/kg-bw-d)	Bird LOAEL TRV (mg/kg-bw-d)	Elk Drinking Water Dose (mg/kg-BW/d)	Elk LOAEL HQ	Badger Drinking Water Dose (mg/kg-BW/d)	Badger LOAEL HQ	Bat Drinking Water Dose (mg/kg-BW/d)	Bat LOAEL HQ	Killdeer Drinking Water Dose (mg/kg-BW/d)	Killdeer LOAEL HQ	Swallow Drinking Water Dose (mg/kg-BW/d)	Swallow LOAEL HQ	Quail Drinking Water Dose (mg/kg-BW/d)	Quail LOAEL HQ	Meadowlark Drinking Water Dose (mg/kg-BW/d)	Meadowlark LOAEL HQ	Hawk Drinking Water Dose (mg/kg-BW/d)	Hawk LOAEL HQ
Unfiltered samples																			
1,1,2-Trichloroethane	6.90E-04	1.00E+03	3.44E+01	3.01E-05	3.01E-08	4.18E-05	4.18E-08	5.40E-05	5.40E-08	7.16E-05	2.08E-06	1.05E-04	3.04E-06	5.38E-05	1.56E-06	3.06E-05	8.89E-07	2.89E-05	8.41E-07
1,2-Dichloroethane	8.70E-04	5.00E+01	3.44E+01	3.80E-05	7.59E-07	5.27E-05	1.05E-06	6.81E-05	1.36E-06	9.03E-05	2.62E-06	1.32E-04	3.84E-06	6.78E-05	1.97E-06	3.86E-05	1.12E-06	3.65E-05	1.06E-06
1,4-Dichlorobenzene	2.50E-04	2.82E+02	1.64E+02	1.45E-05	5.16E-08	1.52E-05	5.37E-08	1.96E-05	6.93E-08	2.59E-05	1.58E-07	3.79E-05	2.31E-07	1.95E-05	1.19E-07	1.11E-05	6.76E-08	1.05E-05	6.39E-08
Acetone	3.34E-03	5.00E+02	5.20E+01	1.94E-04	3.88E-07	2.02E-04	4.05E-07	2.61E-04	5.22E-07	3.46E-04	6.66E-06	5.07E-04	9.74E-06	2.60E-04	5.00E-06	1.48E-04	2.85E-06	1.40E-04	2.69E-06
Aluminum	2.56E+00	1.93E+01	1.10E+02	1.49E-01	7.72E-03	1.55E-01	8.05E-03	2.00E-01	**1.04E-02**	2.66E-01	2.42E-03	3.89E-01	3.54E-03	2.00E-01	1.82E-03	1.14E-01	1.04E-03	1.07E-01	9.79E-04
Antimony	3.45E-04	5.90E-01	NA	2.01E-05	3.40E-05	2.09E-05	3.55E-05	2.70E-05	4.58E-05	3.58E-05	NA	5.24E-05	NA	2.69E-05	NA	1.53E-05	NA	1.45E-05	NA
Arsenic	2.18E-03	1.66E+00	4.03E+01	1.27E-04	7.63E-05	1.32E-04	7.95E-05	1.70E-04	1.03E-04	2.26E-04	5.60E-06	3.30E-04	8.20E-06	1.70E-04	4.21E-06	9.65E-05	2.39E-06	9.12E-05	2.26E-06
Barium	1.20E-01	7.50E+01	4.17E+01	7.01E-03	9.34E-05	7.30E-03	9.74E-05	9.42E-03	1.26E-04	1.25E-02	3.00E-04	1.83E-02	4.38E-04	9.39E-03	2.25E-04	5.34E-03	1.28E-04	5.05E-03	1.21E-04
Beryllium	2.32E-04	5.32E-01	NA	1.35E-05	2.53E-05	1.40E-05	2.64E-05	1.81E-05	3.41E-05	2.40E-05	NA	3.51E-05	NA	1.81E-05	NA	1.03E-05	NA	9.71E-06	NA
Bismuth	8.08E-05	NA	NA	4.70E-06	NA	4.90E-06	NA	6.32E-06	NA	8.38E-06	NA	1.23E-05	NA	6.30E-06	NA	3.58E-06	NA	3.39E-06	NA
Boron	1.37E-01	9.36E+01	1.00E+02	7.97E-03	8.51E-05	8.30E-03	8.87E-05	1.07E-02	1.14E-04	1.42E-02	1.42E-04	2.08E-02	2.08E-04	1.07E-02	1.07E-04	6.07E-03	6.07E-05	5.74E-03	5.74E-05
Bromide	1.00E-01	NA	NA	5.82E-03	NA	6.06E-03	NA	7.82E-03	NA	1.04E-02	NA	1.52E-02	NA	7.79E-03	NA	4.43E-03	NA	4.19E-03	NA
Cadmium	2.82E-04	1.00E+01	1.47E+00	1.64E-05	1.64E-06	1.71E-05	1.71E-06	2.21E-05	2.21E-06	2.93E-05	1.99E-05	4.28E-05	2.91E-05	2.20E-05	1.50E-05	1.25E-05	8.51E-06	1.18E-05	8.05E-06
Calculated Total Uranium	8.64E-02	6.13E+00	1.60E+01	5.03E-03	8.20E-04	5.24E-03	8.54E-04	6.76E-03	1.10E-03	8.96E-03	5.60E-04	1.31E-02	8.19E-04	6.73E-03	4.21E-04	3.83E-03	2.39E-04	3.62E-03	2.26E-04
Carbon disulfide	4.60E-04	NA	NA	2.68E-05	NA	2.79E-05	NA	3.60E-05	NA	4.77E-05	NA	6.98E-05	NA	3.58E-05	NA	2.04E-05	NA	1.93E-05	NA
Chloride	1.55E+01	NA	NA	8.99E-01	NA	9.37E-01	NA	1.21E+00	NA	1.60E+00	NA	2.35E+00	NA	1.20E+00	NA	6.85E-01	NA	6.48E-01	NA
Chloroform	3.40E-03	4.10E+01	3.44E+01	1.98E-04	4.82E-06	2.06E-04	5.03E-06	2.66E-04	6.49E-06	3.53E-04	1.03E-05	5.16E-04	1.50E-05	2.65E-04	7.70E-06	1.51E-04	4.38E-06	1.42E-04	4.14E-06
Chromium	7.44E-03	9.62E+00	2.78E+00	4.33E-04	4.50E-05	4.51E-04	4.69E-05	5.82E-04	6.05E-05	7.72E-04	2.78E-04	1.13E-03	4.06E-04	5.80E-04	2.09E-04	3.30E-04	1.19E-04	3.12E-04	1.12E-04
cis-1,2-Dichloroethylene	3.86E-04	4.52E+01	3.44E+01	2.25E-05	4.97E-07	2.34E-05	5.18E-07	3.02E-05	6.68E-07	4.01E-05	1.16E-06	5.86E-05	1.70E-06	3.01E-05	8.75E-07	1.71E-05	4.98E-07	1.62E-05	4.70E-07
Cobalt	8.30E-03	1.09E+01	7.80E+00	4.83E-04	4.43E-05	5.03E-04	4.62E-05	6.49E-04	5.96E-05	8.61E-04	1.10E-04	1.26E-03	1.61E-04	6.47E-04	8.29E-05	3.68E-04	4.72E-05	3.48E-04	4.46E-05
Copper	1.00E-02	9.34E+00	1.21E+01	5.83E-04	6.24E-05	6.08E-04	6.51E-05	7.84E-04	8.39E-05	1.04E-03	8.59E-05	1.52E-03	1.26E-04	7.81E-04	6.45E-05	4.44E-04	3.67E-05	4.20E-04	3.47E-05
Fluoride	3.64E-01	5.28E+01	3.20E+01	2.11E-02	4.01E-04	2.20E-02	4.18E-04	2.84E-02	5.39E-04	3.77E-02	1.18E-03	5.52E-02	1.72E-03	2.83E-02	8.85E-04	1.61E-02	5.04E-04	1.52E-02	4.76E-04
Hexavalent Chromium	9.00E-04	4.00E+01	NA	5.23E-05	1.31E-06	5.46E-05	1.36E-06	7.04E-05	1.76E-06	9.34E-05	NA	1.37E-04	NA	7.01E-05	NA	3.99E-05	NA	3.77E-05	NA
Iodine	1.47E-02	1.37E+01	NA	8.52E-04	6.22E-05	8.88E-04	6.48E-05	1.15E-03	8.37E-05	1.52E-03	NA	2.22E-03	NA	1.14E-03	NA	6.49E-04	NA	6.14E-04	NA
Iron	4.70E+00	NA	NA	2.73E-01	NA	2.85E-01	NA	3.68E-01	NA	4.88E-01	NA	7.13E-01	NA	3.66E-01	NA	2.08E-01	NA	1.97E-01	NA
Lead	8.28E-03	8.90E+00	3.26E+00	4.82E-04	5.41E-05	5.02E-04	5.64E-05	6.48E-04	7.28E-05	8.60E-04	2.64E-04	1.26E-03	3.86E-04	6.46E-04	1.98E-04	3.67E-04	1.13E-04	3.47E-04	1.07E-04
Lithium	5.68E-03	NA	1.88E+01	3.30E-04	NA	3.44E-04	NA	4.44E-04	NA	5.89E-04	NA	8.62E-04	4.58E-05	4.43E-04	2.35E-05	2.52E-04	1.34E-05	2.38E-04	1.27E-05
Manganese	1.72E-01	7.10E+01	3.48E+02	1.00E-02	1.41E-04	1.04E-02	1.47E-04	1.34E-02	1.89E-04	1.78E-02	5.13E-05	2.61E-02	7.49E-05	1.34E-02	3.85E-05	7.62E-03	2.19E-05	7.20E-03	2.07E-05
Mercury	2.70E-06	1.60E-01	3.70E-01	1.57E-07	9.83E-07	1.64E-07	1.02E-06	2.11E-07	1.32E-06	2.80E-07	7.58E-07	4.10E-07	1.11E-06	2.11E-07	5.69E-07	1.20E-07	3.24E-07	1.13E-07	3.06E-07
Methylene chloride	6.60E-04	5.00E+01	3.44E+01	3.84E-05	7.68E-07	4.00E-05	8.00E-07	5.16E-05	1.03E-06	6.85E-05	1.99E-06	1.00E-04	2.91E-06	5.14E-05	1.50E-06	2.93E-05	8.50E-07	2.77E-05	8.04E-07
Nickel	9.15E-03	3.40E+00	1.15E+01	5.32E-04	1.56E-04	5.54E-04	1.63E-04	7.15E-04	2.10E-04	9.49E-04	8.25E-05	1.39E-03	1.21E-04	7.13E-04	6.20E-05	4.05E-04	3.52E-05	3.83E-04	3.33E-05
Nitrogen	2.05E+03	NA	NA	1.19E+02	NA	1.24E+02	NA	1.61E+02	NA	2.13E+02	NA	3.12E+02	NA	1.60E+02	NA	9.10E+01	NA	8.61E+01	NA
Selenium	2.89E-03	2.15E-01	5.79E-01	1.68E-04	7.82E-04	1.75E-04	8.15E-04	2.26E-04	1.05E-03	3.00E-04	5.18E-04	4.39E-04	7.57E-04	2.25E-04	3.89E-04	1.28E-04	2.21E-04	1.21E-04	2.09E-04
Silver	2.47E-05	6.02E+01	2.02E+01	1.43E-06	2.38E-08	1.49E-06	2.48E-08	1.93E-06	3.20E-08	2.56E-06	1.27E-07	3.74E-06	1.85E-07	1.92E-06	9.51E-08	1.09E-06	5.41E-08	1.03E-06	5.12E-08
Strontium	2.20E-01	2.63E+02	NA	1.28E-02	4.87E-05	1.33E-02	5.07E-05	1.72E-02	6.54E-05	2.28E-02	NA	3.34E-02	NA	1.71E-02	NA	9.75E-03	NA	9.22E-03	NA
Sulfate	4.77E+01	NA	NA	2.78E+00	NA	2.89E+00	NA	3.73E+00	NA	4.95E+00	NA	7.24E+00	NA	3.72E+00	NA	2.12E+00	NA	2.00E+00	NA
Tetrachloroethene	7.00E-04	7.00E+01	1.64E+02	4.07E-05	5.82E-07	4.24E-05	6.06E-07	5.48E-05	7.82E-07	7.26E-05	4.43E-07	1.06E-04	6.48E-07	5.45E-05	3.33E-07	3.10E-05	1.89E-07	2.93E-05	1.79E-07
Thallium	1.15E-04	7.50E-02	NA	6.68E-06	8.91E-05	6.96E-06	9.29E-05	8.99E-06	1.20E-04	1.19E-05	NA	1.74E-05	NA	8.95E-06	NA	5.09E-06	NA	4.81E-06	NA
Thorium	4.05E-04	NA	NA	2.36E-05	NA	2.46E-05	NA	3.17E-05	NA	4.20E-05	NA	6.14E-05	NA	3.16E-05	NA	1.80E-05	NA	1.70E-05	NA
Toluene	4.48E-04	5.20E+02	4.07E+01	2.61E-05	5.01E-08	2.72E-05	5.23E-08	3.51E-05	6.74E-08	4.65E-05	1.14E-06	6.80E-05	1.67E-06	3.49E-05	8.58E-07	1.99E-05	4.88E-07	1.88E-05	4.62E-07
Trichloroethene	2.19E-03	7.00E+01	1.65E+02	1.27E-04	1.82E-06	1.32E-04	1.89E-06	1.71E-04	2.44E-06	2.27E-04	1.37E-06	3.32E-04	2.01E-06	1.70E-04	1.03E-06	9.69E-05	5.87E-07	9.16E-05	5.55E-07
Uranium	2.29E-01	6.13E+00	1.60E+01	1.33E-02	2.17E-03	1.39E-02	2.26E-03	1.79E-02	2.92E-03	2.38E-02	1.48E-03	3.47E-02	2.17E-03	1.78E-02	1.12E-03	1.02E-02	6.34E-04	9.60E-03	6.00E-04
Vanadium	7.30E-03	8.31E+00	6.88E-01	4.25E-04	5.11E-05	4.43E-04	5.33E-05	5.71E-04	6.87E-05	7.57E-04	1.10E-03	1.11E-03	1.61E-03	5.69E-04	8.27E-04	3.24E-04	4.70E-04	3.06E-04	4.45E-04
Xylenes [total]	3.40E-04	3.50E+02	4.07E+01	1.98E-05	5.65E-08	2.06E-05	5.89E-08	2.66E-05	7.60E-08	3.53E-05	8.67E-07	5.16E-05	1.27E-06	2.65E-05	6.51E-07	1.51E-05	3.70E-07	1.42E-05	3.50E-07
Zinc	4.92E-02	7.59E+01	6.65E+01	2.86E-03	3.77E-05	2.98E-03	3.93E-05	3.85E-03	5.07E-05	5.10E-03	7.67E-05	7.46E-03	1.12E-04	3.83E-03	5.76E-05	2.18E-03	3.28E-05	2.06E-03	3.10E-05
Filtered samples																			
Antimony	2.62E-04	5.90E-01	NA	1.52E-05	2.58E-05	1.59E-05	2.69E-05	2.05E-05	3.47E-05	2.72E-05	NA	3.98E-05	NA	2.04E-05	NA	1.16E-05	NA	1.10E-05	NA
Arsenic	1.61E-03	1.66E+00	4.03E+01	9.36E-05	5.64E-05	9.76E-05	5.88E-05	1.26E-04	7.59E-05	1.67E-04	4.14E-06	2.44E-04	6.06E-06	1.25E-04	3.11E-06	7.14E-05	1.77E-06	6.75E-05	1.67E-06
Cadmium	2.77E-05	1.00E+01	1.47E+00	1.61E-06	1.61E-07	1.68E-06	1.68E-07	2.17E-06	2.17E-07	2.87E-06	1.96E-06	4.20E-06	2.86E-06	2.16E-06	1.47E-06	1.23E-06	8.35E-07	1.16E-06	7.90E-07
Chromium	4.96E-03	9.62E+00	2.78E+00	2.89E-04	3.00E-05	3.01E-04	3.13E-05	3.88E-04	4.03E-05	5.15E-04	1.85E-04	7.53E-04	2.71E-04	3.87E-04	1.39E-04	2.20E-04	7.91E-05	2.08E-04	7.48E-05
Copper	4.47E-04	9.34E+00	1.21E+01	2.60E-05	2.78E-06	2.71E-05	2.90E-06	3.50E-05	3.74E-06	4.64E-05	3.83E-06	6.78E-05	5.60E-06	3.48E-05	2.88E-06	1.98E-05	1.64E-06	1.87E-05	1.55E-06
Lead	3.48E-04	8.90E+00	3.26E+00	2.02E-05	2.27E-06	2.11E-05	2.37E-06	2.72E-05	3.06E-06	3.61E-05	1.11E-05	5.28E-05	1.62E-05	2.71E-05	8.32E-06	1.54E-05	4.73E-06	1.46E-05	4.47E-06
Nickel	1.52E-03	3.40E+00	1.15E+01	8.84E-05	2.60E-05	9.21E-05	2.71E-05	1.19E-04	3.50E-05	1.58E-04	1.37E-05	2.31E-04	2.01E-05	1.18E-04	1.03E-05	6.74E-05	5.86E-06	6.37E-05	5.54E-06
Selenium	3.07E-03	2.15E-01	5.79E-01	1.79E-04	8.31E-04	1.86E-04	8.66E-04	2.40E-04	1.12E-03	3.19E-04	5.50E-04	4.66E-04	8.04E-04	2.39E-04	4.13E-04	1.36E-04	2.35E-04	1.29E-04	2.22E-04
Thallium	1.57E-05	7.50E-02	NA	9.13E-07	1.22E-05	9.52E-07	1.27E-05	1.23E-06	1.64E-05	1.63E-06	NA	2.38E-06	NA	1.22E-06	NA	6.96E-07	NA	6.58E-07	NA
Zinc	1.91E-03	7.59E+01	6.65E+01	1.11E-04	1.46E-06	1.16E-04	1.53E-06	1.49E-04	1.97E-06	1.98E-04	2.98E-06	2.90E-04	4.36E-06	1.49E-04	2.24E-06	8.47E-05	1.27E-06	8.00E-05	1.20E-06

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Table H-11. Wildlife Exposure to Non-Radionuclide Chemicals through Drinking from Seeps in the 300 Area Riparian Area

Chemical	Seep EPC (mg/L)	Mammal LOAEL TRV (mg/kg-bw-d)	Bird LOAEL TRV (mg/kg-bw-d)	Elk Drinking Water Dose (mg/kg-BW/d)	Elk LOAEL HQ	Badger Drinking Water Dose (mg/kg-BW/d)	Badger LOAEL HQ	Bat Drinking Water Dose (mg/kg-BW/d)	Bat LOAEL HQ	Killdeer Drinking Water Dose (mg/kg-BW/d)	Killdeer LOAEL HQ	Swallow Drinking Water Dose (mg/kg-BW/d)	Swallow LOAEL HQ	Quail Drinking Water Dose (mg/kg-BW/d)	Quail LOAEL HQ	Meadowlark Drinking Water Dose (mg/kg-BW/d)	Meadowlark LOAEL HQ	Hawk Drinking Water Dose (mg/kg-BW/d)	Hawk LOAEL HQ

Notes:

Drinking water ingestion rate estimated using Calder and Braun, 1983

Calder and Braun (1983) regression equation format --> L water/kg body weight/day = *a* (kilograms body weight)^{b} /kg body weight

Group	*a*	*b*
all birds	0.059	0.67
all mammals	0.099	0.90

Body weight: for Elk (kg) = 204 assumed average weight of Rocky Mountain Elk (*Cervus canadensis*) cow (Red Orbit, 2012)

Badger = 7.6 median from multiple studies (Messick and Hornocker, 1981; Silva and Downing, 1995)

Little Brown Bat = 0.0103 assumed average weight (*Myotis lucifugus*) from Silva and Downing, 1995

Killdeer = 0.0756 median from multiple studies (Purdue and Haines, 1977; Stegeman, 1955; Jackson and Jackson, 2000; Dunning, 1993)

Swallow = 0.0239 mean adult weight (*Hirundo pyrrhonota*) during breeding (Brown and Brown, 1995)

California Quail = 0.18 median from multiple studies (Robel, 1969;Roseberry and Klimstra, 1971;Guthery et al., 1988)

Western Meadowlark = 0.995 median from multiple studies (Wiens and Rotenberry, 1980; Maher, 1979)

Red-tailed Hawk = 1.179 median from multiple studies (Craighead and Craighead,1956; Steenhof,1983; Springer and Osborne,1983)

	Elk	Badger	Bat	Killdeer	Swallow	California Quail	Western Meadowlark	Red-tailed Hawk
Drinking Water Ingestion Rate (L/kg-bw-d) =	0.058	0.081	0.156	0.138	0.202	0.104	0.059	0.056
Area use factor (unitless) =	0.750	0.750	0.500	0.750	0.750	0.750	0.750	0.750

Acronyms:

EPC = exposure point concentration

HQ = hazard quotient

LOAEL = lowest observed adverse effect level

mg/kg-bw/d = milligrams of chemical per kilogram bodyweight per day

mg/L = milligrams per liter

NA = not available

NOAEL = no observed adverse effect level

pCi/L = picoCuries per liter

TRV = toxicological reference value

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Table H-12. Wildlife Exposure to Radionuclides through Drinking from Seeps in the 300 Area Riparian Area

Analyte Name	Units	Seeps Max Detect	Water BCG	Exposure Dose to Wildlife	Wildlife HQ	Exposure Dose to Bats	Bats HQ
Antimony-125	pCi/L	3.20E+00	4.40E+06	2.40E+00	5.45E-07	1.60E+00	3.64E-07
Cesium-137	pCi/L	9.68E-01	4.26E+01	7.26E-01	**1.70E-02**	4.84E-01	**1.14E-02**
Cobalt-60	pCi/L	1.76E+00	4.78E+03	1.32E+00	2.76E-04	8.79E-01	1.84E-04
Europium-154	pCi/L	2.24E+00	5.73E+04	1.68E+00	2.93E-05	1.12E+00	1.95E-05
Gross alpha	pCi/L	8.03E+01	--	6.02E+01	--	4.01E+01	--
Gross beta	pCi/L	3.77E+01	--	2.83E+01	--	1.89E+01	--
Iodine-129	pCi/L	4.88E-03	3.84E+04	3.66E-03	9.54E-08	2.44E-03	6.36E-08
Ruthenium-106	pCi/L	1.34E+01	--	1.01E+01	--	6.70E+00	--
Strontium-90	pCi/L	1.53E+00	2.78E+02	1.14E+00	4.11E-03	7.63E-01	2.74E-03
Technetium-99	pCi/L	1.83E+01	6.67E+05	1.37E+01	2.05E-05	9.13E+00	1.37E-05
Thorium-228	pCi/L	2.50E-01	2.04E+03	1.88E-01	9.21E-05	1.25E-01	6.14E-05
Thorium-230	pCi/L	1.09E+00	1.39E+04	8.18E-01	5.88E-05	5.45E-01	3.92E-05
Thorium-232	pCi/L	4.99E-01	1.68E+03	3.74E-01	2.23E-04	2.50E-01	1.49E-04
Tritium	pCi/L	9.63E+03	2.31E+08	7.22E+03	3.13E-05	4.81E+03	2.08E-05
Uranium [radionuclide]	pCi/L	7.46E+01	6.76E+02	5.59E+01	**8.27E-02**	3.73E+01	**5.52E-02**
Rads SOF	pCi/L	--	--	--	**1.05E-01**	--	**6.98E-02**

Notes:

AUF = area use factor which was assumed as 0.75 due to inaccessibility of seeps from mid April to mid July for all wildlife except bats for which it was assumed to be 0.5 due to their hibernation in winter in addition to the summer inaccessibility of the seeps.

EPC (Exposure Point Concentrations) were calculated as the 95 percent upper confidence limit (UCL) on the arithmetic mean using the most recent version of EPA's Pro UCL software.

BCG (Biota Concentration Guides) represent the lowest value among those calculated for riparian and terrestrial animals.

BCGs for cesium-137, europium-154, europium-155, strontium-90, technetium-99, tritium, and uranium isotopes were published in DOE-STD-1153-2002.

BCGs for cesium-134, and cobalt-60 were calcualted according to DOE/EH-0676 using RESRAD-BIOTA, Version 1.5 (ANL, 2009).

HQ = hazard quotient calculated as the exposure dose divided by the water BCG

SOF = sum of fractions calculated as the sum of hazard quotients for individual radionuclides.

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Table H-12. Wildlife Exposure to Radionuclides through Drinking from Seeps in the 300 Area Riparian Area

Analyte Name	Units	Seeps Max Detect	Water BCG	Exposure Dose to Wildlife	Wildlife HQ	Exposure Dose to Bats	Bats HQ

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Ecological Risk Evaluation for the 300-FF-2 Source Operable Unit

Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

Contractor for the U.S. Department of Energy
under Contract DE-AC06-08RL14788

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**Approved for Public Release;
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Document Type: ENV Program/Project: EP & SP

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Environmental Calculation Cover Page

Part 1: Completed by the Responsible Manager
Project: 300 Area Remedial Investigation/Feasibility Study Report **Date:** 10/23/2012

Calculation Title & Description: Ecological Risk Evaluation for the 300-FF-2 Source Operable Unit

Preparer: Mike Elias	**Basis of Qualification:** Senior Risk Assessor
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Senior Reviewer: Harry Ohlendorf	**Basis of Qualification:** Principal Scientist

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Rev. 0.	Addition of Total U Isotopes and RAD SOF, HI and Drinking water ingestion tables and text	04/30/12	all
Rev. 1	Added new PRGs for 5 chemicals into Tables 6 and 7	09/27/12	Tables 6 and 7

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1 Purpose

This Environmental Calculation for the 300 Area documents the following:

- Calculation of Hazard Quotients (HQs), Hazard Indexes (HIs), and Sum of Fractions (SOFs) for the evaluation of risk to ecological receptors (plants, soil invertebrates, and wildlife) from chemical constituents and radionuclides in the upper 4.6 m (15 ft) of the upland area soils; and,
- Evaluation of the site-relatedness of constituents based on the comparison of site concentrations to non site-impacted background concentrations for chemical constituents and radionuclides with HQs, HIs, or SOFs $\geq$ 1.

The HQ, HI, SOF, and background comparisons presented in this document are intended for use in the ecological risk assessment (ERA) being prepared for the 300 Area of the Hanford Site. That ERA completes both a screening and Preliminary Remediation Goal (PRG) evaluation; the results of the ERA will be used to evaluate the ecological risk remaining following remediation and to provide information for risk managers to consider when deciding if additional remediation is necessary with respect to ecological risks for the 300 Area.

HQs and HIs are intended to characterize the potential for risk to the specified receptors from exposure to contaminants via the evaluated exposure pathways. HQs are the ratios of the estimated site-specific exposures to a constituent compared to estimated exposure thresholds for adverse health effects. Because the dose from polychlorinated biphenyls (Aroclors) is additive, the total contributions of Aroclors were calculated using the HI method. Similarly, the dose from radionuclides is additive (*Principles and Issues in Radiological Ecological Risk Assessment* [Jones et al., 2003]), so the total contribution of radionuclides known to be associated with Hanford Site processes was calculated using the SOF method. For constituents indicating a potential risk (HQ, HIs, or SOF $\geq$ 1) for at least one ecological receptor, background comparisons were additionally conducted to determine if the concentrations of those constituents are elevated above those in non site-impacted areas. Risks are not considered to be site-related if onsite concentrations do not exceed those concentrations present as background. Background concentrations were not available for organic constituents.

The risk characterization process described in this document is consistent with that presented in *Ecological Risk Assessment Guidance for Superfund: Process for Designing and Conducting Ecological Risk Assessments, Interim Final* (EPA/540-R-97-006). The HQs, SOF, and background comparison outcomes presented in this Environmental Calculation are not intended to be final risk outcomes. This Environmental Calculation document will be revised as needed to incorporate updates to the risk characterization process and/or underlying values used to calculate risks that occur during the Remedial Investigation/Feasibility Study (RI/FS) process for the 300 Area.

The risk characterization process presented in this document is intended for use in evaluating risks for waste sites located in upland habitats. It is not intended for evaluating riparian or near-shore areas of the River Corridor, as these have been defined in the *River Corridor Baseline Risk Assessment Volume 1: Ecological Risk Assessment* (DOE/RL-2007-21 Volume 1, Rev. 0).

2 Methodology

The HQs, HIs, SOFs, and background comparisons are based on the evaluation of risk to ecological receptors as described in Section 1. The following sections describe the steps used to develop the soil screening level (SSL)-based HQs, HIs, and SOFs (Section 2.1), the approach for comparing site to background concentrations (Section 2.2), the approach for developing the preliminary remediation goal

(PRG)-based HQs (Section 2.3), and the approach for estimating wildlife exposure to chemicals and radionuclides received by drinking from seeps in the 300 Area OUs (Section 2.4).

2.1 SSL HQ, HI, and SOF Calculation

Risks at the 300 Area OUs were evaluated based on the ratio of Exposure Point Concentrations (EPCs) to SSLs (defined below), resulting in HQs, and are described by the following equation:

$$HQ = EPC/SSL$$

where:

HQ	=	ecological hazard quotient (unitless)
EPC	=	soil concentration (µg/kg for non-radionuclides and pCi/g for radionuclides)
SSL	=	soil screening level (µg/kg for non-radionuclides and pCi/g for radionuclides)

Once the HQ was calculated, the HI for Aroclors and SOF for radionuclides were calculated as follows:

$$\text{HI or SOF} = \sum_{j=1}^{n} \text{Exposure}_j / \text{SSL}_j$$

where:

HI = hazard index

SOF = sum of fractions

Exposure_j = exposure concentration for chemical constituents or radionuclides

SSL_j = Soil screening level for chemical constituents or radionuclides

HQ, HI, or SOF values less than 1.0 indicate that adverse effects associated with exposure to a given analyte are unlikely (EPA/540-R-97-006). These analytes were not considered to represent a risk and were excluded from further evaluation in the refined COPC identification. An HQ, HI, or SOF equal to or greater than 1.0 indicates a potential for risk, but does not indicate that a risk is actually present. Constituents with HQs, HIs, or SOFs equal to or greater than 1.0 for at least one ecological receptor (plant, invertebrate, bird, or mammal) were further evaluated, as discussed in Section 2.2, to determine if the detected concentration of the constituent(s) with an HQ $\geq$ 1 exceeds background (when available). As noted above, background concentrations were not available for organic constituents, so this evaluation was not completed for Aroclors or other organics. Where the HI or SOF was equal to or greater than 1.0, the individual detected Aroclors or radionuclides, respectively, were carried forward for additional evaluation.

Table 1 identifies the soil decision units that were designated for each waste site in the 300 Area RI/FS. Table 2 defines the area and depth sampled within each soil decision unit and describes the sampling design used. All focused samples were collected using the focused study design. The soil depth decision units evaluated in the supplemental risk evaluation, and for which EPCs were calculated, are staging-pile footprint, overburden and overburden focused (backfill), shallow (0 to 15 ft bgs), and shallow-focused (0 to 15 ft bgs). Samples collected greater than 15 ft bgs (deep soil) were not included in the risk assessment.

The EPC represents the Upper Confidence Limit (UCL) of the arithmetic mean concentration of the analyzed constituent from EPA ProUCL (EPA, 2011) for each decision unit within the footprint of each

remediated waste site. A detailed description of the process used to calculate the EPCs and the resulting EPC values for the constituents analyzed within the soils of each decision unit in the 300 Area are provided in the *Computation of Exposure Point Concentrations for the 300-FF-2 Source Operable Units* (ECF-300NPL-11-0137)[1].

The soil EPCs for each evaluated waste site and decision unit were compared to the following SSLs for each receptor group selected for evaluation:

- Terrestrial Plants and Soil Invertebrates - The overall lowest of the available plant and soil invertebrate values in *Tier 1 Risk Based Concentrations for the Protection of Ecological Receptors at the Hanford Site* (CHPRC-00784, found in Appendix H of *Remedial Investigation/ Feasibility Study for the 100-KR1, 100-KR-2, and 100-KR4 Operable Units* [DOE/RL-2010-97]) were used as the SSLs for terrestrial plants and soil invertebrates.
- Avian and Mammalian Wildlife - The overall lowest of the avian and mammalian lowest observed adverse effect level (LOAEL)-based values in *Tier 1 Risk-Based Soil Concentrations Protective of Ecological Receptors at the Hanford Site* (CHPRC-00784, found in Appendix H of DOE/RL-2010-97) were used as the SSLs for avian and mammalian wildlife.

Because the plant/invertebrate and/or wildlife SSL values for 10 COPCs (arsenic, boron, lithium, mercury, manganese, molybdenum, selenium, strontium, thallium, and uranium) were higher than the corresponding PRG values, these COPCs were reviewed to confirm they were below both the SSL and PRG. Any of these 10 COPCs greater than either the SSL or PRG were then carried forward.

2.2 Background Concentration Comparison

The soil EPC (Section 2.1) for each inorganic or radionuclide with an HQ, HI, or SOF $\geq$ 1.0 is compared to the lognormal 90th percentile background concentrations for the Hanford Site. However, background values are not available for most organics, including Aroclors. Background concentrations for inorganic constituents in soil at the Hanford Site are described in DOE/RL-92-24, *Hanford Site Background, Part 1, Soil Background for Nonradioactive Analytes*. That document provides the 90th percentile background concentrations for several inorganic constituents. For selected inorganic constituents not included in DOE/RL-92-24, the 90th percentile concentrations were obtained from Pacific Northwest National Laboratory (PNNL) as summarized in ECF-HANFORD-11-0038 (*Soil Background for Interim Use at the Hanford Site)*, and in DOE/RL-96-17 (*Remedial Design Report/Remedial Action Work Plan for the 100 Area*) for uranium. Background concentrations for radiological constituents in soil at the Hanford Site are described in DOE/RL-96-12, *Hanford Site Background, Part 2, Soil Background for Radionuclides,* which provides the 90th percentile background concentrations for several radiological constituents.

Constituents with EPCs meeting or exceeding SSLs (i.e., HQ $\geq$ 1.0) but with EPCs that do not exceed the 90th percentile background concentration were not considered to represent a site-related risk and were excluded from further evaluation. Constituents with EPCs meeting or exceeding SSLs and with EPCs greater than the 90th percentile background concentrations were further considered in the PRG evaluation.

[1]It should be noted that uranium was measured as inorganic uranium reported in milligrams (mg) uranium per kilogram (kg) of soil as well as radiological doses for specific uranium isotopes reported as pico Curies (pCi) of activity per gram (g) of soil. For sites with only an inorganic measurement, only total measured inorganic uranium was evaluated. For sites where radiological measurements were conducted, measures of isotopes were converted to soil concentrations in milligrams of inorganic isotope per kilogram of soil and a total concentration of uranium isotopes was calculated. At these sites, only the total of uranium isotopes was evaluated.

2.3 PRG HQ Calculation

Chemical-decision-unit combinations with EPCs meeting or exceeding the SSLs and with EPCs greater than the 90th percentile background concentrations at the 300 Area were further evaluated based on the ratio of EPCs to PRGs (defined below), resulting in HQs, and are described by the following equation:

$$HQ = EPC/PRG$$

where:

HQ	=	ecological hazard quotient (unitless)
EPC	=	soil concentration (µg/kg for non-radionuclides and pCi/g for radionuclides)
PRG	=	preliminary remediation goal (µg/kg for non-radionuclides and pCi/g for radionuclides)

As described in Section 2.1, the EPC represents the UCL of the arithmetic mean concentration of the analyzed constituent for each decision unit within the footprint of each remediated waste site. The soil EPCs for each evaluated waste site and decision unit were compared to PRGs for each receptor group with EPCs exceeding SSLs and background.

The primary difference between the SSL and PRG comparisons for wildlife is the use of bioaccumulation factors that are based on the foodchain present at the Hanford site (e.g., ants, other arthropods in soil) for the calculation of the PRG, and the incorporation of Hanford-specific tissue data in the models. Development of the PRGs for birds and mammals focused on the integration of available Hanford-specific bioaccumulation data for plants, terrestrial arthropods, and small mammals into existing bioaccumulation models to more accurately reflect site-specific conditions and the potential exposure of wildlife to chemicals from the ingestion of prey at this Site. Details of the calculations of the avian and mammalian PRGs are found in CHPRC-01311 (*Tier 2 Risk Based Concentrations for the Protection of Ecological Receptors at the Hanford Site)*. As with SSLs, the PRGs selected are also based on LOAELs.

PRGs for the evaluation of potential impacts to terrestrial plants and soil invertebrates are primarily no observed effect concentrations (NOECs) from the RCBRA (DOE/RL-2007-21 Volume 1, Rev. 0), *Ecological Soil Screening Levels for Arsenic and Lead in the Tacoma Smelter Plume Footprint and Hanford Site Old Orchards* (Ecology Publication-11-003-006), and from a recent study in 2011 as presented in ECF HANFORD-11-0158 (*Tier 2 Terrestrial Plant and Invertebrate Preliminary Remediation Goals (PRGs) for Nonradionuclides for Use at the Hanford Site*).

2.4 Freshwater Seeps Drinking Water and HQ Calculations

The estimates of exposure from drinking water ingestion by wildlife include the use of a simplified model whereby the rate of ingestion is standardized to the body weight of the receptor on a per kilogram basis. The simplified allometric scaling equations presented in *Scaling of Osmotic Regulation in Mammals and Birds* (Calder and Braun, 1983) were used to estimate the number of liters consumed per kilogram body weight per day. These rates of ingestion were then multiplied by the concentration of chemicals to calculate the total dose from the drinking water pathway as shown below:

$$Dose = [Water \times DWIR] \times AUF$$

where:

Dose	=	drinking water exposure (mg/kg body weight/day)
Water	=	chemical concentration in seep (mg/L)
DWIR	=	drinking water ingestion rate (L/kg body weight/day)

AUF = area use factor (area of site/home range of receptor) (unitless)

Drinking water ingestion was estimated for several species of birds and mammals expected to occur in the 300 Area riparian areas along the Columbia River, with the initial assumption that they reside at the site and fulfill their drinking water requirements exclusively from the seeps, but only for nine months of the year as the river stage is elevated from mid-April to mid-July making the seeps inaccessible. Therefore, an AUF of 0.75 was employed for all species except bats. For bats, an AUF of 0.5 was used because bats use a combination of hibernating and seeking alternative sources of emergent insects during the winter months (WDFW, 2012).

Estimates are not included for small mammals because they maintain water balance through excreting concentrated urine, obtaining water from food and water generated during metabolism (Verts and Kirkland, 1988, "*Perognathus parvus*").

Assuming that wildlife meet their daily drinking water requirements from the seeps, instead of a more readily available source such as the river, is a conservative approach meant to evaluate a worst-case scenario. Therefore, though it represents an overestimate, the 95% UCL of the arithmetic mean concentration of the analyzed constituent (as described in Section 2.1) was employed as the EPC as a conservative estimate of exposure. While filtered water data are used in evaluations of the effects on aquatic receptors (because those are the concentrations that are bioavailable), unfiltered concentrations are more appropriate for drinking water (because bioavailability may change within the digestive tract). Both were included to be comprehensive as in rare cases filtered measurements can be higher than unfiltered. Results of filtered concentration and unfiltered concentration data were evaluated separately. When both filtered and unfiltered concentrations were measured in the same sampling location and event they were not pooled because doing so would overestimate the exposure concentration.

HQs for inorganics were estimated as the ratio of estimated ingestion doses to toxicological reference values (TRVs). The TRVs employed were the same as those used to develop the wildlife PRGs used to evaluate soil as presented in *Tier 1 Risk-Based Concentrations for the Protection of Ecological Receptors at the Hanford Site* (CHPRC-00784) and *Tier 2 Risk-Based Concentrations for the Protection of Ecological Receptors at the Hanford Site* (CHPRC-01311).

$$HQ = Dose/TRV$$

where:

HQ = ecological hazard quotient (unitless)
Dose = drinking water exposure (mg/kg body weight/day)
TRV = toxicological reference value (mg/kg-body weight-day)

For radionuclides, the HQs were simply a ratio of the measured concentrations in water to the biota concentration guides (BCGs) for wildlife. The lowest water BCGs of terrestrial or riparian animal receptors were taken from the DOE's *A Graded Approach for Evaluating Radiation Doses to Aquatic and terrestrial Biota* (DOE-STD-1153-2002) or, when not available, were calculated using *RESRAD-BIOTA: A Tool for Implementing a Graded Approach to Biota Dose Evaluation, User's Guide, Version 1* (DOE/EH-0676). SOFs were calculated as described in Section 2.1. As an added measure of conservatism, the EPC represents the maximum detected concentrations of the analyzed constituent.

$$HQ = (EPC*AUF) / BCG$$

where:

HQ = ecological hazard quotient (unitless)
EPC = radionuclide concentration in seep (pCi/L)
AUF = area use factor (unitless)
BCG = biota concentration guides (pCi/L)

3 Assumptions and Inputs

The following sections provide the input values for the HQ calculations (Sections 3.1, 3.2, and 3.4) and comparison to background concentrations (Section 3.3).

3.1 EPC Concentrations

Site and decision unit EPCs (described in Section 2.1) used to calculate HQs, HIs, and SOFs are shown in Table 3.

3.2 SSL Evaluation

SSLs (described in Section 2.1) used to calculate the SSL HQs, HIs, and SOFs are included in Table 3.

3.3 Background Concentrations

Background concentrations (described in Section 2.2) used to evaluate exceedances of background are provided in Table 4. The results of the comparisons are then summarized in Table 5.

3.4 PRG Evaluation

PRGs (described in Section 2.3) used to calculate the PRG HQs, HIs, and SOFs for chemicals with EPCs that exceeded both SSLs and background are provided in Table 6. The results of the comparison to PRGs are then summarized in Table 7.

3.5 Freshwater Seeps Drinking Water Evaluation

EPCs of seep data for inorganics used to calculate drinking water ingestion HQs are found in Table 8 and those for radionuclides in seeps are found in Table 9. TRVs, AUFs, body weights and allometric scaling-based drinking water ingestion rates are provided in Table 8, while BCGs are provided in Table 9.

4 Software Applications

All supporting calculations were performed on electronic spreadsheets using Microsoft Excel. Electronic versions of all spreadsheets are provided with calculations included to facilitate comparison with hand calculations and checking of logical or lookup functions. This approach meets the requirements for "Single Use Software" as described in *CHPRC Environmental Calculation Preparation and Issue*, PRC-PRO-EP-40205.

5 Calculation

5.1 Screening HQ, SOF, HI, and PRG HQ Calculations

HQs were calculated by comparing EPC concentrations to SSLs and PRGs using Microsoft Excel spreadsheets. EPCs were compared to SSLs and PRGs for both terrestrial plants or soil invertebrates (the lower of the two) and for avian or mammalian wildlife (similarly, the lower of the two). HIs and SOFs were calculated, by decision unit, by the addition of HQs for Aroclors and radioisotopes, respectively.

The results of these calculations are presented in Table 3 for the SSL comparison and Table 6 for the PRG comparison.

5.2 Background Concentration Comparison

Site concentrations were compared to background by comparing EPC concentrations to background concentrations using Microsoft Excel spreadsheets. EPCs were compared only for constituents with SSL-based HQs, HIs, or SOFs $\geq$ 1.0. The results of these calculations are presented in Table 4.

5.3 Freshwater Seeps Drinking Water Evaluation

EPCs of chemicals in seeps were used to estimate a worst case scenario of potential wildlife exposure to chemicals in seep water based on the assumption that wildlife use seeps as an exclusive source of drinking water. Results of the comparisons for inorganic chemicals are presented in Table 8. For radionuclides, exposure EPCs of radioactivity were compared to BCGs to evaluate the potential dose of radioactivity received through drinking seep water. Results are presented in Table 9.

6 Results/Conclusions

A summary of the chemicals exceeding the SSLs (plant/invertebrate and/or wildlife) or both the SSLs and background is presented in Table 5 for the 300 Area. The SOFs for radionuclides were less than 1 for all waste sites and therefore were not carried forward for background evaluation. Aldrin, Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260 were detected greater than the SSLs and no background values were available; therefore, these COPCs were carried forward for additional evaluation. Arsenic, boron, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, total uranium isotopes, uranium, and zinc were detected greater than the SSL and outside of the range of background, so these COPCs were carried forward for additional evaluation.

Comparisons of EPCs to PRGs for the chemicals carried forward are shown in Table 6, and summaries of the chemicals exceeding the PRGs at the 300 Area OUs waste sites are presented in Table 7. Boron, copper, mercury, nickel, selenium, silver, total uranium isotopes, aldrin, Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, and Aroclor-1260 were retained as chemicals of potential ecological concern (COPECs) due to concentrations exceeding one or both groups of PRGs (plants/invertebrates and wildlife) or because PRGs were not available. COPECs were retained from the following 300 Area waste sites:

- 300-260_Shallow_Focused: Copper
- 300-49_Overburden: Copper
- 300-50_Overburden: Copper
- 316-1_Overburden: Total Uranium Isotopes
- 316-1_Shallow_1: Aroclor-1248, Total Uranium Isotopes
- 316-1_Shallow_3: Copper, Mercury, Nickel, Silver, Selenium, Total Uranium Isotopes
- 316-1_Shallow_4: Total Uranium Isotopes
- 316-2_Shallow_1: Total Uranium Isotopes
- 316-2_Shallow_2: Aroclor-1248, Aroclors HI, Total Uranium Isotopes
- 316-2_Shallow_3: Total Uranium Isotopes
- 316-5_Shallow_1: Total Uranium Isotopes
- 316-5_Shallow_2: Silver, Total Uranium Isotopes
- 316-5_Shallow_Focused: Total Uranium Isotopes
- 300-33, 300-41, 300-256_Shallow_Focused: Aroclor-1248, Aroclors HI
- 300-37_Shallow_Focused: Aroclor-1260, Aroclors HI

- 600-243_Shallow: Boron, Selenium
- 618-3_Shallow_Focused: Total Uranium Isotopes
- 618-9_Shallow_Focused: Mercury, Aldrin, Aroclor-1016, Aroclor-1221, Aroclor-1232, Aroclor-1242, Aroclor-1248, Aroclor-1254, Aroclor-1260, Aroclors HI
- 628-4_Shallow: Aroclor-1248, Aroclors HI
- UPR-300-17_Shallow : Aroclor-1248, Aroclors HI, Nickel
- UPR-300-46_Shallow : Aroclor-1248, Aroclors HI

These chemicals represent a potential risk to ecological receptors within these areas.

Comparison of EPCs for seeps along the 300 Area riparian area to TRVs resulted in HQs of less than 0.01 for all non-radionuclides except for aluminum (Tables 8). For aluminum the dose from ingestion of prey and soil is not significant in terrestrial environments with soil pH greater than 5.5 as the aluminum is bound and unavailable for biological uptake (OSWER Directive 9285.7-60). Hence drinking water ingestion represents the primary contribution to the total dose and for all wildlife evaluated and yielded a maximum HQ less than 0.02 (Table 8) under the worst-case scenario, even for the more susceptible bats. Thus, potential adverse effects to wildlife due to exposure through drinking water ingestion was not significant. These results indicate that no further evaluation of non-radionuclides in drinking water is warranted. The same conclusion is reached even when considering the drinking water ingestion in combination with total ingestion from terrestrial pathways.

Comparison of maximum detected concentrations of radionuclides in seeps along the 300 Area riparian area to TRVs resulted in HQs of less than 0.01 except for cesium-137, uranium (radionuclide), uranium-233/234, and uranium-238 (Tables 9). With the maximum (worst case) dietary SOF from any waste site within the 300 Area being 0.04 (316-2_Shallow_2as shown n Table 3), there is no additional risk for wildlife exposure to radionuclides from drinking seeps at the 300 Area. Similar to the non-radionuclides assessment, the same conclusion is reached even when considering the drinking water ingestion in combination with total ingestion from terrestrial pathways.

6.1 Supporting Information

The backup information supporting these calculations is provided in the following tables:

- Table 1. Waste Sites and Decision Units for the 300 Area OUs
- Table 2. Summary of Decision Unit Soil Reaches
- Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)
- Table 4. Comparison of 300 Area OUs Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)
- Table 5. Summary of 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs and Background for Surface Soils (0 to 15 feet)
- Table 6. Ecological PRG Comparisons for 300 Area OUs Waste Site Decision Units
- Table 7. Summary of 300 Area OUs Waste Sites Ecological Evaluation Based on PRGs for Surface Soils (0 to 15 feet)

- Table 8. Wildlife Exposure to Non-radionuclide Chemicals through Drinking from Seeps in the 300 Area Riparian Area
- Table 9 Wildlife Exposure to Radionuclides through Drinking from Seeps in the 300 Area Riparian Area

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Table 1. Waste Sites and Decision Units for the 300 Area OUs

Waste Site	Decision Unit	Operable Unit	Reasonable Anticipated Future Land Use	Reclassification Status	RCBRA?
300-FF-1					
300 ASH PITS	Shallow	300-FF-1	Industrial	Closed Out	Yes
300-275	Shallow_1	300-FF-1	Industrial	Interim Closed Out	No
	Shallow_2				
300-44	Overburden_Focused	300-FF-1	Industrial	Closed Out	No
	Shallow_Focused				
300-49	Overburden	300-FF-1	Industrial	Closed Out	Yes
	Shallow				
300-50	Overburden	300-FF-1	Industrial	Closed Out	Yes
	Shallow				
316-1	Overburden	300-FF-1	Industrial	Closed Out	Yes
	Shallow_1				
	Shallow_3				
	Shallow_4				
316-2	Shallow_1	300-FF-1	Industrial	Closed Out	Yes
	Shallow_2				
	Shallow_3				
316-5	Shallow_1	300-FF-1	Industrial	Closed Out	Yes
	Shallow_2				
	Shallow_Focused				
618-12	Shallow	300-FF-1	Industrial	Closed Out	Yes
618-4	Deep	300-FF-1	Industrial	Closed Out	Yes
	Deep_Focused				
	Overburden_2				
	Overburden_3				
	Overburden_4				
	Shallow				
628-4	Overburden	300-FF-1	Industrial	Closed Out	Yes
	Shallow				
300 RFBP	See 316-1	300-FF-1	Industrial	Closed Out	No
300-262	See 316-1	300-FF-1	Industrial	Closed Out	No
UPR-300-15	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-19	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-20	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-21	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-22	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-23	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-24	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-25	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-26	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-27	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-28	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-29	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-30	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-32	See 316-1	300-FF-1	Industrial	Closed Out	No
UPR-300-33	See 316-1	300-FF-1	Industrial	Closed Out	No
UPR-300-34	See 316-1	300-FF-1	Industrial	Closed Out	No

Table 1. Waste Sites and Decision Units for the 300 Area OUs

Waste Site	Decision Unit	Operable Unit	Reasonable Anticipated Future Land Use	Reclassification Status	RCBRA?
UPR-300-35	See 316-1	300-FF-1	Industrial	Closed Out	No
UPR-300-36	See 316-1	300-FF-1	Industrial	Closed Out	No
UPR-300-37	See 316-1	300-FF-1	Industrial	Closed Out	No
UPR-300-47	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-8	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-9	See 316-5	300-FF-1	Industrial	Closed Out	No
UPR-300-FF-1	See 316-1	300-FF-1	Industrial	Closed Out	No
		300-FF-2			
300 VTS	Shallow	300-FF-2	Unrestricted	Interim Closed Out	Yes
300-10	Shallow_Focused	300-FF-2	Industrial	Closed Out	Yes
300-109	Shallow_Focused	300-FF-2	Industrial	Interim Closed Out	No
	Staging Pile Area_Focused				
300-110	See 618-1	300-FF-2	Industrial	Interim Closed Out	No
300-18	Shallow	300-FF-2	Industrial	Interim Closed Out	Yes
300-223	Shallow_Focused	300-FF-2	Industrial	Closed Out	No
300-23	Overburden_Focused	300-FF-2	Industrial	Closed Out	No
	Shallow_Focused				
300-259	Shallow	300-FF-2	Industrial	Interim Closed Out	No
300-260	Shallow_Focused	300-FF-2	Industrial	No Action	No
300-272	Overburden_Focused	300-FF-2	Industrial	Closed Out	No
	Shallow_Focused				
300-33, 300-41, 300-256	Shallow	300-FF-2	Industrial	Interim Closed Out	No
	Shallow_Focused				
300-37	Shallow_Focused	300-FF-2	Industrial	Closed Out	No
300-45	Shallow_Focused	300-FF-2	Industrial	Closed Out	Yes
300-8	Shallow	300-FF-2	Industrial	Interim Closed Out	Yes
303-M SA	See 618-1	300-FF-2	Industrial	Interim Closed Out	No
303-M UOF	See 618-1	300-FF-2	Industrial	Interim Closed Out	No
331 LSLDF	Shallow_Focused	300-FF-2	Industrial	No Action	No
333 ESHWSA	See 618-1	300-FF-2	Industrial	Interim Closed Out	No
600-243	Shallow	300-FF-2	Industrial	Interim Closed Out	No
600-259	Overburden	300-FF-2	Unrestricted	Interim Closed Out	Yes
	Shallow				
	Shallow_Focused				
600-47	Shallow	300-FF-2	Unrestricted	Interim Closed Out	Yes
618-1	Deep	300-FF-2	Industrial	Interim Closed Out	No
	Deep_Focused				
	Shallow				
	Shallow_Focused				
618-13	Shallow	300-FF-2	Unrestricted	Interim closed Out	No
	Shallow_Focused				
618-2	Deep	300-FF-2	Industrial	Interim Closed out	No
	Deep_Focused				
	Overburden				
	Shallow				
	Staging Pile				

Table 1. Waste Sites and Decision Units for the 300 Area OUs

Waste Site	Decision Unit	Operable Unit	Reasonable Anticipated Future Land Use	Reclassification Status	RCBRA?
618-3	Shallow	300-FF-2	Industrial	Interim Closed Out	No
	Shallow_Focused				
618-5	Deep	300-FF-2	Industrial	Interim Closed Out	Yes
	Deep_Focused				
	Overburden				
	Shallow				
	Staging Pile_4				
	Staging Pile_5				
618-7	Shallow_1	300-FF-2	Unrestricted	Interim Closed Out	No
	Shallow_2				
	Shallow_3				
	Shallow_4				
	Shallow_Focused				
618-8	Shallow	300-FF-2	Industrial	Interim Closed Out	No
618-9	Shallow_Focused	300-FF-2	Industrial	Closed Out	No
UPR-300-17	Shallow	300-FF-2	Industrial	Interim Closed Out	No
UPR-300-46	Shallow	300-FF-2	Industrial	Interim Closed Out	No
600-290:1	See 618-13	300-FF-2	Unrestricted--see 618-3	Interim Closed Out	No

Table 2. Summary of Decision Unit Soil Reaches

Decision Unit Name	Depth	Sampling Design Description
Shallow	0 to 4.6 m (15 ft) bgs	Samples collected using a statistical sampling design
Deep	Greater than 4.6 m (15 ft) bgs	
Overburden	Not applicable	
Shallow_Focused	0 to 4.6 m (15 ft) bgs	Samples collected using a focused sampling design
Deep_Focused	Greater than 4.6 m (15 ft) bgs	
Staging pile area_Footprint	Not applicable	
Overburden_Focused	Not applicable	

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300 ASH PITS_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	5.20E+01	4.00E+04	1.30E-03	3.25E+02	1.60E-01
300 ASH PITS_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	6.08E+03	1.00E+04	6.08E-01	1.90E+05	3.20E-02
300 ASH PITS_Shallow	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	9.60E+01	1.00E+05	9.60E-04	4.54E+04	2.11E-03
300 ASH PITS_Shallow	non-Rad	Butylbenzylphthalate	85-68-7	ug/kg	76	No Value	--	No Value	--
300 ASH PITS_Shallow	Rad	RADs SOF	--	pCi/g	--	--	5.38E-05	--	1.69E-04
300 ASH PITS_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	3.88E-02	2.74E+04	1.42E-06	4.36E+03	8.89E-06
300 ASH PITS_Shallow	Rad	Uranium-238	U-238	pCi/g	8.23E-01	1.57E+04	5.24E-05	5.15E+03	1.60E-04
300 ASH PITS_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.45E+03	5.00E+03	4.90E-01	7.86E+05	3.12E-03
300 VTS_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	2.90E-02	2.21E+03	1.31E-05	9.24E+02	3.14E-05
300-10_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	13500	1.00E+04	**1.35E+00**	1.90E+05	7.11E-02
300-10_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	2.00E+02	1.00E+05	2.00E-03	4.54E+04	4.41E-03
300-10_Shallow_Focused	non-Rad	Butylbenzylphthalate	85-68-7	ug/kg	230	No Value	--	No Value	--
300-10_Shallow_Focused	Rad	Cesium-137	10045-97-3	pCi/g	1.55E-01	2.21E+03	7.01E-05	9.24E+02	1.68E-04
300-10_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	1.59E-04	--	4.43E-04
300-10_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	4.06E-02	2.74E+04	1.48E-06	4.36E+03	9.31E-06
300-10_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	1.37E+00	1.57E+04	8.73E-05	5.15E+03	2.66E-04
300-10_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	4.08E+03	5.00E+03	8.16E-01	7.86E+05	5.19E-03
300-109_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	1.22E+02	4.00E+04	3.05E-03	1.47E+03	8.30E-02
300-109_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3.97E+01	4.00E+04	9.93E-04	1.47E+03	2.70E-02
300-109_Shallow_Focused	non-Rad	Aroclors HI	--	ug/kg	--	--	4.04E-03	--	1.10E-01
300-109_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	2.42E+03	1.00E+04	2.42E-01	1.90E+05	1.27E-02
300-109_Shallow_Focused	non-Rad	Barium	7440-39-3	ug/kg	6.33E+04	3.30E+05	1.92E-01	1.32E+06	4.80E-02
300-109_Shallow_Focused	non-Rad	Benzo(a)pyrene	50-32-8	ug/kg	1.24E+00	1.80E+04	6.89E-05	7.64E+04	1.62E-05
300-109_Shallow_Focused	non-Rad	Benzo(b)fluoranthene	205-99-2	ug/kg	2.30E+00	1.80E+04	1.28E-04	3.92E+04	5.87E-05
300-109_Shallow_Focused	non-Rad	Beryllium	7440-41-7	ug/kg	1.80E+02	1.00E+04	1.80E-02	1.39E+04	1.29E-02
300-109_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	632	5.00E+02	**1.26E+00**	1.33E+05	4.75E-03
300-109_Shallow_Focused	non-Rad	Cadmium	7440-43-9	ug/kg	5.90E+01	4.00E+03	1.48E-02	1.63E+03	3.62E-02
300-109_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	6950	4.00E+02	**1.74E+01**	3.82E+04	1.82E-01
300-109_Shallow_Focused	non-Rad	Chrysene	218-01-9	ug/kg	1.77E+00	1.80E+04	9.83E-05	4.45E+04	3.98E-05
300-109_Shallow_Focused	non-Rad	Cobalt	7440-48-4	ug/kg	6.42E+03	1.30E+04	4.94E-01	1.11E+05	5.78E-02
300-109_Shallow_Focused	non-Rad	Copper	7440-50-8	ug/kg	1.08E+04	5.00E+04	2.16E-01	1.07E+05	1.01E-01
300-109_Shallow_Focused	non-Rad	Indeno(1,2,3-cd)pyrene	193-39-5	ug/kg	1.40E+01	1.80E+04	7.78E-04	3.57E+04	3.92E-04
300-109_Shallow_Focused	non-Rad	Lead	7439-92-1	ug/kg	2.89E+03	5.00E+04	5.78E-02	3.56E+04	8.12E-02
300-109_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	278000	2.20E+05	**1.26E+00**	5.80E+06	4.79E-02
300-109_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	2.20E+01	1.00E+02	2.20E-01	1.87E+03	1.18E-02
300-109_Shallow_Focused	non-Rad	Molybdenum	7439-98-7	ug/kg	3.41E+02	2.00E+03	1.71E-01	1.40E+04	2.44E-02
300-109_Shallow_Focused	non-Rad	Nickel	7440-02-0	ug/kg	8.49E+03	3.00E+04	2.83E-01	3.26E+04	2.60E-01
300-109_Shallow_Focused	non-Rad	Pyrene	129-00-0	ug/kg	1.56E+00	1.80E+04	8.67E-05	6.00E+05	2.60E-06
300-109_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	1.15E-04	--	4.88E-04
300-109_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	1.40E+00	5.16E+04	2.71E-05	6.37E+03	2.20E-04
300-109_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	1.38E+00	1.57E+04	8.79E-05	5.15E+03	2.68E-04
300-109_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	47600	2.00E+03	**2.38E+01**	3.11E+04	**1.53E+00**
300-109_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	3.47E+04	5.00E+04	6.94E-01	6.78E+04	5.12E-01
300-109_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	4.11E+03	5.00E+03	8.22E-01	7.86E+05	5.23E-03
300-109_Staging Pile Area_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3.68E+01	4.00E+04	9.20E-04	1.47E+03	2.50E-02
300-109_Staging Pile Area_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	1.94E+01	4.00E+04	4.85E-04	1.47E+03	1.32E-02
300-109_Staging Pile Area_Focused	non-Rad	Aroclors HI	--	ug/kg	--	--	1.41E-03	--	3.82E-02
300-109_Staging Pile Area_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	2.58E+03	1.00E+04	2.58E-01	1.90E+05	1.36E-02

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-109_Staging Pile Area_Focused	non-Rad	Barium	7440-39-3	ug/kg	7.27E+04	3.30E+05	2.20E-01	1.32E+06	5.51E-02
300-109_Staging Pile Area_Focused	non-Rad	Benzo(a)anthracene	56-55-3	ug/kg	2.08E+00	1.80E+04	1.16E-04	6.40E+04	3.25E-05
300-109_Staging Pile Area_Focused	non-Rad	Benzo(a)pyrene	50-32-8	ug/kg	3.30E+00	1.80E+04	1.83E-04	7.64E+04	4.32E-05
300-109_Staging Pile Area_Focused	non-Rad	Benzo(b)fluoranthene	205-99-2	ug/kg	1.31E+00	1.80E+04	7.28E-05	3.92E+04	3.34E-05
300-109_Staging Pile Area_Focused	non-Rad	Beryllium	7440-41-7	ug/kg	2.03E+02	1.00E+04	2.03E-02	1.39E+04	1.46E-02
300-109_Staging Pile Area_Focused	non-Rad	Boron	7440-42-8	ug/kg	1060	5.00E+02	**2.12E+00**	1.33E+05	7.97E-03
300-109_Staging Pile Area_Focused	non-Rad	Cadmium	7440-43-9	ug/kg	6.60E+01	4.00E+03	1.65E-02	1.63E+03	4.05E-02
300-109_Staging Pile Area_Focused	non-Rad	Chromium	7440-47-3	ug/kg	8170	4.00E+02	**2.04E+01**	3.82E+04	2.14E-01
300-109_Staging Pile Area_Focused	non-Rad	Cobalt	7440-48-4	ug/kg	5.95E+03	1.30E+04	4.58E-01	1.11E+05	5.36E-02
300-109_Staging Pile Area_Focused	non-Rad	Copper	7440-50-8	ug/kg	1.16E+04	5.00E+04	2.32E-01	1.07E+05	1.08E-01
300-109_Staging Pile Area_Focused	non-Rad	Fluoranthene	206-44-0	ug/kg	5.14E+00	1.80E+04	2.86E-04	8.39E+05	6.13E-06
300-109_Staging Pile Area_Focused	non-Rad	Indeno(1,2,3-cd)pyrene	193-39-5	ug/kg	2.92E+01	1.80E+04	1.62E-03	3.57E+04	8.18E-04
300-109_Staging Pile Area_Focused	non-Rad	Lead	7439-92-1	ug/kg	5.03E+03	5.00E+04	1.01E-01	3.56E+04	1.41E-01
300-109_Staging Pile Area_Focused	non-Rad	Manganese	7439-96-5	ug/kg	286000	2.20E+05	**1.30E+00**	5.80E+06	4.93E-02
300-109_Staging Pile Area_Focused	non-Rad	Molybdenum	7439-98-7	ug/kg	4.08E+02	2.00E+03	2.04E-01	1.40E+04	2.91E-02
300-109_Staging Pile Area_Focused	non-Rad	Nickel	7440-02-0	ug/kg	8.57E+03	3.00E+04	2.86E-01	3.26E+04	2.63E-01
300-109_Staging Pile Area_Focused	non-Rad	Pyrene	129-00-0	ug/kg	6.96E+00	1.80E+04	3.87E-04	6.00E+05	1.16E-05
300-109_Staging Pile Area_Focused	Rad	RADs SOF	--	pCi/g	--	--	1.96E-04	--	8.48E-04
300-109_Staging Pile Area_Focused	non-Rad	Tin	7440-31-5	ug/kg	1.45E+03	5.00E+04	2.90E-02	2.04E+05	7.11E-03
300-109_Staging Pile Area_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	2.54E+00	5.16E+04	4.92E-05	6.37E+03	3.99E-04
300-109_Staging Pile Area_Focused	Rad	Uranium-238	U-238	pCi/g	2.31E+00	1.57E+04	1.47E-04	5.15E+03	4.49E-04
300-109_Staging Pile Area_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	45100	2.00E+03	**2.26E+01**	3.11E+04	**1.45E+00**
300-109_Staging Pile Area_Focused	non-Rad	Zinc	7440-66-6	ug/kg	4.88E+04	5.00E+04	9.76E-01	6.78E+04	7.20E-01
300-109_Staging Pile Area_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	6877	5.00E+03	**1.38E+00**	7.86E+05	8.75E-03
300-18_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	2.20E+03	1.00E+04	2.20E-01	1.90E+05	1.16E-02
300-18_Shallow	non-Rad	Barium	7440-39-3	ug/kg	6.34E+04	3.30E+05	1.92E-01	1.32E+06	4.80E-02
300-18_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	6.50E+02	1.00E+04	6.50E-02	1.39E+04	4.68E-02
300-18_Shallow	non-Rad	Cadmium	7440-43-9	ug/kg	4.00E+01	4.00E+03	1.00E-02	1.63E+03	2.45E-02
300-18_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	6900	4.00E+02	**1.73E+01**	3.82E+04	1.81E-01
300-18_Shallow	non-Rad	Lead	7439-92-1	ug/kg	3.60E+03	5.00E+04	7.20E-02	3.56E+04	1.01E-01
300-18_Shallow	Rad	RADs SOF	--	pCi/g	--	--	3.88E-05	--	1.82E-04
300-18_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	6.49E-01	5.16E+04	1.26E-05	6.37E+03	1.02E-04
300-18_Shallow	Rad	Uranium-238	U-238	pCi/g	4.11E-01	1.57E+04	2.62E-05	5.15E+03	7.98E-05
300-18_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.14E+03	5.00E+03	2.27E-01	7.86E+05	1.45E-03
300-223_Shallow_Focused	non-Rad	Total petroleum hydrocarbons - diesel range	TPHDIESEL	ug/kg	1.20E+05	2.00E+05	6.00E-01	3.56E+08	3.37E-04
300-223_Shallow_Focused	non-Rad	Total petroleum hydrocarbons - motor oil (high boiling)	TPH/OILH	ug/kg	230000	No Value	--	No Value	--
300-23_Shallow_Focused	non-Rad	Total petroleum hydrocarbons - motor oil (high boiling)	TPH/OILH	ug/kg	52000	No Value	--	No Value	--
300-259_Shallow	non-Rad	Antimony	7440-36-0	ug/kg	3.22E+02	5.00E+03	6.45E-02	5.98E+03	5.39E-02
300-259_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	2.10E+03	1.00E+04	2.10E-01	1.90E+05	1.10E-02
300-259_Shallow	non-Rad	Barium	7440-39-3	ug/kg	7.52E+04	3.30E+05	2.28E-01	1.32E+06	5.70E-02
300-259_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	2.26E+02	1.00E+04	2.26E-02	1.39E+04	1.62E-02
300-259_Shallow	non-Rad	Boron	7440-42-8	ug/kg	1302.923	5.00E+02	**2.61E+00**	1.33E+05	9.80E-03
300-259_Shallow	non-Rad	Cadmium	7440-43-9	ug/kg	2.52E+02	4.00E+03	6.29E-02	1.63E+03	1.54E-01
300-259_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	7901.1621	4.00E+02	**1.98E+01**	3.82E+04	2.07E-01
300-259_Shallow	non-Rad	Cobalt	7440-48-4	ug/kg	5.83E+03	1.30E+04	4.49E-01	1.11E+05	5.25E-02
300-259_Shallow	non-Rad	Copper	7440-50-8	ug/kg	1.07E+04	5.00E+04	2.14E-01	1.07E+05	9.99E-02
300-259_Shallow	non-Rad	Lead	7439-92-1	ug/kg	4.62E+03	5.00E+04	9.25E-02	3.56E+04	1.30E-01
300-259_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	318873.58	2.20E+05	**1.45E+00**	5.80E+06	5.50E-02
300-259_Shallow	non-Rad	Mercury	7439-97-6	ug/kg	1.00E+01	1.00E+02	1.00E-01	1.87E+03	5.35E-03
300-259_Shallow	non-Rad	Molybdenum	7439-98-7	ug/kg	3.03E+02	2.00E+03	1.51E-01	1.40E+04	2.16E-02
300-259_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	8.75E+03	3.00E+04	2.92E-01	3.26E+04	2.68E-01

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-259_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.17E-04	--	5.12E-04
300-259_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.59E+00	5.16E+04	3.09E-05	6.37E+03	2.50E-04
300-259_Shallow	Rad	Uranium-238	U-238	pCi/g	1.35E+00	1.57E+04	8.58E-05	5.15E+03	2.62E-04
300-259_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	42625.614	2.00E+03	**2.13E+01**	3.11E+04	**1.37E+00**
300-259_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	479584.29	5.00E+04	**9.59E+00**	6.78E+04	**7.07E+00**
300-259_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	3.88E+03	5.00E+03	7.75E-01	7.86E+05	4.93E-03
300-260_Shallow_Focused	non-Rad	Antimony	7440-36-0	ug/kg	9.22E+02	5.00E+03	1.84E-01	5.98E+03	1.54E-01
300-260_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	3.16E+03	1.00E+04	3.16E-01	1.90E+05	1.66E-02
300-260_Shallow_Focused	non-Rad	Barium	7440-39-3	ug/kg	1.22E+05	3.30E+05	3.70E-01	1.32E+06	9.24E-02
300-260_Shallow_Focused	non-Rad	Beryllium	7440-41-7	ug/kg	2.39E+02	1.00E+04	2.39E-02	1.39E+04	1.72E-02
300-260_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	8360	5.00E+02	**1.67E+01**	1.33E+05	6.29E-02
300-260_Shallow_Focused	non-Rad	Cadmium	7440-43-9	ug/kg	1.10E+02	4.00E+03	2.75E-02	1.63E+03	6.75E-02
300-260_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	9890	4.00E+02	**2.47E+01**	3.82E+04	2.59E-01
300-260_Shallow_Focused	non-Rad	Cobalt	7440-48-4	ug/kg	7.43E+03	1.30E+04	5.72E-01	1.11E+05	6.69E-02
300-260_Shallow_Focused	non-Rad	Copper	7440-50-8	ug/kg	73300	5.00E+04	**1.47E+00**	1.07E+05	6.85E-01
300-260_Shallow_Focused	non-Rad	Lead	7439-92-1	ug/kg	1.83E+04	5.00E+04	3.66E-01	3.56E+04	5.14E-01
300-260_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	328000	2.20E+05	**1.49E+00**	5.80E+06	5.66E-02
300-260_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	1.20E+01	1.00E+02	1.20E-01	1.87E+03	6.42E-03
300-260_Shallow_Focused	non-Rad	Molybdenum	7439-98-7	ug/kg	5.37E+02	2.00E+03	2.69E-01	1.40E+04	3.84E-02
300-260_Shallow_Focused	non-Rad	Nickel	7440-02-0	ug/kg	1.02E+04	3.00E+04	3.40E-01	3.26E+04	3.13E-01
300-260_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	2.83E-04	--	8.93E-04
300-260_Shallow_Focused	non-Rad	Silver	7440-22-4	ug/kg	2.06E+02	2.00E+03	1.03E-01	4.96E+04	4.15E-03
300-260_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	2.51E-01	2.74E+04	9.16E-06	4.36E+03	5.76E-05
300-260_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	4.30E+00	1.57E+04	2.74E-04	5.15E+03	8.35E-04
300-260_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	59000	2.00E+03	**2.95E+01**	3.11E+04	**1.90E+00**
300-260_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	77400	5.00E+04	**1.55E+00**	6.78E+04	**1.14E+00**
300-260_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	12800	5.00E+03	**2.56E+00**	7.86E+05	1.63E-02
300-272_Overburden_Focused	non-Rad	Total petroleum hydrocarbons - diesel range	TPHDIESEL	ug/kg	1.31E+04	2.00E+05	6.55E-02	3.56E+08	3.68E-05
300-272_Shallow_Focused	non-Rad	Total petroleum hydrocarbons - diesel range	TPHDIESEL	ug/kg	4.31E+04	2.00E+05	2.16E-01	3.56E+08	1.21E-04
300-275_Shallow_1	non-Rad	Acenaphthene	83-32-9	ug/kg	9.60E+02	2.00E+04	4.80E-02	1.10E+06	8.73E-04
300-275_Shallow_1	non-Rad	Antimony	7440-36-0	ug/kg	2.60E+02	5.00E+03	5.20E-02	5.98E+03	4.35E-02
300-275_Shallow_1	non-Rad	Arsenic	7440-38-2	ug/kg	2.21E+03	1.00E+04	2.21E-01	1.90E+05	1.16E-02
300-275_Shallow_1	non-Rad	Barium	7440-39-3	ug/kg	7.53E+04	3.30E+05	2.28E-01	1.32E+06	5.70E-02
300-275_Shallow_1	non-Rad	Benzo(a)pyrene	50-32-8	ug/kg	1.30E+00	1.80E+04	7.22E-05	7.64E+04	1.70E-05
300-275_Shallow_1	non-Rad	Benzo(b)fluoranthene	205-99-2	ug/kg	1.86E+00	1.80E+04	1.03E-04	3.92E+04	4.73E-05
300-275_Shallow_1	non-Rad	Beryllium	7440-41-7	ug/kg	4.52E+02	1.00E+04	4.52E-02	1.39E+04	3.25E-02
300-275_Shallow_1	non-Rad	Boron	7440-42-8	ug/kg	1466.2284	5.00E+02	**2.93E+00**	1.33E+05	1.10E-02
300-275_Shallow_1	non-Rad	Cadmium	7440-43-9	ug/kg	8.33E+01	4.00E+03	2.08E-02	1.63E+03	5.11E-02
300-275_Shallow_1	Rad	Cesium-137	10045-97-3	pCi/g	8.20E-02	2.21E+03	3.71E-05	9.24E+02	8.87E-05
300-275_Shallow_1	non-Rad	Chromium	7440-47-3	ug/kg	8021.7632	4.00E+02	**2.01E+01**	3.82E+04	2.10E-01
300-275_Shallow_1	non-Rad	Chrysene	218-01-9	ug/kg	2.20E+00	1.80E+04	1.22E-04	4.45E+04	4.94E-05
300-275_Shallow_1	non-Rad	Cobalt	7440-48-4	ug/kg	5.85E+03	1.30E+04	4.50E-01	1.11E+05	5.27E-02
300-275_Shallow_1	non-Rad	Copper	7440-50-8	ug/kg	4.29E+04	5.00E+04	8.58E-01	1.07E+05	4.01E-01
300-275_Shallow_1	non-Rad	Fluoranthene	206-44-0	ug/kg	2.30E+03	1.80E+04	1.28E-01	8.39E+05	2.74E-03
300-275_Shallow_1	non-Rad	Fluorene	86-73-7	ug/kg	8.11E+01	2.90E+04	2.80E-03	1.75E+05	4.64E-04
300-275_Shallow_1	non-Rad	Lead	7439-92-1	ug/kg	7.19E+03	5.00E+04	1.44E-01	3.56E+04	2.02E-01
300-275_Shallow_1	non-Rad	Lithium	7439-93-2	ug/kg	6686.355	2.00E+03	**3.34E+00**	5.15E+05	1.30E-02
300-275_Shallow_1	non-Rad	Manganese	7439-96-5	ug/kg	276815.49	2.20E+05	**1.26E+00**	5.80E+06	4.77E-02
300-275_Shallow_1	non-Rad	Mercury	7439-97-6	ug/kg	1.67E+01	1.00E+02	1.67E-01	1.87E+03	8.91E-03
300-275_Shallow_1	non-Rad	Molybdenum	7439-98-7	ug/kg	3.78E+02	2.00E+03	1.89E-01	1.40E+04	2.70E-02
300-275_Shallow_1	non-Rad	Nickel	7440-02-0	ug/kg	9.46E+03	3.00E+04	3.15E-01	3.26E+04	2.90E-01

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-275_Shallow_1	Rad	RADs SOF	--	pCi/g	--	--	6.96E-04	--	2.97E-03
300-275_Shallow_1	non-Rad	Silver	7440-22-4	ug/kg	1.21E+02	2.00E+03	6.04E-02	4.96E+04	2.44E-03
300-275_Shallow_1	non-Rad	Strontium	7440-24-6	ug/kg	20195.541	No Value	--	4.23E+06	4.77E-03
300-275_Shallow_1	non-Rad	Tin	7440-31-5	ug/kg	1.47E+03	5.00E+04	2.93E-02	2.04E+05	7.18E-03
300-275_Shallow_1	non-Rad	Uranium	7440-61-1	ug/kg	2.50E+03	5.00E+03	5.00E-01	7.86E+05	3.18E-03
300-275_Shallow_1	Rad	Uranium-233/234	U-233/234	pCi/g	7.72E+00	5.16E+04	1.50E-04	6.37E+03	1.21E-03
300-275_Shallow_1	Rad	Uranium-235	15117-96-1	pCi/g	1.00E+00	2.74E+04	3.65E-05	4.36E+03	2.29E-04
300-275_Shallow_1	Rad	Uranium-238	U-238	pCi/g	7.41E+00	1.57E+04	4.72E-04	5.15E+03	1.44E-03
300-275_Shallow_1	non-Rad	Vanadium	7440-62-2	ug/kg	45127.74	2.00E+03	**2.26E+01**	3.11E+04	**1.45E+00**
300-275_Shallow_1	non-Rad	Zinc	7440-66-6	ug/kg	4.10E+04	5.00E+04	8.20E-01	6.78E+04	6.05E-01
300-275_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	22251	5.00E+03	**4.45E+00**	7.86E+05	2.83E-02
300-275_Shallow_2	non-Rad	Acenaphthene	83-32-9	ug/kg	3.60E+00	2.00E+04	1.80E-04	1.10E+06	3.27E-06
300-275_Shallow_2	non-Rad	Arsenic	7440-38-2	ug/kg	2.76E+03	1.00E+04	2.76E-01	1.90E+05	1.45E-02
300-275_Shallow_2	non-Rad	Barium	7440-39-3	ug/kg	6.86E+04	3.30E+05	2.08E-01	1.32E+06	5.20E-02
300-275_Shallow_2	non-Rad	Beryllium	7440-41-7	ug/kg	2.54E+02	1.00E+04	2.54E-02	1.39E+04	1.83E-02
300-275_Shallow_2	non-Rad	Boron	7440-42-8	ug/kg	1146.5781	5.00E+02	**2.29E+00**	1.33E+05	8.62E-03
300-275_Shallow_2	non-Rad	Cadmium	7440-43-9	ug/kg	1.44E+02	4.00E+03	3.60E-02	1.63E+03	8.83E-02
300-275_Shallow_2	non-Rad	Chromium	7440-47-3	ug/kg	8993.6377	4.00E+02	**2.25E+01**	3.82E+04	2.35E-01
300-275_Shallow_2	non-Rad	Cobalt	7440-48-4	ug/kg	5.98E+03	1.30E+04	4.60E-01	1.11E+05	5.38E-02
300-275_Shallow_2	non-Rad	Copper	7440-50-8	ug/kg	1.16E+04	5.00E+04	2.32E-01	1.07E+05	1.08E-01
300-275_Shallow_2	non-Rad	Fluoranthene	206-44-0	ug/kg	5.60E+01	1.80E+04	3.11E-03	8.39E+05	6.67E-05
300-275_Shallow_2	non-Rad	Fluorene	86-73-7	ug/kg	2.60E+00	2.90E+04	8.97E-05	1.75E+05	1.49E-05
300-275_Shallow_2	non-Rad	Lead	7439-92-1	ug/kg	4.10E+03	5.00E+04	8.20E-02	3.56E+04	1.15E-01
300-275_Shallow_2	non-Rad	Lithium	7439-93-2	ug/kg	7066.6688	2.00E+03	**3.53E+00**	5.15E+05	1.37E-02
300-275_Shallow_2	non-Rad	Manganese	7439-96-5	ug/kg	292731.34	2.20E+05	**1.33E+00**	5.80E+06	5.05E-02
300-275_Shallow_2	non-Rad	Mercury	7439-97-6	ug/kg	2.73E+01	1.00E+02	2.73E-01	1.87E+03	1.46E-02
300-275_Shallow_2	non-Rad	Molybdenum	7439-98-7	ug/kg	4.04E+02	2.00E+03	2.02E-01	1.40E+04	2.88E-02
300-275_Shallow_2	non-Rad	Nickel	7440-02-0	ug/kg	9.59E+03	3.00E+04	3.20E-01	3.26E+04	2.94E-01
300-275_Shallow_2	Rad	RADs SOF	--	pCi/g	--	--	1.13E-04	--	5.01E-04
300-275_Shallow_2	non-Rad	Strontium	7440-24-6	ug/kg	27080.652	No Value	--	4.23E+06	6.40E-03
300-275_Shallow_2	non-Rad	Tin	7440-31-5	ug/kg	1.15E+03	5.00E+04	2.30E-02	2.04E+05	5.63E-03
300-275_Shallow_2	Rad	Uranium-233/234	U-233/234	pCi/g	1.31E+00	5.16E+04	2.53E-05	6.37E+03	2.05E-04
300-275_Shallow_2	Rad	Uranium-235	15117-96-1	pCi/g	2.37E-01	2.74E+04	8.65E-06	4.36E+03	5.44E-05
300-275_Shallow_2	Rad	Uranium-238	U-238	pCi/g	1.24E+00	1.57E+04	7.93E-05	5.15E+03	2.42E-04
300-275_Shallow_2	non-Rad	Vanadium	7440-62-2	ug/kg	51631.53	2.00E+03	**2.58E+01**	3.11E+04	**1.66E+00**
300-275_Shallow_2	non-Rad	Zinc	7440-66-6	ug/kg	4.12E+04	5.00E+04	8.25E-01	6.78E+04	6.08E-01
300-275_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	3.73E+03	5.00E+03	7.45E-01	7.86E+05	4.74E-03
300-33, 300-41, 300-256_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5349	5.00E+03	**1.07E+00**	7.86E+05	6.81E-03
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclor-1016	12674-11-2	ug/kg	1.03E+01	4.00E+04	2.58E-04	1.82E+03	5.66E-03
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclor-1242	53469-21-9	ug/kg	1.64E+01	4.00E+04	4.10E-04	1.49E+03	1.10E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1.90E+02	4.00E+04	4.75E-03	3.25E+02	5.85E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	8.49E+01	4.00E+04	2.12E-03	1.47E+03	5.78E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	1.75E+01	4.00E+04	4.36E-04	1.47E+03	1.19E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Aroclors HI	--	ug/kg	--	--	7.97E-03	--	6.71E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	2.64E+03	1.00E+04	2.64E-01	1.90E+05	1.39E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Barium	7440-39-3	ug/kg	7.24E+04	3.30E+05	2.19E-01	1.32E+06	5.49E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	2.56E+02	1.00E+04	2.56E-02	1.39E+04	1.84E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Boron	7440-42-8	ug/kg	1483.9168	5.00E+02	**2.97E+00**	1.33E+05	1.12E-02

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-33, 300-41, 300-256_Shallow	non-Rad	Butylbenzylphthalate	85-68-7	ug/kg	228	No Value	--	No Value	--
300-33, 300-41, 300-256_Shallow	non-Rad	Cadmium	7440-43-9	ug/kg	9.37E+01	4.00E+03	2.34E-02	1.63E+03	5.75E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	8781.1801	4.00E+02	**2.20E+01**	3.82E+04	2.30E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Cobalt	7440-48-4	ug/kg	6.27E+03	1.30E+04	4.83E-01	1.11E+05	5.65E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Copper	7440-50-8	ug/kg	1.37E+04	5.00E+04	2.73E-01	1.07E+05	1.28E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Fluoride	16984-48-8	ug/kg	1651.3546	No Value	--	2.28E+06	7.24E-04
300-33, 300-41, 300-256_Shallow	non-Rad	Lead	7439-92-1	ug/kg	4.27E+03	5.00E+04	8.54E-02	3.56E+04	1.20E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Lithium	7439-93-2	ug/kg	5495.0169	2.00E+03	**2.75E+00**	5.15E+05	1.07E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	314762.37	2.20E+05	**1.43E+00**	5.80E+06	5.43E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Mercury	7439-97-6	ug/kg	1.60E+01	1.00E+02	1.60E-01	1.87E+03	8.56E-03
300-33, 300-41, 300-256_Shallow	non-Rad	Methylene chloride	75-09-2	ug/kg	2.913436	No Value	--	1.66E+05	1.76E-05
300-33, 300-41, 300-256_Shallow	non-Rad	Molybdenum	7439-98-7	ug/kg	4.86E+02	2.00E+03	2.43E-01	1.40E+04	3.47E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	8.88E+03	3.00E+04	2.96E-01	3.26E+04	2.72E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Nitrate	14797-55-8	ug/kg	8866.6667	No Value	--	3.40E+08	2.61E-05
300-33, 300-41, 300-256_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.85E-04	--	8.14E-04
300-33, 300-41, 300-256_Shallow	non-Rad	Silver	7440-22-4	ug/kg	7.82E+02	2.00E+03	3.91E-01	4.96E+04	1.58E-02
300-33, 300-41, 300-256_Shallow	non-Rad	Uranium	7440-61-1	ug/kg	7260	5.00E+03	**1.45E+00**	7.86E+05	9.24E-03
300-33, 300-41, 300-256_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	2.14E+00	5.16E+04	4.14E-05	6.37E+03	3.36E-04
300-33, 300-41, 300-256_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	3.38E-01	2.74E+04	1.23E-05	4.36E+03	7.75E-05
300-33, 300-41, 300-256_Shallow	Rad	Uranium-238	U-238	pCi/g	2.06E+00	1.57E+04	1.31E-04	5.15E+03	4.00E-04
300-33, 300-41, 300-256_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	52694.189	2.00E+03	**2.63E+01**	3.11E+04	**1.69E+00**
300-33, 300-41, 300-256_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	4.15E+04	5.00E+04	8.29E-01	6.78E+04	6.12E-01
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Aroclor-1248	12672-29-6	ug/kg	3.30E+02	4.00E+04	8.25E-03	3.25E+02	**1.02E+00**
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3.85E+02	4.00E+04	9.63E-03	1.47E+03	2.62E-01
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Aroclor-1260	11096-82-5	ug/kg	5.20E+01	4.00E+04	1.30E-03	1.47E+03	3.54E-02
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Aroclors HI	--	ug/kg	--	--	1.92E-02	--	**1.32E+00**
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Arsenic	7440-38-2	ug/kg	3.24E+03	1.00E+04	3.24E-01	1.90E+05	1.71E-02
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Barium	7440-39-3	ug/kg	6.46E+04	3.30E+05	1.96E-01	1.32E+06	4.89E-02
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Beryllium	7440-41-7	ug/kg	1.69E+02	1.00E+04	1.69E-02	1.39E+04	1.22E-02
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Boron	7440-42-8	ug/kg	1030	5.00E+02	**2.06E+00**	1.33E+05	7.74E-03
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Cadmium	7440-43-9	ug/kg	1.00E+02	4.00E+03	2.50E-02	1.63E+03	6.13E-02
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Chromium	7440-47-3	ug/kg	8080	4.00E+02	**2.02E+01**	3.82E+04	2.12E-01
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Cobalt	7440-48-4	ug/kg	5.64E+03	1.30E+04	4.34E-01	1.11E+05	5.08E-02
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Copper	7440-50-8	ug/kg	1.04E+04	5.00E+04	2.08E-01	1.07E+05	9.72E-02
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Fluoride	16984-48-8	ug/kg	1300	No Value	--	2.28E+06	5.70E-04
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Lead	7439-92-1	ug/kg	3.16E+03	5.00E+04	6.32E-02	3.56E+04	8.88E-02
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Lithium	7439-93-2	ug/kg	6580	2.00E+03	**3.29E+00**	5.15E+05	1.28E-02
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Manganese	7439-96-5	ug/kg	259000	2.20E+05	**1.18E+00**	5.80E+06	4.47E-02
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Methylene chloride	75-09-2	ug/kg	2.21	No Value	--	1.66E+05	1.33E-05
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Molybdenum	7439-98-7	ug/kg	2.75E+02	2.00E+03	1.38E-01	1.40E+04	1.96E-02
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Nickel	7440-02-0	ug/kg	8.04E+03	3.00E+04	2.68E-01	3.26E+04	2.47E-01
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Nitrate	14797-55-8	ug/kg	17900	No Value	--	3.40E+08	5.26E-05
300-33, 300-41, 300-256_Shallow_Focu	Rad	RADs SOF	--	pCi/g	--	--	1.97E-04	--	8.95E-04
300-33, 300-41, 300-256_Shallow_Focu	Rad	Uranium-233/234	U-233/234	pCi/g	3.02E+00	5.16E+04	5.85E-05	6.37E+03	4.74E-04
300-33, 300-41, 300-256_Shallow_Focu	Rad	Uranium-238	U-238	pCi/g	2.17E+00	1.57E+04	1.38E-04	5.15E+03	4.21E-04
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Vanadium	7440-62-2	ug/kg	51400	2.00E+03	**2.57E+01**	3.11E+04	**1.65E+00**
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Zinc	7440-66-6	ug/kg	3.89E+04	5.00E+04	7.78E-01	6.78E+04	5.74E-01
300-33, 300-41, 300-256_Shallow_Focu	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	6460	5.00E+03	**1.29E+00**	7.86E+05	8.22E-03
300-37_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	1.00E+02	4.00E+04	2.50E-03	1.47E+03	6.80E-02
300-37_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3.20E+03	4.00E+04	8.00E-02	1.47E+03	**2.18E+00**
300-37_Shallow_Focused	non-Rad	Aroclors HI	--	ug/kg	--	--	8.25E-02	--	**2.25E+00**

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-44_Overburden_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	9.10E+03	1.00E+04	9.10E-01	1.90E+05	4.79E-02
300-44_Overburden_Focused	Rad	Uranium-238	U-238	pCi/g	3.45E-01	1.57E+04	2.20E-05	5.15E+03	6.70E-05
300-44_Overburden_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.03E+03	5.00E+03	2.05E-01	7.86E+05	1.31E-03
300-44_Shallow_Focused	non-Rad	Antimony	7440-36-0	ug/kg	4.10E+03	5.00E+03	8.20E-01	5.98E+03	6.86E-01
300-44_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	16900	1.00E+04	**1.69E+00**	1.90E+05	8.89E-02
300-44_Shallow_Focused	non-Rad	Barium	7440-39-3	ug/kg	7.52E+04	3.30E+05	2.28E-01	1.32E+06	5.70E-02
300-44_Shallow_Focused	non-Rad	Beryllium	7440-41-7	ug/kg	4.80E+02	1.00E+04	4.80E-02	1.39E+04	3.45E-02
300-44_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	9300	4.00E+02	**2.33E+01**	3.82E+04	2.43E-01
300-44_Shallow_Focused	non-Rad	Cobalt	7440-48-4	ug/kg	8.20E+03	1.30E+04	6.31E-01	1.11E+05	7.39E-02
300-44_Shallow_Focused	non-Rad	Copper	7440-50-8	ug/kg	7.80E+03	5.00E+04	1.56E-01	1.07E+05	7.29E-02
300-44_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	303000	2.20E+05	**1.38E+00**	5.80E+06	5.22E-02
300-44_Shallow_Focused	non-Rad	Nickel	7440-02-0	ug/kg	8.60E+03	3.00E+04	2.87E-01	3.26E+04	2.64E-01
300-44_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	2.93E-01	1.57E+04	1.87E-05	5.15E+03	5.69E-05
300-44_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	43200	2.00E+03	**2.16E+01**	3.11E+04	**1.39E+00**
300-44_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	3.78E+04	5.00E+04	7.56E-01	6.78E+04	5.58E-01
300-44_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	8.72E+02	5.00E+03	1.74E-01	7.86E+05	1.11E-03
300-45_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	8.60E+01	4.00E+04	2.15E-03	1.47E+03	5.85E-02
300-45_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	2.90E+02	1.00E+05	2.90E-03	4.54E+04	6.39E-03
300-45_Shallow_Focused	Rad	Cesium-137	10045-97-3	pCi/g	2.28E-02	2.21E+03	1.03E-05	9.24E+02	2.47E-05
300-45_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	8.89E-05	--	2.72E-04
300-45_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	6.06E-02	2.74E+04	2.21E-06	4.36E+03	1.39E-05
300-45_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	1.20E+00	1.57E+04	7.64E-05	5.15E+03	2.33E-04
300-45_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	3.60E+03	5.00E+03	7.20E-01	7.86E+05	4.58E-03
300-49_Overburden	non-Rad	1,2,4-Trichlorobenzene	120-82-1	ug/kg	30.521	No Value	--	No Value	--
300-49_Overburden	non-Rad	1,4-Dichlorobenzene	106-46-7	ug/kg	28.761	No Value	--	No Value	--
300-49_Overburden	non-Rad	2,4-Dinitrotoluene	121-14-2	ug/kg	18.933	No Value	--	2.64E+04	7.17E-04
300-49_Overburden	non-Rad	2-Chlorophenol	95-57-8	ug/kg	51.333	No Value	--	No Value	--
300-49_Overburden	non-Rad	4-Chloro-3-methylphenol	59-50-7	ug/kg	45.95	No Value	--	No Value	--
300-49_Overburden	non-Rad	Acenaphthene	83-32-9	ug/kg	3.07E+01	2.00E+04	1.54E-03	1.10E+06	2.79E-05
300-49_Overburden	non-Rad	Antimony	7440-36-0	ug/kg	2.32E+02	5.00E+03	4.64E-02	5.98E+03	3.88E-02
300-49_Overburden	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3.01E+03	4.00E+04	7.52E-02	1.47E+03	**2.05E+00**
300-49_Overburden	non-Rad	Arsenic	7440-38-2	ug/kg	3.29E+03	1.00E+04	3.29E-01	1.90E+05	1.73E-02
300-49_Overburden	non-Rad	Barium	7440-39-3	ug/kg	7.61E+04	3.30E+05	2.31E-01	1.32E+06	5.76E-02
300-49_Overburden	non-Rad	Beryllium	7440-41-7	ug/kg	2.01E+02	1.00E+04	2.01E-02	1.39E+04	1.45E-02
300-49_Overburden	non-Rad	Cadmium	7440-43-9	ug/kg	1.74E+02	4.00E+03	4.36E-02	1.63E+03	1.07E-01
300-49_Overburden	non-Rad	Chromium	7440-47-3	ug/kg	18105.752	4.00E+02	**4.53E+01**	3.82E+04	4.74E-01
300-49_Overburden	non-Rad	Cobalt	7440-48-4	ug/kg	7.13E+03	1.30E+04	5.48E-01	1.11E+05	6.42E-02
300-49_Overburden	non-Rad	Copper	7440-50-8	ug/kg	536000	5.00E+04	**1.07E+01**	1.07E+05	**5.01E+00**
300-49_Overburden	non-Rad	Di-n-butylphthalate	84-74-2	ug/kg	51.612	No Value	--	No Value	--
300-49_Overburden	non-Rad	Lead	7439-92-1	ug/kg	3.70E+04	5.00E+04	7.39E-01	3.56E+04	**1.04E+00**
300-49_Overburden	non-Rad	Manganese	7439-96-5	ug/kg	316668.7	2.20E+05	**1.44E+00**	5.80E+06	5.46E-02
300-49_Overburden	non-Rad	Nickel	7440-02-0	ug/kg	1.30E+04	3.00E+04	4.35E-01	3.26E+04	4.00E-01
300-49_Overburden	non-Rad	n-Nitrosodi-n-dipropylamine	621-64-7	ug/kg	39.728	No Value	--	No Value	--
300-49_Overburden	non-Rad	Pentachlorophenol	87-86-5	ug/kg	49.824	No Value	--	No Value	--
300-49_Overburden	non-Rad	Phenol	108-95-2	ug/kg	5.00E+01	3.00E+04	1.67E-03	1.51E+06	3.31E-05
300-49_Overburden	non-Rad	Pyrene	129-00-0	ug/kg	4.01E+01	1.80E+04	2.23E-03	6.00E+05	6.69E-05
300-49_Overburden	Rad	RADs SOF	--	pCi/g	--	--	8.70E-05	--	3.70E-04
300-49_Overburden	non-Rad	Silver	7440-22-4	ug/kg	7.03E+02	2.00E+03	3.51E-01	4.96E+04	1.42E-02

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
300-49_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	1.01E+00	5.16E+04	1.95E-05	6.37E+03	1.58E-04
300-49_Overburden	Rad	Uranium-235	15117-96-1	pCi/g	5.70E-02	2.74E+04	2.08E-06	4.36E+03	1.31E-05
300-49_Overburden	Rad	Uranium-238	U-238	pCi/g	1.03E+00	1.57E+04	6.54E-05	5.15E+03	1.99E-04
300-49_Overburden	non-Rad	Vanadium	7440-62-2	ug/kg	50379.9	2.00E+03	**2.52E+01**	3.11E+04	**1.62E+00**
300-49_Overburden	non-Rad	Zinc	7440-66-6	ug/kg	141984.11	5.00E+04	**2.84E+00**	6.78E+04	**2.09E+00**
300-49_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	3.07E+03	5.00E+03	6.13E-01	7.86E+05	3.90E-03
300-49_Shallow	non-Rad	Antimony	7440-36-0	ug/kg	1.76E+02	5.00E+03	3.52E-02	5.98E+03	2.94E-02
300-49_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	4.43E+03	1.00E+04	4.43E-01	1.90E+05	2.33E-02
300-49_Shallow	non-Rad	Barium	7440-39-3	ug/kg	8.99E+04	3.30E+05	2.72E-01	1.32E+06	6.81E-02
300-49_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	3.03E+02	1.00E+04	3.03E-02	1.39E+04	2.18E-02
300-49_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	1.51E-01	2.21E+03	6.83E-05	9.24E+02	1.63E-04
300-49_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	9170.4553	4.00E+02	**2.29E+01**	3.82E+04	2.40E-01
300-49_Shallow	non-Rad	Cobalt	7440-48-4	ug/kg	9.32E+03	1.30E+04	7.17E-01	1.11E+05	8.40E-02
300-49_Shallow	non-Rad	Copper	7440-50-8	ug/kg	1.49E+04	5.00E+04	2.97E-01	1.07E+05	1.39E-01
300-49_Shallow	non-Rad	Lead	7439-92-1	ug/kg	6.63E+03	5.00E+04	1.33E-01	3.56E+04	1.86E-01
300-49_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	361805.31	2.20E+05	**1.64E+00**	5.80E+06	6.24E-02
300-49_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	1.07E+04	3.00E+04	3.55E-01	3.26E+04	3.27E-01
300-49_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.70E-04	--	6.32E-04
300-49_Shallow	non-Rad	Silver	7440-22-4	ug/kg	3.82E+02	2.00E+03	1.91E-01	4.96E+04	7.71E-03
300-49_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.32E+00	5.16E+04	2.55E-05	6.37E+03	2.07E-04
300-49_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	2.40E-01	2.74E+04	8.76E-06	4.36E+03	5.50E-05
300-49_Shallow	Rad	Uranium-238	U-238	pCi/g	1.06E+00	1.57E+04	6.78E-05	5.15E+03	2.07E-04
300-49_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	58672.352	2.00E+03	**2.93E+01**	3.11E+04	**1.89E+00**
300-49_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	54650.548	5.00E+04	**1.09E+00**	6.78E+04	8.06E-01
300-49_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.98E+03	5.00E+03	5.97E-01	7.86E+05	3.80E-03
300-50_Overburden	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3.34E+01	4.00E+04	8.36E-04	1.47E+03	2.28E-02
300-50_Overburden	non-Rad	Aroclor-1260	11096-82-5	ug/kg	2.29E+02	4.00E+04	5.73E-03	1.47E+03	1.56E-01
300-50_Overburden	non-Rad	Aroclors HI	--	ug/kg	--	--	6.57E-03	--	1.79E-01
300-50_Overburden	non-Rad	Arsenic	7440-38-2	ug/kg	6.90E+03	1.00E+04	6.90E-01	1.90E+05	3.63E-02
300-50_Overburden	non-Rad	Barium	7440-39-3	ug/kg	1.18E+05	3.30E+05	3.57E-01	1.32E+06	8.92E-02
300-50_Overburden	non-Rad	Beryllium	7440-41-7	ug/kg	3.25E+02	1.00E+04	3.25E-02	1.39E+04	2.34E-02
300-50_Overburden	non-Rad	Cadmium	7440-43-9	ug/kg	5.63E+02	4.00E+03	1.41E-01	1.63E+03	3.45E-01
300-50_Overburden	Rad	Cesium-137	10045-97-3	pCi/g	5.60E-02	2.21E+03	2.53E-05	9.24E+02	6.06E-05
300-50_Overburden	non-Rad	Chromium	7440-47-3	ug/kg	12197.473	4.00E+02	**3.05E+01**	3.82E+04	3.19E-01
300-50_Overburden	non-Rad	Cobalt	7440-48-4	ug/kg	9.39E+03	1.30E+04	7.22E-01	1.11E+05	8.46E-02
300-50_Overburden	non-Rad	Copper	7440-50-8	ug/kg	64526.564	5.00E+04	**1.29E+00**	1.07E+05	6.03E-01
300-50_Overburden	non-Rad	Lead	7439-92-1	ug/kg	5.90E+03	5.00E+04	1.18E-01	3.56E+04	1.66E-01
300-50_Overburden	non-Rad	Manganese	7439-96-5	ug/kg	314270.52	2.20E+05	**1.43E+00**	5.80E+06	5.42E-02
300-50_Overburden	non-Rad	Nickel	7440-02-0	ug/kg	1.52E+04	3.00E+04	5.08E-01	3.26E+04	4.67E-01
300-50_Overburden	Rad	RADs SOF	--	pCi/g	--	--	5.38E-04	--	2.27E-03
300-50_Overburden	non-Rad	Silver	7440-22-4	ug/kg	1.20E+03	2.00E+03	6.01E-01	4.96E+04	2.42E-02
300-50_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	6.03E+00	5.16E+04	1.17E-04	6.37E+03	9.46E-04
300-50_Overburden	Rad	Uranium-235	15117-96-1	pCi/g	4.49E-01	2.74E+04	1.64E-05	4.36E+03	1.03E-04
300-50_Overburden	Rad	Uranium-238	U-238	pCi/g	5.95E+00	1.57E+04	3.79E-04	5.15E+03	1.16E-03
300-50_Overburden	non-Rad	Vanadium	7440-62-2	ug/kg	45242.833	2.00E+03	**2.26E+01**	3.11E+04	**1.45E+00**
300-50_Overburden	non-Rad	Zinc	7440-66-6	ug/kg	4.59E+04	5.00E+04	9.18E-01	6.78E+04	6.77E-01
300-50_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	17919	5.00E+03	**3.58E+00**	7.86E+05	2.28E-02
300-50_Shallow	non-Rad	Antimony	7440-36-0	ug/kg	3.00E+03	5.00E+03	6.00E-01	5.98E+03	5.02E-01

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildife SSL[2]	Hazard Quotient
300-50_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	1.26E+02	4.00E+04	3.16E-03	1.47E+03	8.59E-02
300-50_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	6.40E+03	1.00E+04	6.40E-01	1.90E+05	3.37E-02
300-50_Shallow	non-Rad	Barium	7440-39-3	ug/kg	1.03E+05	3.30E+05	3.12E-01	1.32E+06	7.81E-02
300-50_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	2.82E+02	1.00E+04	2.82E-02	1.39E+04	2.03E-02
300-50_Shallow	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	1.93E+01	1.00E+05	1.93E-04	4.54E+04	4.25E-04
300-50_Shallow	non-Rad	Cadmium	7440-43-9	ug/kg	4.63E+02	4.00E+03	1.16E-01	1.63E+03	2.84E-01
300-50_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	5.60E-02	2.21E+03	2.53E-05	9.24E+02	6.06E-05
300-50_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	16841.216	4.00E+02	**4.21E+01**	3.82E+04	4.41E-01
300-50_Shallow	non-Rad	Cobalt	7440-48-4	ug/kg	9.11E+03	1.30E+04	7.01E-01	1.11E+05	8.21E-02
300-50_Shallow	non-Rad	Copper	7440-50-8	ug/kg	1.68E+04	5.00E+04	3.36E-01	1.07E+05	1.57E-01
300-50_Shallow	non-Rad	Lead	7439-92-1	ug/kg	6.38E+03	5.00E+04	1.28E-01	3.56E+04	1.79E-01
300-50_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	318119.94	2.20E+05	**1.45E+00**	5.80E+06	5.48E-02
300-50_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	1.24E+04	3.00E+04	4.14E-01	3.26E+04	3.81E-01
300-50_Shallow	Rad	RADs SOF	--	pCi/g	--	--	7.39E-04	--	3.08E-03
300-50_Shallow	non-Rad	Silver	7440-22-4	ug/kg	2991.6221	2.00E+03	**1.50E+00**	4.96E+04	6.03E-02
300-50_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	7.89E+00	5.16E+04	1.53E-04	6.37E+03	1.24E-03
300-50_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	6.64E-01	2.74E+04	2.42E-05	4.36E+03	1.52E-04
300-50_Shallow	Rad	Uranium-238	U-238	pCi/g	8.41E+00	1.57E+04	5.36E-04	5.15E+03	1.63E-03
300-50_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	46964.326	2.00E+03	**2.35E+01**	3.11E+04	**1.51E+00**
300-50_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	4.13E+04	5.00E+04	8.27E-01	6.78E+04	6.10E-01
300-50_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	22938	5.00E+03	**4.59E+00**	7.86E+05	2.92E-02
300-8_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	5.74E+02	1.00E+04	5.74E-02	1.39E+04	4.13E-02
300-8_Shallow	Rad	RADs SOF	--	pCi/g	--	--	6.75E-05	--	2.83E-04
300-8_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	7.86E-01	5.16E+04	1.52E-05	6.37E+03	1.23E-04
300-8_Shallow	Rad	Uranium-238	U-238	pCi/g	8.21E-01	1.57E+04	5.23E-05	5.15E+03	1.60E-04
300-8_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.37E+03	5.00E+03	4.75E-01	7.86E+05	3.02E-03
316-1_Overburden	Rad	Cesium-137	10045-97-3	pCi/g	1.01E-01	2.21E+03	4.57E-05	9.24E+02	1.09E-04
316-1_Overburden	Rad	Cobalt-60	10198-40-0	pCi/g	3.18E-01	6.13E+03	5.19E-05	8.05E+02	3.95E-04
316-1_Overburden	Rad	RADs SOF	--	pCi/g	--	--	1.25E-03	--	5.39E-03
316-1_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	1.30E+01	5.16E+04	2.51E-04	6.37E+03	2.03E-03
316-1_Overburden	Rad	Uranium-235	15117-96-1	pCi/g	1.08E+00	2.74E+04	3.94E-05	4.36E+03	2.48E-04
316-1_Overburden	Rad	Uranium-238	U-238	pCi/g	1.35E+01	1.57E+04	8.57E-04	5.15E+03	2.61E-03
316-1_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	40572	5.00E+03	**8.11E+00**	7.86E+05	5.16E-02
316-1_Shallow_1	non-Rad	Aroclor-1248	12672-29-6	ug/kg	3.00E+03	4.00E+04	7.50E-02	3.25E+02	**9.23E+00**
316-1_Shallow_1	non-Rad	Arsenic	7440-38-2	ug/kg	19014.394	1.00E+04	**1.90E+00**	1.90E+05	1.00E-01
316-1_Shallow_1	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	6.86E+01	1.00E+05	6.86E-04	4.54E+04	1.51E-03
316-1_Shallow_1	non-Rad	Butylbenzylphthalate	85-68-7	ug/kg	97.692869	No Value	--	No Value	--
316-1_Shallow_1	Rad	Cesium-137	10045-97-3	pCi/g	3.18E-02	2.21E+03	1.44E-05	9.24E+02	3.44E-05
316-1_Shallow_1	Rad	RADs SOF	--	pCi/g	--	--	1.82E-03	--	5.69E-03
316-1_Shallow_1	Rad	Uranium-235	15117-96-1	pCi/g	1.21E+00	2.74E+04	4.43E-05	4.36E+03	2.78E-04
316-1_Shallow_1	Rad	Uranium-238	U-238	pCi/g	2.77E+01	1.57E+04	1.76E-03	5.15E+03	5.38E-03
316-1_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	83027	5.00E+03	**1.66E+01**	7.86E+05	1.06E-01
316-1_Shallow_3	non-Rad	Antimony	7440-36-0	ug/kg	4.90E+02	5.00E+03	9.80E-02	5.98E+03	8.19E-02
316-1_Shallow_3	non-Rad	Aroclor-1254	11097-69-1	ug/kg	9.99E+01	4.00E+04	2.50E-03	1.47E+03	6.79E-02
316-1_Shallow_3	non-Rad	Arsenic	7440-38-2	ug/kg	5.14E+03	1.00E+04	5.14E-01	1.90E+05	2.70E-02
316-1_Shallow_3	non-Rad	Barium	7440-39-3	ug/kg	1.29E+05	3.30E+05	3.91E-01	1.32E+06	9.78E-02
316-1_Shallow_3	non-Rad	Beryllium	7440-41-7	ug/kg	4.16E+02	1.00E+04	4.16E-02	1.39E+04	2.99E-02
316-1_Shallow_3	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	3.42E+02	1.00E+05	3.42E-03	4.54E+04	7.54E-03

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
316-1_Shallow_3	non-Rad	Cadmium	7440-43-9	ug/kg	4.70E+02	4.00E+03	1.18E-01	1.63E+03	2.88E-01
316-1_Shallow_3	Rad	Cesium-137	10045-97-3	pCi/g	3.77E-01	2.21E+03	1.71E-04	9.24E+02	4.08E-04
316-1_Shallow_3	non-Rad	Chromium	7440-47-3	ug/kg	50455.279	4.00E+02	**1.26E+02**	3.82E+04	**1.32E+00**
316-1_Shallow_3	non-Rad	Cobalt	7440-48-4	ug/kg	9.70E+03	1.30E+04	7.46E-01	1.11E+05	8.74E-02
316-1_Shallow_3	Rad	Cobalt-60	10198-40-0	pCi/g	2.28E+00	6.13E+03	3.72E-04	8.05E+02	2.83E-03
316-1_Shallow_3	non-Rad	Copper	7440-50-8	ug/kg	1366370.3	5.00E+04	**2.73E+01**	1.07E+05	**1.28E+01**
316-1_Shallow_3	non-Rad	Heptachlor epoxide	1024-57-3	ug/kg	2.6479397	No Value	--	No Value	--
316-1_Shallow_3	non-Rad	Lead	7439-92-1	ug/kg	1.44E+04	5.00E+04	2.88E-01	3.56E+04	4.05E-01
316-1_Shallow_3	non-Rad	Manganese	7439-96-5	ug/kg	392825.12	2.20E+05	**1.79E+00**	5.80E+06	6.77E-02
316-1_Shallow_3	non-Rad	Mercury	7439-97-6	ug/kg	1105.3045	1.00E+02	**1.11E+01**	1.87E+03	5.91E-01
316-1_Shallow_3	non-Rad	Nickel	7440-02-0	ug/kg	94655.889	3.00E+04	**3.16E+00**	3.26E+04	**2.90E+00**
316-1_Shallow_3	non-Rad	Phenol	108-95-2	ug/kg	2.80E+01	3.00E+04	9.33E-04	1.51E+06	1.85E-05
316-1_Shallow_3	Rad	RADs SOF	--	pCi/g	--	--	2.41E-03	--	1.14E-02
316-1_Shallow_3	non-Rad	Selenium	7782-49-2	ug/kg	1444.348	5.20E+02	**2.78E+00**	1.90E+03	7.60E-01
316-1_Shallow_3	non-Rad	Silver	7440-22-4	ug/kg	13195.532	2.00E+03	**6.60E+00**	4.96E+04	2.66E-01
316-1_Shallow_3	Rad	Uranium-233/234	U-233/234	pCi/g	2.27E+01	5.16E+04	4.40E-04	6.37E+03	3.57E-03
316-1_Shallow_3	Rad	Uranium-235	15117-96-1	pCi/g	2.55E+00	2.74E+04	9.30E-05	4.36E+03	5.84E-04
316-1_Shallow_3	Rad	Uranium-238	U-238	pCi/g	2.08E+01	1.57E+04	1.33E-03	5.15E+03	4.04E-03
316-1_Shallow_3	non-Rad	Vanadium	7440-62-2	ug/kg	56706.602	2.00E+03	**2.84E+01**	3.11E+04	**1.82E+00**
316-1_Shallow_3	non-Rad	Zinc	7440-66-6	ug/kg	82015.898	5.00E+04	**1.64E+00**	6.78E+04	**1.21E+00**
316-1_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	63074	5.00E+03	**1.26E+01**	7.86E+05	8.02E-02
316-1_Shallow_4	non-Rad	Aroclor-1254	11097-69-1	ug/kg	6.20E+01	4.00E+04	1.55E-03	1.47E+03	4.22E-02
316-1_Shallow_4	Rad	Cobalt-60	10198-40-0	pCi/g	1.20E-01	6.13E+03	1.96E-05	8.05E+02	1.49E-04
316-1_Shallow_4	Rad	RADs SOF	--	pCi/g	--	--	1.28E-03	--	5.69E-03
316-1_Shallow_4	Rad	Uranium-233/234	U-233/234	pCi/g	1.61E+01	5.16E+04	3.13E-04	6.37E+03	2.53E-03
316-1_Shallow_4	Rad	Uranium-235	15117-96-1	pCi/g	1.07E+00	2.74E+04	3.90E-05	4.36E+03	2.45E-04
316-1_Shallow_4	Rad	Uranium-238	U-238	pCi/g	1.43E+01	1.57E+04	9.09E-04	5.15E+03	2.77E-03
316-1_Shallow_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	42963	5.00E+03	**8.59E+00**	7.86E+05	5.47E-02
316-2_Shallow_1	Rad	Cesium-137	10045-97-3	pCi/g	3.10E-02	2.21E+03	1.40E-05	9.24E+02	3.35E-05
316-2_Shallow_1	Rad	Cobalt-60	10198-40-0	pCi/g	9.22E-02	6.13E+03	1.50E-05	8.05E+02	1.14E-04
316-2_Shallow_1	Rad	RADs SOF	--	pCi/g	--	--	6.53E-03	--	2.99E-02
316-2_Shallow_1	Rad	Uranium-233/234	U-233/234	pCi/g	8.64E+01	5.16E+04	1.67E-03	6.37E+03	1.36E-02
316-2_Shallow_1	Rad	Uranium-235	15117-96-1	pCi/g	1.22E+01	2.74E+04	4.45E-04	4.36E+03	2.80E-03
316-2_Shallow_1	Rad	Uranium-238	U-238	pCi/g	6.88E+01	1.57E+04	4.39E-03	5.15E+03	1.34E-02
316-2_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	210452	5.00E+03	**4.21E+01**	7.86E+05	2.68E-01
316-2_Shallow_2	non-Rad	Aroclor-1248	12672-29-6	ug/kg	6.97E+02	4.00E+04	1.74E-02	3.25E+02	**2.14E+00**
316-2_Shallow_2	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.20E+01	4.00E+04	1.05E-03	1.47E+03	2.86E-02
316-2_Shallow_2	non-Rad	Aroclor-1260	11096-82-5	ug/kg	1.10E+02	4.00E+04	2.75E-03	1.47E+03	7.48E-02
316-2_Shallow_2	non-Rad	Aroclors HI	--	ug/kg	--	--	2.12E-02	--	**2.24E+00**
316-2_Shallow_2	Rad	Cesium-137	10045-97-3	pCi/g	4.48E-01	2.21E+03	2.03E-04	9.24E+02	4.85E-04
316-2_Shallow_2	Rad	Cobalt-60	10198-40-0	pCi/g	4.53E-01	6.13E+03	7.38E-05	8.05E+02	5.62E-04
316-2_Shallow_2	Rad	RADs SOF	--	pCi/g	--	--	9.03E-03	--	4.03E-02
316-2_Shallow_2	Rad	Uranium-233/234	U-233/234	pCi/g	1.15E+02	5.16E+04	2.22E-03	6.37E+03	1.80E-02
316-2_Shallow_2	Rad	Uranium-235	15117-96-1	pCi/g	1.11E+01	2.74E+04	4.05E-04	4.36E+03	2.55E-03
316-2_Shallow_2	Rad	Uranium-238	U-238	pCi/g	9.62E+01	1.57E+04	6.13E-03	5.15E+03	1.87E-02
316-2_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	291369	5.00E+03	**5.83E+01**	7.86E+05	3.71E-01
316-2_Shallow_3	non-Rad	Arsenic	7440-38-2	ug/kg	8.00E+03	1.00E+04	8.00E-01	1.90E+05	4.21E-02
316-2_Shallow_3	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	2.60E+02	1.00E+05	2.60E-03	4.54E+04	5.73E-03

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildife SSL[2]	Hazard Quotient
316-2_Shallow_3	non-Rad	Butylbenzylphthalate	85-68-7	ug/kg	180	No Value	--	No Value	--
316-2_Shallow_3	Rad	RADs SOF	--	pCi/g	--	--	1.59E-03	--	4.96E-03
316-2_Shallow_3	Rad	Uranium-235	15117-96-1	pCi/g	9.09E-01	2.74E+04	3.32E-05	4.36E+03	2.08E-04
316-2_Shallow_3	Rad	Uranium-238	U-238	pCi/g	2.44E+01	1.57E+04	1.56E-03	5.15E+03	4.75E-03
316-2_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	73174	5.00E+03	**1.46E+01**	7.86E+05	9.31E-02
316-5_Shallow_1	Rad	Americium-241	14596-10-2	pCi/g	4.79E-01	2.15E+04	2.23E-05	4.84E+03	9.90E-05
316-5_Shallow_1	non-Rad	Arsenic	7440-38-2	ug/kg	3.07E+03	1.00E+04	3.07E-01	1.90E+05	1.62E-02
316-5_Shallow_1	non-Rad	Benzo(a)anthracene	56-55-3	ug/kg	3.80E+01	1.80E+04	2.11E-03	6.40E+04	5.94E-04
316-5_Shallow_1	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	1.46E+02	1.00E+05	1.46E-03	4.54E+04	3.21E-03
316-5_Shallow_1	non-Rad	Butylbenzylphthalate	85-68-7	ug/kg	100	No Value	--	No Value	--
316-5_Shallow_1	Rad	Cesium-137	10045-97-3	pCi/g	2.29E+00	2.21E+03	1.04E-03	9.24E+02	2.48E-03
316-5_Shallow_1	Rad	RADs SOF	--	pCi/g	--	--	7.42E-03	--	2.41E-02
316-5_Shallow_1	Rad	Uranium-235	15117-96-1	pCi/g	1.86E+01	2.74E+04	6.79E-04	4.36E+03	4.27E-03
316-5_Shallow_1	Rad	Uranium-238	U-238	pCi/g	8.92E+01	1.57E+04	5.68E-03	5.15E+03	1.73E-02
316-5_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	271835	5.00E+03	**5.44E+01**	7.86E+05	3.46E-01
316-5_Shallow_2	non-Rad	1,1,2,2-Tetrachloroethane	79-34-5	ug/kg	140	No Value	--	1.65E+05	8.48E-04
316-5_Shallow_2	non-Rad	2-Butoxyethanol	111-76-2	ug/kg	240	No Value	--	No Value	--
316-5_Shallow_2	Rad	Americium-241	14596-10-2	pCi/g	1.24E-01	2.15E+04	5.77E-06	4.84E+03	2.56E-05
316-5_Shallow_2	non-Rad	Arsenic	7440-38-2	ug/kg	3.18E+03	1.00E+04	3.18E-01	1.90E+05	1.67E-02
316-5_Shallow_2	non-Rad	Barium	7440-39-3	ug/kg	7.67E+04	3.30E+05	2.32E-01	1.32E+06	5.81E-02
316-5_Shallow_2	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	1.80E+02	1.00E+05	1.80E-03	4.54E+04	3.97E-03
316-5_Shallow_2	non-Rad	Butylbenzylphthalate	85-68-7	ug/kg	110	No Value	--	No Value	--
316-5_Shallow_2	Rad	Cesium-137	10045-97-3	pCi/g	1.71E+00	2.21E+03	7.76E-04	9.24E+02	1.85E-03
316-5_Shallow_2	non-Rad	Chromium	7440-47-3	ug/kg	6900	4.00E+02	**1.73E+01**	3.82E+04	1.81E-01
316-5_Shallow_2	non-Rad	Chrysene	218-01-9	ug/kg	3.80E+01	1.80E+04	2.11E-03	4.45E+04	8.54E-04
316-5_Shallow_2	Rad	Cobalt-60	10198-40-0	pCi/g	1.18E-01	6.13E+03	1.92E-05	8.05E+02	1.47E-04
316-5_Shallow_2	non-Rad	Di-n-butylphthalate	84-74-2	ug/kg	146.4259	No Value	--	No Value	--
316-5_Shallow_2	non-Rad	Lead	7439-92-1	ug/kg	3.20E+03	5.00E+04	6.40E-02	3.56E+04	8.99E-02
316-5_Shallow_2	Rad	RADs SOF	--	pCi/g	--	--	5.43E-03	--	1.72E-02
316-5_Shallow_2	non-Rad	Selenium	7782-49-2	ug/kg	4.90E+02	5.20E+02	9.42E-01	1.90E+03	2.58E-01
316-5_Shallow_2	non-Rad	Silver	7440-22-4	ug/kg	3600	2.00E+03	**1.80E+00**	4.96E+04	7.26E-02
316-5_Shallow_2	Rad	Uranium-235	15117-96-1	pCi/g	9.04E+00	2.74E+04	3.30E-04	4.36E+03	2.07E-03
316-5_Shallow_2	Rad	Uranium-238	U-238	pCi/g	6.75E+01	1.57E+04	4.30E-03	5.15E+03	1.31E-02
316-5_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	204701	5.00E+03	**4.09E+01**	7.86E+05	2.60E-01
316-5_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	ug/kg	5.70E+01	4.00E+04	1.43E-03	3.25E+02	1.75E-01
316-5_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	7.00E+01	4.00E+04	1.75E-03	1.47E+03	4.76E-02
316-5_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	5.20E+01	4.00E+04	1.30E-03	1.47E+03	3.54E-02
316-5_Shallow_Focused	non-Rad	Aroclors HI	--	ug/kg	--	--	4.48E-03	--	2.58E-01
316-5_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	4.30E+03	1.00E+04	4.30E-01	1.90E+05	2.26E-02
316-5_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	1.90E+02	1.00E+05	1.90E-03	4.54E+04	4.19E-03
316-5_Shallow_Focused	Rad	Cesium-137	10045-97-3	pCi/g	1.83E+00	2.21E+03	8.28E-04	9.24E+02	1.98E-03
316-5_Shallow_Focused	non-Rad	Di-n-butylphthalate	84-74-2	ug/kg	1500	No Value	--	No Value	--
316-5_Shallow_Focused	Rad	Europium-155	14391-16-3	pCi/g	7.19E-02	1.53E+05	4.70E-07	3.34E+04	2.15E-06
316-5_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	3.99E-03	--	1.25E-02
316-5_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	7.67E+00	2.74E+04	2.80E-04	4.36E+03	1.76E-03
316-5_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	4.52E+01	1.57E+04	2.88E-03	5.15E+03	8.78E-03
316-5_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	138095	5.00E+03	**2.76E+01**	7.86E+05	1.76E-01
331 LSLDF_Shallow_Focused	non-Rad	4,4'-DDE (Dichlorodiphenyldichloroethylene)	72-55-9	ug/kg	25	No Value	--	4.00E+02	6.25E-02

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
331 LSLDF_Shallow_Focused	non-Rad	Acetone	67-64-1	ug/kg	590	No Value	--	No Value	--
331 LSLDF_Shallow_Focused	non-Rad	Aldrin	309-00-2	ug/kg	0.56	No Value	--	1.65E+02	3.39E-03
331 LSLDF_Shallow_Focused	non-Rad	Alpha-BHC	319-84-6	ug/kg	0.39	No Value	--	No Value	--
331 LSLDF_Shallow_Focused	non-Rad	Antimony	7440-36-0	ug/kg	3.60E+02	5.00E+03	7.20E-02	5.98E+03	6.02E-02
331 LSLDF_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	8.50E+02	4.00E+04	2.13E-02	1.47E+03	5.78E-01
331 LSLDF_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	2.40E+03	1.00E+04	2.40E-01	1.90E+05	1.26E-02
331 LSLDF_Shallow_Focused	non-Rad	Barium	7440-39-3	ug/kg	7.86E+04	3.30E+05	2.38E-01	1.32E+06	5.95E-02
331 LSLDF_Shallow_Focused	non-Rad	Beryllium	7440-41-7	ug/kg	5.70E+02	1.00E+04	5.70E-02	1.39E+04	4.10E-02
331 LSLDF_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	9.10E+02	1.00E+05	9.10E-03	4.54E+04	2.00E-02
331 LSLDF_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	1700	5.00E+02	**3.40E+00**	1.33E+05	1.28E-02
331 LSLDF_Shallow_Focused	non-Rad	Butylbenzylphthalate	85-68-7	ug/kg	340	No Value	--	No Value	--
331 LSLDF_Shallow_Focused	non-Rad	Cadmium	7440-43-9	ug/kg	1.40E+02	4.00E+03	3.50E-02	1.63E+03	8.59E-02
331 LSLDF_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	10300	4.00E+02	**2.58E+01**	3.82E+04	2.70E-01
331 LSLDF_Shallow_Focused	non-Rad	Cobalt	7440-48-4	ug/kg	8.60E+03	1.30E+04	6.62E-01	1.11E+05	7.75E-02
331 LSLDF_Shallow_Focused	non-Rad	Copper	7440-50-8	ug/kg	1.54E+04	5.00E+04	3.08E-01	1.07E+05	1.44E-01
331 LSLDF_Shallow_Focused	non-Rad	Dieldrin	60-57-1	ug/kg	13	No Value	--	2.09E+01	6.22E-01
331 LSLDF_Shallow_Focused	non-Rad	Di-n-butylphthalate	84-74-2	ug/kg	98	No Value	--	No Value	--
331 LSLDF_Shallow_Focused	non-Rad	Endosulfan I	959-98-8	ug/kg	1.9	No Value	--	7.10E+02	2.68E-03
331 LSLDF_Shallow_Focused	non-Rad	Endosulfan II	33213-65-9	ug/kg	3.1	No Value	--	7.10E+02	4.37E-03
331 LSLDF_Shallow_Focused	non-Rad	Lead	7439-92-1	ug/kg	9.00E+03	5.00E+04	1.80E-01	3.56E+04	2.53E-01
331 LSLDF_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	349000	2.20E+05	**1.59E+00**	5.80E+06	6.02E-02
331 LSLDF_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	110	1.00E+02	**1.10E+00**	1.87E+03	5.88E-02
331 LSLDF_Shallow_Focused	non-Rad	Methoxychlor	72-43-5	ug/kg	3.3	No Value	--	2.18E+04	1.51E-04
331 LSLDF_Shallow_Focused	non-Rad	Methylene chloride	75-09-2	ug/kg	11	No Value	--	1.66E+05	6.63E-05
331 LSLDF_Shallow_Focused	non-Rad	Molybdenum	7439-98-7	ug/kg	5.90E+02	2.00E+03	2.95E-01	1.40E+04	4.21E-02
331 LSLDF_Shallow_Focused	non-Rad	Nickel	7440-02-0	ug/kg	1.00E+04	3.00E+04	3.33E-01	3.26E+04	3.07E-01
331 LSLDF_Shallow_Focused	non-Rad	Nitrate	14797-55-8	ug/kg	41700	No Value	--	3.40E+08	1.23E-04
331 LSLDF_Shallow_Focused	non-Rad	Nitrogen in Nitrite and Nitrate	NO2+NO3-N	ug/kg	9500	No Value	--	No Value	--
331 LSLDF_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	4.05E-05	--	1.76E-04
331 LSLDF_Shallow_Focused	non-Rad	Silver	7440-22-4	ug/kg	1.10E+03	2.00E+03	5.50E-01	4.96E+04	2.22E-02
331 LSLDF_Shallow_Focused	non-Rad	Uranium	7440-61-1	ug/kg	2.30E+03	5.00E+03	4.60E-01	7.86E+05	2.93E-03
331 LSLDF_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	5.40E-01	5.16E+04	1.05E-05	6.37E+03	8.48E-05
331 LSLDF_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	4.71E-01	1.57E+04	3.00E-05	5.15E+03	9.15E-05
331 LSLDF_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	53100	2.00E+03	**2.66E+01**	3.11E+04	**1.71E+00**
331 LSLDF_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	137000	5.00E+04	**2.74E+00**	6.78E+04	**2.02E+00**
331 LSLDF_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.40E+03	5.00E+03	2.80E-01	7.86E+05	1.78E-03
600-243_Shallow	non-Rad	2-Methylnaphthalene	91-57-6	ug/kg	2.79E+02	2.90E+04	9.61E-03	6.01E+03	4.64E-02
600-243_Shallow	non-Rad	Anthracene	120-12-7	ug/kg	3.13E+01	2.90E+04	1.08E-03	6.78E+05	4.61E-05
600-243_Shallow	non-Rad	Antimony	7440-36-0	ug/kg	1.30E+03	5.00E+03	2.60E-01	5.98E+03	2.17E-01
600-243_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	2.70E+01	4.00E+04	6.75E-04	1.47E+03	1.84E-02
600-243_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	1.85E+01	4.00E+04	4.63E-04	1.47E+03	1.26E-02
600-243_Shallow	non-Rad	Aroclors HI	--	ug/kg	--	--	1.14E-03	--	3.10E-02
600-243_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	6.16E+03	1.00E+04	6.16E-01	1.90E+05	3.24E-02
600-243_Shallow	non-Rad	Barium	7440-39-3	ug/kg	2.92E+05	3.30E+05	8.85E-01	1.32E+06	2.21E-01
600-243_Shallow	non-Rad	Benzo(a)anthracene	56-55-3	ug/kg	4.33E+01	1.80E+04	2.40E-03	6.40E+04	6.76E-04
600-243_Shallow	non-Rad	Benzo(a)pyrene	50-32-8	ug/kg	4.27E+01	1.80E+04	2.37E-03	7.64E+04	5.59E-04
600-243_Shallow	non-Rad	Benzo(b)fluoranthene	205-99-2	ug/kg	4.63E+01	1.80E+04	2.57E-03	3.92E+04	1.18E-03
600-243_Shallow	non-Rad	Benzo(k)fluoranthene	207-08-9	ug/kg	3.18E+01	1.80E+04	1.76E-03	3.92E+04	8.10E-04
600-243_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	2.08E+03	1.00E+04	2.08E-01	1.39E+04	1.50E-01
600-243_Shallow	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	4.32E+02	1.00E+05	4.32E-03	4.54E+04	9.52E-03
600-243_Shallow	non-Rad	Boron	7440-42-8	ug/kg	294462.62	5.00E+02	**5.89E+02**	1.33E+05	**2.21E+00**
600-243_Shallow	non-Rad	Cadmium	7440-43-9	ug/kg	7.96E+02	4.00E+03	1.99E-01	1.63E+03	4.88E-01
600-243_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	18006.452	4.00E+02	**4.50E+01**	3.82E+04	4.71E-01
600-243_Shallow	non-Rad	Chrysene	218-01-9	ug/kg	6.26E+01	1.80E+04	3.48E-03	4.45E+04	1.41E-03
600-243_Shallow	non-Rad	Cobalt	7440-48-4	ug/kg	6.21E+03	1.30E+04	4.77E-01	1.11E+05	5.59E-02
600-243_Shallow	non-Rad	Copper	7440-50-8	ug/kg	53981.061	5.00E+04	**1.08E+00**	1.07E+05	5.04E-01

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
600-243_Shallow	non-Rad	Dibenzofuran	132-64-9	ug/kg	78.499839	No Value	--	No Value	--
600-243_Shallow	non-Rad	Di-n-butylphthalate	84-74-2	ug/kg	37.233317	No Value	--	No Value	--
600-243_Shallow	non-Rad	Fluoranthene	206-44-0	ug/kg	7.91E+01	1.80E+04	4.39E-03	8.39E+05	9.43E-05
600-243_Shallow	non-Rad	Indeno(1,2,3-cd)pyrene	193-39-5	ug/kg	2.80E+01	1.80E+04	1.56E-03	3.57E+04	7.84E-04
600-243_Shallow	non-Rad	Lead	7439-92-1	ug/kg	4.01E+04	5.00E+04	8.03E-01	3.56E+04	**1.13E+00**
600-243_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	2.08E+05	2.20E+05	9.47E-01	5.80E+06	3.59E-02
600-243_Shallow	non-Rad	Molybdenum	7439-98-7	ug/kg	1.87E+03	2.00E+03	9.35E-01	1.40E+04	1.34E-01
600-243_Shallow	non-Rad	Naphthalene	91-20-3	ug/kg	2.04E+02	2.90E+04	7.02E-03	1.00E+05	2.04E-03
600-243_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	2.14E+04	3.00E+04	7.13E-01	3.26E+04	6.56E-01
600-243_Shallow	non-Rad	Pyrene	129-00-0	ug/kg	7.00E+01	1.80E+04	3.89E-03	6.00E+05	1.17E-04
600-243_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	5708.5512	5.20E+02	**1.10E+01**	1.90E+03	**3.00E+00**
600-243_Shallow	non-Rad	Silver	7440-22-4	ug/kg	5.00E+02	2.00E+03	2.50E-01	4.96E+04	1.01E-02
600-243_Shallow	non-Rad	Total petroleum hydrocarbons - diesel range	TPHDIESEL	ug/kg	9.53E+04	2.00E+05	4.77E-01	3.56E+08	2.68E-04
600-243_Shallow	non-Rad	Total petroleum hydrocarbons - motor oil (high boiling)	TPH/OILH	ug/kg	334524.06	No Value	--	No Value	--
600-243_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	46986.305	2.00E+03	**2.35E+01**	3.11E+04	**1.51E+00**
600-243_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	84099.429	5.00E+04	**1.68E+00**	6.78E+04	**1.24E+00**
600-259_Overburden	Rad	Cesium-137	10045-97-3	pCi/g	3.40E-02	2.21E+03	1.54E-05	9.24E+02	3.68E-05
600-259_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	6.80E-02	2.21E+03	3.08E-05	9.24E+02	7.36E-05
600-259_Shallow_Focused	Rad	Cesium-137	10045-97-3	pCi/g	3.80E-02	2.21E+03	1.72E-05	9.24E+02	4.11E-05
600-47_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	2.30E+03	1.00E+04	2.30E-01	1.90E+05	1.21E-02
600-47_Shallow	non-Rad	Barium	7440-39-3	ug/kg	6.70E+04	3.30E+05	2.03E-01	1.32E+06	5.08E-02
600-47_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	5.00E+02	1.00E+04	5.00E-02	1.39E+04	3.60E-02
600-47_Shallow	non-Rad	Cadmium	7440-43-9	ug/kg	9.00E+01	4.00E+03	2.25E-02	1.63E+03	5.52E-02
600-47_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	5500	4.00E+02	**1.38E+01**	3.82E+04	1.44E-01
600-47_Shallow	non-Rad	Lead	7439-92-1	ug/kg	3.50E+03	5.00E+04	7.00E-02	3.56E+04	9.83E-02
600-47_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.27E-04	--	5.21E-04
600-47_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.36E+00	5.16E+04	2.64E-05	6.37E+03	2.14E-04
600-47_Shallow	Rad	Uranium-238	U-238	pCi/g	1.58E+00	1.57E+04	1.01E-04	5.15E+03	3.07E-04
600-47_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	4.30E+03	5.00E+03	8.61E-01	7.86E+05	5.47E-03
618-1_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	2.64E+02	4.00E+04	6.60E-03	1.47E+03	1.80E-01
618-1_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	5.35E+01	4.00E+04	1.34E-03	1.47E+03	3.64E-02
618-1_Shallow	non-Rad	Aroclors HI	--	ug/kg	--	--	7.94E-03	--	2.16E-01
618-1_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	2.28E+03	1.00E+04	2.28E-01	1.90E+05	1.20E-02
618-1_Shallow	non-Rad	Barium	7440-39-3	ug/kg	9.72E+04	3.30E+05	2.95E-01	1.32E+06	7.36E-02
618-1_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	1.88E+02	1.00E+04	1.88E-02	1.39E+04	1.35E-02
618-1_Shallow	non-Rad	Boron	7440-42-8	ug/kg	1190	5.00E+02	**2.38E+00**	1.33E+05	8.95E-03
618-1_Shallow	non-Rad	Cadmium	7440-43-9	ug/kg	6.80E+01	4.00E+03	1.70E-02	1.63E+03	4.17E-02
618-1_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	7930	4.00E+02	**1.98E+01**	3.82E+04	2.08E-01
618-1_Shallow	non-Rad	Cobalt	7440-48-4	ug/kg	6.36E+03	1.30E+04	4.89E-01	1.11E+05	5.73E-02
618-1_Shallow	non-Rad	Copper	7440-50-8	ug/kg	1.14E+04	5.00E+04	2.28E-01	1.07E+05	1.07E-01
618-1_Shallow	non-Rad	Fluoride	16984-48-8	ug/kg	400	No Value	--	2.28E+06	1.75E-04
618-1_Shallow	non-Rad	Lead	7439-92-1	ug/kg	3.10E+03	5.00E+04	6.20E-02	3.56E+04	8.71E-02
618-1_Shallow	non-Rad	Lithium	7439-93-2	ug/kg	6380	2.00E+03	**3.19E+00**	5.15E+05	1.24E-02
618-1_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	300000	2.20E+05	**1.36E+00**	5.80E+06	5.17E-02
618-1_Shallow	non-Rad	Mercury	7439-97-6	ug/kg	3.10E+01	1.00E+02	3.10E-01	1.87E+03	1.66E-02
618-1_Shallow	non-Rad	Molybdenum	7439-98-7	ug/kg	3.36E+02	2.00E+03	1.68E-01	1.40E+04	2.40E-02
618-1_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	8.15E+03	3.00E+04	2.72E-01	3.26E+04	2.50E-01
618-1_Shallow	non-Rad	Nitrate	14797-55-8	ug/kg	1600	No Value	--	3.40E+08	4.71E-06
618-1_Shallow	non-Rad	Nitrogen in Nitrite and Nitrate	NO2+NO3-N	ug/kg	300	No Value	--	No Value	--
618-1_Shallow	Rad	RADs SOF	--	pCi/g	--	--	2.67E-04	--	1.19E-03
618-1_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.34E-04	--	5.96E-04
618-1_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.93E+00	5.16E+04	3.74E-05	6.37E+03	3.03E-04
618-1_Shallow	Rad	Uranium-238	U-238	pCi/g	1.51E+00	1.57E+04	9.62E-05	5.15E+03	2.93E-04
618-1_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	56300	2.00E+03	**2.82E+01**	3.11E+04	**1.81E+00**

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildife SSL[2]	Hazard Quotient
618-1_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	4.21E+04	5.00E+04	8.42E-01	6.78E+04	6.21E-01
618-1_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	4.22E+03	5.00E+03	8.45E-01	7.86E+05	5.37E-03
618-1_Shallow_Focused	non-Rad	Antimony	7440-36-0	ug/kg	4.55E+02	5.00E+03	9.10E-02	5.98E+03	7.61E-02
618-1_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	ug/kg	3.51E+01	4.00E+04	8.78E-04	3.25E+02	1.08E-01
618-1_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	9.81E+02	4.00E+04	2.45E-02	1.47E+03	6.67E-01
618-1_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	5.60E+01	4.00E+04	1.40E-03	1.47E+03	3.81E-02
618-1_Shallow_Focused	non-Rad	Aroclors HI	--	ug/kg	--	--	2.68E-02	--	8.13E-01
618-1_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	6.09E+03	1.00E+04	6.09E-01	1.90E+05	3.21E-02
618-1_Shallow_Focused	non-Rad	Barium	7440-39-3	ug/kg	1.02E+05	3.30E+05	3.09E-01	1.32E+06	7.73E-02
618-1_Shallow_Focused	non-Rad	Beryllium	7440-41-7	ug/kg	3.71E+02	1.00E+04	3.71E-02	1.39E+04	2.67E-02
618-1_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	3740	5.00E+02	**7.48E+00**	1.33E+05	2.81E-02
618-1_Shallow_Focused	non-Rad	Cadmium	7440-43-9	ug/kg	2.66E+02	4.00E+03	6.65E-02	1.63E+03	1.63E-01
618-1_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	19500	4.00E+02	**4.88E+01**	3.82E+04	5.10E-01
618-1_Shallow_Focused	non-Rad	Cobalt	7440-48-4	ug/kg	8.60E+03	1.30E+04	6.62E-01	1.11E+05	7.75E-02
618-1_Shallow_Focused	non-Rad	Copper	7440-50-8	ug/kg	2.38E+04	5.00E+04	4.76E-01	1.07E+05	2.22E-01
618-1_Shallow_Focused	non-Rad	Fluoride	16984-48-8	ug/kg	900	No Value	--	2.28E+06	3.95E-04
618-1_Shallow_Focused	non-Rad	Lead	7439-92-1	ug/kg	6.21E+03	5.00E+04	1.24E-01	3.56E+04	1.74E-01
618-1_Shallow_Focused	non-Rad	Lithium	7439-93-2	ug/kg	13300	2.00E+03	**6.65E+00**	5.15E+05	2.58E-02
618-1_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	403000	2.20E+05	**1.83E+00**	5.80E+06	6.95E-02
618-1_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	198	1.00E+02	**1.98E+00**	1.87E+03	1.06E-01
618-1_Shallow_Focused	non-Rad	Molybdenum	7439-98-7	ug/kg	3.56E+02	2.00E+03	1.78E-01	1.40E+04	2.54E-02
618-1_Shallow_Focused	non-Rad	Nickel	7440-02-0	ug/kg	1.68E+04	3.00E+04	5.60E-01	3.26E+04	5.15E-01
618-1_Shallow_Focused	non-Rad	Nitrate	14797-55-8	ug/kg	3800	No Value	--	3.40E+08	1.12E-05
618-1_Shallow_Focused	non-Rad	Nitrogen in Nitrite and Nitrate	NO2+NO3-N	ug/kg	260	No Value	--	No Value	--
618-1_Shallow_Focused	non-Rad	Silver	7440-22-4	ug/kg	1.12E+03	2.00E+03	5.60E-01	4.96E+04	2.26E-02
618-1_Shallow_Focused	non-Rad	Uranium	7440-61-1	ug/kg	7080	5.00E+03	**1.42E+00**	7.86E+05	9.01E-03
618-1_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	1.13E+01	5.16E+04	2.19E-04	6.37E+03	1.77E-03
618-1_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	9.87E-01	2.74E+04	3.60E-05	4.36E+03	2.26E-04
618-1_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	8.23E+00	1.57E+04	5.24E-04	5.15E+03	1.60E-03
618-1_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	64700	2.00E+03	**3.24E+01**	3.11E+04	**2.08E+00**
618-1_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	68100	5.00E+04	**1.36E+00**	6.78E+04	**1.00E+00**
618-1_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	24957	5.00E+03	**4.99E+00**	7.86E+05	3.18E-02
618-12_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	8.52E+03	1.00E+04	8.52E-01	1.90E+05	4.49E-02
618-12_Shallow	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	6.30E+01	1.00E+05	6.30E-04	4.54E+04	1.39E-03
618-12_Shallow	non-Rad	Butylbenzylphthalate	85-68-7	ug/kg	60	No Value	--	No Value	--
618-12_Shallow	Rad	RADs SOF	--	pCi/g	--	--	6.99E-04	--	2.19E-03
618-12_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	4.71E-01	2.74E+04	1.72E-05	4.36E+03	1.08E-04
618-12_Shallow	Rad	Uranium-238	U-238	pCi/g	1.07E+01	1.57E+04	6.82E-04	5.15E+03	2.08E-03
618-12_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	32092	5.00E+03	**6.42E+00**	7.86E+05	4.08E-02
618-13_Shallow	non-Rad	Acetone	67-64-1	ug/kg	8.64	No Value	--	No Value	--
618-13_Shallow	non-Rad	Antimony	7440-36-0	ug/kg	3.12E+02	5.00E+03	6.24E-02	5.98E+03	5.22E-02
618-13_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	3.50E+03	1.00E+04	3.50E-01	1.90E+05	1.84E-02
618-13_Shallow	non-Rad	Barium	7440-39-3	ug/kg	7.40E+04	3.30E+05	2.24E-01	1.32E+06	5.61E-02
618-13_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	2.12E+02	1.00E+04	2.12E-02	1.39E+04	1.53E-02
618-13_Shallow	non-Rad	Boron	7440-42-8	ug/kg	1050	5.00E+02	**2.10E+00**	1.33E+05	7.89E-03
618-13_Shallow	non-Rad	Cadmium	7440-43-9	ug/kg	6.30E+01	4.00E+03	1.58E-02	1.63E+03	3.87E-02
618-13_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	3.80E-02	2.21E+03	1.72E-05	9.24E+02	4.11E-05
618-13_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	10700	4.00E+02	**2.68E+01**	3.82E+04	2.80E-01
618-13_Shallow	non-Rad	Cobalt	7440-48-4	ug/kg	6.29E+03	1.30E+04	4.84E-01	1.11E+05	5.67E-02
618-13_Shallow	non-Rad	Copper	7440-50-8	ug/kg	1.15E+04	5.00E+04	2.30E-01	1.07E+05	1.07E-01
618-13_Shallow	non-Rad	Lead	7439-92-1	ug/kg	3.62E+03	5.00E+04	7.24E-02	3.56E+04	1.02E-01
618-13_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	344000	2.20E+05	**1.56E+00**	5.80E+06	5.93E-02
618-13_Shallow	non-Rad	Methylene chloride	75-09-2	ug/kg	5.12	No Value	--	1.66E+05	3.08E-05
618-13_Shallow	non-Rad	Molybdenum	7439-98-7	ug/kg	4.20E+02	2.00E+03	2.10E-01	1.40E+04	3.00E-02
618-13_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	1.24E+04	3.00E+04	4.13E-01	3.26E+04	3.80E-01

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildife SSL[2]	Hazard Quotient
618-13_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.62E-04	--	6.72E-04
618-13_Shallow	non-Rad	Tin	7440-31-5	ug/kg	1.05E+03	5.00E+04	2.10E-02	2.04E+05	5.15E-03
618-13_Shallow	non-Rad	Uranium	7440-61-1	ug/kg	1.75E+03	5.00E+03	3.50E-01	7.86E+05	2.23E-03
618-13_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.92E+00	5.16E+04	3.72E-05	6.37E+03	3.01E-04
618-13_Shallow	Rad	Uranium-238	U-238	pCi/g	1.70E+00	1.57E+04	1.08E-04	5.15E+03	3.30E-04
618-13_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	55800	2.00E+03	**2.79E+01**	3.11E+04	**1.79E+00**
618-13_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	4.14E+04	5.00E+04	8.28E-01	6.78E+04	6.11E-01
618-13_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5061	5.00E+03	**1.01E+00**	7.86E+05	6.44E-03
618-13_Shallow_Focused	non-Rad	Acetone	67-64-1	ug/kg	5.9	No Value	--	No Value	--
618-13_Shallow_Focused	non-Rad	Antimony	7440-36-0	ug/kg	2.33E+02	5.00E+03	4.66E-02	5.98E+03	3.90E-02
618-13_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	3.39E+03	1.00E+04	3.39E-01	1.90E+05	1.78E-02
618-13_Shallow_Focused	non-Rad	Barium	7440-39-3	ug/kg	5.77E+04	3.30E+05	1.75E-01	1.32E+06	4.37E-02
618-13_Shallow_Focused	non-Rad	Beryllium	7440-41-7	ug/kg	1.84E+02	1.00E+04	1.84E-02	1.39E+04	1.32E-02
618-13_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	960	5.00E+02	**1.92E+00**	1.33E+05	7.22E-03
618-13_Shallow_Focused	non-Rad	Cadmium	7440-43-9	ug/kg	4.70E+01	4.00E+03	1.18E-02	1.63E+03	2.88E-02
618-13_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	8740	4.00E+02	**2.19E+01**	3.82E+04	2.29E-01
618-13_Shallow_Focused	non-Rad	Cobalt	7440-48-4	ug/kg	5.71E+03	1.30E+04	4.39E-01	1.11E+05	5.14E-02
618-13_Shallow_Focused	non-Rad	Copper	7440-50-8	ug/kg	1.01E+04	5.00E+04	2.02E-01	1.07E+05	9.44E-02
618-13_Shallow_Focused	non-Rad	Hexavalent Chromium	18540-29-9	ug/kg	150	No Value	--	1.25E+06	1.20E-04
618-13_Shallow_Focused	non-Rad	Lead	7439-92-1	ug/kg	4.94E+03	5.00E+04	9.88E-02	3.56E+04	1.39E-01
618-13_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	268000	2.20E+05	**1.22E+00**	5.80E+06	4.62E-02
618-13_Shallow_Focused	non-Rad	Methylene chloride	75-09-2	ug/kg	5.03	No Value	--	1.66E+05	3.03E-05
618-13_Shallow_Focused	non-Rad	Molybdenum	7439-98-7	ug/kg	2.97E+02	2.00E+03	1.49E-01	1.40E+04	2.12E-02
618-13_Shallow_Focused	non-Rad	Nickel	7440-02-0	ug/kg	1.00E+04	3.00E+04	3.33E-01	3.26E+04	3.07E-01
618-13_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	8.32E-05	--	3.65E-04
618-13_Shallow_Focused	non-Rad	Tin	7440-31-5	ug/kg	7.45E+02	5.00E+04	1.49E-02	2.04E+05	3.65E-03
618-13_Shallow_Focused	non-Rad	Uranium	7440-61-1	ug/kg	1.50E+03	5.00E+03	3.00E-01	7.86E+05	1.91E-03
618-13_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	1.14E+00	5.16E+04	2.21E-05	6.37E+03	1.79E-04
618-13_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	9.59E-01	1.57E+04	6.11E-05	5.15E+03	1.86E-04
618-13_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	48600	2.00E+03	**2.43E+01**	3.11E+04	**1.56E+00**
618-13_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	3.71E+04	5.00E+04	7.42E-01	6.78E+04	5.47E-01
618-13_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.85E+03	5.00E+03	5.71E-01	7.86E+05	3.63E-03
618-2_Overburden	non-Rad	Arsenic	7440-38-2	ug/kg	2.70E+03	1.00E+04	2.70E-01	1.90E+05	1.42E-02
618-2_Overburden	non-Rad	Barium	7440-39-3	ug/kg	7.47E+04	3.30E+05	2.26E-01	1.32E+06	5.66E-02
618-2_Overburden	Rad	Cesium-137	10045-97-3	pCi/g	5.80E-02	2.21E+03	2.62E-05	9.24E+02	6.28E-05
618-2_Overburden	non-Rad	Chromium	7440-47-3	ug/kg	6600	4.00E+02	**1.65E+01**	3.82E+04	1.73E-01
618-2_Overburden	non-Rad	Lead	7439-92-1	ug/kg	4.30E+03	5.00E+04	8.60E-02	3.56E+04	1.21E-01
618-2_Overburden	Rad	RADs SOF	--	pCi/g	--	--	7.63E-05	--	2.79E-04
618-2_Overburden	non-Rad	Selenium	7782-49-2	ug/kg	1000	5.20E+02	**1.92E+00**	1.90E+03	5.26E-01
618-2_Overburden	non-Rad	Tin	7440-31-5	ug/kg	2.70E+03	5.00E+04	5.40E-02	2.04E+05	1.32E-02
618-2_Overburden	non-Rad	Uranium	7440-61-1	ug/kg	1.14E+00	5.00E+03	2.28E-04	7.86E+05	1.45E-06
618-2_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	6.44E-01	5.16E+04	1.25E-05	6.37E+03	1.01E-04
618-2_Overburden	Rad	Uranium-238	U-238	pCi/g	5.91E-01	1.57E+04	3.76E-05	5.15E+03	1.15E-04
618-2_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.75E+03	5.00E+03	3.50E-01	7.86E+05	2.23E-03
618-2_Shallow	Rad	Americium-241	14596-10-2	pCi/g	8.13E-01	2.15E+04	3.78E-05	4.84E+03	1.68E-04
618-2_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	1.90E+03	1.00E+04	1.90E-01	1.90E+05	1.00E-02
618-2_Shallow	non-Rad	Barium	7440-39-3	ug/kg	7.91E+04	3.30E+05	2.40E-01	1.32E+06	5.99E-02
618-2_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	2.24E+00	2.21E+03	1.01E-03	9.24E+02	2.42E-03

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-2_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	7100	4.00E+02	**1.78E+01**	3.82E+04	1.86E-01
618-2_Shallow	non-Rad	Lead	7439-92-1	ug/kg	5.60E+03	5.00E+04	1.12E-01	3.56E+04	1.57E-01
618-2_Shallow	Rad	Plutonium-239/240	PU-239/240	pCi/g	7.67E+00	1.27E+04	6.04E-04	6.27E+03	1.22E-03
618-2_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.84E-03	--	4.63E-03
618-2_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	760	5.20E+02	**1.46E+00**	1.90E+03	4.00E-01
618-2_Shallow	non-Rad	Tin	7440-31-5	ug/kg	2.40E+03	5.00E+04	4.80E-02	2.04E+05	1.18E-02
618-2_Shallow	non-Rad	Uranium	7440-61-1	ug/kg	4.53E+03	5.00E+03	9.06E-01	7.86E+05	5.76E-03
618-2_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	2.20E+00	5.16E+04	4.26E-05	6.37E+03	3.45E-04
618-2_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	2.14E-01	2.74E+04	7.81E-06	4.36E+03	4.91E-05
618-2_Shallow	Rad	Uranium-238	U-238	pCi/g	2.20E+00	1.57E+04	1.40E-04	5.15E+03	4.27E-04
618-2_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5852	5.00E+03	**1.17E+00**	7.86E+05	7.45E-03
618-2_Staging Pile	Rad	Americium-241	14596-10-2	pCi/g	8.18E-01	2.15E+04	3.80E-05	4.84E+03	1.69E-04
618-2_Staging Pile	non-Rad	Arsenic	7440-38-2	ug/kg	3.06E+03	1.00E+04	3.06E-01	1.90E+05	1.61E-02
618-2_Staging Pile	non-Rad	Barium	7440-39-3	ug/kg	6.77E+04	3.30E+05	2.05E-01	1.32E+06	5.13E-02
618-2_Staging Pile	Rad	Cesium-137	10045-97-3	pCi/g	9.50E-02	2.21E+03	4.30E-05	9.24E+02	1.03E-04
618-2_Staging Pile	non-Rad	Chromium	7440-47-3	ug/kg	6424.1864	4.00E+02	**1.61E+01**	3.82E+04	1.68E-01
618-2_Staging Pile	non-Rad	Lead	7439-92-1	ug/kg	4.01E+03	5.00E+04	8.02E-02	3.56E+04	1.13E-01
618-2_Staging Pile	Rad	Plutonium-239/240	PU-239/240	pCi/g	1.00E+01	1.27E+04	7.87E-04	6.27E+03	1.59E-03
618-2_Staging Pile	Rad	RADs SOF	--	pCi/g	--	--	1.04E-03	--	8.14E-03
618-2_Staging Pile	Rad	Tritium	10028-17-8	pCi/g	2.33E+00	1.68E+06	1.39E-06	4.20E+02	5.55E-03
618-2_Staging Pile	non-Rad	Uranium	7440-61-1	ug/kg	5022	5.00E+03	**1.00E+00**	7.86E+05	6.39E-03
618-2_Staging Pile	Rad	Uranium-233/234	U-233/234	pCi/g	2.04E+00	5.16E+04	3.95E-05	6.37E+03	3.20E-04
618-2_Staging Pile	Rad	Uranium-235	15117-96-1	pCi/g	1.23E-01	2.74E+04	4.50E-06	4.36E+03	2.83E-05
618-2_Staging Pile	Rad	Uranium-238	U-238	pCi/g	1.97E+00	1.57E+04	1.26E-04	5.15E+03	3.83E-04
618-2_Staging Pile	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	9201	5.00E+03	**1.84E+00**	7.86E+05	1.17E-02
618-3_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	2.80E+03	1.00E+04	2.80E-01	1.90E+05	1.47E-02
618-3_Shallow	non-Rad	Barium	7440-39-3	ug/kg	7.65E+04	3.30E+05	2.32E-01	1.32E+06	5.80E-02
618-3_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	9700	4.00E+02	**2.43E+01**	3.82E+04	2.54E-01
618-3_Shallow	non-Rad	Lead	7439-92-1	ug/kg	3.90E+03	5.00E+04	7.80E-02	3.56E+04	1.10E-01
618-3_Shallow	Rad	RADs SOF	--	pCi/g	--	--	6.07E-05	--	2.51E-04
618-3_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	659	5.20E+02	**1.27E+00**	1.90E+03	3.47E-01
618-3_Shallow	non-Rad	Uranium	7440-61-1	ug/kg	1.61E+03	5.00E+03	3.22E-01	7.86E+05	2.05E-03
618-3_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	6.77E-01	5.16E+04	1.31E-05	6.37E+03	1.06E-04
618-3_Shallow	Rad	Uranium-238	U-238	pCi/g	7.47E-01	1.57E+04	4.76E-05	5.15E+03	1.45E-04
618-3_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.22E+03	5.00E+03	4.45E-01	7.86E+05	2.83E-03
618-3_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	6.78E-03	--	2.90E-02
618-3_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	7.96E+01	5.16E+04	1.54E-03	6.37E+03	1.25E-02
618-3_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	4.79E+00	2.74E+04	1.75E-04	4.36E+03	1.10E-03
618-3_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	7.94E+01	1.57E+04	5.06E-03	5.15E+03	1.54E-02
618-3_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	238577	5.00E+03	**4.77E+01**	7.86E+05	3.04E-01
618-4_Overburden_2	non-Rad	Arsenic	7440-38-2	ug/kg	2.50E+03	1.00E+04	2.50E-01	1.90E+05	1.32E-02
618-4_Overburden_2	non-Rad	Lead	7439-92-1	ug/kg	4.70E+03	5.00E+04	9.40E-02	3.56E+04	1.32E-01
618-4_Overburden_2	Rad	RADs SOF	--	pCi/g	--	--	1.15E-04	--	4.78E-04
618-4_Overburden_2	Rad	Uranium-233/234	U-233/234	pCi/g	1.30E+00	5.16E+04	2.52E-05	6.37E+03	2.04E-04
618-4_Overburden_2	Rad	Uranium-238	U-238	pCi/g	1.41E+00	1.57E+04	8.98E-05	5.15E+03	2.74E-04
618-4_Overburden_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	4.20E+03	5.00E+03	8.39E-01	7.86E+05	5.34E-03
618-4_Overburden_3	non-Rad	Lead	7439-92-1	ug/kg	5.00E+03	5.00E+04	1.00E-01	3.56E+04	1.40E-01
618-4_Overburden_3	Rad	RADs SOF	--	pCi/g	--	--	3.73E-05	--	1.59E-04

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-4_Overburden_3	Rad	Uranium-233/234	U-233/234	pCi/g	4.24E-01	5.16E+04	8.22E-06	6.37E+03	6.66E-05
618-4_Overburden_3	Rad	Uranium-235	15117-96-1	pCi/g	3.20E-02	2.74E+04	1.17E-06	4.36E+03	7.34E-06
618-4_Overburden_3	Rad	Uranium-238	U-238	pCi/g	4.38E-01	1.57E+04	2.79E-05	5.15E+03	8.50E-05
618-4_Overburden_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.17E+03	5.00E+03	2.34E-01	7.86E+05	1.49E-03
618-4_Overburden_4	non-Rad	Lead	7439-92-1	ug/kg	4.80E+03	5.00E+04	9.60E-02	3.56E+04	1.35E-01
618-4_Overburden_4	Rad	RADs SOF	--	pCi/g	--	--	7.83E-05	--	3.31E-04
618-4_Overburden_4	Rad	Uranium-233/234	U-233/234	pCi/g	9.42E-01	5.16E+04	1.83E-05	6.37E+03	1.48E-04
618-4_Overburden_4	Rad	Uranium-238	U-238	pCi/g	9.42E-01	1.57E+04	6.00E-05	5.15E+03	1.83E-04
618-4_Overburden_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.32E+03	5.00E+03	4.65E-01	7.86E+05	2.96E-03
618-4_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	3.20E+03	1.00E+04	3.20E-01	1.90E+05	1.68E-02
618-4_Shallow	non-Rad	Lead	7439-92-1	ug/kg	4.90E+04	5.00E+04	9.80E-01	3.56E+04	**1.38E+00**
618-4_Shallow	Rad	RADs SOF	--	pCi/g	--	--	2.58E-04	--	1.10E-03
618-4_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	3.22E+00	5.16E+04	6.24E-05	6.37E+03	5.05E-04
618-4_Shallow	Rad	Uranium-238	U-238	pCi/g	3.07E+00	1.57E+04	1.96E-04	5.15E+03	5.96E-04
618-4_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	7456	5.00E+03	**1.49E+00**	7.86E+05	9.49E-03
618-5_Overburden	non-Rad	Arsenic	7440-38-2	ug/kg	3.40E+03	1.00E+04	3.40E-01	1.90E+05	1.79E-02
618-5_Overburden	non-Rad	Cadmium	7440-43-9	ug/kg	1.70E+02	4.00E+03	4.25E-02	1.63E+03	1.04E-01
618-5_Overburden	non-Rad	Chromium	7440-47-3	ug/kg	9700	4.00E+02	**2.43E+01**	3.82E+04	2.54E-01
618-5_Overburden	non-Rad	Lead	7439-92-1	ug/kg	7.50E+03	5.00E+04	1.50E-01	3.56E+04	2.11E-01
618-5_Overburden	Rad	RADs SOF	--	pCi/g	--	--	3.70E-04	--	1.54E-03
618-5_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	4.14E+00	5.16E+04	8.02E-05	6.37E+03	6.50E-04
618-5_Overburden	Rad	Uranium-238	U-238	pCi/g	4.56E+00	1.57E+04	2.90E-04	5.15E+03	8.85E-04
618-5_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	9773	5.00E+03	**1.95E+00**	7.86E+05	1.24E-02
618-5_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	4.30E+03	1.00E+04	4.30E-01	1.90E+05	2.26E-02
618-5_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	11300	4.00E+02	**2.83E+01**	3.82E+04	2.96E-01
618-5_Shallow	non-Rad	Lead	7439-92-1	ug/kg	6.10E+03	5.00E+04	1.22E-01	3.56E+04	1.71E-01
618-5_Shallow	Rad	RADs SOF	--	pCi/g	--	--	8.51E-05	--	3.51E-04
618-5_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	9.38E-01	5.16E+04	1.82E-05	6.37E+03	1.47E-04
618-5_Shallow	Rad	Uranium-238	U-238	pCi/g	1.05E+00	1.57E+04	6.69E-05	5.15E+03	2.04E-04
618-5_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.85E+03	5.00E+03	5.70E-01	7.86E+05	3.62E-03
618-5_Staging Pile_4	non-Rad	Arsenic	7440-38-2	ug/kg	3.30E+03	1.00E+04	3.30E-01	1.90E+05	1.74E-02
618-5_Staging Pile_4	non-Rad	Cadmium	7440-43-9	ug/kg	5.00E+01	4.00E+03	1.25E-02	1.63E+03	3.07E-02
618-5_Staging Pile_4	non-Rad	Chromium	7440-47-3	ug/kg	11800	4.00E+02	**2.95E+01**	3.82E+04	3.09E-01
618-5_Staging Pile_4	non-Rad	Lead	7439-92-1	ug/kg	5.30E+03	5.00E+04	1.06E-01	3.56E+04	1.49E-01
618-5_Staging Pile_4	Rad	RADs SOF	--	pCi/g	--	--	9.43E-05	--	4.00E-04
618-5_Staging Pile_4	Rad	Uranium-233/234	U-233/234	pCi/g	1.15E+00	5.16E+04	2.23E-05	6.37E+03	1.81E-04
618-5_Staging Pile_4	Rad	Uranium-238	U-238	pCi/g	1.13E+00	1.57E+04	7.20E-05	5.15E+03	2.19E-04
618-5_Staging Pile_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	3.36E+03	5.00E+03	6.73E-01	7.86E+05	4.28E-03
618-5_Staging Pile_5	non-Rad	Arsenic	7440-38-2	ug/kg	2.70E+03	1.00E+04	2.70E-01	1.90E+05	1.42E-02
618-5_Staging Pile_5	non-Rad	Chromium	7440-47-3	ug/kg	10300	4.00E+02	**2.58E+01**	3.82E+04	2.70E-01
618-5_Staging Pile_5	non-Rad	Lead	7439-92-1	ug/kg	3.90E+03	5.00E+04	7.80E-02	3.56E+04	1.10E-01
618-5_Staging Pile_5	Rad	RADs SOF	--	pCi/g	--	--	1.45E-04	--	6.10E-04
618-5_Staging Pile_5	Rad	Uranium-233/234	U-233/234	pCi/g	1.52E+00	5.16E+04	2.95E-05	6.37E+03	2.39E-04
618-5_Staging Pile_5	Rad	Uranium-235	15117-96-1	pCi/g	1.68E-01	2.74E+04	6.13E-06	4.36E+03	3.85E-05
618-5_Staging Pile_5	Rad	Uranium-238	U-238	pCi/g	1.71E+00	1.57E+04	1.09E-04	5.15E+03	3.32E-04
618-5_Staging Pile_5	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	4.33E+03	5.00E+03	8.65E-01	7.86E+05	5.50E-03
618-7_Shallow_1	non-Rad	Antimony	7440-36-0	ug/kg	5.59E+02	5.00E+03	1.12E-01	5.98E+03	9.34E-02
618-7_Shallow_1	non-Rad	Arsenic	7440-38-2	ug/kg	1.89E+03	1.00E+04	1.89E-01	1.90E+05	9.95E-03
618-7_Shallow_1	non-Rad	Barium	7440-39-3	ug/kg	6.89E+04	3.30E+05	2.09E-01	1.32E+06	5.22E-02

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildife SSL[2]	Hazard Quotient
618-7_Shallow_1	non-Rad	Beryllium	7440-41-7	ug/kg	2.77E+02	1.00E+04	2.77E-02	1.39E+04	1.99E-02
618-7_Shallow_1	non-Rad	Cadmium	7440-43-9	ug/kg	6.54E+01	4.00E+03	1.63E-02	1.63E+03	4.01E-02
618-7_Shallow_1	Rad	Cesium-137	10045-97-3	pCi/g	8.20E-02	2.21E+03	3.71E-05	9.24E+02	8.87E-05
618-7_Shallow_1	non-Rad	Chromium	7440-47-3	ug/kg	10227.486	4.00E+02	**2.56E+01**	3.82E+04	2.68E-01
618-7_Shallow_1	non-Rad	Cobalt	7440-48-4	ug/kg	9.15E+03	1.30E+04	7.04E-01	1.11E+05	8.25E-02
618-7_Shallow_1	non-Rad	Copper	7440-50-8	ug/kg	1.61E+04	5.00E+04	3.22E-01	1.07E+05	1.51E-01
618-7_Shallow_1	non-Rad	Lead	7439-92-1	ug/kg	1.46E+04	5.00E+04	2.91E-01	3.56E+04	4.09E-01
618-7_Shallow_1	non-Rad	Manganese	7439-96-5	ug/kg	326067.08	2.20E+05	**1.48E+00**	5.80E+06	5.62E-02
618-7_Shallow_1	non-Rad	Mercury	7439-97-6	ug/kg	4.43E+01	1.00E+02	4.43E-01	1.87E+03	2.37E-02
618-7_Shallow_1	non-Rad	Nickel	7440-02-0	ug/kg	2.10E+04	3.00E+04	6.99E-01	3.26E+04	6.43E-01
618-7_Shallow_1	Rad	RADs SOF	--	pCi/g	--	--	3.49E-04	--	1.43E-03
618-7_Shallow_1	non-Rad	Tin	7440-31-5	ug/kg	1.55E+03	5.00E+04	3.09E-02	2.04E+05	7.58E-03
618-7_Shallow_1	Rad	Uranium-233/234	U-233/234	pCi/g	3.61E+00	5.16E+04	7.01E-05	6.37E+03	5.67E-04
618-7_Shallow_1	Rad	Uranium-235	15117-96-1	pCi/g	3.64E-01	2.74E+04	1.33E-05	4.36E+03	8.34E-05
618-7_Shallow_1	Rad	Uranium-238	U-238	pCi/g	3.57E+00	1.57E+04	2.28E-04	5.15E+03	6.94E-04
618-7_Shallow_1	non-Rad	Vanadium	7440-62-2	ug/kg	74575.766	2.00E+03	**3.73E+01**	3.11E+04	**2.40E+00**
618-7_Shallow_1	non-Rad	Zinc	7440-66-6	ug/kg	4.92E+04	5.00E+04	9.84E-01	6.78E+04	7.25E-01
618-7_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	10814	5.00E+03	**2.16E+00**	7.86E+05	1.38E-02
618-7_Shallow_2	non-Rad	Antimony	7440-36-0	ug/kg	6.60E+02	5.00E+03	1.32E-01	5.98E+03	1.10E-01
618-7_Shallow_2	non-Rad	Arsenic	7440-38-2	ug/kg	2.50E+03	1.00E+04	2.50E-01	1.90E+05	1.32E-02
618-7_Shallow_2	non-Rad	Barium	7440-39-3	ug/kg	7.38E+04	3.30E+05	2.24E-01	1.32E+06	5.59E-02
618-7_Shallow_2	non-Rad	Beryllium	7440-41-7	ug/kg	4.40E+02	1.00E+04	4.40E-02	1.39E+04	3.17E-02
618-7_Shallow_2	non-Rad	Chromium	7440-47-3	ug/kg	6800	4.00E+02	**1.70E+01**	3.82E+04	1.78E-01
618-7_Shallow_2	non-Rad	Cobalt	7440-48-4	ug/kg	9.30E+03	1.30E+04	7.15E-01	1.11E+05	8.38E-02
618-7_Shallow_2	non-Rad	Copper	7440-50-8	ug/kg	1.36E+04	5.00E+04	2.72E-01	1.07E+05	1.27E-01
618-7_Shallow_2	non-Rad	Lead	7439-92-1	ug/kg	2.80E+03	5.00E+04	5.60E-02	3.56E+04	7.87E-02
618-7_Shallow_2	non-Rad	Manganese	7439-96-5	ug/kg	364000	2.20E+05	**1.65E+00**	5.80E+06	6.28E-02
618-7_Shallow_2	non-Rad	Mercury	7439-97-6	ug/kg	2.00E+01	1.00E+02	2.00E-01	1.87E+03	1.07E-02
618-7_Shallow_2	non-Rad	Nickel	7440-02-0	ug/kg	9.70E+03	3.00E+04	3.23E-01	3.26E+04	2.98E-01
618-7_Shallow_2	Rad	RADs SOF	--	pCi/g	--	--	4.50E-05	--	1.93E-04
618-7_Shallow_2	non-Rad	Tin	7440-31-5	ug/kg	1.50E+03	5.00E+04	3.00E-02	2.04E+05	7.35E-03
618-7_Shallow_2	Rad	Uranium-233/234	U-233/234	pCi/g	5.66E-01	5.16E+04	1.10E-05	6.37E+03	8.89E-05
618-7_Shallow_2	Rad	Uranium-238	U-238	pCi/g	5.34E-01	1.57E+04	3.40E-05	5.15E+03	1.04E-04
618-7_Shallow_2	non-Rad	Vanadium	7440-62-2	ug/kg	74700	2.00E+03	**3.74E+01**	3.11E+04	**2.40E+00**
618-7_Shallow_2	non-Rad	Zinc	7440-66-6	ug/kg	4.62E+04	5.00E+04	9.24E-01	6.78E+04	6.81E-01
618-7_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.57E+03	5.00E+03	3.15E-01	7.86E+05	2.00E-03
618-7_Shallow_3	non-Rad	Antimony	7440-36-0	ug/kg	4.50E+02	5.00E+03	9.00E-02	5.98E+03	7.53E-02
618-7_Shallow_3	non-Rad	Arsenic	7440-38-2	ug/kg	2.80E+03	1.00E+04	2.80E-01	1.90E+05	1.47E-02
618-7_Shallow_3	non-Rad	Barium	7440-39-3	ug/kg	8.25E+04	3.30E+05	2.50E-01	1.32E+06	6.25E-02
618-7_Shallow_3	non-Rad	Beryllium	7440-41-7	ug/kg	3.10E+02	1.00E+04	3.10E-02	1.39E+04	2.23E-02
618-7_Shallow_3	non-Rad	Cadmium	7440-43-9	ug/kg	1.90E+02	4.00E+03	4.75E-02	1.63E+03	1.17E-01
618-7_Shallow_3	non-Rad	Chromium	7440-47-3	ug/kg	10100	4.00E+02	**2.53E+01**	3.82E+04	2.64E-01
618-7_Shallow_3	non-Rad	Cobalt	7440-48-4	ug/kg	8.60E+03	1.30E+04	6.62E-01	1.11E+05	7.75E-02
618-7_Shallow_3	non-Rad	Copper	7440-50-8	ug/kg	1.36E+04	5.00E+04	2.72E-01	1.07E+05	1.27E-01
618-7_Shallow_3	non-Rad	Lead	7439-92-1	ug/kg	4.30E+03	5.00E+04	8.60E-02	3.56E+04	1.21E-01
618-7_Shallow_3	non-Rad	Manganese	7439-96-5	ug/kg	357000	2.20E+05	**1.62E+00**	5.80E+06	6.16E-02
618-7_Shallow_3	non-Rad	Mercury	7439-97-6	ug/kg	2.00E+01	1.00E+02	2.00E-01	1.87E+03	1.07E-02

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildife SSL[2]	Hazard Quotient
618-7_Shallow_3	non-Rad	Nickel	7440-02-0	ug/kg	1.01E+04	3.00E+04	3.37E-01	3.26E+04	3.10E-01
618-7_Shallow_3	Rad	RADs SOF	--	pCi/g	--	--	8.40E-05	--	3.71E-04
618-7_Shallow_3	non-Rad	Tin	7440-31-5	ug/kg	1.80E+03	5.00E+04	3.60E-02	2.04E+05	8.82E-03
618-7_Shallow_3	Rad	Uranium-233/234	U-233/234	pCi/g	1.07E+00	5.16E+04	2.07E-05	6.37E+03	1.68E-04
618-7_Shallow_3	Rad	Uranium-235	15117-96-1	pCi/g	8.50E-02	2.74E+04	3.10E-06	4.36E+03	1.95E-05
618-7_Shallow_3	Rad	Uranium-238	U-238	pCi/g	9.45E-01	1.57E+04	6.02E-05	5.15E+03	1.83E-04
618-7_Shallow_3	non-Rad	Vanadium	7440-62-2	ug/kg	68200	2.00E+03	**3.41E+01**	3.11E+04	**2.19E+00**
618-7_Shallow_3	non-Rad	Zinc	7440-66-6	ug/kg	4.45E+04	5.00E+04	8.90E-01	6.78E+04	6.56E-01
618-7_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.85E+03	5.00E+03	5.70E-01	7.86E+05	3.63E-03
618-7_Shallow_4	non-Rad	Antimony	7440-36-0	ug/kg	2.50E+02	5.00E+03	5.00E-02	5.98E+03	4.18E-02
618-7_Shallow_4	non-Rad	Arsenic	7440-38-2	ug/kg	5.20E+03	1.00E+04	5.20E-01	1.90E+05	2.74E-02
618-7_Shallow_4	non-Rad	Barium	7440-39-3	ug/kg	5.79E+04	3.30E+05	1.75E-01	1.32E+06	4.39E-02
618-7_Shallow_4	non-Rad	Beryllium	7440-41-7	ug/kg	2.20E+02	1.00E+04	2.20E-02	1.39E+04	1.58E-02
618-7_Shallow_4	non-Rad	Cadmium	7440-43-9	ug/kg	9.00E+01	4.00E+03	2.25E-02	1.63E+03	5.52E-02
618-7_Shallow_4	non-Rad	Chromium	7440-47-3	ug/kg	11400	4.00E+02	**2.85E+01**	3.82E+04	2.98E-01
618-7_Shallow_4	non-Rad	Cobalt	7440-48-4	ug/kg	6.70E+03	1.30E+04	5.15E-01	1.11E+05	6.04E-02
618-7_Shallow_4	non-Rad	Copper	7440-50-8	ug/kg	1.32E+04	5.00E+04	2.64E-01	1.07E+05	1.23E-01
618-7_Shallow_4	non-Rad	Lead	7439-92-1	ug/kg	3.00E+03	5.00E+04	6.00E-02	3.56E+04	8.43E-02
618-7_Shallow_4	non-Rad	Manganese	7439-96-5	ug/kg	285000	2.20E+05	**1.30E+00**	5.80E+06	4.91E-02
618-7_Shallow_4	non-Rad	Nickel	7440-02-0	ug/kg	1.29E+04	3.00E+04	4.30E-01	3.26E+04	3.96E-01
618-7_Shallow_4	Rad	RADs SOF	--	pCi/g	--	--	6.20E-05	--	2.56E-04
618-7_Shallow_4	non-Rad	Tin	7440-31-5	ug/kg	7.10E+02	5.00E+04	1.42E-02	2.04E+05	3.48E-03
618-7_Shallow_4	Rad	Uranium-233/234	U-233/234	pCi/g	6.89E-01	5.16E+04	1.34E-05	6.37E+03	1.08E-04
618-7_Shallow_4	Rad	Uranium-238	U-238	pCi/g	7.63E-01	1.57E+04	4.86E-05	5.15E+03	1.48E-04
618-7_Shallow_4	non-Rad	Vanadium	7440-62-2	ug/kg	54800	2.00E+03	**2.74E+01**	3.11E+04	**1.76E+00**
618-7_Shallow_4	non-Rad	Zinc	7440-66-6	ug/kg	3.70E+04	5.00E+04	7.40E-01	6.78E+04	5.46E-01
618-7_Shallow_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.06E+03	5.00E+03	4.13E-01	7.86E+05	2.63E-03
618-7_Shallow_Focused	non-Rad	Acenaphthene	83-32-9	ug/kg	1.50E+02	2.00E+04	7.50E-03	1.10E+06	1.36E-04
618-7_Shallow_Focused	non-Rad	Antimony	7440-36-0	ug/kg	9.80E+02	5.00E+03	1.96E-01	5.98E+03	1.64E-01
618-7_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	ug/kg	6.70E+00	4.00E+04	1.68E-04	3.25E+02	2.06E-02
618-7_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	4.20E+03	1.00E+04	4.20E-01	1.90E+05	2.21E-02
618-7_Shallow_Focused	non-Rad	Barium	7440-39-3	ug/kg	9.28E+04	3.30E+05	2.81E-01	1.32E+06	7.03E-02
618-7_Shallow_Focused	non-Rad	Benzo(a)anthracene	56-55-3	ug/kg	8.80E+01	1.80E+04	4.89E-03	6.40E+04	1.38E-03
618-7_Shallow_Focused	non-Rad	Benzo(a)pyrene	50-32-8	ug/kg	6.60E+01	1.80E+04	3.67E-03	7.64E+04	8.64E-04
618-7_Shallow_Focused	non-Rad	Benzo(b)fluoranthene	205-99-2	ug/kg	5.20E+01	1.80E+04	2.89E-03	3.92E+04	1.33E-03
618-7_Shallow_Focused	non-Rad	Benzo(k)fluoranthene	207-08-9	ug/kg	1.10E+01	1.80E+04	6.11E-04	3.92E+04	2.81E-04
618-7_Shallow_Focused	non-Rad	Beryllium	7440-41-7	ug/kg	3.70E+02	1.00E+04	3.70E-02	1.39E+04	2.66E-02
618-7_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	4.70E+02	1.00E+05	4.70E-03	4.54E+04	1.04E-02
618-7_Shallow_Focused	non-Rad	Cadmium	7440-43-9	ug/kg	6200	4.00E+03	**1.55E+00**	1.63E+03	**3.80E+00**
618-7_Shallow_Focused	Rad	Cesium-137	10045-97-3	pCi/g	1.00E-02	2.21E+03	4.52E-06	9.24E+02	1.08E-05
618-7_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	65900	4.00E+02	**1.65E+02**	3.82E+04	**1.73E+00**
618-7_Shallow_Focused	non-Rad	Chrysene	218-01-9	ug/kg	6.90E+01	1.80E+04	3.83E-03	4.45E+04	1.55E-03
618-7_Shallow_Focused	non-Rad	Cobalt	7440-48-4	ug/kg	1.10E+04	1.30E+04	8.46E-01	1.11E+05	9.91E-02
618-7_Shallow_Focused	non-Rad	Copper	7440-50-8	ug/kg	2.50E+04	5.00E+04	5.00E-01	1.07E+05	2.34E-01
618-7_Shallow_Focused	non-Rad	Dibenz[a,h]anthracene	53-70-3	ug/kg	4.50E+01	1.80E+04	2.50E-03	4.41E+04	1.02E-03
618-7_Shallow_Focused	non-Rad	Di-n-butylphthalate	84-74-2	ug/kg	33	No Value	--	No Value	--
618-7_Shallow_Focused	non-Rad	Fluoranthene	206-44-0	ug/kg	4.80E+01	1.80E+04	2.67E-03	8.39E+05	5.72E-05
618-7_Shallow_Focused	non-Rad	Lead	7439-92-1	ug/kg	6.50E+03	5.00E+04	1.30E-01	3.56E+04	1.83E-01
618-7_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	425000	2.20E+05	**1.93E+00**	5.80E+06	7.33E-02
618-7_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	2.00E+01	1.00E+02	2.00E-01	1.87E+03	1.07E-02
618-7_Shallow_Focused	non-Rad	Nickel	7440-02-0	ug/kg	1.72E+04	3.00E+04	5.73E-01	3.26E+04	5.28E-01

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-7_Shallow_Focused	non-Rad	Pyrene	129-00-0	ug/kg	4.10E+02	1.80E+04	2.28E-02	6.00E+05	6.83E-04
618-7_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	6.60E-04	--	3.19E-03
618-7_Shallow_Focused	non-Rad	Tin	7440-31-5	ug/kg	1.20E+03	5.00E+04	2.40E-02	2.04E+05	5.88E-03
618-7_Shallow_Focused	non-Rad	Total petroleum hydrocarbons - motor oil (high boiling)	TPH/OILH	ug/kg	680000	No Value	--	No Value	--
618-7_Shallow_Focused	Rad	Uranium-233/234	U-233/234	pCi/g	1.09E+01	5.16E+04	2.11E-04	6.37E+03	1.71E-03
618-7_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	9.74E-01	2.74E+04	3.55E-05	4.36E+03	2.23E-04
618-7_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	6.42E+00	1.57E+04	4.09E-04	5.15E+03	1.25E-03
618-7_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	80500	2.00E+03	**4.03E+01**	3.11E+04	**2.59E+00**
618-7_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	52400	5.00E+04	**1.05E+00**	6.78E+04	7.73E-01
618-7_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	19563	5.00E+03	**3.91E+00**	7.86E+05	2.49E-02
618-8_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	4.10E+03	1.00E+04	4.10E-01	1.90E+05	2.16E-02
618-8_Shallow	non-Rad	Barium	7440-39-3	ug/kg	9.76E+04	3.30E+05	2.96E-01	1.32E+06	7.39E-02
618-8_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	12400	4.00E+02	**3.10E+01**	3.82E+04	3.25E-01
618-8_Shallow	non-Rad	Lead	7439-92-1	ug/kg	5.10E+03	5.00E+04	1.02E-01	3.56E+04	1.43E-01
618-8_Shallow	Rad	RADs SOF	--	pCi/g	--	--	6.99E-05	--	3.30E-04
618-8_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	846	5.20E+02	**1.63E+00**	1.90E+03	4.45E-01
618-8_Shallow	non-Rad	Uranium	7440-61-1	ug/kg	1.72E+03	5.00E+03	3.44E-01	7.86E+05	2.19E-03
618-8_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.19E+00	5.16E+04	2.31E-05	6.37E+03	1.87E-04
618-8_Shallow	Rad	Uranium-238	U-238	pCi/g	7.34E-01	1.57E+04	4.68E-05	5.15E+03	1.43E-04
618-8_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.94E+03	5.00E+03	3.87E-01	7.86E+05	2.46E-03
618-9_Shallow_Focused	non-Rad	1,1,2,2-Tetrachloroethane	79-34-5	ug/kg	110	No Value	--	1.65E+05	6.67E-04
618-9_Shallow_Focused	non-Rad	Acetone	67-64-1	ug/kg	680	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aldrin	309-00-2	ug/kg	390	No Value	--	1.65E+02	**2.36E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1016	12674-11-2	ug/kg	1.90E+03	4.00E+04	4.75E-02	1.82E+03	**1.04E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1221	11104-28-2	ug/kg	1.90E+03	4.00E+04	4.75E-02	1.47E+03	**1.29E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1232	11141-16-5	ug/kg	1.90E+03	4.00E+04	4.75E-02	1.44E+03	**1.32E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1242	53469-21-9	ug/kg	1.90E+03	4.00E+04	4.75E-02	1.49E+03	**1.28E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1.90E+03	4.00E+04	4.75E-02	3.25E+02	**5.85E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3.90E+03	4.00E+04	9.75E-02	1.47E+03	**2.65E+00**
618-9_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3.90E+03	4.00E+04	9.75E-02	1.47E+03	**2.65E+00**
618-9_Shallow_Focused	non-Rad	Aroclors HI	--	ug/kg	--	--	4.33E-01	--	**1.61E+01**
618-9_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	11600	1.00E+04	**1.16E+00**	1.90E+05	6.11E-02
618-9_Shallow_Focused	non-Rad	Barium	7440-39-3	ug/kg	9.02E+04	3.30E+05	2.73E-01	1.32E+06	6.83E-02
618-9_Shallow_Focused	non-Rad	Beryllium	7440-41-7	ug/kg	3.30E+02	1.00E+04	3.30E-02	1.39E+04	2.37E-02
618-9_Shallow_Focused	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	5.20E+03	1.00E+05	5.20E-02	4.54E+04	1.15E-01
618-9_Shallow_Focused	non-Rad	Butylbenzylphthalate	85-68-7	ug/kg	2700	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Chlordane	57-74-9	ug/kg	6.90E+01	1.00E+03	6.90E-02	5.04E+04	1.37E-03
618-9_Shallow_Focused	non-Rad	Chloroform	67-66-3	ug/kg	9	No Value	--	1.65E+05	5.45E-05
618-9_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	9700	4.00E+02	**2.43E+01**	3.82E+04	2.54E-01
618-9_Shallow_Focused	non-Rad	Cobalt	7440-48-4	ug/kg	1.14E+04	1.30E+04	8.77E-01	1.11E+05	1.03E-01
618-9_Shallow_Focused	non-Rad	Copper	7440-50-8	ug/kg	1.67E+04	5.00E+04	3.34E-01	1.07E+05	1.56E-01
618-9_Shallow_Focused	non-Rad	Di-n-butylphthalate	84-74-2	ug/kg	7200	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Heptachlor epoxide	1024-57-3	ug/kg	44	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Hexachlorobutadiene	87-68-3	ug/kg	760	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Hexachloroethane	67-72-1	ug/kg	17000	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Lead	7439-92-1	ug/kg	7.70E+03	5.00E+04	1.54E-01	3.56E+04	2.16E-01
618-9_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	359000	2.20E+05	**1.63E+00**	5.80E+06	6.19E-02
618-9_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	330	1.00E+02	**3.30E+00**	1.87E+03	1.76E-01
618-9_Shallow_Focused	non-Rad	Methylene chloride	75-09-2	ug/kg	2300	No Value	--	1.66E+05	1.39E-02

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
618-9_Shallow_Focused	non-Rad	Nickel	7440-02-0	ug/kg	1.06E+04	3.00E+04	3.53E-01	3.26E+04	3.25E-01
618-9_Shallow_Focused	non-Rad	Nitrate	14797-55-8	ug/kg	1670000	No Value	--	3.40E+08	4.91E-03
618-9_Shallow_Focused	Rad	RADs SOF	--	pCi/g	--	--	1.94E-04	--	5.99E-04
618-9_Shallow_Focused	non-Rad	Tetrachloroethene	127-18-4	ug/kg	920	No Value	--	6.98E+04	1.32E-02
618-9_Shallow_Focused	non-Rad	Toluene	108-88-3	ug/kg	9.00E+00	2.00E+05	4.50E-05	5.20E+06	1.73E-06
618-9_Shallow_Focused	non-Rad	Trichloroethene	79-01-6	ug/kg	2	No Value	--	7.01E+04	2.85E-05
618-9_Shallow_Focused	non-Rad	Uranium	7440-61-1	ug/kg	3.10E+03	5.00E+03	6.20E-01	7.86E+05	3.94E-03
618-9_Shallow_Focused	Rad	Uranium-235	15117-96-1	pCi/g	7.10E-02	2.74E+04	2.59E-06	4.36E+03	1.63E-05
618-9_Shallow_Focused	Rad	Uranium-238	U-238	pCi/g	3.00E+00	1.57E+04	1.91E-04	5.15E+03	5.83E-04
618-9_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	59300	2.00E+03	**2.97E+01**	3.11E+04	**1.91E+00**
618-9_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	52300	5.00E+04	**1.05E+00**	6.78E+04	7.71E-01
618-9_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	8963	5.00E+03	**1.79E+00**	7.86E+05	1.14E-02
628-4_Overburden	non-Rad	Arsenic	7440-38-2	ug/kg	3.37E+03	1.00E+04	3.37E-01	1.90E+05	1.78E-02
628-4_Overburden	non-Rad	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	6.09E+01	1.00E+05	6.09E-04	4.54E+04	1.34E-03
628-4_Overburden	Rad	Cesium-137	10045-97-3	pCi/g	3.30E-02	2.21E+03	1.49E-05	9.24E+02	3.57E-05
628-4_Overburden	non-Rad	Lead	7439-92-1	ug/kg	7.28E+03	5.00E+04	1.46E-01	3.56E+04	2.05E-01
628-4_Overburden	Rad	RADs SOF	--	pCi/g	--	--	8.12E-05	--	3.24E-04
628-4_Overburden	Rad	Uranium-233/234	U-233/234	pCi/g	8.70E-01	5.16E+04	1.69E-05	6.37E+03	1.37E-04
628-4_Overburden	Rad	Uranium-238	U-238	pCi/g	7.75E-01	1.57E+04	4.94E-05	5.15E+03	1.51E-04
628-4_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.31E+03	5.00E+03	4.62E-01	7.86E+05	2.94E-03
628-4_Shallow	non-Rad	Aroclor-1242	53469-21-9	ug/kg	4.24E+01	4.00E+04	1.06E-03	1.49E+03	2.84E-02
628-4_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1.12E+03	4.00E+04	2.79E-02	3.25E+02	**3.43E+00**
628-4_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.05E+02	4.00E+04	1.01E-02	1.47E+03	2.75E-01
628-4_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3.78E+01	4.00E+04	9.44E-04	1.47E+03	2.57E-02
628-4_Shallow	non-Rad	Aroclors HI	--	ug/kg	--	--	4.00E-02	--	**3.76E+00**
628-4_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	3.86E+03	1.00E+04	3.86E-01	1.90E+05	2.03E-02
628-4_Shallow	non-Rad	Lead	7439-92-1	ug/kg	99167.457	5.00E+04	**1.98E+00**	3.56E+04	**2.79E+00**
628-4_Shallow	Rad	RADs SOF	--	pCi/g	--	--	9.28E-05	--	4.07E-04
628-4_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.13E+00	5.16E+04	2.19E-05	6.37E+03	1.77E-04
628-4_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	1.12E-01	2.74E+04	4.08E-06	4.36E+03	2.57E-05
628-4_Shallow	Rad	Uranium-238	U-238	pCi/g	1.05E+00	1.57E+04	6.68E-05	5.15E+03	2.04E-04
628-4_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	3.16E+03	5.00E+03	6.33E-01	7.86E+05	4.02E-03
UPR-300-17_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	12420	5.00E+03	**2.48E+00**	7.86E+05	1.58E-02
UPR-300-17_Shallow	non-Rad	Acenaphthene	83-32-9	ug/kg	1.17E+02	2.00E+04	5.85E-03	1.10E+06	1.06E-04
UPR-300-17_Shallow	non-Rad	Anthracene	120-12-7	ug/kg	7.01E+00	2.90E+04	2.42E-04	6.78E+05	1.03E-05
UPR-300-17_Shallow	non-Rad	Antimony	7440-36-0	ug/kg	3.59E+02	5.00E+03	7.17E-02	5.98E+03	6.00E-02
UPR-300-17_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1.97E+03	4.00E+04	4.93E-02	3.25E+02	**6.06E+00**
UPR-300-17_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.50E+02	4.00E+04	1.13E-02	1.47E+03	3.06E-01
UPR-300-17_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	1.13E+02	4.00E+04	2.83E-03	1.47E+03	7.71E-02
UPR-300-17_Shallow	non-Rad	Aroclors HI	--	ug/kg	--	--	6.34E-02	--	**6.44E+00**
UPR-300-17_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	2.57E+03	1.00E+04	2.57E-01	1.90E+05	1.35E-02
UPR-300-17_Shallow	non-Rad	Barium	7440-39-3	ug/kg	8.10E+04	3.30E+05	2.45E-01	1.32E+06	6.14E-02
UPR-300-17_Shallow	non-Rad	Benzo(a)anthracene	56-55-3	ug/kg	5.92E+01	1.80E+04	3.29E-03	6.40E+04	9.26E-04
UPR-300-17_Shallow	non-Rad	Benzo(a)pyrene	50-32-8	ug/kg	4.38E+01	1.80E+04	2.43E-03	7.64E+04	5.73E-04
UPR-300-17_Shallow	non-Rad	Benzo(b)fluoranthene	205-99-2	ug/kg	3.27E+01	1.80E+04	1.82E-03	3.92E+04	8.34E-04
UPR-300-17_Shallow	non-Rad	Benzo(k)fluoranthene	207-08-9	ug/kg	1.00E+01	1.80E+04	5.57E-04	3.92E+04	2.56E-04
UPR-300-17_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	2.40E+02	1.00E+04	2.40E-02	1.39E+04	1.73E-02

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildlife SSL[2]	Hazard Quotient
UPR-300-17_Shallow	non-Rad	Boron	7440-42-8	ug/kg	3902.7336	5.00E+02	**7.81E+00**	1.33E+05	2.93E-02
UPR-300-17_Shallow	non-Rad	Cadmium	7440-43-9	ug/kg	1.73E+02	4.00E+03	4.31E-02	1.63E+03	1.06E-01
UPR-300-17_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	13794.625	4.00E+02	**3.45E+01**	3.82E+04	3.61E-01
UPR-300-17_Shallow	non-Rad	Chrysene	218-01-9	ug/kg	3.93E+01	1.80E+04	2.18E-03	4.45E+04	8.82E-04
UPR-300-17_Shallow	non-Rad	Cobalt	7440-48-4	ug/kg	6.69E+03	1.30E+04	5.14E-01	1.11E+05	6.02E-02
UPR-300-17_Shallow	non-Rad	Copper	7440-50-8	ug/kg	1.51E+04	5.00E+04	3.03E-01	1.07E+05	1.41E-01
UPR-300-17_Shallow	non-Rad	Fluoranthene	206-44-0	ug/kg	3.53E+01	1.80E+04	1.96E-03	8.39E+05	4.21E-05
UPR-300-17_Shallow	non-Rad	Fluorene	86-73-7	ug/kg	2.93E+00	2.90E+04	1.01E-04	1.75E+05	1.67E-05
UPR-300-17_Shallow	non-Rad	Indeno(1,2,3-cd)pyrene	193-39-5	ug/kg	5.85E+00	1.80E+04	3.25E-04	3.57E+04	1.64E-04
UPR-300-17_Shallow	non-Rad	Lead	7439-92-1	ug/kg	1.12E+04	5.00E+04	2.25E-01	3.56E+04	3.16E-01
UPR-300-17_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	285159.32	2.20E+05	**1.30E+00**	5.80E+06	4.92E-02
UPR-300-17_Shallow	non-Rad	Mercury	7439-97-6	ug/kg	6.90E+01	1.00E+02	6.90E-01	1.87E+03	3.69E-02
UPR-300-17_Shallow	non-Rad	Molybdenum	7439-98-7	ug/kg	4.12E+02	2.00E+03	2.06E-01	1.40E+04	2.95E-02
UPR-300-17_Shallow	non-Rad	Naphthalene	91-20-3	ug/kg	4.79E+01	2.90E+04	1.65E-03	1.00E+05	4.79E-04
UPR-300-17_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	563653.88	3.00E+04	**1.88E+01**	3.26E+04	**1.73E+01**
UPR-300-17_Shallow	non-Rad	Pyrene	129-00-0	ug/kg	3.41E+01	1.80E+04	1.90E-03	6.00E+05	5.69E-05
UPR-300-17_Shallow	Rad	RADs SOF	--	pCi/g	--	--	4.09E-04	--	1.96E-03
UPR-300-17_Shallow	non-Rad	Silver	7440-22-4	ug/kg	3.40E+02	2.00E+03	1.70E-01	4.96E+04	6.85E-03
UPR-300-17_Shallow	non-Rad	Total petroleum hydrocarbons - diesel range	TPHDIESEL	ug/kg	2.95E+03	2.00E+05	1.48E-02	3.56E+08	8.29E-06
UPR-300-17_Shallow	non-Rad	Total petroleum hydrocarbons - motor oil (high boiling)	TPH/OILH	ug/kg	210419.68	No Value	--	No Value	--
UPR-300-17_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	6.15E+00	5.16E+04	1.19E-04	6.37E+03	9.65E-04
UPR-300-17_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	9.14E-01	2.74E+04	3.34E-05	4.36E+03	2.10E-04
UPR-300-17_Shallow	Rad	Uranium-238	U-238	pCi/g	4.04E+00	1.57E+04	2.57E-04	5.15E+03	7.85E-04
UPR-300-17_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	52149.755	2.00E+03	**2.61E+01**	3.11E+04	**1.68E+00**
UPR-300-17_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	157172	5.00E+04	**3.14E+00**	6.78E+04	**2.32E+00**
UPR-300-46_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	4.90E+03	5.00E+03	9.79E-01	7.86E+05	6.23E-03
UPR-300-46_Shallow	non-Rad	Acenaphthene	83-32-9	ug/kg	1.31E+01	2.00E+04	6.54E-04	1.10E+06	1.19E-05
UPR-300-46_Shallow	non-Rad	Antimony	7440-36-0	ug/kg	3.81E+02	5.00E+03	7.61E-02	5.98E+03	6.37E-02
UPR-300-46_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	8.79E+02	4.00E+04	2.20E-02	3.25E+02	**2.70E+00**
UPR-300-46_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.90E+02	4.00E+04	1.22E-02	1.47E+03	3.33E-01
UPR-300-46_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	8.44E+01	4.00E+04	2.11E-03	1.47E+03	5.74E-02
UPR-300-46_Shallow	non-Rad	Aroclors HI	--	ug/kg	--	--	3.63E-02	--	**3.09E+00**
UPR-300-46_Shallow	non-Rad	Arsenic	7440-38-2	ug/kg	2.85E+03	1.00E+04	2.85E-01	1.90E+05	1.50E-02
UPR-300-46_Shallow	non-Rad	Barium	7440-39-3	ug/kg	8.21E+04	3.30E+05	2.49E-01	1.32E+06	6.22E-02
UPR-300-46_Shallow	non-Rad	Benzo(a)anthracene	56-55-3	ug/kg	3.88E+00	1.80E+04	2.15E-04	6.40E+04	6.06E-05
UPR-300-46_Shallow	non-Rad	Benzo(a)pyrene	50-32-8	ug/kg	3.40E+00	1.80E+04	1.89E-04	7.64E+04	4.46E-05
UPR-300-46_Shallow	non-Rad	Benzo(b)fluoranthene	205-99-2	ug/kg	5.30E+00	1.80E+04	2.95E-04	3.92E+04	1.35E-04
UPR-300-46_Shallow	non-Rad	Benzo(k)fluoranthene	207-08-9	ug/kg	2.78E+00	1.80E+04	1.55E-04	3.92E+04	7.10E-05
UPR-300-46_Shallow	non-Rad	Beryllium	7440-41-7	ug/kg	2.22E+02	1.00E+04	2.22E-02	1.39E+04	1.60E-02
UPR-300-46_Shallow	non-Rad	Boron	7440-42-8	ug/kg	1713.9346	5.00E+02	**3.43E+00**	1.33E+05	1.29E-02
UPR-300-46_Shallow	non-Rad	Cadmium	7440-43-9	ug/kg	9.47E+01	4.00E+03	2.37E-02	1.63E+03	5.81E-02
UPR-300-46_Shallow	Rad	Cesium-137	10045-97-3	pCi/g	7.00E-02	2.21E+03	3.17E-05	9.24E+02	7.58E-05
UPR-300-46_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	10173.082	4.00E+02	**2.54E+01**	3.82E+04	2.66E-01
UPR-300-46_Shallow	non-Rad	Chrysene	218-01-9	ug/kg	5.58E+00	1.80E+04	3.10E-04	4.45E+04	1.25E-04
UPR-300-46_Shallow	non-Rad	Cobalt	7440-48-4	ug/kg	6.36E+03	1.30E+04	4.89E-01	1.11E+05	5.73E-02
UPR-300-46_Shallow	non-Rad	Copper	7440-50-8	ug/kg	1.32E+04	5.00E+04	2.63E-01	1.07E+05	1.23E-01
UPR-300-46_Shallow	non-Rad	Dibenz[a,h]anthracene	53-70-3	ug/kg	1.25E+00	1.80E+04	6.94E-05	4.41E+04	2.83E-05
UPR-300-46_Shallow	non-Rad	Fluoranthene	206-44-0	ug/kg	9.55E+00	1.80E+04	5.31E-04	8.39E+05	1.14E-05
UPR-300-46_Shallow	non-Rad	Fluorene	86-73-7	ug/kg	2.15E+00	2.90E+04	7.41E-05	1.75E+05	1.23E-05
UPR-300-46_Shallow	non-Rad	Indeno(1,2,3-cd)pyrene	193-39-5	ug/kg	7.80E+00	1.80E+04	4.33E-04	3.57E+04	2.18E-04
UPR-300-46_Shallow	non-Rad	Lead	7439-92-1	ug/kg	7.11E+03	5.00E+04	1.42E-01	3.56E+04	2.00E-01
UPR-300-46_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	311000.56	2.20E+05	**1.41E+00**	5.80E+06	5.36E-02
UPR-300-46_Shallow	non-Rad	Mercury	7439-97-6	ug/kg	2.92E+01	1.00E+02	2.92E-01	1.87E+03	1.56E-02
UPR-300-46_Shallow	non-Rad	Molybdenum	7439-98-7	ug/kg	4.56E+02	2.00E+03	2.28E-01	1.40E+04	3.26E-02
UPR-300-46_Shallow	non-Rad	Naphthalene	91-20-3	ug/kg	3.57E+01	2.90E+04	1.23E-03	1.00E+05	3.57E-04
UPR-300-46_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	9.23E+03	3.00E+04	3.08E-01	3.26E+04	2.83E-01
UPR-300-46_Shallow	non-Rad	Pyrene	129-00-0	ug/kg	4.44E+00	1.80E+04	2.46E-04	6.00E+05	7.39E-06
UPR-300-46_Shallow	Rad	RADs SOF	--	pCi/g	--	--	1.85E-04	--	7.45E-04
UPR-300-46_Shallow	Rad	Uranium-233/234	U-233/234	pCi/g	1.77E+00	5.16E+04	3.43E-05	6.37E+03	2.78E-04
UPR-300-46_Shallow	Rad	Uranium-235	15117-96-1	pCi/g	2.43E-01	2.74E+04	8.87E-06	4.36E+03	5.57E-05
UPR-300-46_Shallow	Rad	Uranium-238	U-238	pCi/g	1.73E+00	1.57E+04	1.10E-04	5.15E+03	3.35E-04

Table 3. 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/Invertebrate SSL[1]	Hazard Quotient	Wildife SSL[2]	Hazard Quotient
UPR-300-46_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	53808.248	2.00E+03	**2.69E+01**	3.11E+04	**1.73E+00**
UPR-300-46_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	4.79E+04	5.00E+04	9.59E-01	6.78E+04	7.07E-01

Notes:

Bolded HQ values are greater than or equal to 1.

[1] = Plant/Invertebrate SSL are the lowest available Generic Lookup Value (ECF-Hanford-11-0060).

[2] = Wildlife SSLs are the lowest available Tier 1 avian or mammal preliminary remediation goal (ECF-Hanford-11-0060).

All data represent detected concentrations of the chemicals.

µg/kg = Microgram per kilogram

Aroclors HI - Sum of HQs within each decisional unit

Hazard Quotients greater than one are in bold font.

pCi/g = pico Curie per gram

Rad = Radionuclide

RADs SOF = Sum of HQs for radionuclide isotopes within each decisional unit

SOF = Sum of fractions

SSL = Soil screening level

Uranium 234 SSLs were used as surrogates for Uranium 233/234.

Table 4. Comparison of 300 Area OUs Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Lognormal 90th Percentile Background Value	EPC > 90th Percentile Background Value
300-10_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	13,500	6.47E+03	**Yes**
300-109_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	632	3.89E+03	No
300-109_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	6,950	1.85E+04	No
300-109_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	278,000	5.12E+05	No
300-109_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	47,600	8.51E+04	No
300-109_Staging Pile Area_Focused	non-Rad	Boron	7440-42-8	ug/kg	1,060	3.89E+03	No
300-109_Staging Pile Area_Focused	non-Rad	Chromium	7440-47-3	ug/kg	8,170	1.85E+04	No
300-109_Staging Pile Area_Focused	non-Rad	Manganese	7439-96-5	ug/kg	286,000	5.12E+05	No
300-109_Staging Pile Area_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	45,100	8.51E+04	No
300-109_Staging Pile Area_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	6877	3.21E+03	**Yes**
300-18_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	6,900	1.85E+04	No
300-259_Shallow	non-Rad	Boron	7440-42-8	ug/kg	1,303	3.89E+03	No
300-259_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	7,901	1.85E+04	No
300-259_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	318,874	5.12E+05	No
300-259_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	42,626	8.51E+04	No
300-259_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	479,584	6.78E+04	**Yes**
300-260_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	8,360	3.89E+03	**Yes**
300-260_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	9,890	1.85E+04	No
300-260_Shallow_Focused	non-Rad	Copper	7440-50-8	ug/kg	73,300	2.20E+04	**Yes**
300-260_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	328,000	5.12E+05	No
300-260_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	59,000	8.51E+04	No
300-260_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	77,400	6.78E+04	**Yes**
300-260_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	12800	3.21E+03	**Yes**
300-275_Shallow_1	non-Rad	Boron	7440-42-8	ug/kg	1,466	3.89E+03	No
300-275_Shallow_1	non-Rad	Chromium	7440-47-3	ug/kg	8,022	1.85E+04	No
300-275_Shallow_1	non-Rad	Lithium	7439-93-2	ug/kg	6,686	1.33E+04	No
300-275_Shallow_1	non-Rad	Manganese	7439-96-5	ug/kg	276,815	5.12E+05	No
300-275_Shallow_1	non-Rad	Vanadium	7440-62-2	ug/kg	45,128	8.51E+04	No
300-275_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	22251	3.21E+03	**Yes**
300-275_Shallow_2	non-Rad	Boron	7440-42-8	ug/kg	1,147	3.89E+03	No
300-275_Shallow_2	non-Rad	Chromium	7440-47-3	ug/kg	8,994	1.85E+04	No
300-275_Shallow_2	non-Rad	Lithium	7439-93-2	ug/kg	7,067	1.33E+04	No
300-275_Shallow_2	non-Rad	Manganese	7439-96-5	ug/kg	292,731	5.12E+05	No
300-275_Shallow_2	non-Rad	Vanadium	7440-62-2	ug/kg	51,632	8.51E+04	No
300-33, 300-41, 300-256_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5349	3.21E+03	**Yes**
300-33, 300-41, 300-256_Shallow	non-Rad	Boron	7440-42-8	ug/kg	1,484	3.89E+03	No
300-33, 300-41, 300-256_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	8,781	1.85E+04	No
300-33, 300-41, 300-256_Shallow	non-Rad	Lithium	7439-93-2	ug/kg	5,495	1.33E+04	No
300-33, 300-41, 300-256_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	314,762	5.12E+05	No
300-33, 300-41, 300-256_Shallow	non-Rad	Uranium	7440-61-1	ug/kg	7,260	3.21E+03	**Yes**
300-33, 300-41, 300-256_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	52,694	8.51E+04	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	ug/kg	330	--	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	385	--	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	52	--	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	1,030	3.89E+03	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	8,080	1.85E+04	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Lithium	7439-93-2	ug/kg	6,580	1.33E+04	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	259,000	5.12E+05	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	51,400	8.51E+04	No
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	6460	3.21E+03	**Yes**
300-37_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	100	--	--
300-37_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3200	--	--
300-44_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	16,900	6.47E+03	**Yes**
300-44_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	9,300	1.85E+04	No
300-44_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	303,000	5.12E+05	No
300-44_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	43,200	8.51E+04	No
300-49_Overburden	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3007.72	--	--
300-49_Overburden	non-Rad	Chromium	7440-47-3	ug/kg	18,106	1.85E+04	No
300-49_Overburden	non-Rad	Copper	7440-50-8	ug/kg	536,000	2.20E+04	**Yes**
300-49_Overburden	non-Rad	Lead	7439-92-1	ug/kg	36,964	1.02E+04	**Yes**
300-49_Overburden	non-Rad	Manganese	7439-96-5	ug/kg	316,669	5.12E+05	No
300-49_Overburden	non-Rad	Vanadium	7440-62-2	ug/kg	50,380	8.51E+04	No
300-49_Overburden	non-Rad	Zinc	7440-66-6	ug/kg	141,984	6.78E+04	**Yes**
300-49_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	9,170	1.85E+04	No
300-49_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	361,805	5.12E+05	No
300-49_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	58,672	8.51E+04	No
300-49_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	54,651	6.78E+04	No
300-50_Overburden	non-Rad	Chromium	7440-47-3	ug/kg	12,197	1.85E+04	No
300-50_Overburden	non-Rad	Copper	7440-50-8	ug/kg	64,527	2.20E+04	**Yes**
300-50_Overburden	non-Rad	Manganese	7439-96-5	ug/kg	314,271	5.12E+05	No
300-50_Overburden	non-Rad	Vanadium	7440-62-2	ug/kg	45,243	8.51E+04	No
300-50_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	17919	3.21E+03	**Yes**
300-50_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	16,841	1.85E+04	No
300-50_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	318,120	5.12E+05	No
300-50_Shallow	non-Rad	Silver	7440-22-4	ug/kg	2,992	1.67E+02	**Yes**
300-50_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	46,964	8.51E+04	No
300-50_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	22938	3.21E+03	**Yes**
316-1_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	40572	3.21E+03	**Yes**
316-1_Shallow_1	non-Rad	Aroclor-1248	12672-29-6	ug/kg	3000	--	--
316-1_Shallow_1	non-Rad	Arsenic	7440-38-2	ug/kg	19,014	6.47E+03	**Yes**
316-1_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	83027	3.21E+03	**Yes**
316-1_Shallow_3	non-Rad	Chromium	7440-47-3	ug/kg	50,455	1.85E+04	**Yes**
316-1_Shallow_3	non-Rad	Copper	7440-50-8	ug/kg	1.37E+06	2.20E+04	**Yes**
316-1_Shallow_3	non-Rad	Manganese	7439-96-5	ug/kg	392,825	5.12E+05	No
316-1_Shallow_3	non-Rad	Mercury	7439-97-6	ug/kg	1,105	1.31E+01	**Yes**
316-1_Shallow_3	non-Rad	Nickel	7440-02-0	ug/kg	94,656	1.91E+04	**Yes**

Table 4. Comparison of 300 Area OUs Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Lognormal 90th Percentile Background Value	EPC > 90th Percentile Background Value
316-1_Shallow_3	non-Rad	Selenium	7782-49-2	ug/kg	1,444	7.80E+02	**Yes**
316-1_Shallow_3	non-Rad	Silver	7440-22-4	ug/kg	13,196	1.67E+02	**Yes**
316-1_Shallow_3	non-Rad	Vanadium	7440-62-2	ug/kg	56,707	8.51E+04	No
316-1_Shallow_3	non-Rad	Zinc	7440-66-6	ug/kg	82,016	6.78E+04	**Yes**
316-1_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	63074	3.21E+03	**Yes**
316-1_Shallow_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	42963	3.21E+03	**Yes**
316-2_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	210452	3.21E+03	**Yes**
316-2_Shallow_2	non-Rad	Aroclor-1248	12672-29-6	ug/kg	696.77511	--	--
316-2_Shallow_2	non-Rad	Aroclor-1254	11097-69-1	ug/kg	42	--	--
316-2_Shallow_2	non-Rad	Aroclor-1260	11096-82-5	ug/kg	110	--	--
316-2_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	291369	3.21E+03	**Yes**
316-2_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	73174	3.21E+03	**Yes**
316-5_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	271835	3.21E+03	**Yes**
316-5_Shallow_2	non-Rad	Chromium	7440-47-3	ug/kg	6,900	1.85E+04	No
316-5_Shallow_2	non-Rad	Silver	7440-22-4	ug/kg	3,600	1.67E+02	**Yes**
316-5_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	204701	3.21E+03	**Yes**
316-5_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	138095	3.21E+03	**Yes**
331 LSLDF_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	1,700	3.89E+03	No
331 LSLDF_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	10,300	1.85E+04	No
331 LSLDF_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	349,000	5.12E+05	No
331 LSLDF_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	110	1.31E+01	**Yes**
331 LSLDF_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	53,100	8.51E+04	No
331 LSLDF_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	137,000	6.78E+04	**Yes**
600-243_Shallow	non-Rad	Boron	7440-42-8	ug/kg	294,463	3.89E+03	**Yes**
600-243_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	18,006	1.85E+04	No
600-243_Shallow	non-Rad	Copper	7440-50-8	ug/kg	53,981	2.20E+04	**Yes**
600-243_Shallow	non-Rad	Lead	7439-92-1	ug/kg	40,139	1.02E+04	**Yes**
600-243_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	5,709	7.80E+02	**Yes**
600-243_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	46,986	8.51E+04	No
600-243_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	84,099	6.78E+04	**Yes**
600-47_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	5,500	1.85E+04	No
618-1_Shallow	non-Rad	Boron	7440-42-8	ug/kg	1,190	3.89E+03	No
618-1_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	7,930	1.85E+04	No
618-1_Shallow	non-Rad	Lithium	7439-93-2	ug/kg	6,380	1.33E+04	No
618-1_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	300,000	5.12E+05	No
618-1_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	56,300	8.51E+04	No
618-1_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	3,740	3.89E+03	**Yes**
618-1_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	19,500	1.85E+04	**Yes**
618-1_Shallow_Focused	non-Rad	Lithium	7439-93-2	ug/kg	13,300	1.33E+04	No
618-1_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	403,000	5.12E+05	No
618-1_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	198	1.31E+01	**Yes**
618-1_Shallow_Focused	non-Rad	Uranium	7440-61-1	ug/kg	7,080	3.21E+03	**Yes**
618-1_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	64,700	8.51E+04	No
618-1_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	68,100	6.78E+04	**Yes**
618-1_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	24957	3.21E+03	**Yes**
618-12_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	32092	3.21E+03	**Yes**
618-13_Shallow	non-Rad	Boron	7440-42-8	ug/kg	1,050	3.89E+03	No
618-13_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	10,700	1.85E+04	No
618-13_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	344,000	5.12E+05	No
618-13_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	55,800	8.51E+04	No
618-13_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5061	3.21E+03	**Yes**
618-13_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	960	3.89E+03	No
618-13_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	8,740	1.85E+04	No
618-13_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	268,000	5.12E+05	No
618-13_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	48,600	8.51E+04	No
618-2_Overburden	non-Rad	Chromium	7440-47-3	ug/kg	6,600	1.85E+04	No
618-2_Overburden	non-Rad	Selenium	7782-49-2	ug/kg	1,000	7.80E+02	**Yes**
618-2_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	7,100	1.85E+04	No
618-2_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	760	7.80E+02	No
618-2_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5852	3.21E+03	**Yes**
618-2_Staging Pile	non-Rad	Chromium	7440-47-3	ug/kg	6,424	1.85E+04	No
618-2_Staging Pile	non-Rad	Uranium	7440-61-1	ug/kg	5,022	3.21E+03	**Yes**
618-2_Staging Pile	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	9201	3.21E+03	**Yes**
618-3_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	9,700	1.85E+04	No
618-3_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	659	7.80E+02	No
618-3_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	238577	3.21E+03	**Yes**
618-4_Shallow	non-Rad	Lead	7439-92-1	ug/kg	49,000	1.02E+04	**Yes**
618-4_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	7456	3.21E+03	**Yes**
618-5_Overburden	non-Rad	Chromium	7440-47-3	ug/kg	9,700	1.85E+04	No
618-5_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	9773	3.21E+03	**Yes**
618-5_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	11,300	1.85E+04	No
618-5_Staging Pile_4	non-Rad	Chromium	7440-47-3	ug/kg	11,800	1.85E+04	No
618-5_Staging Pile_5	non-Rad	Chromium	7440-47-3	ug/kg	10,300	1.85E+04	No
618-7_Shallow_1	non-Rad	Chromium	7440-47-3	ug/kg	10,227	1.85E+04	No
618-7_Shallow_1	non-Rad	Manganese	7439-96-5	ug/kg	326,067	5.12E+05	No
618-7_Shallow_1	non-Rad	Vanadium	7440-62-2	ug/kg	74,576	8.51E+04	No
618-7_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	10814	3.21E+03	**Yes**
618-7_Shallow_2	non-Rad	Chromium	7440-47-3	ug/kg	6,800	1.85E+04	No
618-7_Shallow_2	non-Rad	Manganese	7439-96-5	ug/kg	364,000	5.12E+05	No
618-7_Shallow_2	non-Rad	Vanadium	7440-62-2	ug/kg	74,700	8.51E+04	No
618-7_Shallow_3	non-Rad	Chromium	7440-47-3	ug/kg	10,100	1.85E+04	No
618-7_Shallow_3	non-Rad	Manganese	7439-96-5	ug/kg	357,000	5.12E+05	No
618-7_Shallow_3	non-Rad	Vanadium	7440-62-2	ug/kg	68,200	8.51E+04	No
618-7_Shallow_4	non-Rad	Chromium	7440-47-3	ug/kg	11,400	1.85E+04	No

Table 4. Comparison of 300 Area OUs Waste Sites Exposure Point Concentrations (Exceeding SSLs) to Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Lognormal 90th Percentile Background Value	EPC > 90th Percentile Background Value
618-7_Shallow_4	non-Rad	Manganese	7439-96-5	ug/kg	285,000	5.12E+05	No
618-7_Shallow_4	non-Rad	Vanadium	7440-62-2	ug/kg	54,800	8.51E+04	No
618-7_Shallow_Focused	non-Rad	Cadmium	7440-43-9	ug/kg	6,200	5.63E+02	**Yes**
618-7_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	65,900	1.85E+04	**Yes**
618-7_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	425,000	5.12E+05	No
618-7_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	80,500	8.51E+04	No
618-7_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	52,400	6.78E+04	No
618-7_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	19563	3.21E+03	**Yes**
618-8_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	12,400	1.85E+04	No
618-8_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	846	7.80E+02	**Yes**
618-9_Shallow_Focused	non-Rad	Aldrin	309-00-2	ug/kg	390	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1016	12674-11-2	ug/kg	1900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1221	11104-28-2	ug/kg	1900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1232	11141-16-5	ug/kg	1900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1242	53469-21-9	ug/kg	1900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3900	--	--
618-9_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3900	--	--
618-9_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	11,600	6.47E+03	**Yes**
618-9_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	9,700	1.85E+04	**No**
618-9_Shallow_Focused	non-Rad	Manganese	7439-96-5	ug/kg	359,000	5.12E+05	**No**
618-9_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	330	1.31E+01	**Yes**
618-9_Shallow_Focused	non-Rad	Vanadium	7440-62-2	ug/kg	59,300	8.51E+04	**No**
618-9_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	52,300	6.78E+04	**No**
618-9_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	8963	3.21E+03	**Yes**
628-4_Shallow	non-Rad	Aroclor-1242	53469-21-9	ug/kg	42.354	--	--
628-4_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1115.476	--	--
628-4_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	404.954	--	--
628-4_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	37.768	--	--
628-4_Shallow	non-Rad	Lead	7439-92-1	ug/kg	99,167	1.02E+04	**Yes**
UPR-300-17_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	12420	3.21E+03	**Yes**
UPR-300-17_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1970	--	--
UPR-300-17_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	450.00081	--	--
UPR-300-17_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	113.2752	--	--
UPR-300-17_Shallow	non-Rad	Boron	7440-42-8	ug/kg	3,903	3.89E+03	**Yes**
UPR-300-17_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	13,795	1.85E+04	**No**
UPR-300-17_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	285,159	5.12E+05	**No**
UPR-300-17_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	563,654	1.91E+04	**Yes**
UPR-300-17_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	52,150	8.51E+04	**No**
UPR-300-17_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	157,172	6.78E+04	**Yes**
UPR-300-46_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	8.79E+02	--	--
UPR-300-46_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.90E+02	--	--
UPR-300-46_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	8.44E+01	--	--
UPR-300-46_Shallow	non-Rad	Boron	7440-42-8	ug/kg	1.71E+03	3.89E+03	**No**
UPR-300-46_Shallow	non-Rad	Chromium	7440-47-3	ug/kg	1.02E+04	1.85E+04	**No**
UPR-300-46_Shallow	non-Rad	Manganese	7439-96-5	ug/kg	3.11E+05	5.12E+05	**No**
UPR-300-46_Shallow	non-Rad	Vanadium	7440-62-2	ug/kg	5.38E+04	8.51E+04	**No**

Notes-
EPC = Exposure point concentration
pCi/g = picocuries per gram
SSL = Soil screening level
ug/kg - microgram per kilogram

Table 5. Summary of 300 Area OUs Waste Sites Ecological Evaluation Based on SSLs and Background for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit	Exceedances based on comparisons to SSLs and Background[1]	
	Plant/Invertebrate SSL-based HQ	Wildlife SSL-based HQ
300-10_Shallow_Focused	Arsenic (1.35e00)	--
300-109_Staging Pile Area_Focused	Total Uranium Isotopes (1.38e00)	--
300-259_Shallow	Zinc (9.59e00)	Zinc (7.07e00)
300-260_Shallow_Focused	Boron (1.67e01) Copper (1.47e00) Total Uranium Isotopes (2.56e00) Zinc (1.55e00)	Zinc (1.14e00)
300-275_Shallow_1	Total Uranium Isotopes (4.45e00)	--
300-33, 300-41, 300-256_Shallow	Total Uranium Isotopes (1.07e00) Uranium (1.45e00)	--
300-33, 300-41, 300-256_Shallow_Focused	Total Uranium Isotopes (1.29e00)	Aroclor-1248 (1.02e00) Aroclor HI (1.32e00)
300-37_Shallow_Focused	--	Aroclor-1260 (2.18e00) Aroclor HI (2.25e00)
300-44_Shallow_Focused	Arsenic (1.69e00)	--
300-49_Overburden	Copper (1.07e01) Zinc (2.84e00)	Aroclor-1254 (2.05e00) Copper (5.01e00) Lead (1.04e00) Zinc (2.09e00)
300-50_Overburden	Copper (1.29e00) Total Uranium Isotopes (3.58e00)	--
300-50_Shallow	Silver (1.50e00) Total Uranium Isotopes (4.59e00)	--
316-1_Overburden	Total Uranium Isotopes (8.11e00)	--
316-1_Shallow_1	Arsenic (1.90e00) Total Uranium Isotopes (1.66e01)	Aroclor-1248 (9.23e00)
316-1_Shallow_3	Chromium (1.26e02) Copper (2.73e01) Mercury (1.11e01) Nickel (3.16e00) Total Uranium Isotopes (1.26e01) Selenium (2.78e00) Silver (6.60e00) Zinc (1.64e00)	Chromium (1.32e00) Copper (1.28e01) Nickel (2.90e00) Zinc (1.21e00)
316-1_Shallow_4	Total Uranium Isotopes (8.59e00)	--
316-2_Shallow_1	Total Uranium Isotopes (4.21e01)	--
316-2_Shallow_2	Total Uranium Isotopes (5.83e01)	Aroclor-1248 (2.14e00) Aroclor HI (2.24e00)
316-2_Shallow_3	Total Uranium Isotopes (1.46e01)	--
316-5_Shallow_1	Total Uranium Isotopes (5.44e01)	--
316-5_Shallow_2	Silver (1.80e00) Total Uranium Isotopes (4.09e01)	--
316-5_Shallow_Focused	Total Uranium Isotopes (2.76e01)	--
331 LSLDF_Shallow_Focused	Mercury (1.10e00) Zinc (2.74e00)	Zinc (2.02e00)
600-243_Shallow	Boron (5.89e02) Copper (1.08e00) Selenium (1.10e01) Zinc (1.68e00)	Boron (2.21e00) Lead (1.13e00) Selenium (3.00e00) Zinc (1.24e00)
618-1_Shallow_Focused	Boron (7.48e00) Chromium (4.88e01) Mercury (1.98e00) Total Uranium Isotopes (4.99e00) Uranium (1.42e00) Zinc (1.36e00)	Zinc (1.00e00)
618-12_Shallow	Total Uranium Isotopes (6.42e00)	--
618-13_Shallow	Total Uranium Isotopes (1.01e00)	--
618-2_Overburden	Selenium (1.92e00)	--
618-2_Shallow	Total Uranium Isotopes (1.17e00)	--
618-2_Staging Pile	Total Uranium Isotopes (1.84e00) Uranium (1.00e00)	--
618-3_Shallow_Focused	Total Uranium Isotopes (4.77e01)	--
618-4_Shallow	Total Uranium Isotopes (1.49e00)	Lead (1.38e00)
618-5_Overburden	Total Uranium Isotopes (1.95e00)	--
618-7_Shallow_1	Total Uranium Isotopes (2.16e00)	--
618-7_Shallow_Focused	Cadmium (1.55e00) Chromium (1.65e02) Total Uranium Isotopes (3.91e00)	Cadmium (3.80e00) Chromium (1.73e00)
618-8_Shallow	Selenium (1.63e00)	--
618-9_Shallow_Focused	Arsenic (1.16e00) Mercury (3.30e00) Total Uranium Isotopes (1.79e00)	Aldrin (2.36e00) Aroclor-1016 (1.04e00) Aroclor-1221 (1.29e00) Aroclor-1232 (1.32e00) Aroclor-1242 (1.28e00) Aroclor-1248 (5.85e00) Aroclor-1254 (2.65e00) Aroclor-1260 (2.65e00) Aroclor HI (1.61e+01)
628-4_Shallow	Lead (1.98e00)	Aroclor-1248 (3.43e00) Aroclor HI (3.76e00) Lead (2.79e00)
UPR-300-17_Shallow	Boron (7.81e00) Nickel (1.88e01) Total Uranium Isotopes (2.48e00) Zinc (3.14e00)	Aroclor-1248 (6.06e00) Aroclor HI (6.44e00) Nickel (1.73e01) Zinc (2.32e00)
UPR-300-46_Shallow	--	Aroclor-1248 (2.70e00) Aroclor HI (3.09e00)

Notes:

1 = 90th percentile of Hanford site background concentration

HQ = Hazard Quotient

SSL = Soil screening level

Table 6. Ecological PRG Comparisons for 300 Area OUs Waste Site Decision Units

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/ Invertebrate PRG	Hazard Quotient	Wildlife PRG	Hazard Quotient
300-10_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	1.35E+04	1.28E+05	1.05E-01	1.27E+05	1.06E-01
300-109_Staging Pile Area_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	6.88E+03	1.00E+05	6.88E-02	4.03E+04	1.71E-01
300-259_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	4.80E+05	6.21E+05	7.72E-01	8.56E+05	5.60E-01
300-260_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	8.36E+03	2.86E+04	2.92E-01	3.20E+04	2.61E-01
300-260_Shallow_Focused	non-Rad	Copper	7440-50-8	ug/kg	7.33E+04	5.80E+04	**1.26E+00**	1.93E+05	3.80E-01
300-260_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.28E+04	1.00E+05	1.28E-01	4.03E+04	3.18E-01
300-260_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	7.74E+04	6.21E+05	1.25E-01	8.56E+05	9.04E-02
300-275_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.23E+04	1.00E+05	2.23E-01	4.03E+04	5.52E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5.35E+03	1.00E+05	5.35E-02	4.03E+04	1.33E-01
300-33, 300-41, 300-256_Shallow	non-Rad	Uranium	7440-61-1	ug/kg	7.26E+03	1.00E+05	7.26E-02	4.03E+04	1.80E-01
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	ug/kg	3.30E+02	No Value	--	No Value	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3.85E+02	No Value	--	No Value	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	5.20E+01	No Value	--	No Value	--
300-33, 300-41, 300-256_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	6.46E+03	1.00E+05	6.46E-02	4.03E+04	1.60E-01
300-37_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	1.00E+02	No Value	--	No Value	--
300-37_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3.20E+03	No Value	--	No Value	--
300-44_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	1.69E+04	1.28E+05	1.32E-01	1.27E+05	1.33E-01
300-49_Overburden	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3.01E+03	No Value	--	No Value	--
300-49_Overburden	non-Rad	Copper	7440-50-8	ug/kg	5.36E+05	5.80E+04	**9.24E+00**	1.93E+05	**2.78E+00**
300-49_Overburden	non-Rad	Lead	7439-92-1	ug/kg	3.70E+04	1.70E+06	2.17E-02	1.56E+05	2.37E-01
300-49_Overburden	non-Rad	Zinc	7440-66-6	ug/kg	1.42E+05	6.21E+05	2.29E-01	8.56E+05	1.66E-01
300-50_Overburden	non-Rad	Copper	7440-50-8	ug/kg	6.45E+04	5.80E+04	**1.11E+00**	1.93E+05	3.34E-01
300-50_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.79E+04	1.00E+05	1.79E-01	4.03E+04	4.45E-01
300-50_Shallow	non-Rad	Silver	7440-22-4	ug/kg	2.99E+03	2.99E+03	**1.00E+00**	9.83E+05	3.04E-03
300-50_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.29E+04	1.00E+05	2.29E-01	4.03E+04	5.69E-01
316-1_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	4.06E+04	1.00E+05	4.06E-01	4.03E+04	1.01E+00
316-1_Shallow_1	non-Rad	Aroclor-1248	12672-29-6	ug/kg	3.00E+03	No Value	--	No Value	--
316-1_Shallow_1	non-Rad	Arsenic	7440-38-2	ug/kg	1.90E+04	1.28E+05	1.49E-01	1.27E+05	1.50E-01
316-1_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	8.30E+04	1.00E+05	8.30E-01	4.03E+04	2.06E+00
316-1_Shallow_3	non-Rad	Chromium	7440-47-3	ug/kg	5.05E+04	1.49E+05	3.39E-01	1.09E+05	4.63E-01
316-1_Shallow_3	non-Rad	Copper	7440-50-8	ug/kg	1.37E+06	5.80E+04	**2.36E+01**	1.93E+05	**7.08E+00**
316-1_Shallow_3	non-Rad	Mercury	7439-97-6	ug/kg	1.11E+03	3.00E+02	**3.68E+00**	1.56E+03	7.09E-01
316-1_Shallow_3	non-Rad	Nickel	7440-02-0	ug/kg	9.47E+04	3.80E+04	**2.49E+00**	2.47E+05	3.83E-01
316-1_Shallow_3	non-Rad	Selenium	7782-49-2	ug/kg	1.44E+03	2.02E+03	7.15E-01	1.43E+03	1.01E+00
316-1_Shallow_3	non-Rad	Silver	7440-22-4	ug/kg	1.32E+04	2.99E+03	**4.41E+00**	9.83E+05	1.34E-02
316-1_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	6.31E+04	1.00E+05	6.31E-01	4.03E+04	1.56E+00
316-1_Shallow_3	non-Rad	Zinc	7440-66-6	ug/kg	8.20E+04	6.21E+05	1.32E-01	8.56E+05	9.58E-02
316-1_Shallow_4	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	4.30E+04	1.00E+05	4.30E-01	4.03E+04	1.07E+00
316-2_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.10E+05	1.00E+05	**2.10E+00**	4.03E+04	5.22E+00
316-2_Shallow_2	non-Rad	Aroclor-1248	12672-29-6	ug/kg	6.97E+02	No Value	--	No Value	--
316-2_Shallow_2	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.20E+01	No Value	--	No Value	--
316-2_Shallow_2	non-Rad	Aroclor-1260	11096-82-5	ug/kg	1.10E+02	No Value	--	No Value	--
316-2_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.91E+05	1.00E+05	**2.91E+00**	4.03E+04	7.23E+00
316-2_Shallow_3	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	7.32E+04	1.00E+05	7.32E-01	4.03E+04	1.82E+00
316-5_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.72E+05	1.00E+05	**2.72E+00**	4.03E+04	6.74E+00
316-5_Shallow_2	non-Rad	Silver	7440-22-4	ug/kg	3.60E+03	2.99E+03	**1.20E+00**	9.83E+05	3.66E-03
316-5_Shallow_2	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.05E+05	1.00E+05	**2.05E+00**	4.03E+04	5.08E+00
316-5_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.38E+05	1.00E+05	**1.38E+00**	4.03E+04	3.43E+00
331 LSLDF_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	1.10E+02	3.00E+02	3.67E-01	1.56E+03	7.05E-02
331 LSLDF_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	1.37E+05	6.21E+05	2.21E-01	8.56E+05	1.60E-01
600-243_Shallow	non-Rad	Boron	7440-42-8	ug/kg	2.94E+05	2.86E+04	**1.03E+01**	3.20E+04	**9.20E+00**
600-243_Shallow	non-Rad	Copper	7440-50-8	ug/kg	5.40E+04	5.80E+04	9.31E-01	1.93E+05	2.80E-01
600-243_Shallow	non-Rad	Lead	7439-92-1	ug/kg	4.01E+04	1.70E+06	2.36E-02	1.56E+05	2.57E-01
600-243_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	5.71E+03	2.02E+03	**2.83E+00**	1.43E+03	3.99E+00
600-243_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	8.41E+04	6.21E+05	1.35E-01	8.56E+05	9.82E-02
618-1_Shallow_Focused	non-Rad	Boron	7440-42-8	ug/kg	3.74E+03	2.96E+04	1.26E-01	3.20E+04	1.17E-01
618-1_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	1.95E+04	1.49E+05	1.31E-01	1.09E+05	1.79E-01
618-1_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	1.98E+02	3.00E+02	6.60E-01	1.56E+03	1.27E-01
618-1_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.50E+04	1.00E+05	2.50E-01	4.03E+04	6.19E-01
618-1_Shallow_Focused	non-Rad	Uranium	7440-61-1	ug/kg	7.08E+03	1.00E+05	7.08E-02	4.03E+04	1.76E-01
618-1_Shallow_Focused	non-Rad	Zinc	7440-66-6	ug/kg	6.81E+04	6.21E+05	1.10E-01	8.56E+05	7.96E-02
618-12_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	3.21E+04	1.00E+05	3.21E-01	4.03E+04	7.96E-01
618-13_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5.06E+03	1.00E+05	5.06E-02	4.03E+04	1.26E-01
618-2_Overburden	non-Rad	Selenium	7782-49-2	ug/kg	1.00E+03	2.02E+03	4.95E-01	1.43E+03	6.99E-01
618-2_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	5.85E+03	1.00E+05	5.85E-02	4.03E+04	1.45E-01
618-2_Staging Pile	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	9.20E+03	1.00E+05	9.20E-02	4.03E+04	2.28E-01
618-2_Staging Pile	non-Rad	Uranium	7440-61-1	ug/kg	5.02E+03	1.00E+05	5.02E-02	4.03E+04	1.25E-01
618-3_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	2.39E+05	1.00E+05	**2.39E+00**	4.03E+04	5.92E+00
618-4_Shallow	non-Rad	Lead	7439-92-1	ug/kg	4.90E+04	1.70E+06	2.88E-02	1.56E+05	3.14E-01
618-4_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	7.46E+03	1.00E+05	7.46E-02	4.03E+04	1.85E-01
618-5_Overburden	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	9.77E+03	1.00E+05	9.77E-02	4.03E+04	2.42E-01
618-7_Shallow_1	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.08E+04	1.00E+05	1.08E-01	4.03E+04	2.68E-01
618-7_Shallow_Focused	non-Rad	Cadmium	7440-43-9	ug/kg	6.20E+03	9.84E+03	6.30E-01	2.86E+04	2.17E-01
618-7_Shallow_Focused	non-Rad	Chromium	7440-47-3	ug/kg	6.59E+04	1.49E+05	4.42E-01	1.09E+05	6.05E-01
618-7_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.96E+04	1.00E+05	1.96E-01	4.03E+04	4.85E-01
618-8_Shallow	non-Rad	Selenium	7782-49-2	ug/kg	8.46E+02	2.02E+03	4.19E-01	1.43E+03	5.92E-01
618-9_Shallow_Focused	non-Rad	Aldrin	309-00-2	ug/kg	3.90E+02	No Value	--	9.90E+00	3.94E+01
618-9_Shallow_Focused	non-Rad	Aroclor-1016	12674-11-2	ug/kg	1.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1221	11104-28-2	ug/kg	1.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1232	11141-16-5	ug/kg	1.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1242	53469-21-9	ug/kg	1.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1254	11097-69-1	ug/kg	3.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3.90E+03	No Value	--	No Value	--
618-9_Shallow_Focused	non-Rad	Arsenic	7440-38-2	ug/kg	1.16E+04	1.28E+05	9.06E-02	1.27E+05	9.13E-02
618-9_Shallow_Focused	non-Rad	Mercury	7439-97-6	ug/kg	3.30E+02	3.00E+02	**1.10E+00**	1.56E+03	2.12E-01
618-9_Shallow_Focused	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	8.96E+03	1.00E+05	8.96E-02	4.03E+04	2.22E-01
628-4_Shallow	non-Rad	Aroclor-1242	53469-21-9	ug/kg	4.24E+01	No Value	--	No Value	--
628-4_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1.12E+03	No Value	--	No Value	--
628-4_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.05E+02	No Value	--	No Value	--
628-4_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	3.78E+01	No Value	--	No Value	--
628-4_Shallow	non-Rad	Lead	7439-92-1	ug/kg	9.92E+04	1.70E+06	5.83E-02	1.56E+05	6.36E-01
UPR-300-17_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	1.97E+03	No Value	--	No Value	--
UPR-300-17_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.50E+02	No Value	--	No Value	--
UPR-300-17_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	1.13E+02	No Value	--	No Value	--
UPR-300-17_Shallow	non-Rad	Boron	7440-42-8	ug/kg	3.90E+03	2.86E+04	1.36E-01	3.20E+04	1.22E-01
UPR-300-17_Shallow	non-Rad	Nickel	7440-02-0	ug/kg	5.64E+05	3.80E+04	**1.48E+01**	2.47E+05	**2.28E+00**
UPR-300-17_Shallow	non-Rad	Total_U_Isotopes	Total_U_Isotopes	ug/kg	1.24E+04	1.00E+05	1.24E-01	4.03E+04	3.08E-01
UPR-300-17_Shallow	non-Rad	Zinc	7440-66-6	ug/kg	1.57E+05	6.21E+05	2.53E-01	8.56E+05	1.84E-01

Table 6. Ecological PRG Comparisons for 300 Area OUs Waste Site Decision Units

Waste Site/Decision Unit	Analyte Group	Analyte Name	CAS No.	Units	Exposure Point Concentration	Plant/ Invertebrate PRG	Hazard Quotient	Wildlife PRG	Hazard Quotient
UPR-300-46_Shallow	non-Rad	Aroclor-1248	12672-29-6	ug/kg	8.79E+02	No Value	--	No Value	--
UPR-300-46_Shallow	non-Rad	Aroclor-1254	11097-69-1	ug/kg	4.90E+02	No Value	--	No Value	--
UPR-300-46_Shallow	non-Rad	Aroclor-1260	11096-82-5	ug/kg	8.44E+01	No Value	--	No Value	--

Acronyms:

PRG = Preliminary remediation goal

Table 7. Summary of 300 Area OUs Waste Sites Ecological Evaluation Based on PRGs for Surface Soils (0 to 15 feet)

Waste Site/Decision Unit		
	Plant/Invertebrate HQ	**Wildlife HQ**
300-223_Shallow_Focused	TPH-Motor Oil (uncertainty)	--
300-23_Shallow_Focused	TPH-Motor Oil (uncertainty)	--
300-260_Shallow_Focused	Copper (1.3)	
300-49_Overburden	Copper (9.2)	Copper (2.8)
300-50_Overburden	Copper (1.1)	--
300-8_Shallow	--	--
316-1_Overburden	--	Total Uranium Isotopes (1.0)
316-1_Shallow_1	--	Aroclor-1248 (NoPRG) Total Uranium Isotopes (2.1)
316-1_Shallow_3	Copper (23.6) Mercury (3.7) Nickel (2.5) Silver (4.4)	Copper (7.1) Selenium (1.0) Total Uranium Isotopes (1.6)
316-1_Shallow_4	--	Total Uranium Isotopes (1.1)
316-2_Shallow_1	Total Uranium Isotopes (2.1)	Total Uranium Isotopes (5.2)
316-2_Shallow_2	Total Uranium Isotopes (2.9)	Aroclor-1248 (NoPRG) Aroclors HI (No PRGs) Total Uranium Isotopes (7.2)
316-2_Shallow_3	--	Total Uranium Isotopes (1.8)
316-5_Shallow_1	Total Uranium Isotopes (2.7)	Total Uranium Isotopes (6.7)
316-5_Shallow_2	Silver (1.2) Total Uranium Isotopes (2.1)	Total Uranium Isotopes (5.1)
316-5_Shallow_Focused	Total Uranium Isotopes (1.4)	Total Uranium Isotopes (3.4)
300-33, 300-41, 300-256_Shallow_Focused	--	Aroclor-1248 (NoPRG) Aroclors HI (No PRGs)
300-37_Shallow_Focused	--	Aroclor-1260 (NoPRG) Aroclors HI (No PRGs)
331 LSLDF_Shallow_Focused	--	--
600-243_Shallow	Boron (10.3) Selenium (2.8) TPH-Motor Oil (uncertainty)	Boron (9.2) Selenium (4.0)
618-1_Shallow	--	--
618-1_Shallow_Focused	--	--
618-13_Shallow	--	--
618-13_Shallow_Focused	--	--
618-3_Shallow_Focused	Total Uranium Isotopes (2.4)	Total Uranium Isotopes (5.9)
618-7_Shallow_1	--	--
618-7_Shallow_2	--	--
618-7_Shallow_3	--	--
618-7_Shallow_4	--	--
618-7_Shallow_Focused	TPH-Motor Oil (uncertainty)	--
618-9_Shallow_Focused	Mercury (1.1)	Aldrin (39) Aroclor-1016 (NoPRG) Aroclor-1221 (NoPRG) Aroclor-1232 (NoPRG) Aroclor-1242 (NoPRG) Aroclor-1248 (NoPRG) Aroclor-1254 (NoPRG) Aroclor-1260 (NoPRG) Aroclors HI (No PRGs)
628-4_Shallow	--	Aroclor-1248 (NoPRG) Aroclors HI (No PRGs)
UPR-300-17_Shallow	Nickel (15) TPH-Motor Oil (uncertainty)	Aroclor-1248 (NoPRG) Aroclors HI (No PRGs) Nickel (2.3)
UPR-300-46_Shallow	--	Aroclor-1248 (NoPRG) Aroclors HI (No PRGs)

PRG = Preliminary remediation goal

HQ = Hazard Quotient

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Table 8. Wildlife Exposure to Non-Radionuclide Chemicals through Drinking from Seeps in the 300 Area Riparian Area

Chemical	Seep EPC (mg/L)	Mammal LOAEL TRV (mg/kg-bw-d)	Bird LOAEL TRV (mg/kg-bw-d)	Elk Drinking Water Dose (mg/kg-BW/d)	Elk LOAEL HQ	Badger Drinking Water Dose (mg/kg-BW/d)	Badger LOAEL HQ	Bat Drinking Water Dose (mg/kg-BW/d)	Bat LOAEL HQ	Killdeer Drinking Water Dose (mg/kg-BW/d)	Killdeer LOAEL HQ	Swallow Drinking Water Dose (mg/kg-BW/d)	Swallow LOAEL HQ	Quail Drinking Water Dose (mg/kg-BW/d)	Quail LOAEL HQ	Meadowlark Drinking Water Dose (mg/kg-BW/d)	Meadowlark LOAEL HQ	Hawk Drinking Water Dose (mg/kg-BW/d)	Hawk LOAEL HQ
Unfiltered samples																			
1,1,2-Trichloroethane	6.90E-04	1.00E+03	3.44E+01	3.01E-05	3.01E-08	4.18E-05	4.18E-08	5.40E-05	5.40E-08	7.16E-05	2.08E-06	1.05E-04	3.04E-06	5.38E-05	1.56E-06	3.06E-05	8.89E-07	2.89E-05	8.41E-07
1,2-Dichloroethane	8.70E-04	5.00E+01	3.44E+01	3.80E-05	7.59E-07	5.27E-05	1.05E-06	6.81E-05	1.36E-06	9.03E-05	2.62E-06	1.32E-04	3.84E-06	6.78E-05	1.97E-06	3.86E-05	1.12E-06	3.65E-05	1.06E-06
1,4-Dichlorobenzene	2.50E-04	2.82E+02	1.64E+02	1.45E-05	5.16E-08	1.52E-05	5.37E-08	1.96E-05	6.93E-08	2.59E-05	1.58E-07	3.79E-05	2.31E-07	1.95E-05	1.19E-07	1.11E-05	6.76E-08	1.05E-05	6.39E-08
Acetone	3.34E-03	5.00E+02	5.20E+01	1.94E-04	3.88E-07	2.02E-04	4.05E-07	2.61E-04	5.22E-07	3.46E-04	6.66E-06	5.07E-04	9.74E-06	2.60E-04	5.00E-06	1.48E-04	2.85E-06	1.40E-04	2.69E-06
Aluminum	2.56E+00	1.93E+01	1.10E+02	1.49E-01	7.72E-03	1.55E-01	8.05E-03	2.00E-01	1.04E-02	2.66E-01	2.42E-03	3.89E-01	3.54E-03	2.00E-01	1.82E-03	1.14E-01	1.04E-03	1.07E-01	9.79E-04
Antimony	3.45E-04	5.90E-01	NA	2.01E-05	3.40E-05	2.09E-05	3.55E-05	2.70E-05	4.58E-05	3.58E-05	NA	5.24E-05	NA	2.69E-05	NA	1.53E-05	NA	1.45E-05	NA
Arsenic	2.18E-03	1.66E+00	4.03E+01	1.27E-04	7.63E-05	1.32E-04	7.95E-05	1.70E-04	1.03E-04	2.26E-04	5.60E-06	3.30E-04	8.20E-06	1.70E-04	4.21E-06	9.65E-05	2.39E-06	9.12E-05	2.26E-06
Barium	1.20E-01	7.50E+01	4.17E+01	7.01E-03	9.34E-05	7.30E-03	9.74E-05	9.42E-03	1.26E-04	1.25E-02	3.00E-04	1.83E-02	4.38E-04	9.39E-03	2.25E-04	5.34E-03	1.28E-04	5.05E-03	1.21E-04
Beryllium	2.32E-04	5.32E-01	NA	1.35E-05	2.53E-05	1.40E-05	2.64E-05	1.81E-05	3.41E-05	2.40E-05	NA	3.51E-05	NA	1.81E-05	NA	1.03E-05	NA	9.71E-06	NA
Bismuth	8.08E-05	NA	NA	4.70E-06	NA	4.90E-06	NA	6.32E-06	NA	8.38E-06	NA	1.23E-05	NA	6.30E-06	NA	3.58E-06	NA	3.39E-06	NA
Boron	1.37E-01	9.36E+01	1.00E+02	7.97E-03	8.51E-05	8.30E-03	8.87E-05	1.07E-02	1.14E-04	1.42E-02	1.42E-04	2.08E-02	2.08E-04	1.07E-02	1.07E-04	6.07E-03	6.07E-05	5.74E-03	5.74E-05
Bromide	1.00E-01	NA	NA	5.82E-03	NA	6.06E-03	NA	7.82E-03	NA	1.04E-02	NA	1.52E-02	NA	7.79E-03	NA	4.43E-03	NA	4.19E-03	NA
Cadmium	2.82E-04	1.00E+01	1.47E+00	1.64E-05	1.64E-06	1.71E-05	1.71E-06	2.21E-05	2.21E-06	2.93E-05	1.99E-05	4.28E-05	2.91E-05	2.20E-05	1.50E-05	1.25E-05	8.51E-06	1.18E-05	8.05E-06
Calculated Total Uranium	8.64E-02	6.13E+00	1.60E+01	5.03E-03	8.20E-04	5.24E-03	8.54E-04	6.76E-03	1.10E-03	8.96E-03	5.60E-04	1.31E-02	8.19E-04	6.73E-03	4.21E-04	3.83E-03	2.39E-04	3.62E-03	2.26E-04
Carbon disulfide	4.60E-04	NA	NA	2.68E-05	NA	2.79E-05	NA	3.60E-05	NA	4.77E-05	NA	6.98E-05	NA	3.58E-05	NA	2.04E-05	NA	1.93E-05	NA
Chloride	1.55E+01	NA	NA	8.99E-01	NA	9.37E-01	NA	1.21E+00	NA	1.60E+00	NA	2.35E+00	NA	1.20E+00	NA	6.85E-01	NA	6.48E-01	NA
Chloroform	3.40E-03	4.10E+01	3.44E+01	1.98E-04	4.82E-06	2.06E-04	5.03E-06	2.66E-04	6.49E-06	3.53E-04	1.03E-05	5.16E-04	1.50E-05	2.65E-04	7.70E-06	1.51E-04	4.38E-06	1.42E-04	4.14E-06
Chromium	7.44E-03	9.62E+00	2.78E+00	4.33E-04	4.50E-05	4.51E-04	4.69E-05	5.82E-04	6.05E-05	7.72E-04	2.78E-04	1.13E-03	4.06E-04	5.80E-04	2.09E-04	3.30E-04	1.19E-04	3.12E-04	1.12E-04
cis-1,2-Dichloroethylene	3.86E-04	4.52E+01	3.44E+01	2.25E-05	4.97E-07	2.34E-05	5.18E-07	3.02E-05	6.68E-07	4.01E-05	1.16E-06	5.86E-05	1.70E-06	3.01E-05	8.75E-07	1.71E-05	4.98E-07	1.62E-05	4.70E-07
Cobalt	8.30E-03	1.09E+01	7.80E+00	4.83E-04	4.43E-05	5.03E-04	4.62E-05	6.49E-04	5.96E-05	8.61E-04	1.10E-04	1.26E-03	1.61E-04	6.47E-04	8.29E-05	3.68E-04	4.72E-05	3.48E-04	4.46E-05
Copper	1.00E-02	9.34E+00	1.21E+01	5.83E-04	6.24E-05	6.08E-04	6.51E-05	7.84E-04	8.39E-05	1.04E-03	8.59E-05	1.52E-03	1.26E-04	7.81E-04	6.45E-05	4.44E-04	3.67E-05	4.20E-04	3.47E-05
Fluoride	3.64E-01	5.28E+01	3.20E+01	2.11E-02	4.01E-04	2.20E-02	4.18E-04	2.84E-02	5.39E-04	3.77E-02	1.18E-03	5.52E-02	1.72E-03	2.83E-02	8.85E-04	1.61E-02	5.04E-04	1.52E-02	4.76E-04
Hexavalent Chromium	9.00E-04	4.00E+01	NA	5.23E-05	1.31E-06	5.46E-05	1.36E-06	7.04E-05	1.76E-06	9.34E-05	NA	1.37E-04	NA	7.01E-05	NA	3.99E-05	NA	3.77E-05	NA
Iodine	1.47E-02	1.37E+01	NA	8.52E-04	6.22E-05	8.88E-04	6.48E-05	1.15E-03	8.37E-05	1.52E-03	NA	2.22E-03	NA	1.14E-03	NA	6.49E-04	NA	6.14E-04	NA
Iron	4.70E+00	NA	NA	2.73E-01	NA	2.85E-01	NA	3.68E-01	NA	4.88E-01	NA	7.13E-01	NA	3.66E-01	NA	2.08E-01	NA	1.97E-01	NA
Lead	8.28E-03	8.90E+00	3.26E+00	4.82E-04	5.41E-05	5.02E-04	5.64E-05	6.48E-04	7.28E-05	8.60E-04	2.64E-04	1.26E-03	3.86E-04	6.46E-04	1.98E-04	3.67E-04	1.13E-04	3.47E-04	1.07E-04
Lithium	5.68E-03	NA	1.88E+01	3.30E-04	NA	3.44E-04	NA	4.44E-04	NA	5.89E-04	NA	8.62E-04	4.58E-05	4.43E-04	2.35E-05	2.52E-04	1.34E-05	2.38E-04	1.27E-05
Manganese	1.72E-01	7.10E+01	3.48E+02	1.00E-02	1.41E-04	1.04E-02	1.47E-04	1.34E-02	1.89E-04	1.78E-02	5.13E-05	2.61E-02	7.49E-05	1.34E-02	3.85E-05	7.62E-03	2.19E-05	7.20E-03	2.07E-05
Mercury	2.70E-06	1.60E-01	3.70E-01	1.57E-07	9.83E-07	1.64E-07	1.02E-06	2.11E-07	1.32E-06	2.80E-07	7.58E-07	4.10E-07	1.11E-06	2.11E-07	5.69E-07	1.20E-07	3.24E-07	1.13E-07	3.06E-07
Methylene chloride	6.60E-04	5.00E+01	3.44E+01	3.84E-05	7.68E-07	4.00E-05	8.00E-07	5.16E-05	1.03E-06	6.85E-05	1.99E-06	1.00E-04	2.91E-06	5.14E-05	1.50E-06	2.93E-05	8.50E-07	2.77E-05	8.04E-07
Nickel	9.15E-03	3.40E+00	1.15E+01	5.32E-04	1.56E-04	5.54E-04	1.63E-04	7.15E-04	2.10E-04	9.49E-04	8.25E-05	1.39E-03	1.21E-04	7.13E-04	6.20E-05	4.05E-04	3.52E-05	3.83E-04	3.33E-05
Nitrogen	2.05E+03	NA	NA	1.19E+02	NA	1.24E+02	NA	1.61E+02	NA	2.13E+02	NA	3.12E+02	NA	1.60E+02	NA	9.10E+01	NA	8.61E+01	NA
Selenium	2.89E-03	2.15E-01	5.79E-01	1.68E-04	7.82E-04	1.75E-04	8.15E-04	2.26E-04	1.05E-03	3.00E-04	5.18E-04	4.39E-04	7.57E-04	2.25E-04	3.89E-04	1.28E-04	2.21E-04	1.21E-04	2.09E-04
Silver	2.47E-05	6.02E+01	2.02E+01	1.43E-06	2.38E-08	1.49E-06	2.48E-08	1.93E-06	3.20E-08	2.56E-06	1.27E-07	3.74E-06	1.85E-07	1.92E-06	9.51E-08	1.09E-06	5.41E-08	1.03E-06	5.12E-08
Strontium	2.20E-01	2.63E+02	NA	1.28E-02	4.87E-05	1.33E-02	5.07E-05	1.72E-02	6.54E-05	2.28E-02	NA	3.34E-02	NA	1.71E-02	NA	9.75E-03	NA	9.22E-03	NA
Sulfate	4.77E+01	NA	NA	2.78E+00	NA	2.89E+00	NA	3.73E+00	NA	4.95E+00	NA	7.24E+00	NA	3.72E+00	NA	2.12E+00	NA	2.00E+00	NA
Tetrachloroethene	7.00E-04	7.00E+01	1.64E+02	4.07E-05	5.82E-07	4.24E-05	6.06E-07	5.48E-05	7.82E-07	7.26E-05	4.43E-07	1.06E-04	6.48E-07	5.45E-05	3.33E-07	3.10E-05	1.89E-07	2.93E-05	1.79E-07
Thallium	1.15E-04	7.50E-02	NA	6.68E-06	8.91E-05	6.96E-06	9.29E-05	8.99E-06	1.20E-04	1.19E-05	NA	1.74E-05	NA	8.95E-06	NA	5.09E-06	NA	4.81E-06	NA
Thorium	4.05E-04	NA	NA	2.36E-05	NA	2.46E-05	NA	3.17E-05	NA	4.20E-05	NA	6.14E-05	NA	3.16E-05	NA	1.80E-05	NA	1.70E-05	NA
Toluene	4.48E-04	5.20E+02	4.07E+01	2.61E-05	5.01E-08	2.72E-05	5.23E-08	3.51E-05	6.74E-08	4.65E-05	1.14E-06	6.80E-05	1.67E-06	3.49E-05	8.58E-07	1.99E-05	4.88E-07	1.88E-05	4.62E-07
Trichloroethene	2.19E-03	7.00E+01	1.65E+02	1.27E-04	1.82E-06	1.32E-04	1.89E-06	1.71E-04	2.44E-06	2.27E-04	1.37E-06	3.32E-04	2.01E-06	1.70E-04	1.03E-06	9.69E-05	5.87E-07	9.16E-05	5.55E-07
Uranium	2.29E-01	6.13E+00	1.60E+01	1.33E-02	2.17E-03	1.39E-02	2.26E-03	1.79E-02	2.92E-03	2.38E-02	1.48E-03	3.47E-02	2.17E-03	1.78E-02	1.12E-03	1.02E-02	6.34E-04	9.60E-03	6.00E-04
Vanadium	7.30E-03	8.31E+00	6.88E-01	4.25E-04	5.11E-05	4.43E-04	5.33E-05	5.71E-04	6.87E-05	7.57E-04	1.10E-03	1.11E-03	1.61E-03	5.69E-04	8.27E-04	3.24E-04	4.70E-04	3.06E-04	4.45E-04
Xylenes [total]	3.40E-04	3.50E+02	4.07E+01	1.98E-05	5.65E-08	2.06E-05	5.89E-08	2.66E-05	7.60E-08	3.53E-05	8.67E-07	5.16E-05	1.27E-06	2.65E-05	6.51E-07	1.51E-05	3.70E-07	1.42E-05	3.50E-07
Zinc	4.92E-02	7.59E+01	6.65E+01	2.86E-03	3.77E-05	2.98E-03	3.93E-05	3.85E-03	5.07E-05	5.10E-03	7.67E-05	7.46E-03	1.12E-04	3.83E-03	5.76E-05	2.18E-03	3.28E-05	2.06E-03	3.10E-05

Table 8. Wildlife Exposure to Non-Radionuclide Chemicals through Drinking from Seeps in the 300 Area Riparian Area

Chemical	Seep EPC (mg/L)	Mammal LOAEL TRV (mg/kg-bw-d)	Bird LOAEL TRV (mg/kg-bw-d)	Elk Drinking Water Dose (mg/kg-BW/d)	Elk LOAEL HQ	Badger Drinking Water Dose (mg/kg-BW/d)	Badger LOAEL HQ	Bat Drinking Water Dose (mg/kg-BW/d)	Bat LOAEL HQ	Killdeer Drinking Water Dose (mg/kg-BW/d)	Killdeer LOAEL HQ	Swallow Drinking Water Dose (mg/kg-BW/d)	Swallow LOAEL HQ	Quail Drinking Water Dose (mg/kg-BW/d)	Quail LOAEL HQ	Meadowlark Drinking Water Dose (mg/kg-BW/d)	Meadowlark LOAEL HQ	Hawk Drinking Water Dose (mg/kg-BW/d)	Hawk LOAEL HQ
Filtered samples																			
Antimony	2.62E-04	5.90E-01	NA	1.52E-05	2.58E-05	1.59E-05	2.69E-05	2.05E-05	3.47E-05	2.72E-05	NA	3.98E-05	NA	2.04E-05	NA	1.16E-05	NA	1.10E-05	NA
Arsenic	1.61E-03	1.66E+00	4.03E+01	9.36E-05	5.64E-05	9.76E-05	5.88E-05	1.26E-04	7.59E-05	1.67E-04	4.14E-06	2.44E-04	6.06E-06	1.25E-04	3.11E-06	7.14E-05	1.77E-06	6.75E-05	1.67E-06
Cadmium	2.77E-05	1.00E+01	1.47E+00	1.61E-06	1.61E-07	1.68E-06	1.68E-07	2.17E-06	2.17E-07	2.87E-06	1.96E-06	4.20E-06	2.86E-06	2.16E-06	1.47E-06	1.23E-06	8.35E-07	1.16E-06	7.90E-07
Chromium	4.96E-03	9.62E+00	2.78E+00	2.89E-04	3.00E-05	3.01E-04	3.13E-05	3.88E-04	4.03E-05	5.15E-04	1.85E-04	7.53E-04	2.71E-04	3.87E-04	1.39E-04	2.20E-04	7.91E-05	2.08E-04	7.48E-05
Copper	4.47E-04	9.34E+00	1.21E+01	2.60E-05	2.78E-06	2.71E-05	2.90E-06	3.50E-05	3.74E-06	4.64E-05	3.83E-06	6.78E-05	5.60E-06	3.48E-05	2.88E-06	1.98E-05	1.64E-06	1.87E-05	1.55E-06
Lead	3.48E-04	8.90E+00	3.26E+00	2.02E-05	2.27E-06	2.11E-05	2.37E-06	2.72E-05	3.06E-06	3.61E-05	1.11E-05	5.28E-05	1.62E-05	2.71E-05	8.32E-06	1.54E-05	4.73E-06	1.46E-05	4.47E-06
Nickel	1.52E-03	3.40E+00	1.15E+01	8.84E-05	2.60E-05	9.21E-05	2.71E-05	1.19E-04	3.50E-05	1.58E-04	1.37E-05	2.31E-04	2.01E-05	1.18E-04	1.03E-05	6.74E-05	5.86E-06	6.37E-05	5.54E-06
Selenium	3.07E-03	2.15E-01	5.79E-01	1.79E-04	8.31E-04	1.86E-04	8.66E-04	2.40E-04	1.12E-03	3.19E-04	5.50E-04	4.66E-04	8.04E-04	2.39E-04	4.13E-04	1.36E-04	2.35E-04	1.29E-04	2.22E-04
Thallium	1.57E-05	7.50E-02	NA	9.13E-07	1.22E-05	9.52E-07	1.27E-05	1.23E-06	1.64E-05	1.63E-06	NA	2.38E-06	NA	1.22E-06	NA	6.96E-07	NA	6.58E-07	NA
Zinc	1.91E-03	7.59E+01	6.65E+01	1.11E-04	1.46E-06	1.16E-04	1.53E-06	1.49E-04	1.97E-06	1.98E-04	2.98E-06	2.90E-04	4.36E-06	1.49E-04	2.24E-06	8.47E-05	1.27E-06	8.00E-05	1.20E-06

Notes:

Drinking water ingestion rate estimated using Calder and Braun, 1983

Calder and Braun (1983) regression equation format --> L water/kg body weight/daya (kilograms body weight^{a} /kg body weigh

	Group	***a***	***b***
	all birds	0.059	0.67
	all mammals	0.099	0.90

Body weight: for Elk (kg) =	204	assumed average weight of Rocky Mountain Elk (*Cervus canadensis*) cow (Red Orbit, 2012)
Badger =	7.6	median from multiple studies (Messick and Hornocker, 1981; Silva and Downing, 1995)
Little Brown Bat =	0.0103	assumed average weight *Myotis lucifugus*) from Silva and Downing, 199
Killdeer =	0.0756	median from multiple studies (Purdue and Haines, 1977; Stegeman, 1955; Jackson and Jackson, 2000; Dunning, 1993)
Swallow =	0.0239	mean adult weight *Hirundo pyrrhonota*) during breeding (Brown and Brown, 199
California Quail =	0.18	median from multiple studies (Robel, 1969; Roseberry and Klimstra, 1971; Guthery et al., 1988)
Western Meadowlark =	0.995	median from multiple studies (Wiens and Rotenberry, 1980; Maher, 1979)
Red-tailed Hawk =	1.179	median from multiple studies (Craighead and Craighead,1956; Steenhof,1983; Springer and Osborne,1983)

	Elk	Badger	Bat	Killdeer	Swallow	California Quail	Western Meadowlark	Red-tailed Hawk
Drinking Water Ingestion Rate (L/kg-bw-d) =	0.058	0.081	0.156	0.138	0.202	0.104	0.059	0.056
Area use factor (unitless) =	0.750	0.750	0.500	0.750	0.750	0.750	0.750	0.750

Acronyms:

EPC = exposure point concentration

HQ = hazard quotient

LOAEL = lowest observed adverse effect level

mg/kg-bw/d = milligrams of chemical per kilogram bodyweight per day

mg/L = milligrams per liter

NA = not available

NOAEL = no observed adverse effect level

pCi/L = picoCuries per liter

TRV = toxicological reference value

Citations:

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Table 9. Wildlife Exposure to Radionuclides through Drinking from Seeps in the 300 Area Riparian Area

Analyte Name	Units	Seeps Max Detect	Water BCG	Exposure Dose to Wildlife	Wildlife HQ	Exposure Dose to Bats	Bats HQ
Antimony-125	pCi/L	3.20E+00	4.40E+06	2.40E+00	5.45E-07	1.60E+00	3.64E-07
Cesium-137	pCi/L	9.68E-01	4.26E+01	7.26E-01	**1.70E-02**	4.84E-01	**1.14E-02**
Cobalt-60	pCi/L	1.76E+00	4.78E+03	1.32E+00	2.76E-04	8.79E-01	1.84E-04
Europium-154	pCi/L	2.24E+00	5.73E+04	1.68E+00	2.93E-05	1.12E+00	1.95E-05
Gross alpha	pCi/L	8.03E+01	--	6.02E+01	--	4.01E+01	--
Gross beta	pCi/L	3.77E+01	--	2.83E+01	--	1.89E+01	--
Iodine-129	pCi/L	4.88E-03	3.84E+04	3.66E-03	9.54E-08	2.44E-03	6.36E-08
Ruthenium-106	pCi/L	1.34E+01	--	1.01E+01	--	6.70E+00	--
Strontium-90	pCi/L	1.53E+00	2.78E+02	1.14E+00	4.11E-03	7.63E-01	2.74E-03
Technetium-99	pCi/L	1.83E+01	6.67E+05	1.37E+01	2.05E-05	9.13E+00	1.37E-05
Thorium-228	pCi/L	2.50E-01	2.04E+03	1.88E-01	9.21E-05	1.25E-01	6.14E-05
Thorium-230	pCi/L	1.09E+00	1.39E+04	8.18E-01	5.88E-05	5.45E-01	3.92E-05
Thorium-232	pCi/L	4.99E-01	1.68E+03	3.74E-01	2.23E-04	2.50E-01	1.49E-04
Tritium	pCi/L	9.63E+03	2.31E+08	7.22E+03	3.13E-05	4.81E+03	2.08E-05
Uranium [radionuclide]	pCi/L	7.46E+01	6.76E+02	5.59E+01	**8.27E-02**	3.73E+01	**5.52E-02**
Rads SOF	pCi/L	--	--	--	**1.05E-01**	--	**6.98E-02**

Notes:

AUF = area use factor which was assumed as 0.75 due to inaccessibility of seeps from mid April to mid July for all wildlife except bats for which it was assumed to be 0.5 due to their hibernation in winter in addition to the summer inaccessibility of the seeps.

EPC (Exposure Point Concentrations) were calculated as the 95 percent upper confidence limit (UCL) on the arithmetic mean using the most recent version of EPA's Pro UCL software

BCG (Biota Concentration Guides) represent the lowest value among those calculated for riparian and terrestrial animals

BCGs for cesium-137, europium-154, europium-155, strontium-90, technetium-99, tritium, and uranium isotopes were published in DOE-STD-1153-2002

BCGs for cesium-134, and cobalt-60 were calcualted according to DOE/EH-0676 using RESRAD BIOTA version 1.5 (DOE, 2009).

HQ = hazard quotient calculated as the exposure dose divided by the water BCG

SOF = sum of fractions calculated as the sum of hazard quotients for individual radionuclides.

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Appendix I

Alternatives for Evaluated Waste Sites

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Table

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I1 Introduction

This appendix (Table I-1) provides conceptual design details for each waste site, including the area and depth of individual waste sites. Table I-1 also provides a summary of the remedial components for each waste site that were assumed for the development of the cost estimates. Details regarding the development of cost estimates are presented in Appendix K.

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Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information			Information for Development of Alternatives							
Waste Site	**Site History**	**Feasibility Study Designation**	**Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
300 RLWS	The 300 Area RLWS consists of a network of underground, double-encased, stainless-steel pipe (encased in reinforced-fiberglass or plastic pipe as secondary containment) that transfers radioactive liquid wastes from the generating facilities (324, 325, 325-A, 326, 327, and 329 Buildings) to the 340 Complex. The system was retired in 1998. Contaminants would include uranium, acids, bases, metals, solvents, and fission products. Contaminated soil and piping is estimated to be 8,000 m^3 (280,000 ft^3).	"Accepted" - Remediation Initiated under IROD	Pipeline	6.43 acres	6.4 m (21 ft)	Uranium, radionuclides, metals, organics	1) RTD 6.43 acres of pipeline to 6.4 m (21 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 6.43 acres of pipeline to 6.4 m (21 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 6.43 acres of pipeline to 6.4 m (21 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 6.43 acres of pipeline to 6.4 m (21 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.
300 RRLWS	A network of single-walled, stainless-steel piping and carbon-steel fittings buried between 3 and 6 m (10 and 20 ft) below grade. Received radioactive wastes from various 300 Area facilities including the fuel fabrication and R&D laboratories. Wastes discharged to the sewer included water and small quantities of chemicals, decontamination solutions, aqueous fuel fabrication solutions, acids, and bases. Contaminants of potential concern would include uranium, mercury, acids, bases, fission products, metals, and solvents.	"Accepted" - Remediation Initiated under IROD	Pipeline	20 cm (8 in.) 457 m (1,500 ft)	6 m (20 ft)	Uranium, radionuclides, metals, organics	1) RTD pipeline length of 457 m (1,500 ft) to 6 m (20 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 457 m (1,500 ft) to 6 m (20 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 457 m (1,500 ft) to 6 m (20 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 457 m (1,500 ft) to 6 m (20 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.
300-11	The unmarked site is composed of gasoline-impacted, subsurface soil from a gasoline UST. The release was discovered after leak test failure in 1992. The UST was removed. Contamination remains unremediated.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	7.43 m^2 (80 ft^2)	Ranges from to 1.6 m to 6.25m (5.4 to 20.5 ft)	Petroleum hydrocarbons	1) RTD area of 7.43 m2 (80 ft2) to 6.25 m (20.5 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.43 m2 (80 ft2) to 6.25 m (20.5 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.43 m2 (80 ft2) to 6.25 m (20.5 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.43 m2 (80 ft2) to 6.25 m (20.5 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-121	The site received condensate from the air receivers inside the 3621D Building. Additionally, it may have received spills that reached the floor drains. Petroleum and ethylene glycol contamination is possible.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	9.29 m^2 (100 ft^2)	Soil beneath foundation removal to 4.6 m (15 ft)	Petroleum hydrocarbons, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-123	The site is a French drain that received steam condensate from the 366 Building fuel oil bunker loading station. The French drain is a vertical, metal culvert covered with a 0.7 m (2.25 ft) diameter, diamond plate, metal cover.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Petroleum hydrocarbons	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-15	This underground, process sewer extends throughout the 300 Area. Transfers process wastes (potable water, cooling water, precipitation runoff, waste brine solution [NaCl with Mg salts], Cr, Cu, U, nitrate, sulfate, and fluoride ions with Pb, Ag, acetone, and cyanide. The sewer network includes the original system (20 cm [8 in.] diameter vitrified clay piping with acid-proof joints), which directed liquid waste eastward to the 316-1 and 316-2 Process Pond until 1975, then to the 300 Area Trenches from 1975 to 1994. Starting in 1994, the discharges used a new pipeline to the 300 Area TEDF for treatment and release to the Columbia River. Initially, the system received low-level liquid wastes from the 313 and 314 Buildings, and later from the 3706 and 321 Laboratories. The 321 Building connected to the main 20 cm (8 in.) diameter lines through a	"Accepted" - Remediation Initiated under IROD	Site exceeds groundwater protection criteria for total uranium isotopes and ecological risk criteria for Arochlor-1248. (Chapter 5 and 7). However, portions of the site remain unremediated (which will be remediated after the ROD is signed).	Pipeline length of 14,645 m (48,048 ft)	variable	Metals, cyanide, organics	1) RTD pipeline length of 14,645 m (48,048 ft) to variable depths. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 14,645 m (48,048 ft) to variable depths. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 14,645 m (48,048 ft) to variable depths. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 14,645 m (48,048 ft) to variable depths. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information			Information for Development of Alternatives							
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	combination of 8 cm (3 in.) diameter stainless steel, 20 cm (8 in.) diameter wrought iron, and 15 cm (6 in.) diameter earthenware pipes, all of acid-proof construction. By 1994, more than 50 facilities were connected to the process sewer. As the system was updated and expanded, pipe materials included the original vitrified clay, as well as iron, steel, concrete, PVC, and stainless steel piping.									
300-16	On three occurrences, radioactive contamination (yellow cake uranium) was discovered on the bottom ends of several utility poles that had been removed.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-175	The site is a concrete French drain, with a metal lid, that received non-dangerous/nonradioactive steam condensate. The operational flow rate was <0.04 L/min (0.01 gal/min).	"Accepted" - to be Remediated after ROD signed	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	9.29 m2 (100 ft2)	soil beneath foundation removal to 4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) after demolition of structure. Remediate after 2027 with building 325. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) after demolition of structure. Remediate after 2027 with building 325. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) after demolition of structure. Remediate after 2027 with building 325. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) after demolition of structure. Remediate after 2027 with building 325. 2) Disposal at ERDF or other approved disposal facility.
300-2	About 189,250 L (50,000 gal) of secondary cooling water and other contaminated water containing 33 mCi of I-133 and 12 mCi of I-131 were discharged to the ground. About 10 µCi of alpha emitters (calculated as Pu-239) and about 40 mCi of non-volatile beta emitters, plus rutheniums, were transferred to the trench during the first 36 hours of the incident. A small number of short pumpings were made after that. However, the total volume and radioisotopic inventory are insignificant in comparison to those during the first 36 hours.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	18 m2 (194 ft2)	4.6 m (15 ft)	Radionuclides	1) RTD area of 18 m2 (194 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 18 m2 (194 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 18 m2 (194 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 18 m2 (194 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-214	The site is a subsurface, carbon-steel and PVC pipeline that transfers liquid waste from the 308, 324, 325, 326, 327, and 329 Buildings to the 307 Retention Basins. The waste discharged to the RPS is nonhazardous, potentially radioactive waste (not to exceed 5,000 pCi/L). In FY 1998, approximately 12 million L (3 million gal) flowed through the RPS to the 307 Retention Basins.	"Accepted" - Remediation Initiated under IROD	Pipeline	1,344 m (4,409 ft) in length	4.6 m (15 ft)	Radionuclides	1) RTD pipeline length of 1344 m (4,409 ft) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 1344 m (4,409 ft) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 1344 m (4,409 ft) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 1344 m (4,409 ft) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-218	This building is one of the original World War II-era 300 Area, Manhattan Engineering District/DuPont structures. Exterior walls and partitions are concrete block. The floor is reinforced concrete with test pits and a basement room at the west end. A small second floor or mezzanine exists at the west end of the building.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information			Information for Development of Alternatives							
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
300-219	Includes transfer lines connecting components of the 300 Area WATS and the URO. Piping, located in Pipe Trench 300-224, includes the following: • 333 N Fuels process transfer lines to process acid waste solution storage tanks in 333 and 334-A Facilities • Waste transfer lines to waste treatment facilities in 313 Uranium Recovery/WATS Neutralization Room • Transfer lines to/from 313 Building to neutralized acid waste storage tanks in 311 Tank Farm • Ethylene glycol supply and return lines in Pipe Trench between 333 and 313 Buildings used to heat this portion of Pipe Trench • Fresh nitric and sulfuric acid lines from 334 Tank Farm to 333 Building • Caustic lines from Tank Farm to 313 WATS/URO Room As of November 1, 1998, all process and waste piping inside associated facilities had been disconnected from the Pipe Trench. Only piping inside the Pipe Trench or outside the facilities (e.g., tank farm piping) remains for pipes associated with the 300 Area WATS/URO Acid Treatment System.	"Accepted" - Remediation Initiated under IROD	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides, metals, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-22	The site is a UPR from a parted hose coupling that contaminated the ground outside the emergency airlock of the 309 Building on 9/20/1962. The site is covered with new asphalt. The asphalt area is roped off and trucks are not allowed on the asphalt. The rupture loop annex is present below ground at the site.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	15 m2 (162 ft2)	4.6 m (15 ft)	Radionuclides	1) RTD area of 15 m2 (162 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 15 m2 (162 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 15 m2 (162 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 15 m2 (162 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-224	The site is a subsurface, concrete pipe trench with concrete block and metal plate covers. The pipe trench has several sections that allow piping connections to be made between process operations in the 313 Building, the 303 -F Building, the 311 Tank Farm, the 333 Building, the 334-A Building, and the 334 Tank Farm. The pipe trench and subsurface soil have become contaminated due to multiple releases into the trench. Releases included acids, bases, and solvents. Some of released acids contained dissolved uranium.	"Accepted" - Remediation Initiated under IROD	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-24	This site is contaminated soil near the 314 Building. Mostly uranium and a trace of Cs-137 were detected in soil samples from the trench near the 314 Building at a gross alpha count of 896 pCi/g.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, Cesium-137	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-249	This site is the residual, radioactive contamination remaining from former operations at the 304 Building, which was not closed out as part of 304 Uranium Concretion Facility closure.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-251	Uranium contaminated soil around and under the 303-K	"Accepted" -	Human Health Direct	0	0	Uranium	Not evaluated. Site	Not evaluated.	Not evaluated. Site	Not evaluated. Site

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information				Information for Development of Alternatives						
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Building (aka, the 303-K CWS). The 303-K Building was removed and clean closed on 7/22/2002.	Remediation Initiated under IROD	Contact and/or Ecological risk likely in shallow soil				assumed to pass PRGs.	Site assumed to pass PRGs.	assumed to pass PRGs.	assumed to pass PRGs.
300-255	Soil contamination exists inside the 309 Building Tank Farm fenced area. The source of the contamination was probably the piping related to tanks 309-TW-1, -2 and -3. Potential radioactive contaminants are Cs-137, Co-60, and Am-241. Potential hazardous contaminants are Ba, Cd, Cr, Pb, and Se.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	528 m2 (5,683 ft2)	4.6 m (15 ft)	Radionuclides and metals	1) RTD area of 528 m2 (5,683 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 528 m2 (5,683 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 528 m2 (5,683 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 528 m2 (5,683 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.
300-257	The site is process sewer piping that originally discharged radioactive, liquid waste from the 309 Building's Rupture Loop Holding Tank to the Columbia River. The waste is the process sewer piping. The tank was removed in the late 1970s. Concurrently, the Rupture Loop Holding Tank was removed to a 200 Area burial ground, and the RLWS connections were severed and plugged. The former Rupture Loop Holding Tank area is not a parking lot.	"Accepted" - Remediation Initiated under IROD	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0.9 m (2.95 ft) diameter, 451 m (1,480 ft)	5.9 m (19.3 ft)	Radionuclides	1) RTD length of 451 m (1,480 ft) to 5.9 m (19.3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD length of 451 m (1,480 ft) to 5.9 m (19.3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD length of 451 m (1,480 ft) to 5.9 m (19.3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD length of 451 m (1,480 ft) to 5.9 m (19.3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-258	The site is an abandoned, subsurface, concrete, pipe trench that housed acid transfer piping from the 334 Tank Farm to the 306E Building chemical processing bay in the facility's northeastern corner. From about 1972 to1975, waste etch solution may have been transferred from the 306E Building chemical bay to the 333/334 WATS.	"Accepted" - Remediation Initiated under IROD	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-263	The site is an inactive, unused catch tank. Hazardous or radioactive waste was never transferred from the 324 Building to the tank, which is isolated, and the pipelines are capped. Sample results indicated Cs-137 to be 509 pCi/L. Gross beta was 1,700 pCi/L. During sampling, 15 cm (6 in.) of rainwater had accumulated in the sample area. The water is believed to have come from intrusion because many of the flange bolts were missing. The contamination may have been from surface contamination.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	38 m2 (409 ft2)	4.6 m (15 ft)	Cesium-137	1) RTD area of 38 m2 (409 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 38 m2 (409 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 38 m2 (409 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 38 m2 (409 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information			Information for Development of Alternatives							
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
300-265	The transfer line carried liquid High-Level Waste from spent nuclear fuel processing.	"Accepted" - to be Remediated after ROD signed	Pipeline	The pipes are 3/8 and 3/4" and are encased within a 2" which is encased in a 4" pipe. There are 2 pipelines laid in parallel that would be excavated with 1 trench or 328 m (1,076 ft).	2.29 m (7.5 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	1) RTD 328 m (1,076 ft) length to 2.29 m (7.5 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 328 m (1,076 ft) length to 2.29 m (7.5 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 328 m (1,076 ft) length to 2.29 m (7.5 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 328 m (1,076 ft) length to 2.29 m (7.5 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.
300-268	The contamination related to this building were a result of passive dust from machining irradiated uranium, graphite, and other metallic samples from the 305 Test Pile. The contamination, if remaining, would be associated with any remaining concrete foundation.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-269	The site is a rectangular concrete building foundation. The 331-A Building was used for biological research and demolished in 2000. Residual contamination may be on the pad from past releases at the building.	"Accepted" - to be Remediated after ROD signed	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	465 m2 (5,005 ft2)	Soil beneath foundation removal to 4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB, TPH	1) RTD area of 465 m2 (5,005 ft2) to 4.6 m (15 ft) bgs, after demolition of structure	1) RTD area of 465 m2 (5,005 ft2) to 4.6 m (15 ft) bgs, after demolition of structure	1) RTD area of 465 m2 (5,005 ft2) to 4.6 m (15 ft) bgs, after demolition of structure	1) RTD area of 465 m2 (5,005 ft2) to 4.6 m (15 ft) bgs, after demolition of structure
300-270	The UPR is a milky-white flow of water discharged from a pipe located below the loading dock on the east side of the 313 Building. The dock is used by Richland Specialty Extrusions to store metal (e.g., aluminum) cylinders. The pipe drains stormwater from the 313 Building roof. The release was to the compacted gravel and soil ground surface. The stormwater is nonhazardous and nonradioactive. Soil collected from the area near the pipe showed elevated Pb levels. The contaminated soil was not caused by the milky-white liquid. The Pb source was not documented.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Lead	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-273	The encased pipeline contains two 7.6 cm (3 in.) diameter stainless-steel lines. The underground pipeline transferred fuel oil from the 366 Fuel Oil Bunkers (300-6) to the underground Fuel Oil Day Tanks (300-223) to run the 384 Powerhouse.	"Accepted" - Remediation Initiated under IROD	Pipeline	0	0	Petroleum hydrocarbons, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-274	Transite pipe, treated wood, insulation, and various forms of transite were identified during the OU walk down. The debris was potential asbestos-containing material.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Asbestos, metals, PCBs	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-276	The site includes the surface and subsurface sewer system. The original 300 Area SSS serviced all existing 300 Area Buildings and a process line from the 313 Building with vitrified clay sanitary sewer pipes. The 1943 system fed into a large septic tank with a connection to a tile drainage field. In 1947, a new tile field, overflow ditch, and connecting ditch were added to increase capacity. During that construction, uranium contamination was discovered in the sanitary sewer sludge and water. The system was expanded again in 1951, to cope with the increasing number of 300 Area facilities by adding two more septic tanks and north and	"Accepted" - Remediation Initiated under IROD	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information				Information for Development of Alternatives						
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	south leaching trenches to replace the old tile field. The system continued to be used until 1996, when the 300 Area SSS was connected to the City of Richland's municipal water treatment system. The SSS potentially contains radioactive and chemical contaminants.									
300-277	Unplanned Release. Truck being screened with instruments in the queue leaving the area for ERDF.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	16,248 m2 (174,892 ft2)	1 m (3 ft)	Radionuclides, metals, VOC, SVOC, PCB, asbestos, TPH	1) RTD area of 16,248 m2 (174,892 ft2) to 1 m (3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 16,248 m2 (174,892 ft2) to 1 m (3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 16,248 m2 (174,892 ft2) to 1 m (3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 16,248 m2 (174,892 ft2) to 1 m (3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-279	This feature consists of the historical location of underground diesel and gasoline storage tanks that were located to the north of the original 313 Bldg. (M-2885, Sheet 1), and east of the original 3716 Automotive Repair Bldg. location. The northern expansion of the 313 Bldg. was over this area where the tanks were located.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	37 m2 (398 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 37 m2 (398 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37 m2 (398 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37 m2 (398 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37 m2 (398 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-28	The site is contaminated asphalt and soil beneath Gingko Street. New asphalt patches are visible where utility trenches were excavated. The oxide burner operations caused contamination to spread around the 314 Building area. Uranium metal dust from the fuel fabrication activities provided a pathway for heavy metal dust to become airborne and accumulate in soil throughout the northern portion of the 300 Area.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-280	The construction debris disposal pit was a rectangular 13 m by 38 m (42 ft by 124 ft) pit aligned northwest to southeast with a 6 m (20 ft) wide gravel road ramping into the northwest end of the pit (M-3904, Sheet 16).	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	491 m2 (5,285 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB, asbestos, TPH	1) RTD area of 491 m2 (5,285 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 491 m2 (5,285 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 491 m2 (5,285 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 491 m2 (5,285 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-281	This is the suspected site of a septic tank that was shown on a drawing (H-3-45154). The drawing calls for removal of the septic tank. However, the entire drawing was placed on hold for future construction and it is unclear if the septic tank was ever removed. The drawing was for a facility that was never built.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	7.1 m2 (76.4 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC	1) RTD area of 7.1 m2 (76.4 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.1 m2 (76.4 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.1 m2 (76.4 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.1 m2 (76.4 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information				Information for Development of Alternatives						
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
300-283	The site is a suspected release to soil. The site is currently used as an entry road/parking lot for 300 Area D4 activities.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	68 m2 (729 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB	1) RTD area of 68 m2 (729 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 68 m2 (729 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 68 m2 (729 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 68 m2 (729 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-284	This feature is the historical location of the sand blasting area associated with the former 3221 building location.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	229 m2 (2,465 ft2)	0.6 m (2 ft)	Radionuclides and metals suspected	1) RTD area of 229 m2 (2,465 ft2) to 0.6 m (2 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 229 m2 (2,465 ft2) to 0.6 m (2 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 229 m2 (2,465 ft2) to 0.6 m (2 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 229 m2 (2,465 ft2) to 0.6 m (2 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-286	This site consists of three discrete locations and the underlying soil of a potentially contaminated French drain and drywells and their associated below grade piping components. A drywell and a French drain were discovered during the OSE historical review, and the remaining drywell was discovered during a field walkdown of the area under investigation. Each of the facilities associated with the French drains and drywells were identified and the process or function of the facilities determined. Details of inlet pipes, French drains, drywells, and source facilities are provided when available. Drain number 1 (FD-1) (Orphan site feature 300-FF2-019) is a 61 cm (24 in.) diameter drywell constructed in accordance with Hanford standard AC-4-30 (H-3-14950 & H-3-14947). The drain received liquids from two 0.3 m x 0.3 m x 0.3 m (1 ft x 1 ft x 1ft) sumps located in the 309 Building exhaust filter pit. A 2.5 cm (1 in.) schedule 40 steel drain line from each sump joined a 5.1 cm (2 in.) schedule 40 steel line that drained to the French drain. There is a locked metal cover over the drywell. Drain number 2 (FD-28) is a stormwater catch basin and 10.2 cm (4 in.) slotted drainpipe (corrugated polyethylene with a smooth interior). It is not visible in the field. Drain number 3 (FD-33) is a French drain with a 15.2 cm (6 in.) pipe that empties into it. The pipe was traced 11 m (36 ft) due west using geophysics. The traced end of the pipe is 3 m (10 ft) east of FD-21 (NFE), which was associated with the 3701-N guardhouse.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	9.29 m^2 (100 ft^2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB, TPH	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-287	This feature consists of broken corrugated transite in a pile approximately 0.5 m by 1.5 m (1.6 ft by 5 ft).	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	2 m^2 (21.5 ft^2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB, asbestos, TPH	1) RTD area of 2 m2 (21.5 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 2 m2 (21.5 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 2 m2 (21.5 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 2 m2 (21.5 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-288	This feature consists of two piles of garnet sand within a 5 m (16.4 ft) diameter area. The total volume is	"Accepted" - to be Remediated after	Human Health Direct Contact and/or	34 m^2 (368 ft^2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB,	1) RTD area of 34 m2 (368 ft2) to	1) RTD area of 34 m2 (368 ft2) to	1) RTD area of 34 m2 (368 ft2) to	1) RTD area of 34 m2 (368 ft2) to 4.6 m

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	approximately 15 m^3 (20 yd^3), and each pile is estimated to be 5% garnet sand and 95% soil.	ROD signed	Ecological risk likely in shallow soil			asbestos, TPH	4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	(15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-289	This feature consists of bare ground, with crusting and two drum bung plugs.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	22 m^2 (240 ft^2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 22 m2 (240 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 22 m2 (240 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 22 m2 (240 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 22 m2 (240 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-290	The site is a posted RMA approximately 64 m^2 (689 ft^2). The material in the RMA consisted mostly of rusted metal automotive parts, scraps of crumpled sheet metal, electrical wire debris and engine gaskets.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	58 m^2 (624 ft^2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB, asbestos, TPH	1) RTD area of 58 m2 (624 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58 m2 (624 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58 m2 (624 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58 m2 (624 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-291	This feature consists of garnet sand on a gravel roadbed.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	270 m^2 (2,906 ft^2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-293	The subsite consists of UGL in the 300 Area that has been identified as being greater than 0.23 m (2.5 ft) bgs. The UGLs without an approximate depth were also assigned to this subsite.	"Accepted" - to be Remediated after ROD signed	Pipeline	1,646 m (5,400 ft)	0.75 m (2.5 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD pipe length of 1,646 m (5,400 ft) to 0.75 m (2.5 ft) after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipe length of 1,646 m (5,400 ft) to 0.75 m (2.5 ft) after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipe length of 1,646 m (5,400 ft) to 0.75 m (2.5 ft) after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipe length of 1,646 m (5,400 ft) to 0.75 m (2.5 ft) after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.
300-294	This feature consists of garnet sand on a gravel roadbed.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	270 m^2 (2,906 ft^2)	1.2 m (4 ft)	Radionuclides, metals, SVOC, PCB, asbestos	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-296	Unplanned Release. Soil below building 324 B Cell. Very high contamination with rads (14K rad per hour). 9000 rad per hour in soil under building. Assume D&D on Building 324.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	501 m^2 (5,393 ft^2)	assume to 4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	Internal Government Cost Estimate (IGCE) used for cost estimate	IGCE used for cost estimate	IGCE used for cost estimate	IGCE used for cost estimate
300-32	The site is the remaining contaminated components of	"Accepted" - to be	Structure with Human	3,655 m^2 (39,342 ft^2)	soil beneath foundation	Radionuclides,	1) RTD area of	1) RTD area of	1) RTD area of	1) RTD area of 3,655 m2

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General Waste Site Information				Information for Development of Alternatives						
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	the former 333 Building, including the concrete pad, any subgrade soils and piping. Chemical wastes included nitric, sulfuric, hydrofluoric, chromic-nitric-sulfuric, and other acids, along with degreasers TCE in the 1960s and early 1970s, and PCE and 111-TCA in the 1970s and 1980s. Heat treatment salts included sodium nitrate, sodium and potassium nitrite, and sodium and potassium chloride. Additionally, many alcohol and acetone cleansers were used throughout the building's history.	Remediated after ROD signed	Health Direct Contact and/or Ecological risk likely in shallow soil		removal to 4.6 m (15 ft)	metals, VOC, SVOC, PCB, asbestos, TPH	3,655 m2 (39,342 ft2) to 4.6 m (15 ft) bgs, after demolition of structure 2) Disposal at ERDF or other approved disposal facility.	3,655 m2 (39,342 ft2) to 4.6 m (15 ft) bgs, after demolition of structure 2) Disposal at ERDF or other approved disposal facility.	3,655 m2 (39,342 ft2) to 4.6 m (15 ft) bgs, after demolition of structure 2) Disposal at ERDF or other approved disposal facility.	(39,342 ft2) to 4.6 m (15 ft) bgs, after demolition of structure 2) Disposal at ERDF or other approved disposal facility.
300-34	An unplanned release to soil was discovered during excavation to install a new manhole (PS-87). Radioactive-contaminated soil was found at ~3.65 m (12 ft) bgs. Maximum contamination levels were beta/gamma 10,000 dpm. Soil samples emitted 525 pCi/g total beta and 91 pCi/g total alpha.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	9.3 m^2 (100 ft^2)	3.7 m (12 ft)	Radionuclides	Included with 300-15	Included with 300-15	Included with 300-15	Included with 300-15
300-4	The site consists of uranium-contaminated soil inside the southwest corner of the fenced (active) electrical substation. A potential exists for PCB impact to soil from substation equipment, based on soil samples that contained PCBs at concentrations from 1 to 3 mg/kg.	"Accepted" - to be Remediated after ROD signed	Adjacent to long-term facility Human Health Direct Contact and/or Ecological risk likely in shallow soil	420 m^2 (4,521 ft^2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, asbestos, TPH	1) Temporary Surface Barrier until 2027. 2) RTD area of 420 m2 (4,521 ft2) to 4.6 m (15 ft) bgs [after 2027]. 3) Disposal at ERDF or other approved disposal facility.	1) Temporary Surface Barrier until 2027. 2) RTD area of 420 m2 (4,521 ft2) to 4.6 m (15 ft) bgs [after 2027]. 3) Disposal at ERDF or other approved disposal facility.	1) Temporary Surface Barrier until 2027. 2) RTD area of 420 m2 (4,521 ft2) to 4.6 m (15 ft) bgs [after 2027]. 3) Disposal at ERDF or other approved disposal facility.	1) Temporary Surface Barrier until 2027. 2) RTD area of 420 m2 (4,521 ft2) to 4.6 m (15 ft) bgs [after 2027]. 3) Disposal at ERDF or other approved disposal facility.
300-40	This section of piping that was isolated from the rest of the 300 Area process sewer collected rainwater drainage from the 311 Tank Farm and the 303-F Floor Drains. The piping also collected effluent from the 311 Stillhouse. Potential wastes received in this piping system would consist of chemicals (including nitric acid, NaOH, alcohol, TCE, phosphoric acid, Duponol-M-3, hydrofluorosilicic acid, thorium, uranium, and cutting oils) used in the 313 Building fuels manufacturing process.	"Accepted" - Remediation Initiated under IROD	Pipeline	0	0	Radionuclides, metals, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-43	The waste is uranium-contaminated soil remaining after washdown activities inside the 304 CF and 304 SA facilities had leaked through building wall cracks to the outdoor periphery. Sampling and analysis during TSD closure activities for the 304 CF and 304 SA showed uranium contamination at levels up to 256 µg/g for shallow soils at the exterior storage pad.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-46	Contamination of the area surrounding the 3706 Building may have been caused by operations, and associated spills and releases. Subsurface contamination is suspected, although radiological surveys near and around the 3706 Building have not detected radiologically contaminated soil.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides and metals suspected	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-48	The handling of thorium powder targets spread fine and particulate contamination throughout the 3732 Building. Decontamination practices included hosing down the	"Accepted" - Remediation Initiated	Human Health Direct Contact and/or Ecological risk likely in	0	0	Radionuclides	Not evaluated. Site assumed to pass	Not evaluated. Site assumed to	Not evaluated. Site assumed to pass	Not evaluated. Site assumed to pass PRGs.

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information			Information for Development of Alternatives							
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	facility floors and walls, allowing contaminated liquid to be released to the surrounding soil.	under IROD	shallow soil				PRGs.	pass PRGs.	PRGs.	
300-5	The site was two underground fuel tanks, the pump island, ancillary piping, and contaminated soil. An unknown quantity of contaminated soil, under the fuel dispensing island at the 3709-A Building (300 Area Fire Station) was discovered on April 10, 1992. These tanks were removed on April 14, 1992.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	58.3 m^2 (628 ft^2)	4.6 m (15 ft)	Petroleum hydrocarbons, metals	1) RTD area of 58.3 m2 (628 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58.3 m2 (628 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58.3 m2 (628 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58.3 m2 (628 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-6	In summer 2001, four concrete bunkers (USTs) were removed. In September 2001, excavated, sidewall soil was segregated and stockpiled at the site, based on visible evidence of petroleum contamination. The stockpiled soil awaits characterization and disposition.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Petroleum hydrocarbons, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-7	The vegetated site contains solid construction debris (concrete, metallic waste, asbestos, and uranium contamination). Surface debris piles are visible. Subsurface disturbances have been identified with GPR.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	6,225 m^2 (67,005 ft^2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, asbestos, TPH	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes
300-80	The site is a square concrete structure adjacent to the 314 Building and next to a fenced stairway leading down. The site is covered by a steel plate marked with a sign "Radioactive material, internally contaminated." The purpose of this structure in not clear. The site appears to have become contaminated.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-9	This "Early Burial Ground" and its burial inventory are not well documented. Uranium-contaminated aluminum shavings are scattered on the ground surface. Other surface contaminants may include aluminum-silicon alloy and beryllium-contaminated aluminum. Process knowledge suggests the waste would consist of the uranium-contaminated waste from very early 300 Area experimental processes.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	462 m^2 (4,973 ft^2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, asbestos, TPH	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes
313 ESSP	The area was used to stage mixed waste including byproduct waste materials from the fuels fabrication process and neutralized solids from the 313 Recovery Operations process.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
316-1	The original unlined percolation pond surface area was 45,522 m^2 (490,000 ft^2), at 1.5 m (5 ft) deep, and was separated into five sections. It originally received cooling water and low-level liquid wastes from fuel fabrication facilities and early laboratories (313, 314, 3706, and 321 Buildings). Facilities contaminants included U, Cu, Co, and small amounts of Pu. Combined process wastes discharged from the fuel fabrication facilities to the South and North Process Ponds ranged from 1.5 to 11.4 million L/day (400,000 to 3 million gal/day). In August 1945, the pond overflowed eastward toward the Columbia River. A crushed-rock and earthen dike was built in September 1945. Accumulation of aluminum/uranium hydroxide	Residual source mass causing uranium groundwater plume	Residual source mass causing uranium groundwater plume	59,937 m2 (645,157 ft2)	12 m (40 ft) bgs	Uranium	No Action	1) Phased approach for uranium sequestration via phosphate infiltration and injection over 10,871 m2 (117,015 ft2) 2) Phased approach for uranium sequestration via phosphate	1) Focused deep RTD area of 10,871 m2 (117,015 ft2)10,540 m2 (113,450 ft2) to 12 m (40 ft) bgs 2) Uranium sequestration via phosphate infiltration and injection (20 % of area) over 49,066 m2 (528,142 ft2)	Expanded deep RTD area of 59,937 m2 (645,157 ft2) to 12 m (40 ft) bgs

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General Waste Site Information				Information for Development of Alternatives						
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	precipitate had affected the infiltration rate. In October 1948, the SPP dike breached on the northwest side, releasing the bulk of the pond's contents including 5.4 to 27.7 kg (12 to 61 lb) of uranium into the Columbia River. The breach was attributed aluminum/uranium hydroxide precipitate accumulated on the pond bottom. The 316-2 North Process Pond was built as a substitute for the SPP, while repairs were made, and the bottom was dredged. Afterward, the ponds were regularly maintained by dredging. Dredge sediments were deposited on the surrounding dikes and on the scrapings disposal area. The site was Closed Out under EPA/ROD/R10-96/143. Approximately 234,000 metric tons (257,000 US tons) of material were removed from the site.							infiltration and injection (20 % of area) over 49,066 m2 (528,142 ft2)		
316-2	Seven sections separated by 3.7 m (12-ft) wide dikes, with the entire 40,000 m^2 (10-acre) area surrounded by a dike 4.6 m (15 ft) wide and ~3 m (10 ft) high. It was built to receive waste in 1948, after a dike failure at the SPP. The site originally received cooling water and low-level liquid process wastes from the fuel fabrication facilities and the early laboratories (313, 314, 3706, and 321 Buildings). In 1955, the 316-2 North Process Pond was taken out of service for 14 months to manage accumulated uranium bearing. Dredging recovered 4,672 kg (10,300 lb) of uranium from deposits up to 22.9 cm (9 in.) thick in two locations in the southwest region of the pond. Pre-1954, ~21,955 L (5,800 gal) per month of sodium aluminate containing 22.7 kg (50 lb) of uranium, was released to the 316-1 and 316-2 ponds, resulting in 2,722 kg (6,000 lb) of uranium. An estimated 8,684 kg (19,145 lb) of mostly depleted U-235 was discharged to the ponds from the 321 Building. By 1956, sodium aluminate was included in the 313 Building waste stream instead of being discharged to the ponds. The South and North Process Ponds were phased out in 1974 and 1975. The North Process Pond was Closed Out under EPA/ROD/R10-96/143.	Residual source mass causing uranium groundwater plume	Residual source mass causing uranium groundwater plume	39,994 m2 (430,492 ft2)	12 m (40 ft) bgs	Uranium	No Action	Phased approach for uranium sequestration via phosphate infiltration and injection (20 % of area) over 39,994 m2 (430,492 ft2)	Uranium sequestration via phosphate infiltration and injection (20 % of area) over 39,994 m2 (430,492 ft2)	Expanded deep RTD area of 39,994 m2 (430,492 ft2) to 12 m (40 ft) bgs
316-5	Served as the discharge site for the 300 Area Process Sewer System. The 468 m (1,535-ft) long, 3 m (10-ft) wide ponds, spaced 15 m (50 ft) apart were constructed to receive the low-level waste that had previously gone to the South and North Process Ponds (316-1 and 316-2). The two trenches operated alternately with one being filled to a predetermined level before switching to the other one, usually every 2 to 6 months. The site received approximately 9.8 million L/day (2.6 million gal/day) of water. This water was chlorinated by the water filter plant for the 300 Area and contained minerals added to the water during use. Water discharged to the process sewer was used primarily for cooling and was not modified. Other discharge sources included steam condensates, floor washing/waxing janitorial solutions, water treatment (primarily salt),	Residual source mass causing uranium groundwater plume	Residual source mass causing uranium groundwater plume	49,891 m2 (537,022 ft2	12 m (40 ft) bgs	Uranium	No Action	1) Phased approach for uranium sequestration via phosphate infiltration and injection over 25,971 m2 (279,549 ft2) 2) Phased approach for uranium sequestration via phosphate infiltration and injection (20 % of	1) Focused deep RTD area of 25,971 m2 (279,549 ft2) to 12 m (40 ft) bgs 2) Uranium sequestration via phosphate infiltration and injection (20 % of area) over 23,920 m2 (257,473 ft2)	Expanded deep RTD area of 49,891 m2 (537,022 ft2) to 12 m (40 ft) bgs

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Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	laboratories, process water from fuel fabrication, and other aqueous solutions not designated as dangerous wastes (WAC 173-303). In 1991, an ERA removed contaminated soil and sludge from the trenches sides and bottoms. Excavated sediments were used to fill the north end of the trenches and were immobilized in the Process Trench Spoils Area. Excavation activities removing lifts of 0.3 m (1 ft) of contaminated soil from the sides and 1.3 m (4 ft) from the bottom of each trench. The 300 Area Process Trenches Waste Site was closed out under EPA/ROD/R10-96/143.							area) over 23,920 m2 (257,473 ft2)		
316-3	The site received wastes from the 300 Area Laboratory expansion facilities (329 Biophysics Laboratory, 327 Radiometallurgy Building, 324 Radiochemistry Building, 326 Pile Technology Building, and 329 Mechanical Development Building). The wastes first went through the 307 Retention Basins. Retention Basin waste below discharge limits was released to the trenches.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil Groundwater/surface water protection risk likely for uranium and other COCs.	25,261 m2 (271,907 ft2)	12 m (40 ft) bgs	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	At DOEs request, WCHs costs have been applied for cost estimating purposes for the shallow RTD component.	1) Phased approach for uranium sequestration via phosphate infiltration and injection over 3,755 m2 (40,418 ft2) 2) Phased approach for uranium sequestration via phosphate infiltration and injection (20 % of area) over 21,506 m2 (231,489 ft2) 3) At DOEs request, WCHs costs have been applied for cost estimating purposes for the shallow RTD component.	1) Focused deep RTD area of 3,755 m2 (40,418 ft2) to 12 m (40 ft) bgs 2) Uranium sequestration via phosphate infiltration and injection (20 % of area) over 21,506 m2 (231,489 ft2)	Expanded deep RTD area of 25,261 m2 (271,907 ft2) to 12 m (40 ft) bgs
316-4	The site received hexone-bearing uranium waste and limited amounts of other uranium-bearing waste from the 321 Building. Calculations through July 1955 indicate liquid wastes containing 550 kg (1,230 lb) of uranium were discharged to this site. In 1962, 12,040 L (3,182 gal) of liquid, organic waste was transported to the 300 North Cribs. The crib tanks were removed in 2004.	"Accepted" - to be Remediated after ROD signed	Groundwater/Surface water protection risk likely for Uranium	0	0	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
331 LSLT1	The Life Sciences Laboratory Trench received sanitary wastewater and animal waste from the animal waste pit. Since most of the animal studies involved the use of radioisotopes, animal waste was segregated by activity. Solid animal waste, exceeding 200 pCi/g specific activity, was transported to 100-F trenches regularly. All other solid animal waste (<200 pCi/g specific activity)	"Accepted" - to be Remediated after ROD signed	Underneath long-term facility (no temporary barrier needed) Human Health Direct Contact and/or Ecological risk likely in	4.41 m2 (47.5 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, TPH	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.

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Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	was flushed into the 331 Waste System. Specific contamination cases occurred at the 331 Complex.		shallow soil					facility.	facility.	
331 LSLT2	The Life Sciences Laboratory Trench received liquid animal waste from the animal waste pit. Animal wastes were the most prominent wastes, in terms of volume, generated by the 331 Complex. Originally, liquid animal wastes from the complex, including wash downs from the "hog and dog runs," were disposed to a large, unlined pit, east of the 331-D Building. Sewers carrying animal waste from the 331 Complex were also connected to this pit.	"Accepted" - to be Remediated after ROD signed	Underneath long-term facility (no temporary barrier needed) Human Health Direct Contact and/or Ecological risk likely in shallow soil	4.41 m2 (47.5 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, TPH	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.
333 WSTF	The White Sands Test Facility tank stored used, non-PCB oil from the extrusion press sump. The oil was not ignitable before removal. No known releases were documented. The Uranium Bearing Acid tanks stored spent-acid-containing uranium. The uranium was a recoverable asset for recycling.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Petroleum hydrocarbons, uranium	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
340 Complex	The 340 Complex consists of Buildings 340, 340-A, 340-B, 3707-F, office trailers, 307 Retention Basins, two vaulted underground tanks, six 340A tanks, underground transfer pipes, load-out and decontamination equipment, instrumentation, and before 1963, the 316-3 Trenches, which disposed of retention process waste that met release criteria. The site supported the 325, 326, 237, and 329 Buildings, relieved stress on the 316-1 and 316-2 Process Ponds, and received potentially contaminated "retention" waste liquids. Waste liquids passed through the RPS line to the 307 Retention Basins to reduce radioactivity to less than threshold values before transfer to the 307 Trenches. Threshold-exceeding liquid was transferred to 56,780-L (15,000-gal) capacity collection tanks in the 340 Building before disposal at the 200 Area. Discharge to the basins was 4 g/L gross beta and 0.5 g/L plutonium, later changed to 50,000 pCi/L. The RLWS collected liquid process waste from the laboratories and the 308, 309, and 324 Buildings, and transferred the wastes to the 340 Building tanks. The 307 Trenches received 1 million L (264,172 gal) of uncontaminated low-level radioactive waste liquid from the 307 Retention Basins once the waste streams were less than discharge limits. After 1963 removal from service, the 307 Trenches waste liquids were transferred to the process sewer for disposal in the Process Ponds. The 307 Trenches were excavated, and contaminated soil was transported to the 618-10 Burial Ground. In 1965, the trenches were backfilled with 7,645 m^3 (25,082 ft^3) of uranium-contaminated sediment from the SPP and fly ash. A leak test in 1976, of the single-walled RLWS network showed widespread system leaks. The system was replaced in 1978 to 1979, with double-walled, stainless steel pipes and a leak detection system. During replacement, contaminated soil was removed, but the	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	6,403 m2 (68,921 ft2)	soil beneath foundation removal to 4.6 m (15 ft)	Radionuclides	1) RTD area of 6,403 m2 (68,921 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 6,403 m2 (68,921 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 6,403 m2 (68,921 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 6,403 m2 (68,921 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.

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	RLWS piping and low radioactive level soil remains.									
3712 USSA	The 3712 USSA Building stores uranium fuel elements, fuel fabrication components, and uranium scraps from 313 and 333 fuel fabrication activities.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
400 PPSS	This site is the 400 Area Secondary Cooling Water (400 Area Process Pond and Sewer System). The unit consists of underground piping, a control structure, and the 4608B and 4608C percolation ponds. The process sewer, which empties into the process ponds, is for discharging water from cooling systems, and non-sanitary drains and sumps in the 400 Area facilities, including the FFTF. Water from the FFTF and FMEF cooling towers contains non-regulated quantities of algaecides and other treatment chemicals, including a biocide (Dearcide 702), microbiocide (sodium hypochlorite), and softening agent (Dearborn 878). Chemicals used for secondary cooling water testing (Dearborn Code 550, 562, 595, 899, 904) are present in unregulated quantities.	"Accepted" - to be Remediated after ROD signed	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	3,006 m2 (32,356 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 3,006 m2 (32,356 ft2) to 4.6 m (15 ft) bgs, after demolition of structure in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 3,006 m2 (32,356 ft2) to 4.6 m (15 ft) bgs, after demolition of structure in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 3,006 m2 (32,356 ft2) to 4.6 m (15 ft) bgs, after demolition of structure in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 3,006 m2 (32,356 ft2) to 4.6 m (15 ft) bgs, after demolition of structure in 2027. 2) Disposal at ERDF or other approved disposal facility.
400-37	The site is an underground fuel oil tank. No visual evidence of the tank exists on the surface. The tank supplied diesel fuel to a standby electric generator. Drawing H-4-152061 has a written notation that the fuel oil tank was abandoned in place and that the exact location of the fuel line is unknown. It is believed to have been filled with sand.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	51.83 m2 (557.9 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, TPH	1) RTD area of 51.83 m2 (557.9 ft2) to 4.6 m (15 ft) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 51.83 m2 (557.9 ft2) to 4.6 m (15 ft) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 51.83 m2 (557.9 ft2) to 4.6 m (15 ft) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 51.83 m2 (557.9 ft2) to 4.6 m (15 ft) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.
400-38	The site is an underground fuel tank that supported 4722A. There is no visual evidence of the tank on the surface. Drawing H-4-152061 has a notation reading, "buried fuel tank." It is possible the tank has been filled with sand, but documentation has not been found.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	21 m2 (225 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, TPH	1) RTD area of 21 m2 (225 ft2) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 21 m2 (225 ft2) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 21 m2 (225 ft2) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 21 m2 (225 ft2) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.
600-290	The site was a contaminated pad and loading dock near the 618-13 soil mound that was used for loading waste drums. Rust-colored drum ring patterns on the concrete suggest temporary storage of 208 L (55-gal) drums.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	110 m2 (1184 ft2); 110 m3 (35 ft3) of concrete	soil beneath foundation removal to 4.6 m (15 ft)	Metals, organics suspected	No Alternative; addressed with sub-sets (600-290:1 and -290:2)	No Alternative; addressed with sub-sets (600-290:1 and -290:2)	No Alternative; addressed with sub-sets (600-290:1 and -290:2)	No Alternative; addressed with sub-sets (600-290:1 and -290:2)
600-367	The site is a large, open field with a high soil mound in the center. Several pipes extend vertically through the soil surface in some areas. A small pallet containing damaged bags of bentonite is located in the southeast corner of the area adjacent to some vertical pipes. Two steel-hinged plates cover access holes to underground culverts used as monitoring stations for buried waste tests. Only simulated buried waste was placed at this test site.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	35,000 m2 (376,736 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 35,000 m2 (376,736 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 35,000 m2 (376,736 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 35,000 m2 (376,736 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 35,000 m2 (376,736 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information			Information for Development of Alternatives							
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
600-63	The site, which includes potentially contaminated soil and equipment, is enclosed within barbed, chain-link fencing with a locking gate. A considerable amount of surface debris is observed outside the fenced area. A trace amount of Co-60 was mixed in 1 cm (0.4 in.) of soil and placed 60 cm (24 in.) below the surface of two of the drainage lysimeters. Trace amounts of tritium were placed in two other lysimeters. Contaminant migration was monitored. Buried equipment, including caissons, lysimeters, associated instrumentation, and solar panels are noted, and may be contaminated with Co-60 and tritium.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	1,600 m2 (17,222 ft2)	4.6 m (15 ft)	Cobalt-60 and tritium	BPA lease site. Site will be remediated after ROD, but costs are not included in FS.	BPA lease site. Site will be remediated after ROD, but costs are not included in FS.	BPA lease site. Site will be remediated after ROD, but costs are not included in FS.	BPA lease site. Site will be remediated after ROD, but costs are not included in FS.
618-1	Two trenches received waste from early 300 Area facility operations, including the 305 Reactor, 3706 Laboratory, and 3741 Building. The site contains large quantities (14,500 kg [~16 tons]) of uranium from fuel fabrication activities, and small quantities of plutonium and fission products from laboratory operations. Radiological readings indicated 6,000 dpm alpha and 15 mR/hr beta/gamma. An August 1946, monthly report mentions burial of a bronze crucible that read 170 mR/hr (179 mrads/hr) and 5.5 mR/hr (5.5 mrads/hr) at 10.2 cm (4 in.).	Risk Exceedance	Groundwater Protection risk for Total Uranium Isotopes in deep soil	3,524 m2 (37,932 ft2)	12 m (40 ft)	Uranium	No Action	Phased approach for uranium sequestration via phosphate infiltration and injection (20 % of area) over 3,524 m2 (37,932 ft2)	Uranium sequestration via phosphate infiltration and injection (20 % of area) over 3,524 m2 (37,932 ft2)	Expanded deep RTD area of 3,524 m2 (37,932 ft2) to 12 m (40 ft) bgs
618-10	The site consists of 12 trenches and 94 VPUs. The site contains a broad spectrum of low- to high-level dry wastes, primarily fission products and some TRU from the 300 Area. Low-level wastes are buried in trenches, and medium- to high-level beta/gamma wastes are mostly in the vertical pipe units. Some higher activity wastes were placed in concrete-shielded drums and disposed in the trenches. The site was surface stabilized with clean backfill material in 1983. This burial ground is currently undergoing remediation.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides and TRU	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
618-11	The site consists of three V-shaped trenches, two large-diameter caissons, and 50 VPUs. The burial ground received a variety of waste from the 300 Area operations. Low-level activity waste and large items were placed into the burial trenches. Some high-activity liquid waste or plutonium-contaminated liquid was placed inside barrels and sealed with concrete. The burial ground was surface stabilized with additional clean soil and planted with wheat grass in 1983.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	62,012 m2 (667,489 ft2)	variable	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	1) RTD area of 62,012 m2 (667,489 ft2) to variable depths. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 62,012 m2 (667,489 ft2) to variable depths. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 62,012 m2 (667,489 ft2) to variable depths. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 62,012 m2 (667,489 ft2) to variable depths. 2) Disposal at ERDF or other approved disposal facility.
618-2	The waste site consisted of three east-west trenches. In 1995, GPR identified three distinct trenches. Historical documents stated that there were either three or four trenches. The discrepancy of whether there are three or four trenches could be because the geometry of the middle trench is broken into two pieces at the east end. The unit was used for disposal of uranium-contaminated equipment and materials, plutonium, and fission products. The uranium waste was typically solid metallic uranium oxides in the form of metal cuttings from Reactor Fuel Fabrication facilities in the 300 Area.	Risk Exceedance	Groundwater Protection risk for Total Uranium Isotopes in deep soil	7,802 m2 (83,980 ft2)	12 m (40 ft)	Uranium	No Action	Phased approach for uranium sequestration via phosphate infiltration and injection (20 % of area) over 7,802 m2 (83,980 ft2)	Uranium sequestration via phosphate infiltration and injection (20 % of area) over 7,802 m2 (83,980 ft2)	Expanded deep RTD area of 7,802 m2 (83,980 ft2) to 12 m (40 ft) bgs

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information			Information for Development of Alternatives							
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	Plutonium and fission products came from 300 Area laboratory facilities that began to operate in 1953. The burial ground may also contain tin from the triple dip canning process and lead from the lead dip process. In December 2004, during remedial excavation, bottles with liquid were found in a combination lock safe.									
618-3	The site consists of uranium-contaminated waste, primarily building materials from the remodeling of the 313 Building. It may also contain waste from the 303-J and K upgrades. In 1986, the volume of contaminated soil was estimated to be 12,549 m^3 (443,160 ft^3), with 12,643 m^3 (446,480 ft^3) of overburden.	Risk Exceedance	Human Health Direct Contact and Groundwater Protection risk for Uranium in deep soil	5,449 m2 (58,652 ft2)	12 m (40 ft)	Uranium	No Action	Phased approach for uranium sequestration via phosphate infiltration and injection (20 % of area) over 5,449 m2 (58,652 ft2)	Uranium sequestration via phosphate infiltration and injection (20 % of area) over 5,449 m2 (58,652 ft2)	Expanded deep RTD area of 5,449 m2 (58,652 ft2) to 12 m (40 ft) bgs
UPR-300-1	The site was a release to soil between the 307 Retention Basins and the 340 Building. The discharged waste consisted of process effluent contaminated by TRU fission products including 900 Ci of short-lived radionuclides (mainly promethium-147) and 10 Ci each of Sr-90 and Cs-137. The top 0.61 m (2 ft) of the contaminated drummed and transported to a 200 Area burial ground. Further removal of contaminated soil was considered a threat to adjacent structures. There is no readily apparent sign of subsurface contamination beneath the gravel-covered area. More than 90% of the contamination is confined to an area 3.7 m (12 ft) in diameter and 7.6 m (25 ft) deep.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides and TRU	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-10	The site was a UPR to the soil beneath the northwest corner of the 325 Building. UPR-300-10 occurred in the radioactive waste sewer line that served the 325-B Hot Cells, between the 325 Building's west basement wall of Room 32 and the north foundation wall of Room 202. The release included waste from dissolution of highly radioactive samples including irradiated reactor fuels.	"Accepted" - to be Remediated after ROD signed	Underneath long-term facility (no temporary barrier needed) Human Health Direct Contact and/or Ecological risk likely in shallow soil	232 m2 (2,497 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	1) RTD area of 232 m2 (2,497 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 232 m2 (2,497 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 232 m2 (2,497 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 232 m2 (2,497 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.
UPR-300-11	The site was a release to the soil that involved a 1.2 m (4-ft) diameter column of gravel-covered soil in the 340 Complex yard. The release occurred around and below a leaking, flanged tee that connected the RRLWS to the 340 Vault. Soil samples from near the broken pipe yielded detectable concentrations of Sr-90, Eu-155, Ce-144, Pu-239/240, Am-241, and Pu-238. Approximately 1 Ci of contamination was left in place.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-12	UPR-300-12 occurred in the basement floor of the 325-A Building. The waste migrated through cracks in the floor to the soil beneath the building. The site received radioactive rinse water overflow containing nitrate ions, Pm-147, fission products, and TRU nuclides. Total rinse water activity was estimated at 70 Ci (95% Pm-147). The rinse water contained nitrate ions, Pm-147, fission products, and TRU radionuclides. Nitrate ions, but no radionuclides, were detected in samples from a nearby	"Accepted" - to be Remediated after ROD signed	Underneath long-term facility (no temporary barrier needed) Human Health Direct Contact and/or Ecological risk likely in shallow soil	3.6 m2 (38.75 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	Shallow soil contamination under building will be removed during 325-A Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 325-A Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 325-A Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 325-A Building demolition. Costs are not included in FS.

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information			Information for Development of Alternatives							
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
	groundwater monitoring well. PNNL sampled the underlying soil in January 1979. Decontamination efforts on Room 50-A were completed. Removal of the contaminated soil under the building was considered a threat to the integrity of the 325 Building.									
UPR-300-2	Multiple releases occurred from ongoing decontamination and waste handling activities starting in January 1954. It is unknown if this was related to a single event or all events over the period (1954 to date). An estimated 10 mCi of Cs-137 may have been released.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	241 m2 (2,594 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	1) RTD area of 241 m2 (2,594 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 241 m2 (2,594 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 241 m2 (2,594 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 241 m2 (2,594 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
UPR-300-38	The site is the contaminated, concrete foundation and underlying soil beneath the 313 Building from multiple UPR events. The full contamination extent is pending 313 Building foundation removal. Materials released to soil beneath the building may have included uranium-bearing acid (nitric and sulfuric acid with uranium in solution), neutralized acid waste (typically sodium fluoride, sodium nitrate, sodium dichromate, and sodium sulfate in solution with precipitates of uranium, chromium, copper, and zirconium), etch acids (nitric, hydrofluoric, sulfuric, and chromic acids), TCE, PCE, sodium hydroxide solutions, and contaminated water.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-39	The release site was to the soil adjacent to the caustic storage tanks in the 311 Tank Farm. The waste consisted of caustic solution containing 50% sodium hydroxide solution. If the sodium hydroxide were exposed to uranium contamination (likely the case), the resultant contamination would be sodium diuranate ("yellow cake"). In February 2006, the 311 Tank Farm and concrete containment were demolished. Before demolition, the two, sodium hydroxide tanks were labeled "Empty."	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-4	The site is the soil beneath and south of the 321 Building. The site represents a number of releases that occurred from 1945 to 1988. Complete contaminated soil removal was not attempted because of possible threat to the integrity of the 321 Building. No specific occurrence reports have been documented. The contaminated soil extent is not documented.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides suspected	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-40	The release site was to the soil between the 311 Tank Farm and the 303-F Building. Piping connections were repaired, but contaminated soil was not removed. The waste consisted of uranium-bearing acid waste containing nitric and sulfuric acid with uranium in solution and chromic acids with copper and zinc in solution. A comparison of WIDS Sites UPR-300-31 and UPR-300-40 and their reference documents was performed, and the conclusion was that they both represented the same event. It was decided to join them under WIDS Site UPR-300-40.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information				Information for Development of Alternatives						
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
UPR-300-42	The release was an overflow of 750-1,135 L (200-300 gal) No. 6 fuel oil onto the ground adjacent to the #2 Day Tank, a UST. The adjacent day tanks (300-223) have been remediated, but this release was not removed because of concerns regarding the foundation of the 384 Powerhouse. The surface area around the day tanks was paved with asphalt. This release is not visible.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Petroleum hydrocarbons, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-45	The release site was to the soil beneath the transfer piping, adjacent to the 303-F Building. The leak contained uranium-bearing waste acid identified as nitric and sulfuric with uranium in solution. Analysis showed the solution to contain 3,480, 6,960, and 920 ppm of nitrate, sulfate, and uranium, respectively. Some soil from the release site was exhumed, packaged, and sent to the Low-Level Burial Grounds for disposal. Cleanup effectiveness is not documented. The remaining soil beneath the pipe trench and around the processing facilities is expected to be addressed separately after the RCRA closure plan activities are completed.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-48	The site received radioactive liquid from a leak in the process sewer drainpipe. The site was discovered during dye testing of drains during development of the Facility Effluent Monitoring Plan development for the 325 Building. The contamination may have resulted from routine releases and accumulated in the soil under the crack. Radioactivity up to 1,700 dpm alpha was detected. The TCLP results were below regulatory limits. Radioactivity levels were sufficiently low to permit fixing the contamination in place. This activity was reported as an off normal occurrence in October 1991 (RL-PNL-325-1991-1023).	"Accepted" - to be Remediated after ROD signed	Underneath long-term facility (no temporary barrier needed) Human Health Direct Contact and/or Ecological risk likely in shallow soil	37.3 m2 (400 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	1) RTD area of 37.3 m2 (400 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37.3 m2 (400 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37.3 m2 (400 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37.3 m2 (400 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.
UPR-300-5	The site was a release that contaminated the storage basin area, the filter vault, the stack base, the truck stall, and the truck ramp outside the 309 Building. The waste was low-level radioactive water. The primary isotope was Cs-137.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	7.32 m^2 (78.8 ft^2)	4.6 m (15 ft)	Cesium-137, radionuclides	Shallow soil contamination under building will be removed during 309 Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 309 Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 309 Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 309 Building demolition. Costs are not included in FS.
UPR-600-22	The site consists of a series of small, parallel berms. Before 1972, the area was contaminated with particulate fallout (windblown) from burial activities in the 618-11 Burial Grounds. The contaminated area was covered by scraping the affected ground into windrows. The windrows were cut by backhoe on 10/24/1972. Radiological surveys were made of all removed soil and the walls of each cut. No beta, gamma, or alpha radioactivity was detected above the normal background of 100 counts/min.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides, metals suspected	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.

Table I-1. Alternatives for Evaluated Waste Sites

General Waste Site Information				Information for Development of Alternatives						
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5

Note: The main text of this appendix lists complete reference citations for this table.

bgs = below ground surface
CWS = contaminated waste storage
ERA = Expedited Response Action
ERDF = Environmental Restoration Disposal Facility
FFTF = Fast Flux Test Facility
FMEF = Fuels and Materials Examination Facility
GPR = ground penetrating radar
OSE = Orphan Site Evaluation
OU = Operable Unit
PNNL = Pacific Northwest National Laboratory
R&D = Research and Design
RCRA = *Resource Conservation and Recovery Act of 1976*
RLWS = Radioactive Liquid Waste Sewer
RMA = Radiological Materials Area
RPS = Retention Process Sewer
SPP = South Process Pond
SSS = Sanitary Sewer System
TEDF = Treated Effluent Disposal Facility
TRU = transuranic
TSD = treatment, storage, and/or disposal
UGL = underground utility line
UPR = unplanned release
URO = Uranium Recovery Operations
USSA = Uranium Scrap Storage Area
UST = underground storage tank
VPU = vertical pipe unit
WATS = Waste Acid Treatment System

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Appendix J

Technology Screening—Not Retained Technologies

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Terms

AFO	amorphous ferric oxyhydroxide
BFS	blast furnace slag
bgs	below ground surface
CBA	chlorobenzoic acidCNF Central Neutralization Facility
COC	constituent of concern
CSTR	continuous stirred-tank bioreactor
CVOC	chlorinated volatile organic compound
DCE	dichloroethylene
DNAPL	dense nonaqueous phase liquid
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
EPA	U.S. environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESS	ex situ solidification/stabilization
GCW	groundwater circulation well
HRC®	hydrogen release compound
HTTD	high-temperature thermal desorption
ISCO	in situ chemical oxidation
ISGR	in situ gaseous reduction
ISTD	in situ thermal desorption
ISV	in situ vitrification
LTTD	low-temperature thermal desorption
MWH	megawatt hour
NAPL	nonaqueous phase liquid
NZVI	nano-scale zero-valent iron
O&M	operation and maintenance
ORNL	Oak Ridge National Laboratory
PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl

PCE	tetrachloroethene
PCP	pentachlorophenol
PNNL	Pacific Northwest National Laboratory
ppm	parts per million
RCRA	*Resource Conservation and Recovery Act of 1976*
RO	reverse osmosis
ROI	radius of influence
RPO	remediation process optimization
SLM	supported liquid membrane
SRB	sulfate- reducing bioreactor
SVE	soil vapor extraction
SVOC	semivolatile organic compound
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure
TSCA	*Toxic Substances Control Act of 1976*
TVS	transportable vitrification system
VSEP®	vibratory shear-enhanced processing
VOC	volatile organic compound
ZVI	zero valent iron
WSRC	Westinghouse Savannah River Company
WTP	Waste Treatment and Immobilization Plant

J1 Additional Information on Technologies Not Retained for Waste Site Treatment

This appendix presents information regarding technologies that were not retained for further evaluation for treatment of waste site soil contaminated with uranium and other constituents of concern (COCs).

J1.1 Ex Situ Treatment and Processing

Following excavation, soils can be treated with ex situ methods to reduce contaminant concentrations or toxicity, remove contaminants (transfer to different media), or reduce volume, and allow for less costly disposal. Ex situ treatment technologies not retained for further consideration are discussed in this section.

For this effort, ex situ treatment does not include treatment performed for ultimate disposal (such as at the Environmental Restoration Disposal Facility [ERDF]). Treatment performed as required to meet disposal restrictions is included in the disposal to the onsite landfill process option. It only covers technologies that could be used to treat the soils so that part or all of the soil volume could be backfilled at the locations from which it was removed.

J1.1.1 Ex Situ Solidification/Stabilization

Ex situ solidification/stabilization (ESS) was not retained for treatment of soils contaminated with mobile to semimobile radionuclides and other COCs.

J1.1.1.1 Description

ESS is a treatment process that uses a binding agent to reduce the mobility of contaminants by physically binding or enclosing contaminated soil particles within a stabilized mass (solidification), or via chemical reactions between stabilizing agents and contaminants. ESS can be performed ex situ to meet disposal requirements. A wide variety of solidification/stabilization agents is available, including Portland cement, or other pozzolans, silicates, bitumen, and acrylic polymers. Portland cements typically consist of calcium silicates, aluminosilicates, aluminoferrites, and sulfates. Metals are immobilized in cement type binders as hydroxides or other stable solids. Phosphate or other chemical reagents can also be added to chemically bind metals. Polymeric compounds can be used to bind metal and radionuclides by micro-encapsulation (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]).

ESS is targeted at reducing the mobility of contaminants. It does not necessarily treat or detoxify contaminants. Consequently, it is not applicable to contaminants that are a risk to human health or the environment because of the potential for direct exposure to contaminants in the top 4.5 m (15 ft) of soil. It is only applicable to contaminants that are a risk as a result of migration to groundwater.

J1.1.1.2 Relevant Demonstration Projects

Cement solidification has been a widely used technique for treatment and ultimate disposal of hazardous, low-level, and mixed wastes. A cement solidification/stabilization treatability study was completed at the Fernald Environmental Management Project (*100 Area Source Operable Unit Focused Feasibility Study Report* [DOE/RL-94-61]). The test was completed at six waste pits, all of which contained radionuclide-impacted waste (primarily uranium). Portland cement (Type I/II) and blast furnace slag (BFS) were used as binders; additives included Type F fly ash, site fly ash, absorbents, and sodium silicate. The study indicated the toxicity characteristic leaching procedure (TCLP) was met, and leachability of uranium was controlled except when present at high concentrations. The study also indicated a significant increase in waste volume resulted from the cement stabilization process (*100 Area Source Operable Unit Focused Feasibility Study Report* [DOE/RL-94-61]).

The U.S. Department of Energy (DOE) has demonstrated polyethylene encapsulation to treat a number of radionuclides (e.g., cesium and strontium), and toxic metals (including chromium, lead, and cadmium). DOE's technology information profile (*Technology Catalogue, Second Edition* [DOE/EM-0235]) detailed polyethylene encapsulation to be applicable for stabilization of low-level radioactive and heavy metal waste components that may be in media such as aqueous salt concentrates, salt cake, sludge, fly ash, and ion exchange resins. Scale-up from bench-scale tests demonstrated the feasibility of this process to treat wastes at approximately 907 kg (2,000 lb) per hour (*Technology Catalogue, Second Edition* [DOE/EM-0235]).

J1.1.1.3 Evaluation and Screening Rationale

The effectiveness of ESS is considered low to moderate for immobilizing mobile contaminants in soil that could leach to groundwater. The stabilized mass must be protected from weathering and seismic activity for long-term durability. Although this is a well-established technology, site-specific studies would need to be completed to evaluate equipment required and appropriate cement agents. ESS was screened out in favor of the safer alternative of disposal in the ERDF, a centralized facility engineered to protect against weathering and seismic activity.

J1.1.2 Ex Situ Treatment Soil Washing

Ex situ soil washing was not retained for excavated sediment and soils contaminated with uranium or technetium-99.

J1.1.2.1 Description

Soil washing is an ex situ process that applies a water-based solution to a soil relying upon physical and chemical separation and extraction to remove contaminants sorbed onto fine soil particles from bulk soil. The process uses mechanical scouring, tank emersion, or pressure sprays. The wash water may be augmented by a basic leaching agent, surfactant, or chelating agent or by pH adjustment to help remove the contaminant. According to the U.S. Environmental Protection Agency (EPA), the wash water and various soil size fractions are usually separated using gravity settling (*Innovative Site Remediation Technology Soil Washing/Soil Flushing Volume 3* [EPA 542-B-93-012]).

The soil washing process is applicable to contaminants that preferentially sorb or collect in the small particle fraction. The process requires relatively short contact times and rapid kinetics, thus it is not applicable generally to chemically bound, or relatively insoluble uranium deposits on sediments in the 300 Areas. Use of strong extracting solutions such as acids requires complex and costly downstream process equipment that exceeds the customary scope of soil washing technology. Use of soil washing would likely result in relatively dilute liquid process streams that would require concentration by ion exchange prior to discharge. Assuming washed sediment adequately lower uranium or technetium-99 concentrations to levels to preclude further threat of groundwater contamination, the soil residual would require backfill to excavations. Soil washing technology generally is applied to soil contaminated with semivolatile organic compounds (SVOCs), hydrocarbons, and heavy metals. The technology may be used on selected volatile organic compounds (VOCs) and pesticides. Soil size distribution controls the equipment design and operation. Soil washing is used extensively in Europe. Commercialization in the United States is less extensive ("4.19 Soil Washing" [FRTR, 2011]).

J1.1.2.2 Relevant Demonstration Projects

Limited experience with uranium soil washing is available; however, one application of soil washing of uranium-contaminated soil using a heated bicarbonate solution in a rotary reactor is documented. The pilot demonstration was conducted on uranium-contaminated soil at the RMI Titanium Company Extrusion Plant in Ashtabula, Ohio. The process involved a 0.2 M $NaHCO_3$ solution at 46°C (115°F) and

retention time of 1.5 hours. The reactor was a 0.4 m^3 (15 ft^3) cement mixer. The equipment processed 0.9 to 1.8 metric tons (1 to 2 tons) of soil contaminated with particulates from uranium extrusion operations per batch. The process used a 30 percent solids slurry ratio. A total of 58 metric tons (64 tons) of contaminated soil were treated between January 7, 1997 and February 14, 1997 in 38 batches. The soil consisted of high clay content silt loams and clay loams with low concentrations of organic material. Concentrations of uranium in the treated soil ranged generally between 14 and 47 pCi/g as hexavalent uranium [U(VI)]; however, an elevated concentration of 587 pCi/g U(VI) was treated with only partial success. The treated soil had an overall removal efficiency of approximately 82 percent with a volume reduction to fines of 95 percent. Less than 5 percent of the residual waste required offsite disposal. Difficulties with meeting the cleanup goal were encountered with the very highly contaminated soil (i.e., 587 pCi/g uranium). The total cost for the pilot work, including equipment mobilization and demobilization, analyses, treatment and disposal of waste was $638,670. Full-scale costs were estimated to range between $250 and $350 in 1997 dollars per ton (*Cost and Performance Report: Chemical Extraction for Uranium Contaminated Soil at the RMI Titanium Company Extrusion Plant, Ashtabula, Ohio* [FRTR, 1998]). The cost for soil washing using 2006 Remedial Action Cost Engineering and Requirements software ("4.19 Soil Washing" [FRTR, 2011]) for a large site such as the 300 Area is estimated to be $70 per m^3 using water.

J1.1.2.3 Evaluation and Screening Rationale

Soil washing is considered to have low to moderate effectiveness because the resistant nature of the adhesion of uranium to sediment. Wash solution more aggressive than water would likely be required to remove uranium from excavated sediment. The use of caustic or acid wash solutions complicates the equipment and material handling of the wash process. It is presently unknown whether large-scale wash technology would be sufficiently effective to reduce sorbed uranium on sediment to reduce risk adequately to groundwater contamination of the treated and backfilled sediment. Soil washing is moderately implementable with existing mechanically intense slurry contact equipment and conventional aggregate washing and screening technology. Disposal and post-wash handling of the wash solutions may be problematic, therefore reducing the implementability of the technology. The relative cost of ex situ soil washing is moderately high because of material handling and post-wash liquid treatment and disposal costs. High-end costs for soil washing under Hanford Site conditions could exceed $70 per m^3 of sediment by a factor of 3.

J1.1.3 Ex Situ Vitrification

Ex situ vitrification was not retained for treatment of soils contaminated with radionuclides and other COCs.

J1.1.3.1 Description

Vitrification processes are solidification methods that use heat (1,100 to 2,000°C) to melt and convert waste materials into glass or other glass and crystalline products. This technology is considered highly effective in the treatment of contaminants, and in permanently reducing the mobility, toxicity, and volume of contaminants. The high temperatures destroy any organic constituents with very few byproducts. Materials such as heavy metals and radionuclides are incorporated into the glass structure, which is strong, durable, and resistant to leaching. In addition to solids, waste materials can be liquids, wet, or dry sludges, or combustible materials. Borosilicate and soda lime are the principal glass formers and provide the basic matrix of the vitrified product. When the molten mass cools, it solidifies into a vitreous and crystalline rock-like monolith that is substantially reduced in volume (20 to 50 percent) (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]).

Ex situ joule heating vitrification uses furnaces that have evolved from the glass melters used in the glass industry. The electric furnace uses a ceramic-lined, steel-shelled melter to contain the molten glass and waste material (*100 Area Source Operable Unit Focused Feasibility Study Report* [DOE/RL-94-61]).

J1.1.3.2 Relevant Demonstration Projects

In the early 1990s, DOE developed a transportable vitrification system (TVS) to vitrify applicable mixed-waste sludges and solids effectively across the various DOE complex sites (*Transportable Vitrification System: Mixed Waste Focus Area* [DOE, 1998]). Multiple studies were completed in collaboration with Westinghouse Savannah River Company (WSRC), Oak Ridge National Laboratory (ORNL), and Clemson University. A mixed-waste demonstration was completed in 1997 using Savannah River B&C pond sludge and a mix of B&C pond sludge and Central Neutralization Facility (CNF) sludge. The study indicated the system vitrified 84 m^3 (276 ft^3) of mixed waste into 34 m^3 (112 ft^3) of glass waste, resulting in a 60 percent waste volume reduction. Results of the study indicated the need for high capital costs and extensive upfront development; however, results also indicated the technology is capable of producing highly durable glass waste forms with long-term integrity, and a significant reduction in waste volume as compared to other stabilization techniques.

A vitrification plant is currently being constructed to treat tank wastes at the Hanford Site. The Waste Treatment and Immobilization Plant (WTP) will cover 26 hectares (65 acres) and will consist of four nuclear facilities: Pretreatment, Low-Activity Waste vitrification, High-Level Waste vitrification, and an Analytical Laboratory (http://www.hanfordvitplant.com). Construction activities began in 2002, and it is anticipated that the plant will be operational in 2019. A number of tests have been performed to support the process and design associated with this facility; however, treatability tests on contaminated soil have not been performed. Information regarding the WTP Research and Technology Program is presented in *Project Execution Plan for the River Protection Project Waste Treatment and Immobilization Plant* (DOE/ORP-2003-01).

J1.1.3.3 Evaluation and Screening Rationale

Ex situ vitrification is considered to have low implementability given that highly complex equipment is required. Similarly, given the relative high cost and potential application of other technologies with high effectiveness and implementability, ex situ vitrification is not considered favorable for implementation for treatment of contaminated soil at the 300 Area.

Complex system requirements are inherent to this technology, such as pretreatment to segregate high-level and low-level waste, and multiple vitrification systems to support both the treatment requirements of each type of waste and to allow for an accelerated cleanup strategy. After treatment, the resulting glass structures would need to be tested to ensure the glass produced by the facility meets regulatory requirements and standards. Ultimately, the glass produced still would require final disposal in an alternate facility.

As presented in *Central Plateau Vadose Zone Remediation Technology Screening Evaluation* (RPP-ENV-34028), estimated costs for implementation of this technology can range from $500 to $1,000 per yd^3. These costs include soil excavation, screening to remove debris, installation of the vitrification system and offgas treatment system, operation and maintenance (O&M), utilities, site management, and sampling support, and onsite disposal of vitrified material and offgas treatment. For the WTP facility, *Project Execution Plan for the River Protection Project Waste Treatment and Immobilization Plant* (DOE/ORP-2003-01) indicated that the total project cost for the WTP is estimated to be $5.781 billion.

Because of the complexity of the equipment and associated high cost, this remedial technology is not retained for further evaluation.

J1.1.4 Ex Situ Thermal Desorption

Ex situ thermal desorption was not retained for treatment of soils contaminated with organic compounds.

J1.1.4.1 Description

Ex situ thermal desorption involves the direct application of heat to increase the temperature of soil and volatilize organic compounds from the soil. A carrier gas or vacuum system then transports the organic rich vapors to be further treated. All thermal desorption systems require treatment of offgas in order to remove particulates and contaminants. The process does not involve incineration or pyrolysis. Typically, ex situ thermal desorption involves use of rotary drums or similar mechanical heating devices, vapor capture, and a vacuum system to extract volatilized water and organics to the gas treatment system.

Treatment to low levels of organic contaminants can be achieved with this technology. Based on the operating temperatures, thermal desorption processes can be categorized as either high-temperature thermal desorption (320 to 560ºC) or low-temperature thermal desorption (90 to 320ºC). High-temperature thermal desorption (HTTD) targets SVOCs, polynuclear aromatic hydrocarbons (PAHs), polychlorinated biphenyls (PCBs), and pesticides. VOCs can also be treated with HTTD, although the process is less cost effective. Low-temperature thermal desorption (LTTD) targets nonhalogenated VOCs and fuel, and can treat SVOCs but at a reduced effectiveness.

J1.1.4.2 Relevant Demonstration Projects

A full-scale demonstration project was completed in 1992 at the Outboard Marine Corporation site in Waukegan, Illinois, for the treatment of PCBs from soils, sediments, and sludges using thermal desorption. The demonstration involved treatment using an anaerobic thermal processor licensed by SoilTech ATP Systems, Inc. The study indicates that a total of 224 tons (448,000 lb) of PCB-contaminated soil were treated, and treatment efficiencies for removal of PCB of approximately 99.9 percent were achieved (*SoilTech Anaerobic Thermal Processor: Outboard Marine Corporation Site Soil Tech ATP Systems, Inc.* [EPA/540/MR-92/078]).

J1.1.4.3 Evaluation and Screening Rationale

Ex situ thermal desorption can be a highly effective technology. However, given the relatively low volumes of petroleum-contaminated soil that are likely to be present, and the high mobilization costs, onsite disposal of soil is likely to be much more cost effective. Although equipment for implementation of this technology is readily available, it is mechanically complex and poses technical implementability challenges. Transportability of equipment becomes challenging when the amount of soil to treat is small, and the complexity of the equipment requires skilled operators to treat the soil. For these reasons, ex situ thermal desorption was not retained for further consideration.

J1.2 In Situ Treatment—Reagent Approach

This section discusses reagents/technologies that could be used for in situ treatment of the COCs. Delivery of these reagents is discussed in the following section. These reagents/technologies were not retained for further consideration.

J1.2.1 In Situ Solidification

In situ solidification was not retained for treatment of soils containing mobile COCs including uranium, other radionuclides, and organic compounds such as chlorinated volatile organic compounds (CVOCs).

J1.2.1.1 Description

Solidification/stabilization alters the physical and/or chemical characteristics of a soil or sediment through the addition of binders, including cements, to enclose or coat contaminated soil and thereby immobilize contaminants. Immobilization technologies primarily work by coating and isolation, which make the contaminants less prone to leaching or dissolution. The application of solidifying agents in situ is a form of grouting. Multiple types of grouting/binding materials and emplacement techniques have been developed and demonstrated. Jet grouting and permeation grouting are the two general grout approaches potentially applicable for subsurface contaminant solidification in 300 Area vadose zone sediments. Jet grouting uses high-energy emplacement of cement or chemical grout materials whereby the sediment is displaced and mixed with the grouting material. Permeation grouting is injection of a liquid grout that fills the natural porosity of the formation and then gels to form a solid void-filling material. While permeation grouting is a relatively mature technology for many geotechnical applications, there are uncertainties with grout for in situ contaminant stabilization (*Evaluation of Vadose Zone Treatment Technologies to Immobilize Technetium-99* [WMP-27397]). The uncertainties include: (1) the effectiveness of delivery depends upon subsurface heterogeneity; and (2) the presence of fines (which likely contain the higher proportion of sorbed uranium) adversely affect grout placement. Generally, grout is emplaced via an array of closely spaced vertical boreholes into the subsurface volume to be stabilized.

Two types of grout materials may be used: particulate (cement) grouts and chemical grouts. Cement grouts use Portland cement as the primary component. Portland cement is a mixture of preprocessed mineral solids pulverized, fired, and ground into a fine solid dust. This product is combined with up to 5 percent gypsum, and mixed with water and small quantities of additives to form a flowable mixture of solids and water composing a suspended solids grout. A chemical grout is a solution comprised of a binder (other than Portland cement) that reacts in place to form a gel or solid after injection into a porous subsurface soil, sediment, or rock volume. Chemical grouts do not contain mineral solids in suspension, and therefore their delivery in the subsurface is not limited by particle filtration. Instead, delivery is a function of grout viscosity and gelling time.

J1.2.1.2 Relevant Demonstration Projects

It is important to distinguish applications of injection of grouts into the subsurface at waste sites. The more common approach is to use grouts to form a hydraulic barrier to isolate waste. The second approach is to inject grout into contaminated zones in an attempt to encapsulate contaminated sediment or soil and thereby effect in situ solidification. This second approach is the goal of the technology evaluated in this discussion. In situ solidification is distinct from barrier or waste isolation technology.

Several DOE sites, including the Hanford Site, ORNL, Brookhaven National Laboratory, Idaho National Laboratory, Savannah River Site, and Sandia National Laboratories have evaluated, tested, and/or implemented in situ grouting for shallow waste isolation applications as summarized below. In situ grouting has been evaluated at the Hanford Site for application to waste site isolation (e.g., near surface formation of in situ waste barriers) through a number of efforts in the 1990s, documented in the following reports:

- *Injectable Barriers for Waste Isolation* (LBL-36739)
- *Feasibility of Permeation Grouting for Constructing Subsurface Barriers* (SAND94-0786)
- "Durability of Polymers for Containment Barriers" (Heiser et al., 1994)
- *Summary Report on Close-Coupled Subsurface Barrier Technology Initial Field Trials to Full-Scale Demonstration* (BNL-52531)
- *In Situ Remediation Integrated Program FY 1994 Program Summary* (DOE/RL-95-32)

These efforts provide laboratory and field data for jet grouting techniques applied to shallow waste isolation at the Hanford Site and Brookhaven National Laboratory.

In situ permeation grouting using colloidal silica to develop a hydraulic barrier was evaluated and tested for application at Brookhaven National Laboratory ("Evaluation of Alternative Designs for an Injectable Subsurface Barrier at the Brookhaven National Laboratory Site, Long Island, New York" [Moridis et al., 1999]). Lawrence Berkeley National Laboratory also led a significant program on this application, as documented in the following reports:

- *Physical Barriers Formed from Gelling Liquids: 1. Numerical Design of Laboratory and Field Experiments* (LBL-35113)
- *Injectable Barriers for Waste Isolation* (LBL-36739)
- *Effect of Dilution and Contaminants on Strength and Hydraulic Conductivity of Sand Grouted with Colloidal Silica Gel* (LBNL-39347)
- *A Field Test of Permeation Grouting in Heterogeneous Soils Using a New Generation of Barrier Liquids* (LBL-37554)
- *A Design Study for a Medium-Scale Field Demonstration of the Viscous Barrier Technology* (LBNL-38916)
- *A Field Test of a Waste Containment Technology Using a New Generation of Injectable Barrier Liquids* (LBNL-38817)

Shallow permeation grouting was conducted at ORNL to reduce hydraulic conductivity (*Field Grouting Summary Report on the WAG 4 Seeps 4 and 6 Removal Action Project* [ORNL/ER-401/V1]). Jet injection of standard and microfine cement grout into waste trench material at ORNL improved soil stability, but did not create low hydraulic conductivity conditions (*In Situ Grouting of Low-Level Burial Trenches with a Cement-Based Grout at Oak Ridge National Laboratory* [ORNL/TM-11838]). Other efforts at ORNL included injection of a polyacrylamide grout into a waste trench that enhanced soil stability and had a moderate (2 orders of magnitude) impact on the hydraulic conductivity ("Field Demonstration of In Situ Grouting of Radioactive Solid Waste Burial Trenches with Polyacrylamide" [Spalding and Fontaine, 1992]). Detailed evaluation and treatability testing for in situ grouting of waste sites was completed at Idaho National Laboratory demonstrating the potential viability of grouting to stabilize waste (in situ solidification) in near-surface sites. The following reports provided a thorough review of in situ grouting for shallow waste sites at Idaho National Laboratory and retained this technology as a potential alternative in a feasibility study for Operable Unit 7-13/14 based on the likely ability of the technology to stabilize the waste and reduce hydraulic conductivity in localized hot spots:

- *Final Results Report, In Situ Grouting Technology for Application in Buried Transuranic Waste Sites Volume 1, Technology Description and Treatability Study Results for Operable Unit 7-13/14* (INEEL/EXT-02-00233)
- *Feasibility Study for Operable Unit 7-13/14* (DOE/ID-11268)

The Savannah River Site has implemented in situ grouting for shallow waste sites such as the F Area seepage basins (*Corrective Measures Implementation/Remedial Design Report/Remedial Action Work Plan (CMI/RDR/RAWP) for the F-Area Seepage Basin (904-49G) (U)* [WSRC-RP-97-854]).

J1.2.1.3 Evaluation and Screening Rationale

In situ solidification using commercially available grouting equipment with cement grouts is considered to have moderate to high implementability when applied over smaller areas relative to the large 300 Area. Such limited areas might extend over a total area of up to 0.2 hectare (0.5 acre) and to depths of 4 to 5 m (13 to 16 ft). However, there is little experience with large-scale grouting of soil volumes extending over 19 acres to depths of 10 to 13 m (32 to 42 ft) in proximity to a dynamic groundwater interface. With the large extent and site conditions, the implementability of in situ solidification is ranked as moderate. The effectiveness of in situ solidification is a function of the distribution of the grout into the formation and the degree of encapsulation of contaminated sediment particles. Effective emplacement of grout assumes a typical 0.6 m (2 ft) effective diameter grout column with 0.5 m (16 ft) spacing. Such high-density emplacement provides moderate to high effectiveness but is relatively expensive. Using estimated installation costs for in situ solidification using a jet grouting at Idaho National Engineering and Environmental Laboratory (*Feasibility Study for Operable Unit 7-13/14* [DOE/ID-11268]) unit costs in excess of $1,960 per m^3 ($1,500 per yd^3) are estimated. Consequently, the relative capital cost is high. The relative O&M cost would be low assuming good contact and stable binder chemistry provides a permanent encapsulation. Because of the high capital cost and potential for incomplete contact of grout in the targeted groundwater interface zone, in situ solidification is not retained for further evaluation.

J1.2.2 In Situ Chemical Reduction

In situ chemical reduction is not retained for treatment of soils contaminated with uranium.

J1.2.2.1 Description

Considerable technical development and study of manipulating subsurface geochemical conditions to sequester or immobilize inorganic contaminants have been pursued over the past 25 years. Chemical reducing agents, such as diluted hydrogen sulfide gas, may be used to transform contaminants to a less mobile or less toxic form such as hexavalent chromium to trivalent chromium by means of injection into the vadose zone (*In Situ Gaseous Reduction Pilot Demonstration—Final Report* [PNNL-12121)]. Alternative chemical reducing agents include calcium polysulfide, dithionite, ferrous sulfate, zero valent iron (ZVI). The alternate chemical agents delivered as solids or liquids have the inherent limitation of fully contacting the targeted sediment contamination in the vadose zone. Fundamental to reduction of uranium in the vadose zone is the fact that uranium geochemistry is much more complicated and reversible relative to reduction of other contaminants. It is possible for uranium to form a relatively insoluble form, uranous ion (U^{+4}) and stabilize as sparingly soluble compounds such as uranite (UO_2) and coffinite ($USiO_4$). In a reducing environment promoted by the injection of a strong reducing agent such as hydrogen sulfide, soluble/mobile oxidized forms of uranium may be converted to relatively insoluble forms. The fatal flaw with such redox manipulation in the shallow, naturally oxidizing environment of the 300 Area vadose zone and fluctuating groundwater interface zone is the reversibility of the reaction. Constant, permanent maintenance of the reducing conditions in the shallow vadose zone would be required to sustain uranium stabilization.

J1.2.2.2 Relevant Demonstration Projects

In situ chemical reduction of radionuclides such as technetium-99 has been attempted at the Hanford Site in the deep vadose zone of the 200 Area using reducing agents including dithionite and hydrogen sulfide gas. Gas phase chemical reduction has been studied by various investigators (*In Situ Gaseous Reduction Pilot Demonstration—Final Report* [PNNL-12121]; *Hanford Site Groundwater Monitoring for Fiscal Year 2002* [PNNL-14187]). Chemical reduction by aqueous solutions of sodium dithionite has also been studied and implemented full-scale at the Hanford Site (*Abiotic Reduction of aquifer Materials by Dithionite: A Promising In-Situ Remediation Technology* [PNL-SA-24505]; *Area In Situ Redox*

Treatability Test for Chromate-Contaminated Groundwater [PNNL-13349]). Other aqueous solutions such as those containing iron(II), copper(I), or tin(II) may also reduce technetium-99. However, no attempt to reduce uranium or treat shallow vadose sediments in the 300 Area has been made.

J1.2.2.3 Evaluation and Screening Rationale

Depending upon the delivery method, in situ reduction technologies have low to moderate implementability in the context of the shallow treatment zone. The application of toxic hydrogen sulfide gas to the near surface carries significant risk. The application of liquid reducing agents to contact contaminated sediment uniformly, particularly in the groundwater interface zone, is problematic. The caustic nature of reducing agents is a health and safety concern during application. The effectiveness of reducing agents in the shallow vadose zone is judged to be low for multiple reasons. High application rates would be required to overcome sediment oxidation capacity from other residuals such as nitrates. The reversibility of the uranium reduction geochemistry would require repeated treatments in perpetuity to maintain uranium immobilization. In addition, the aerobic nature of the shallow, relatively permeable groundwater interface zone that is in frequent contact with high dissolved oxygen groundwater influenced by the Columbia River makes effective maintenance of a reduced zone difficult. The relative capital cost for applying reducing agents to the shallow vadose zone is low to moderate, depending upon the area of application and safety controls implemented for the reagent chosen. Because of the requirement for repeated treatment to maintain reducing conditions, the relative O&M cost is estimated to be moderate to high depending upon required renewal frequency.

J1.2.3 In Situ Chemical Oxidation

In situ chemical oxidation (ISCO) was not retained for treatment of soils contaminated with organic compounds. ISCO is not an applicable technology for the treatment of soils contaminated with radionuclides and metals.

J1.2.3.1 Description

ISCO involves the subsurface delivery of chemical oxidants to destroy organic COCs. Commercially available oxidants used in field applications include hydrogen peroxide, ozone, permanganate, persulfate, and percarbonate. The technology is capable of achieving high treatment efficiencies in unsaturated aliphatic and aromatic compounds. Petroleum hydrocarbons and PAHs can be treated with a variety of oxidants (including peroxide, percarbonate, persulfate, and ozone); however, there are limited case studies demonstrating the successful treatment of PCBs with ISCO.

J1.2.3.2 Relevant Demonstration Projects

A pilot study was conducted in fall 2006 to evaluate the effectiveness of permanganate injection to treat CVOCs in shallow unsaturated heterogeneous soils (“Challenges with an ISCO Application in the Unsaturated Zone: Case of the Missing Permanganate” [Borchert et al., 2008]). The treatment zone was 4.8 by 5.4 m (16 by 18 ft) in area and 2.7 m (9 ft) deep. The site geology consisted of silty clay in the upper 1.7 m (5.5 ft) with traces of sand and gravel and an intermittent sandy layer from 0.3 to 0.6 m (1 to 2 ft) below ground surface (bgs), and gravelly sand with some silt and clay from 1.7 to 4.3 m (5.5 to 14 ft) bgs with a discontinuous sandy and silty clay layer from 2.4 to 2.7 m (8 to 9 ft) bgs. Groundwater was encountered between 2.4 and 3 m (8 and 10 ft) bgs.

The maximum concentrations of trichloroethylene (TCE) and cis-1, 2-dichloroethylene (cis-1,2-DCE) were 66,000 and 2,400 µg/kg, respectively. The permanganate soil oxidant demand ranged from about 3 to 17.1 g/kg. Approximately 1,040 L (275 gal) of 40 percent by weight permanganate (about 1,360 kg [3,000 lb]) were injected at nine locations within the pilot study area. Where oxidant was observed visually, the radius of influence (ROI) ranged from 0.8 to 3 m (2.5 to 10 ft); however, several visual

borings had limited evidence of permanganate. Performance monitoring indicated that TCE and cis-1, 2-DCE concentrations in soil decreased between 44 and 93 percent, respectively. However, concentrations in groundwater increased up to 10-fold. Results from the pilot study indicated that a majority of oxidant migrated into the shallow groundwater and was consumed by CVOCs and high oxidant demand (up to 20.7 g/kg permanganate [MnO_4]). Obtaining good distribution of an oxidant solution in shallow silty clay was difficult, even with controlled low pressures and flows and closely spaced injection points. Creating temporarily saturated zones for aqueous-based ISCO reactions in the unsaturated zone was also difficult, particularly in permeable portions of the formation. Based on the results of the pilot study, excavation was selected as a more cost-effective remedial alternative for shallow soil.

An ozone gas vadose zone sparging system for treating PAHs was operated during the summer of 2001 at the Former Fuel Oil Distribution Terminal in Ilion, New York (*Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater* [ITRC, 2005]). Adsorbed PAHs were delineated from approximately 0.6 to 2.4 m (2 to 8 ft) bgs, and initial total PAH concentrations exceeded 30 mg/kg. The subsurface contained both fill materials and native soil consisting primarily of silty sand. Groundwater was encountered 2.1 to 2.4 m (7 to 8 ft) bgs. To achieve a target 60-day period for project completion, a nominal 23 kg (50 lb)/day ozone-generation system was used to inject both ozone and oxygen. Ten initial sparge points were installed at the site by direct-push methodology. A shallow vapor extraction system was installed to control emissions. The injection system operated over a period of 8weeks. Post-remediation soil sampling results indicated no remaining PAH (primarily benzo(a)anthracene, benzo(a)pyrene, and chrysene) concentrations above method detection limits, achieving the remedial goals of 90 percent concentration reduction in 60 days. Naphthalene was also reduced to below New York Department of Environmental Control Technical and Administrative Guidance Memorandum standards. Average reduction of naphthalene was greater than 32 percent in 60 days.

An ozone gas vadose zone sparging demonstration for treating pentachlorophenol (PCP) and creosote (PAHs) was performed in 1998 at the Former Wood Treatment Site, Sonoma County, California (*Technical and Regulatory Guidance for In Situ Chemical Oxidation of Contaminated Soil and Groundwater* [ITRC, 2005]). The former wood treatment facility contained creosote and PCP dip tanks used for treatment of wood poles. Maximum pretreatment soil concentrations were 220 mg/kg PCP and 5,680 mg/kg total PAHs. High levels of dissolved contamination and nonaqueous phase liquid (NAPL) existed in the vadose zone prior to treatment. The site subsurface consisted of very heterogeneous stratified silty sands and clays, and the depth to water varied 1.2 to 4.5 m (4 to 15 ft). The ozone treatment system design included treatment of both the saturated and unsaturated zones. Therefore, ozone gas delivery modes included ozone sparging and ozone gas injection above the water table. Field operation and monitoring of the in situ ozonation demonstration project were conducted from December 1997 through December 1998. Approximately 3,600 kg (8,000 lb) of oxidant were delivered to the subsurface, with an average oxidant dose of approximately 1.9 g ozone per kg of soil (3.8 pounds ozone per ton of soil). Soil samples collected showed an average 93 percent reduction in PCP and PAHs. Concentration at the maximum pretreatment soil contamination was reduced greater than 98 percent, from an initial value of 220 mg/kg PCP and 5,680 mg/kg total PAHs, to below detection limits. Significant contaminant mass reduction was reflected not only in soils data, but also in substantial reductions in aqueous-phase concentrations of PCP and PAHs.

J1.2.3.3 Evaluation and Screening Rationale

The treatment effectiveness of ISCO can be hindered by non-uniform oxidant distribution due to high soil oxidant demand levels in shallow fine-grained soil, and rapid oxidant reaction rates. It may also be difficult to maintain saturated conditions where oxidant can be delivered, to allow the aqueous-based ISCO reactions to occur. Successful treatment of organic COCs has been demonstrated using ozone gas

injection into the vadose zone. However, given the uncertainties in oxidant delivery effectiveness, difficulties with installing a density of injection wells, and higher relative cost compared to other in situ treatment technologies for organics (bioventing and soil vapor extraction [SVE]), ISCO was not retained for further consideration.

J1.2.4 In Situ Biological Reduction

In situ biological reduction is not retained for treatment of soils contaminated with uranium.

J1.2.4.1 Description

Bioreduction involves the concept of promoting the growth of bacteria in reducing and anaerobic environments to utilize soluble U(VI) as an electron acceptor and form the more stable U(IV). The process is also applicable for dechlorination of chlorinated solvents. The process involves the addition of a carbon substrate such as molasses, ethanol, or emulsified oil to contaminated groundwater. Because the process requires saturation of the sediment in water, the viability of the microbial process is very limited in the vadose zone and may only be feasible in the periodically rewetted zone at the fluctuating water table interface. The process requires the absence of oxygen.

J1.2.4.2 Relevant Demonstration Projects

No field scale application of the technology on uranium has been attempted in the vadose zone, and may not be possible due to the unsaturated nature of vadose zones. Laboratory studies have shown indications of the process possibly affecting uranium geochemistry ("Denitrification Across Landscapes and Waterscapes: A Synthesis" [Seitzinger et al., 2006]). Some work on bioreduction of uranium has been conducted at the Oak Ridge Nuclear Reservation ("Bacterial Community Succession During *In Situ* Uranium Bioremediation: Spatial Similarities Along Controlled Flow Paths" [Hwang et al., 2008]). No work to deploy in situ bioreduction for uranium in experimental pilot studies has been performed to date in the vadose zone at the Hanford Site.

J1.2.4.3 Evaluation and Screening Rationale

The treatment effectiveness of in situ bioreduction in the vadose zone in the 300 Area is constrained by the difficulty of uniformly supplying carbon substrate, and sustaining a reducing environment in a naturally aerobic environment to maintain a sufficient microbial biomass to affect bioreduction. The reversibility of the uranium reduction geochemistry would require repeated treatments in perpetuity to maintain uranium immobilization. This technology is judged to have low effectiveness. The implementability of in situ bioreduction is judged to be low to moderate. Although nutrient and substrate infiltration may be feasible but subject to conventional percolation method limitations, methods to deliver and maintain microorganism in the relatively dry, heterogeneous sediment of the vadose zone is unproven. The capital and O&M costs of implementing this technology are estimated to be low to moderate and moderate relative to other technologies.

J1.2.5 In Situ Gaseous Ammonia Reduction

Gaseous ammonia injection is not retained for treatment of vadose zone sediments containing mobile contaminants of concern.

J1.2.5.1 Description

Gaseous ammonia injection is a conceptual process postulated to increase pH in a soil or sediment matrix to a sufficiently high degree that silica dissolves and over time reacts to form aluminosilicate minerals, which in turn may immobilize inorganic contaminants on sediment grains. This prospective technology is being investigated by the Pacific Northwest National Laboratory (PNNL) with respect to possible

application to the Hanford Central Plateau (*Remediation of Uranium in the Hanford Vadose Zone Using Gas-Transported Reactants: Laboratory-Scale Experiments* [PNNL-18879]).

J1.2.5.2 Relevant Demonstration Projects

This is a proposed technology and has not been tested in the field. PNNL is presently conducting a laboratory study as part of an ongoing gas-transported reactant study for remediation of uranium in the deep vadose zone sediments at the Hanford Site. It is not presently viewed as a treatment for the shallow vadose zone in the 300 Area.

J1.2.5.3 Evaluation and Screening Rationale

Gaseous ammonia injection is an unproven conceptual technology. The effectiveness of a mildly alkaline ammonia gas in the relatively dry vadose zone in promoting mineral phase dissolution of silica aluminum and other metals is unknown and may be marginal. The geochemical reaction is reversible and remobilization of any immobilized uranium is possible with exposure to oxygen-saturated water. The implementability of the process is unknown at full scale. Furthermore, considerable health and safety and environmental concerns exist with the injection of ammonia gas near the surface in the 300 Area and along the Columbia River. Since the laboratory technology evaluation results remain to be determined, the implementation costs for the technology is undetermined. Gaseous ammonia injection is not retained for further consideration.

J1.2.6 In Situ Reductive Dechlorination Using Zero-Valent Metals and Bioremediation

Reductive dechlorination using zero-valent metals and bioremediation was not retained for treatment of soils contaminated with PCBs.

J1.2.6.1 Description

Both biological and abiotic methods are potentially applicable for reductive dechlorination of PCBs. During bioremediation, anaerobic bacteria replace chlorine atoms with the electron-donating hydrogen on the PCB molecule. A similar abiotic process occurs with zero-valent metals. Zero-valent metals include iron, palladium, and other combinations (called bi-metals). Bi-metals have been found to be more reactive. Nano-particle-sized bi-metals have also been shown to be superior to micro-sized ZVI (*Emerging Technologies for the In Situ Remediation of PCB-Contaminated Soils and Sediments: Bioremediation and Nanoscale Zero-Valent Iron* [Mikszewski, 2004]). The bioremediation process involves mixing an electron donor (such as lactate) with the contaminated soil and maintaining anaerobic conditions for a number of months. A similar process is used with the zero-valent metals.

J1.2.6.2 Relevant Demonstration Projects

Emerging Technologies for the In Situ Remediation of PCB-Contaminated Soils and Sediments: Bioremediation and Nanoscale Zero-Valent Iron (Mikszewski, 2004) presented a review of emerging technologies for in situ remediation of PCB-contaminated sediments and soils. The study focused on the use of nanoscale zero-valent iron (NZVI) and bioremediation for reductive dechlorination.

The technology review indicated that NZVI particles are capable of reducing a wide range of environmental pollutants including PCBs. In particular, the properties of NZVI and other nanoscale metals (high surface area-to-volume ratios, high surface energies, and a large fraction of stepped surface, zero valency) make them extremely chemically reactive. Several laboratory and field-scale demonstrations have been conducted demonstrating the performance of using NZVI for PCB dechlorination. Results of the studies show conflicting results. Where complete dechlorination could be achieved, percent reduction of PCBs ranged from 25 to 84 percent. In the field study where 84 percent reduction was achieved (“In-situ Dechlorination of Polychlorinated Biphenyls in Sediments Using

Zero-Valent Iron" [Gardner et al., 2004]), complete dechlorination was achieved in only 1 day. In another study ("Development and In Situ Application of Sorbent/reagent-amended 'Active' Sediment Caps for Managing HOC-contaminated Sediments," [Lowry, 2004]), NZVI was shown to dechlorinate PCBs with congener half-lives ranging from 40 days to 77 years, with no biphenyl production noted (indicating incomplete dechlorination).

The technology review indicates that at present, anaerobic reductive dechlorination is not a viable stand-alone PCB remediation technology. A field treatability study conducted by the U.S. Army Corps of Engineers in Mississippi (*Project 3: PCB Bioremediation Strategies and Potential Intermediates of Toxicological Significance, 2001 Progress* [Tiedje, 2004]) highlighted the inherent limitation of anaerobic reductive dechlorination of PCBs. Significant dechlorination of PCBs can take several years under optimal environmental conditions. Aside from length of time required for dechlorination, the limited bioavailability of PCBs severely inhibits reductive dechlorination, as PCBs are often tightly bound to soil and sediment particles, rendering them resistant to the enzymes of dechlorinating organisms. Furthermore, it is difficult to establish and stimulate PCB-dechlorinating organisms at remediation sites. More field studies must be conducted to test methods of bioaugmentation and biostimulation for PCB dechlorinators.

The potential for aerobic bioremediation of PCBs was also discussed. PCBs are broken down aerobically by the catabolic "biphenyl pathway" ("Genetically Modified Organisms to Remediate Polychlorinated Biphenyls. Where Do We Stand?" [Sylvestre, 2004]). A broad range of gram-negative and gram-positive aerobic bacteria is capable of cometabolically degrading PCBs via the biphenyl pathway. However, the complete mineralization of PCB by this pathway is extremely rare. Most of the time, the enzymes degrade the ring with fewer chlorines while releasing the second ring as a chlorobenzoic acid (CBA). This is problematic because CBAs can be toxic and inhibitory to PCB degraders. As a result, genetic engineering has become a necessary tactic to produce organisms with the biphenyl pathway and a CBA degradation pathway. Even with the recent advances of genetically engineered strains, the major problem in field application would be, as it is with anaerobic dechlorination, the limited bioavailability of the PCBs.

J1.2.6.3 Evaluation and Screening Rationale

The effectiveness of these treatment technologies is considered to be poorly known, given the limited availability of published testing results, and/or conflicting technology demonstration data. Implementability is considered moderate because it could be implemented by soil mixing or conventional excavation equipment if the treatment depth is shallow. However, the issue common with all these technologies is the limited availability of PCBs in soils and sediments. The hydrophobic nature of PCBs allows them to adsorb tightly to organic matrices within soils and sediments, rendering them resistant to microbial attack and chemical reduction. Because reductive dechlorination using zero-valent metals and bioremediation are not proven technologies, they were not retained for further consideration.

J1.2.7 In Situ Gaseous Reduction with Chemical Reductant or Biological Substrate

In situ gaseous reduction was not retained for treatment of soils contaminated with uranium and technetium-99.

J1.2.7.1 Description

In situ gaseous reduction (ISGR) is a vadose zone remediation technology that uses a gasses reagents (such as hydrogen sulfide/nitrogen gas mixture) to reduce or treat contaminants. It is applicable to redox sensitive contaminants (e.g., radionuclides and metals), and the objective is to chemically reduce the contaminant to a less mobile, and sometimes less toxic form, thereby preventing further migration and reducing the risk of contaminating the groundwater. For contaminants such as uranium and technetium, the reduced species are significantly less mobile than the oxidized species. With the reduction of iron associated with sediment, the ISGR technology creates a reducing zone within the subsurface that

continues to reduce contaminants or other oxidants (e.g., oxygen) that migrate into the treatment zone until the reducing capacity becomes depleted (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]).

J1.2.7.2 Relevant Demonstration Projects

An ISGR pilot demonstration test was completed at the White Sands Missile Range in New Mexico between 1996 and 1998 (*In Situ Gaseous Reduction Pilot Demonstration—Final Report* [PNNL-12121]). A combination of gas injection and vacuum extraction wells was used to distribute hydrogen sulfide gas. In the demonstration, six extraction wells surrounded a central vacuum well in a hexagonal pattern. The study indicated that 70 percent of the Cr(VI) was reduced to its trivalent state. Highest treatment efficiencies were seen at 1.2 to 3 m (4 to 10 ft) bgs, which was the zone of highest contaminant concentration. Low treatment efficiencies were seen at 3 to 4.9 m (10 to 16 ft) bgs. The study concluded that the treatment gas mixture was largely channeled through the upper zone and bypassed the less-permeable, lower-zone soil (*In Situ Gaseous Reduction Pilot Demonstration—Final Report* [PNNL-12121]).

A second demonstration test was planned at the former 183-DR facility in the 100-D/DR Area of the Hanford Site, which is associated with a significant groundwater contaminant plume (*Characterization Activities Conducted at the 183-DR Site in Support of an In Situ Gaseous Reduction Demonstration* [PNNL-13486]). Site characterization efforts were completed in 2001 in order to obtain information regarding distribution of Cr(VI) and other chemical and geological data that could support an ISGR demonstration. Site characterization data collected from two boreholes at the site failed to show signs of a Cr(VI) vadose zone source for the groundwater plume; therefore, the project was suspended until additional site characterization could be completed.

J1.2.7.3 Evaluation and Screening Rationale

As evaluated in *Central Plateau Vadose Zone Remediation Technology Screening Evaluation* (RPP-ENV-34028), the use of a gas as the reducing agent is advantageous compared to a liquid-based delivery method because there is less risk of mobilizing contaminants and better diffusion of reagent is expected. However, significant uncertainties have been identified regarding the effectiveness of ISGR. Key uncertainties (as identified in *Evaluation of Vadose Zone Treatment Technologies to Immobilize Technetium-99* [WMP-27397]) include:

- Physical heterogeneity of the vadose zone sediments presents a challenge for an even distribution of the hydrogen sulfide gas. Fine-grained soils are likely to contain more contaminants and are more difficult to treat.
- Heterogeneity occurs in the distribution of reducible iron.
- Re-oxidation of the treated zone is likely because of flux of oxygen in soil air into the pore spaces.

Technetium-99, and to some extent uranium, readily re-oxidizes under aerobic conditions, requiring periodic treatment to maintain reducing conditions. Strong reducing conditions can mobilize other constituents (e.g., arsenic and manganese); however, these constituents would likely re-oxidize fairly rapidly once they mobilize outside the treatment zone.

The equipment and processes required to implement ISGR are readily available and have been demonstrated in the field. The major challenge for ISGR is the number of wells that must be installed to achieve overlapping ROIs. Boreholes drilled through large vertical contaminated zones would generate substantial amounts of waste. Implementation of this technology could also lead to risk to workers with respect to exposure and safety. Hydrogen sulfide gas is extremely hazardous, and it would be necessary to

install effective engineering controls to mitigate risk to worker safety (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]).

Better tools are needed to evaluate potential designs for vadose zone remediation using reactive gases. For example, a multiphase flow model would assist in the evaluating the applicability of reactive gas technologies to the deep vadose zone. Because in situ gaseous reduction has the potential to immobilize technetium-99 and uranium and has been demonstrated at the field scale for similar applications, it has been included for further study in *Deep Vadose Zone Treatability Test Plan for the Hanford Central Plateau* (DOE/RL-2007-56).

Additional information resulting from the treatability studies is required prior to making decisions about the full-scale application of ISGR at the Hanford Site. For this reason, ISGR was not retained for further consideration.

J1.2.8 In Situ Leaching

In situ leaching was not retained for treatment of vadose sediments at the fluctuating groundwater interface zone or sediments below the water table contaminated with uranium.

J1.2.8.1 Description

In situ leaching, sometimes termed in situ recovery or "solution mining" in the context of uranium mining consists of injecting a leaching solution (lixiviant) into an ore zone, dissolving uranium, pumping the uranium-bearing solution out of the aquifer, and processing the solution to recover uranium. This process is not generally applied to recover uranium contamination residing on shallow sediments. Application of the process assumes that the targeted uranium resides in a deep, confined aquifer where the lixiviant can thoroughly contact the saturated sediment and that hydrogeologic flow conditions within the aquifer allow controlled recovery of dissolved uranium.

An array of vertical injection/production wells is used to apply and recover the leaching solution. Two types of leaching solutions are applied: alkaline solutions such as ammonium or sodium carbonate/bicarbonate with oxygen or hydrogen peroxide, or acid solutions such as sulfuric acid. The lixiviant solution serves two functions: (1) it oxidizes and dissolves uranium minerals, and (2) it provides a ligand, which forms stable complexes with uranium to facilitate solution transport. (*Aquifer Restoration Techniques for In-Situ Leach Uranium Mines* [NUREG/CR-3104 {PNL-4583}]).

The efficiency of the leaching process depends upon the leaching solution used and sediment/aquifer flow characteristics. The recovery efficiency depends upon the aquifer groundwater flow conditions and the arrangement and withdrawal capability of the extraction wells. A variety of multiple well patterns may be applied, but in all cases, the extraction well is usually surrounded by multiple injection wells.

Within a mining or resource recovery context, the process must employ an aquifer restoration process. The introduction of the caustic or acid solutions severely affects the surface mineralology and water quality of the sediment, and degrades the aquifer relative to environmental quality and regulatory standards. Attempts to restore aquifers to pre-leaching chemical conditions employ natural processes such as promoting the natural influx of water to wash, disperse, and geochemically neutralize the lixiviant residuals and effects, which results in a secondary process of remediation following the uranium-leaching process. The sweep water is disposed of by deep well injection, and surface neutralization followed by injection or surface storage and evaporation. Generally, surface disposal of sweep water to nearby surface water is not permitted by regulators.

The capability of in situ leaching to adequately contact uranium sorbed on sediments in the vadose zone and groundwater interface zone is subject to the same delivery method constraints discussed below for in situ treatment in general.

J1.2.8.2 Relevant Demonstration Projects

While there are numerous examples of in situ mining for uranium production, there are no known applications of the technology to remedy uranium contamination, particularly in shallow, unconfined aquifer situations such as at the 300 Area. Modern in situ uranium leaching began in the 1960s. Since 1996, as many as six commercial in situ leach facilities operated in the United States in Wyoming, Texas, and Nebraska (*Domestic Uranium Production Report-Quarterly* [EIA, 2010]). Additional applications of the process have been applied at uranium mines in Germany, the Czech Republic, Bulgaria, Ukraine, and Russia using sulfuric acid. All of these applications have been in deep sedimentary deposit aquifers. Restoration of the extracted strati has been problematic. Multiple spills through pipe or well failure and uncontrolled lixiviant excursions in the subsurface have occurred in at least nine instances (*Domestic Uranium Production Report-Quarterly* [EIA, 2010]).

J1.2.8.3 Evaluation and Screening Rationale

The treatment effectiveness of In Situ Leaching is a function of the ability of the lixiviant to contact sorbed uranium on sediments in proximity to a fluctuating groundwater table. The heterogeneity and temporal variations of the water table in the 300 Area make effective contact problematic. Uranium that would be mobilized by the leaching solution must be controlled and collected. The dynamic hydrogeology of the Hanford Site aquifer in the application area(s) makes effective recovery of the mobilized uranium difficult. Significant uncontrolled leakage of caustic lixiviant solution with uranium to down gradient aquifer and the Columbia River is likely. Since successful in situ leaching has not been previously known to have been achieved in shallow, unconfined strata near a water table, the implementability of this technology is unproven. In addition, capital and O&M costs for in situ leaching in shallow, unconfined aquifer zones are unknown. Given the uncertainties of lixiviant delivery, difficulties in controlling and capturing leached uranium, risk to the environment with lixiviants, and indeterminate costs, in situ leaching was not retained for further consideration.

J1.3 In Situ Treatment—Delivery Method

This section presents technologies for the delivery of reagents for the in situ treatment of waste site soils. The previous section discussed possible reagents.

J1.3.1 Deep Soil Mixing

Deep soil mixing was not retained for treatment of soils contaminated with radionuclides and other COCs.

J1.3.1.1 Description

Deep soil mixing uses large-diameter augers or horizontally rotating heads to blend in reactants and homogenize soil. The diameter of the augers can vary from 0.3 to 4 m (0.98 to 13 ft) (“Containment, Stabilization and Treatment of Contaminated Soils Using In-Situ Soil Mixing” [Day and Ryan, 1995]). Reports indicate depths ranging from 35 m (114 ft) (“Containment, Stabilization and Treatment of Contaminated Soils Using In-Situ Soil Mixing” [Day and Ryan, 1995]) to 50 m (164 ft) (“In-Situ Stabilization and Fixation of Contaminated Soils By Soil Mixing” [Jasperse and Ryan, 1992]) can be achieved with this technology.

The technology provides the opportunity for uniform mixing in the soil column, and good contact and reaction between contaminants and amendments. The reactants could be chemical reductants, biological

substrates, or solidification/stabilization agents. Soil mixing by means of auger emplacement and incorporation of agents may be effective for shallow, near surface contamination. Overlapping auger borings effectively ensures continuity of reagent emplacement. Effective depth varies, depending upon site-specific conditions. Generally, this method increases soil volume, and excess soil could require disposal. Auger penetration would be substantially reduced, or even refused, in large gravels or well-cemented materials. A backhoe may be required to move the large cobbles.

J1.3.1.2 Relevant Demonstration Projects

Deep soil mixing was used to remediate an abandoned transformer repair facility in Miami, Florida ("In-Situ Stabilization and Fixation of Contaminated Soils By Soil Mixing" [Jasperse and Ryan, 1992]). PCB concentrations over the affected area ranged from 200 to 600 parts per million (ppm), with a maximum concentration of 1,000 ppm. Impacted media was encountered to approximately 15 m bgs (49 ft) bgs. Laboratory bench-scale tests were completed to evaluate potential reagents, and a proprietary pozzolanic additive containing clay absorbents was selected. Full-scale implementation involved use of a four-shaft deep soil-mixing rig and a reagent mixing plant complete with a four-line pump and control system. Reagents were mixed at a rate of 275 kg/m^3 of soil mixed. Results from the study show a decrease in concentrations of PCB after treatment, as well as an increase in unconfined strength and decrease in permeability of the mixed samples over time ("In-Situ Stabilization and Fixation of Contaminated Soils By Soil Mixing" [Jasperse and Ryan, 1992]).

J1.3.1.3 Evaluation and Screening Rationale

Deep soil mixing is considered effective at delivering reagents to contaminated soils. Chemical agents are mixed uniformly with the soil column, providing good contact and reaction between the contaminant of concern and the chemical. Cement or bentonite clay can also be mixed with the chemical slurry to reduce the hydraulic conductivity and leachability of the soil. Implementability of deep soil mixing is considered marginal at the Hanford Site due to the presence of cobbles and boulders in the subsurface. Because the equipment cannot mix to depths significantly deeper than the reach of a backhoe, and the ERDF is available for soil disposal at the Hanford Site, excavating the soil and disposing of it at the ERDF is a much more straightforward and proven option. Because implementability will be limited by site conditions and required depth of treatment, deep soil mixing is not retained for further evaluation.

J1.3.2 Foam Delivery of Reagents

Foam delivery of reagents was not retained for treatment of soils contaminated with radionuclides, Cr(VI), other metals, and organic compounds.

J1.3.2.1 Description

Foam delivery is a relatively new method of delivering chemical reactants to the vadose zone. The foam is created by a surfactant solution and mixed with a chemical such as calcium polysulfide. This mixture is then injected into the vadose zone via vertical wells. The foam helps to move the reactants out horizontally from the injection well, rather than just downward. Depending on the reactant used, it could be used to treat Cr(VI), technetium-99, and uranium.

J1.3.2.2 Relevant Demonstration Projects

Foams have not yet been applied to field-scale dissemination of reagents to remediate sediment contamination. A preliminary evaluation of delivery technologies for lateral injection was conducted by PNNL in 2010 (*Evaluation of Reagent Emplacement Techniques for Phosphate-based Treatment of the Uranium Contamination Source in the 300 Area* [PNNL-19461]). The evaluation concluded that, given the available laboratory research conducted, the lateral application of reagents like phosphate to periodically wetted sediments using foam is inferior to other delivery methods such as injection in a

solution with a shear-thinning agent. Foam, in the limited range of laboratory conditions tested thus far, appears to be limited by a very high pressure at the injection point that reduces the distance of foam propagation; this distance may be as constrained as 1.5 m (5 ft). However, no information is currently available on how far the foam will move out from an injection well in field conditions. Foam delivery of reagent also has the inherent limitation of having only a small percentage of its volume (generally less than 5 percent depending upon the foam quality) available for conveying dissolved reagent. Consequently, a greater quantity of foam relative to a direct liquid application may be required to contact a given volume of contaminated sediment adequately.

J1.3.2.3 Evaluation and Screening Rationale

The technology evaluation has been limited to laboratory column tests; thus, effectiveness, implementability, and costs at the field scale are unknown. The spacing between injection points is also unknown; however, the estimated distance of foam propagation in the field is approximately 1.5 m (5 ft). Evaluation of results from the ongoing treatability study is needed prior to making a decision regarding its full-scale use at the Hanford Site. For this reason, foam delivery of reagents is not retained for further consideration.

J1.3.3 Gaseous Delivery of Reagents (In Situ Gaseous Reduction)

In situ gaseous reduction was not retained for treatment of soils contaminated with radionuclides and other COCs.

J1.3.3.1 Description

ISGR is a vadose zone remediation technology that uses a gasses reagents (such as hydrogen sulfide/nitrogen gas mixture) to reduce or treat contaminants. It is applicable to redox sensitive contaminants, and the objective is to chemically reduce the contaminant (metal or radionuclide) to a less mobile, and sometimes less toxic form, preventing further migration and reducing the risk of contaminating the groundwater. For contaminants such as uranium and technetium, the reduced species are significantly less mobile than the oxidized species. With the reduction of iron associated with sediment, the ISGR technology creates a reducing zone within the subsurface that continues to reduce contaminants or other oxidants (e.g., oxygen) that migrate into the treatment zone until the reducing capacity becomes depleted (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]).

J1.3.3.2 Relevant Demonstration Projects

An ISGR pilot demonstration test was completed at the White Sands Missile Range in New Mexico between 1996 and 1998 (*In Situ Gaseous Reduction Pilot Demonstration—Final Report* [PNNL-12121]). A combination of gas injection and vacuum extraction wells were used to distribute hydrogen sulfide gas. In the demonstration, six extraction wells surrounded a central vacuum well in a hexagonal pattern. The study indicated that 70 percent of the Cr(VI) was reduced to its trivalent state. Highest treatment efficiencies were seen at 1.2 to 3 m (4 to 10 ft) bgs, which was the zone of highest contaminant concentration. Low treatment efficiencies were seen at 3 to 4.8 m (10 to 16 ft) bgs. The study concluded that the treatment gas mixture was largely channeled through the upper zone and bypassed the less-permeable, lower-zone soil (*In Situ Gaseous Reduction Pilot Demonstration—Final Report* [PNNL-12121]).

A second demonstration test was planned at the former 183-DR facility in the 100-D/DR Area of the Hanford Site, which is associated with a significant groundwater contaminant plume (*Characterization Activities Conducted at the 183-DR Site in Support of an In Situ Gaseous Reduction Demonstration* [PNNL-13486]). Site characterization efforts were completed in 2001 in order to obtain information regarding distribution of Cr(VI) and other chemical and geological data that could support an ISGR demonstration. Site characterization data collected from two boreholes at the site failed to show signs of a

Cr(VI) vadose zone source for the groundwater plume; therefore, the project was suspended until additional site characterization could be completed.

J1.3.3.3 Evaluation and Screening Rationale

As evaluated in *Central Plateau Vadose Zone Remediation Technology Screening Evaluation* (RPP-ENV-34028), the use of a gas as the reducing agent is advantageous compared to a liquid-based delivery method, as there is less risk of mobilizing contaminants, and better diffusion of reagent is expected. However, significant uncertainties have been identified regarding the effectiveness of ISGR. Key uncertainties (as identified in *Evaluation of Vadose Zone Treatment Technologies to Immobilize Technetium-99* [WMP-27397]) include:

- Physical heterogeneity of the vadose zone sediments presents a challenge for an even distribution of the hydrogen sulfide gas. Fine-grained soils are likely to contain more contaminants and are more difficult to treat.
- Heterogeneity occurs in the distribution of reducible iron.
- Re-oxidation of the treated zone is likely because of flux of oxygen in soil air into the pore spaces.

Uranium and technetium-99 readily re-oxidizes under aerobic conditions, requiring periodic treatment to maintain reducing conditions. Strong reducing conditions can mobilize other constituents (e.g., arsenic and manganese); however, these constituents would likely re-oxidize rapidly once they mobilize outside the treatment zone.

The equipment and processes required to implement ISGR are readily available and have been demonstrated in the field. The major challenge for ISGR is the number of wells that must be installed to achieve overlapping ROIs. Boreholes drilled through large vertical contaminated zones would generate substantial amounts of waste. Implementation of this technology could also lead to risk to workers with respect to exposure and safety. Hydrogen sulfide gas is extremely hazardous, and effective engineering controls would need to be installed to mitigate risk to worker safety (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]).

Better tools are needed to evaluate potential designs for vadose zone remediation using reactive gases. For example, a multiphase flow model would assist in evaluating the applicability of reactive gas technologies to the deep vadose zone. Because ISGR has the potential to immobilize technetium-99 and uranium and has been demonstrated at the field scale for similar applications, it has been included for further study in *Deep Vadose Zone Treatability Test Plan for the Hanford Central Plateau* (DOE/RL-2007-56).

Additional information resulting from the treatability studies is required prior to making decisions about the full-scale application of in situ gas reduction at the Hanford Site. For this reason, ISGR was not retained for further consideration.

J1.3.4 Horizontal Injection Wells

Delivery of substrates using horizontal injection wells was not retained for treatment of soils contaminated with radionuclides and other COCs.

J1.3.4.1 Description

Horizontal injection wells involve the delivery of amendments through wells installed using horizontal drilling techniques. Horizontal injection may have benefits over vertical injection in shallow treatment areas, and where COCs are characterized within a certain discrete depth interval.

J1.3.4.2 Relevant Demonstration Projects

An unsuccessful horizontal well technology demonstration was conducted at the Hanford Site 100-D Area from November 2009 through January 2010 (*Treatability Demonstration Report for Directional Drilling in the 100-D Area* [SGW-45974]). The scope of work consisted of two phases. First, a surface casing was installed at a 16-degree angle from horizontal through the Hanford formation to an estimated depth of 15 m (50 ft) bgs. The second phase was to drill through the Ringold Formation using horizontal directional drilling techniques and drilling mud. Once this drilling was complete, the drill bit would have been knocked off and the well screen installed inside the drill pipe. Installation of surface casing was required to facilitate circulation of drilling mud in the very porous Hanford formation. The casing was advanced with much difficulty to approximately 6 m (20 ft) bgs (85 linear ft) when downward progress ceased because of inadequate force on the downhole hammer and difficulty removing cuttings from the inclined casing. Rotary-mud directional drilling through the casing and into the Hanford formation was attempted but progress was slow and circulation was never established.

J1.3.4.3 Evaluation and Screening Rationale

As with vertical injection wells, the effectiveness of horizontal injection wells can be hindered by soil heterogeneity, which causes preferential flow paths and limits the treatment effectiveness of lower permeability soil. With anisotropies in vertical hydraulically conductivity more pronounced than horizontal hydraulically conductivity, amendment distribution over a larger depth interval would be more challenging compared to vertical wells. Furthermore, maintaining target borehole depth and alignment with horizontal drilling in gravelly/cobbly lithologies would be difficult; this issue was encountered during the technology demonstration at the Hanford Site. Given the increased difficulty in installation and amendment delivery compared to vertical injection wells, horizontal injection well technology was not retained for further evaluation.

J1.3.5 Jet Grouting

Jet grouting was not retained for treatment of soils contaminated with radionuclides and other COCs.

J1.3.5.1 Description

As mentioned in *Deep Vadose Zone Treatability Test Plan for the Hanford Central Plateau* (DOE/RL-2007-56), grout injection addresses subsurface contaminants by injection of a grout or binding agent into the subsurface to physically or chemically bind or encapsulate contaminants. Grout injection technologies using multiple types of grouting materials have been applied and are currently undergoing testing for in situ contaminant stabilization at other sites. Similarly, more standard grouting techniques also potentially may be useful for selected applications.

J1.3.5.2 Relevant Demonstration Projects

As presented in *Central Plateau Vadose Zone Remediation Technology Screening Evaluation* (RPP-ENV-34028), in situ grouting has been approved by regulating agencies and implemented at several small-scale sites, although in situ grouting has not been applied to large-scale sites with many radiological and chemical hazards.

PNNL conducted a study in 2010 to evaluate water jet injection of phosphate and apatite into subsurface sediments in the Hanford Site 100-N Area (*Hanford 100-N Area In Situ Apatite and Phosphate Emplacement by Groundwater and Jet Injection: Geochemical and Physical Core Analysis* [PNNL-19524]). Sediments that were jet injected with sodium phosphate or fishbone apatite (or both) showed high phosphate concentrations with multiple (six), closely spaced (approximately 1.5 m [5 ft] spacing) injection points. However, with samples taken very close to injection points, it was difficult to assess the relevant areal extent at greater distance (i.e., 1.5 to 6 m [5 to 20 ft]) and to make

recommendations regarding future injection point spacing greater than 1.5 m (5 ft) apart. In addition, jet injection also appeared to deposit more phosphate in finer grained sediments, so the spatial variability of the phosphate mass was much greater compared to groundwater injections. A mechanism that could explain these results is that finer grained sediments are involved in liquefaction during jet injections, which could result in more complete mixing of the phosphate in the sediment, whereas dendritic fracture patterns may develop with jet injection into coarser grained sediments. This may also cause some change in the sediment hydraulic conductivity.

This technology was briefly considered for treating technetium-99 in the vadose zone at the Hanford Site (*Evaluation of Vadose Zone Treatment Technologies to Immobilize Technetium-99* [WMP-27397]). Grouting had been used as a stabilizer in several demonstrations and remedial actions had involved limited and contained volumes (e.g., beryllium reflector blocks and outer shim control cylinders). However, it was not considered practicable for use in the Hanford Site vadose zone because of the number of boreholes that would be required for complete coverage of the grout, the cost of drilling to depth, and the difficulty in confirming a continuous volume (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]).

Grouting of buried mixed waste at the DOE Savannah River Site was rejected as a remedial technology (*100 Area Source Operable Unit Focused Feasibility Study Report* [DOE/RL-94-61]). Evaluations concluded that grouting would not fill enough voids without creating uncontrolled surface cracking and surface releases of grout contaminated with hazardous and radioactive constituents.

J1.3.5.3 Evaluation and Screening Rationale

There are significant uncertainties with use of grouting for in situ contaminant stabilization, especially for the deep vadose zone, as discussed in *Evaluation of Vadose Zone Treatment Technologies to Immobilize Technetium-99* (WMP-27397). The principal challenges to implement this technology are small injection point spacing, heterogeneous amendment distribution, transport of the grout to the deep vadose zone, and verification of proper placement. The vertical variations in stratigraphy, with some levels having relatively low potential permeability to grout flow, pose significant challenges for the technology.

Because grouting technologies have the potential for use as part of a remedy for the deep vadose zone, further efforts to evaluate the performance of grouting technologies are included in the Deep Vadose Zone Treatability Test Plan for the Hanford Central Plateau (*Deep Vadose Zone Treatability Test Plan for the Hanford Central Plateau* [DOE/RL-2007-56]). Additional information resulting from the treatability studies is required prior to making decisions about the full-scale application of grouting technologies at the Hanford Site. Currently, jet grouting is considered cost prohibitive because of the close well spacing required, and with potentially limited effectiveness. For these reasons, jet grouting is not retained for further evaluation.

J1.4 In Situ Treatment—Other

J1.4.1 In Situ Desiccation

Desiccation was not retained for treatment of soils contaminated with radionuclides and other COCs.

J1.4.1.1 Description

As mentioned in *Deep Vadose Zone Treatability Test Plan for the Hanford Central Plateau* (DOE/RL-2007-56), desiccation involves drying a targeted portion of the vadose zone by injecting dry air and extracting soil moisture at SVE wells. Because desiccation removes water already in the vadose zone, it reduces the amount of pore fluid available to support downward transport of contaminants in the deep vadose zone, impedes water movement, and augments the impact of surface water infiltration control.

The impact of desiccation on the movement of COCs is based on physical removal of water from the subsurface. Removing moisture from the contaminated material reduces the driving force for continued vertical migration. Theoretically, desiccation would be effective in immobilizing contaminants to the extent that moisture content is lowered below the point for unsaturated flow to occur. The longevity of the "dry" conditions depends on the soil moisture infiltration rate, the relative humidity of atmospheric air, and the proximity to groundwater. In time, moisture levels recover to pre-extraction levels (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]). Without surface infiltration control, moisture content would eventually return to a state of equilibrium with surface infiltration rates. Therefore, this technology is considered not to be effective in the long term without concurrent infiltration control. A more detailed evaluation of this technology, including some initial feasibility calculations was presented in *Evaluation of Vadose Zone Treatment Technologies to Immobilize Technetium-99* [WMP-27397].

J1.4.1.2 Relevant Demonstration Projects

A very limited desiccation test showing that subsurface airflow can be induced in the Central Plateau vadose zone has been performed in conjunction with a leak detection test (*Summary of Hanford Subsurface Air Flow and Extraction (SAFE) Activities for Fiscal Year 2002* [PNNL-13820]).

J1.4.1.3 Evaluation and Screening Rationale

Equipment and technology required for implementation of desiccation is well established and common. Soil vapor extraction is a well-established technology, and moisture extraction has been safely demonstrated at the Hanford Site (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]). However, there is uncertainty with the number of wells, well spacing, and well configuration details required for optimal field/full-scale implementation. There also are uncertainties with specific aspects of implementation and long-term effectiveness. Desiccation, which was included in *Deep Vadose Zone Treatability Test Plan for the Hanford Central Plateau* (DOE/RL-2007-56), is expected to assist in addressing the abovementioned uncertainties.

Additional information resulting from the treatability studies is required prior to making decisions about the full-scale application of desiccation at the Hanford Site. Therefore, desiccation was not considered for further evaluation.

J1.4.2 In Situ Thermal Desorption

In situ thermal desorption (ISTD) was not retained for treatment of soils contaminated with organic compounds.

J1.4.2.1 Description

ISTD involves the direct application of heat (e.g., using electrical current to heat soil, electrical heater elements, injection of hot air, steam or hot water, or radio frequency) to increase the temperature of soil and destroy or volatilize organic compounds. The use of electrical heating elements installed in closely spaced soil borings (1.5 to 3 m [5 to 10 ft] apart) is the most common approach for implementing ISTD. With heating elements, conductive heating is the primary mechanism that transmits heat to the soil. The technology can achieve rapid removal/destruction of a mix of VOCs and SVOCs, and achieve low residual concentrations. Vapors would be extracted from extraction wells or trenches using a vacuum pump. The vapor stream would be preconditioned by a moisture separator or heat exchanger, and treated by a vapor treatment system.

J1.4.2.2 Relevant Demonstration Projects

Field demonstrations were performed in 1993 and 1994 at the Savannah River Site and the Hanford 300 Area to evaluate six-phase heating (a form of electrical resistive heating) as a vadose remedial technology for tetrachloroethane (PCE) and TCE (*Six-Phase Soil Heating* [DOE/EM-0272]). The demonstration site at the Hanford Site was located in the 300 Area at an uncontaminated, undisturbed site. The objective of the 300 Area demonstration was to refine the design of the six-phase electrodes and other system components and address scale-up issues in the field. The demonstration site at Savannah River Site was located at one of the source areas within the 1 mi^2 VOC groundwater plume. The contaminated target zone was a 3 m (10 ft) thick clay layer at a depth of approximately 12 m (40 ft). TCE and PCE concentrations in sediments ranged from 0 to 181 µg/kg and 0 to 4,529 µg/kg. Six electrodes were placed in the ground in a 9 m (30 ft) (diameter) hexagonal pattern. An extraction well was placed in the center of the hexagon. One to 7.6 L (2 gal)/hour of water with 500 mg/L NaCl were added at each electrode to replenish evaporated water and provide and electrically conductive solution. The soil surrounding each electrode was supplied with water through a drip system. A vacuum system removed contaminant vapors from the subsurface, which were passed through a condenser to remove the steam. The extracted VOCs were treated by electrically heated catalytic oxidation. Key results of the demonstration at SRS indicate 99.7 percent removal of contaminants from within the electrode array. Outside the array, 93 percent of contaminants were removed at a distance of 2.4 m (8 ft) from the array. Clays were heated more rapidly than the adjacent sands, due to their higher moisture content (and, thus, electrical conductivity). Completion of a cost-benefit analysis by Los Alamos National Laboratory showed that six-phase soil heating could be performed for a cost of $115/cubic meter ($88/yd^3), assuming that a contaminated site of 30 m (100 ft) in diameter and 6 to 37 m (20 to 120 ft) deep could be remediated in 5 years.

A full-scale thermal conductive heating treatment system was operated at a confidential chemical manufacturing facility in Portland, Indiana from July to December 1997 (*In Situ Thermal Treatments of Chlorinated Solvents Fundamentals and Field Applications* [EPA 542-R-04-010]). The two target treatment areas were 45 by 15 m (150 by 50 ft) to a depth of 5.5 m (18 ft), and 9 by 6 m (30 by 20 ft) to a depth of 3.4 m (11 ft). Target source areas contained TCE up to 79 mg/kg and PCE up to 3,500 mg/kg. The site geology included fill, a combination of sand, clayey sand and construction debris, to a depth of about 2 m (7 ft). Till consisting of moist, damp, silty clay extended to a depth ranging from 5.5 to 5.8 m (18 to 19 ft), with sand seams running through the till. Below the till was a sand and gravel layer extending to a depth of 9 m (30 ft) and consisting of poorly sorted sand. Groundwater was encountered in the sand and gravel layer at depths of 6.7 to 7.6 m (22 to 25 ft). Heater/vacuum wells were installed on a 2.9 m (7.5 ft) triangular spacing with approximately one well per 4.6 m^2 (50 ft^2)of surface area treated. Wells were operated at 760 to 872°C (1,400 to 1,600°F) and soil gas was extracted through the wells using a vacuum pump. The surface area between wells was covered by an impermeable silicone rubber sheet to prevent fugitive emissions, and thermally insulated mats were used to minimize surface heat loss. The maximum soil temperature in the treatment area at a depth of 4 m (13 ft) ranged from 100 to 260°C (212 to 500°F). Offgases were treated with a 51,000 specific L per minute (1,800 specific cubic feet per minute) flameless thermal oxidizer with an operating temperature range of 980 to 1,040°C (1,800 to 1,900°F). Results of confirmatory sampling showed that concentrations of PCE and TCE in both areas were reduced to below the cleanup goals of 8 mg/kg for PCE and 25 mg/kg for TCE.

J1.4.2.3 Evaluation and Screening Rationale

With ISDT, contaminants are primarily removed as vapors and treated above ground. Collection of volatilized COCs requires a means of active vapor recovery, typically an SVE network, in conjunction with

a vapor barrier constructed over the entire treatment area. ISTD was rejected in favor of other technologies (bioventing and SVE), given that ISTD is mechanically complex and not a cost-competitive alternative.

J1.4.3 In Situ Vitrification

In situ vitrification (ISV) was not retained for treatment of soils contaminated with radionuclides and other COCs.

J1.4.3.1 Description

Vitrification processes are solidification methods that use temperatures between 1,200 and 2,000°C (2,200 to 3,600°F)—depending on the composition of the mixture being melted—to melt and convert waste materials into glass or other glass and crystalline products. In addition to solids, waste materials can be liquids, wet or dry sludges, or combustible materials. Borosilicate and soda lime are the principal glass formers and provide the basic matrix of the vitrified product. Offgases generated by the process are contained under a hood covering the treatment area and are drawn to an offgas treatment system. Organic contaminants are destroyed by pyrolysis, which occurs as the temperature increases before the actual melting, and by catalytic dechlorination reactions, which occur as contaminated soils approach melt temperatures under reducing conditions. Heavy metals and radionuclides are distributed throughout the melt because of the relatively low viscosity of the molten glass and the convective flow that occurs within the melt. When electrical power is shut off, the molten mass cools and solidifies into a vitreous rock-like monolith with excellent physical, chemical, and weathering properties. The resulting product typically is 10 times stronger than concrete, and 10 to 100 times more resistant to leaching than glasses typically used to immobilize high-level wastes. The radionuclides and heavy metals are retained within the melt.

ISV involves passing current through the soil using an array of electrodes. If the soil is too dry, enhancements must be placed to provide an initial flow path for the electrical current. Large areas are treated by fusing together multiple vitrification treatment zones (*Remediation of Metals-Contaminated Soils and Groundwater* [Evanko and Dzombak, 1997]). To accommodate soil densification, clean overburden is placed over the melt zone before the melt is initiated, thereby avoiding subsidence issues while increasing thermal efficiency and radionuclide retention. Excessive water vapor passing through the melt may disrupt or displace the melt; therefore, soil with high moisture content must be treated to remove water prior to ISV. The process requires 700 to 900 kWh/ton of soil to be treated, including soil water. The overall oxide composition of the soil determines the fusion, melt temperature, and viscosity, and it is essential that the media contain sufficient monovalent alkali earth oxides to provide the electrical conductivity required (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]).

J1.4.3.2 Relevant Demonstration Projects

Between 1980, when the ISV process was conceived of by PNNL for the DOE, and 1997, more than 200 tests, demonstrations, and commercial operations of the technology have been conducted (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]). *In Situ Vitrification, U.S. Department of Energy, Hanford Site, Richland, Washington; Oak Ridge National Laboratory WAG 7, Oak Ridge, Tennessee, and Various Commercial Sites* (DOE, 1997) presented information on a case study conducted at the Hanford Site. Information specific to the study (DOE, 1997) is limited; however, it does specify that a *Toxic Substances Control Act of 1976* (TSCA) demonstration showed destruction and removal efficiency for PCBs of greater than 99.9999 percent.

A large-scale ISV test was completed at the 116-B-6A Crib site in 1990 (*In Situ Vitrification of a Mixed-Waste Contaminated Soil Site: The 116-B-6A Crib at Hanford* [PNL-8281]). The site contained mixed waste (chromium, lead, and cesium-137) at an approximate depth of 6 m (20 ft) bgs. The

treatability test consumed 550 megawatt hours (MWH) of electrical energy, and resulted in a 770 metric ton (850-ton) block of vitrified soil. Results from data collection indicated the vitrified block retained over 99.99 percent of chromium and lead, and over 99.98 percent of cesium-137, indicating the favorable resistance of the treated material to leaching. Results also indicated greater treatment depths were in homogeneous soils. The final depth achieved during the treatability test was 4.3 m (14 ft), 1.8 m (6 ft) less than the required treatment depth. The 4.3 m (14 ft) vitrified depth coincided with a cobble layer detected below the crib during the post-treatment core drilling. The rate of melt progression above the cobble layer was satisfactory, indicating the effect of the cobble layer on the achieved treatment depth (*In Situ Vitrification of a Mixed-Waste Contaminated Soil Site: The 116-B-6A Crib at Hanford* [PNL-8281]).

Geosafe Corporation licensed the technology from PNNL and has applied it commercially. In 1995, Geosafe Corporation evaluated the application of ISV under the EPA Superfund Innovative Technology Evaluation Program at the former site of Parsons Chemical Works, Inc. in Grand Ledge, Michigan (*Geosafe Corporation In Situ Vitrification, Innovative Technology Evaluation Report* [EPA/540/R-94/520]). The technology evaluation report summarized the findings associated with a demonstration of the ISV process and its ability to treat pesticides and mercury below EPA Region V mandated limits. The technology was evaluated against the nine *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* feasibility study guidance criteria for decision-making in a Superfund facility. ISV was considered to be effective in destroying organic contamination, immobilizing inorganic material, and as mentioned, in reducing the likelihood of contaminants leaching from the treated soil. Among some of the limitations, the report stated that ISV is not recommended for sites that contain organic content greater than 7 to 10 percent by weight, metal content greater than 25 percent by weight, and inorganic contaminants in excess of 20 percent by volume (*Geosafe Corporation In Situ Vitrification, Innovative Technology Evaluation Report* [EPA/540/R-94/520]). The report also noted that ISV would not be appropriate for sites where contaminated soil exists adjacent to buildings, other structures, or the property line.

A subsurface planar method was recently applied in a demonstration project to treat a portion of a mixed low-level radioactive liquid waste adsorption bed at the Los Alamos National Laboratory's MDA-V site ("Demonstration of Non-Traditional In Situ Vitrification Technology at Los Alamos National Laboratory" [Coel-Roback et al., 2003). Nontraditional planar ISV uses the same general process as in traditional ISV; however, this technology involves joule-heated melting within the subsurface. In contrast to the horizontally oriented melt normally started at or near the surface, this process establishes two vertically oriented planar melts in the subsurface between pairs of electrodes. The planar melts can be initiated at the desired depth and separation within the subsurface, depending on the target treatment volume (*Central Plateau Vadose Zone Remediation Technology Screening Evaluation* [RPP-ENV-34028]). "Demonstration of Non-Traditional In Situ Vitrification Technology at Los Alamos National Laboratory" (Coel-Roback et al., 2003) indicated an average treatment depth of 7.9 m (26 ft) bgs at the electrode locations; radioactive contaminants were seen to have been distributed uniformly through the melt and concentrations were reduced by more than an order of magnitude.

J1.4.3.3 Evaluation and Screening Rationale

As mentioned in *Central Plateau Vadose Zone Remediation Technology Screening Evaluation* (RPP-ENV-34028), the effective treatment depth of this technology is approximately 7.6 m (25 ft) bgs, and treatment area is limited by cost. Elevated worker safety and exposure concerns could be associated with this process as a result of volatilization; however, the risk is considered lower than that of excavating highly contaminated and radioactive soil. Working in proximity to high voltage and high temperatures also requires appropriate safety precautions.

The cost associated with implementation of ISV, as compared to other technologies is considered high, where electric power is generally the most significant contributor. As presented in Table 9-1 of *Central Plateau Vadose Zone Remediation Technology Screening Evaluation* (RPP-ENV-34028), ISV has the highest of all relative technology-specific costs. Given the complex equipment requirements and challenging implementation, as well as the relative high cost, ISV was not retained for further evaluation.

J1.4.4 In Situ Flushing

In situ flushing was not retained for treatment of soils containing soluble contaminants, for example uranium.

J1.4.4.1 Description

In situ flushing consists of flooding contaminated soils with a solution that moves contaminants in the vadose zone soil to the water table and by high rates of groundwater extraction removing the dissolved contaminant. The extracted groundwater with contaminant is treated by an ex situ process that separates, concentrates, and transforms the contaminant. The flushing solution consists of either water or water with additives to enhance solubilization and movement of the contaminant. Uranium contamination may be treated with an acid solution. The flushing solution is either applied by injection into multiple vertical wells with a quantity of water sufficient to raise the groundwater table to contact the contaminated zone sufficiently or to flood contaminated vadose zone sediments vertically. An even higher quantity and rate of water is extracted by multiple extraction wells in the upper aquifer to control, contain, and recover the mobilized contaminant. In the case of uranium, ex situ treatment options including ion exchange may be considered. Mobilized contaminant recovery is of paramount importance; otherwise, soil flushing will increase contaminant concentrations and extent in the groundwater.

J1.4.4.2 Relevant Demonstration Projects

Most documented applications of soil flushing used water to treat hydrocarbon or organic contaminants at contaminated sites. Surfactants were added in some cases. The only application of soil flushing applied to metal contamination in the EPA Superfund database is the use of water to flush chromium from vadose zone soil to groundwater at the United Chrome Products, Inc. Superfund Site, Corvallis, Oregon, between 1988 and 2003. Between August 1991 and February 1994, 21 million L (5.5 million gal) of groundwater was injected. Performance of the operation with respect to removal of chromium from vadose zone is undocumented. No documented applications of full-scale soil flushing of uranium in soil have been found. However, considerable laboratory research on flushing with aqueous carbonate/bicarbonate solutions has shown the potential to accelerate mobilization of U(VI) from contaminated soil ("Extraction of Oxidized and Reduced Forms of Uranium from Contaminated Soils: Effects of Carbonate Concentration and pH" [Zhou and Gu, 2005]).

J1.4.4.3 Evaluation and Screening Rationale

The treatment effectiveness of soil flushing is a function of the solubility of the uranium deposits on sediment and the ability of the wash water to contact the contamination. Laboratory column leaching studies on sorbed uranium associated with vadose zone sediments from the 300 Area have documented that such uranium is not amenable to removal by flushing. The release of U(VI) was found to be very slow and require extensive water volume for even partial removal of the sorbed U(VI) on sediment. U(VI) desorption was found to be a kinetic and not an equilibrium process. Long term leaching experiments removed only 1 to 8 percent of the total U(VI) (*Uranium Geochemistry in Vadose Zone and Aquifer Sediments from the 300 Area Uranium Plume* [PNNL-15121]). In addition, the heterogeneity and temporal variations of the water table in the 300 Area make effective contact of the flushing water difficult. The relatively dynamic groundwater velocities and changes in direction would make effective recovery of the flushing solution in the aquifer problematic. Consequently, the effectiveness of soil

flushing is ranked low. The implementability of soil flushing is ranked low to moderate. Application of large quantities of flushing solution is constrained by the subsurface stratigraphy. Infiltration tests in the 300 Area have thus far been disappointing. Although extraction of flushing solutions using the well established technology of multiple vertical extraction wells is common, the high permeability of the Hanford aquifer would require very high pumping rates on the order of hundreds of gallons per minute per well to effect capture and control. Such high pumping rates would require moderate capital and relatively high operational expenditures. Consequently, soil flushing is not retained for further consideration.

J1.4.5 Phytoremediation

Phytoremediation was not retained for treatment of soils contaminated with bioavailable metals and organic compounds.

J1.4.5.1 Description

Phytoremediation is the use of plants and microorganisms associated with plant roots to extract, evapotranspire, immobilize, contain, or degrade contaminants. In the case of the radionuclides and metals, degradation would not be among the phytoremediation mechanisms, although it is conceivable that microorganisms could reduce reducible metals and radionuclides to some unknown extent. Phytoremediation typically is used as a polishing step and not for high concentrations of contaminants.

J1.4.5.2 Relevant Demonstration Projects

A treatability demonstration project is being conducted at the Hanford Site for treatment of strontium-90 in soil and groundwater along the banks of the Columbia River in the 100-N area using coyote willows. The coyote willow is considered the most suitable plant for use along the Columbia River shore. Known for its rapid and robust regrowth abilities, coyote willow is already used extensively along the Columbia and Yakima Rivers for bank stabilization and revegetation purposes. As part of a treatment train of remedial technologies aimed at treating strontium-90 in the 100-K Decision Unit, phytoremediation using coyote willow would be the final polishing step.

A pilot study began in the late spring of 2007, with the planting of 50 Coyote willow starts in a fenced area at the 100-K Area of the Hanford Site (*100-N Area Strontium-90 Treatability Demonstration Project: Food Chain Transfer Studies for Phytoremediation Along the 100-N Columbia River Riparian Zone* [PNNL-18294]; *Project Work Plan 100-N Area Strontium-90 Treatability Demonstration Project: Phytoremediation Along the 100-N Columbia River Riparian Zone* [PNNL-SA-49953]). This part of the study targeted plant growth rather than phytoremediation capabilities as this location is not contaminated with strontium-90. Often flooded by the annual high Columbia River stage well into June, this site is a severe test of the willow shrubs' ability to survive realistic field conditions.

Greenhouse, laboratory (growth chamber), and field studies have shown that strontium-90 is a nutritional analog of calcium, a plant macronutrient. As such, the Coyote willows will actively accumulate strontium-90 in their leaves and stems to concentrations more than 70 times those present in the soil pore water surrounding their roots. Given the steadily increasing growth rate of the trees at the 100-K Decision Unit following yearly harvests of their aboveground tissue, this type of plant can remove significant amounts of contamination from the shoreline area without disturbing the natural sediment structure. Laboratory studies have also shown that herbivorous insects such as aphids or moth larvae would not be a source of strontium-90 offsite transport from the trees. Further, controlled harvesting schedules, and engineered barriers (fencing and netting), would prevent animal intrusion and plant detritus release (*100-N Area Strontium-90 Treatability Demonstration Project: Food Chain Transfer Studies for Phytoremediation Along the 100-N Columbia River Riparian Zone* [PNNL-18294]).

The phytoremediation demonstration is ongoing at the 100-K Decision Unit. Biomass production over the first 3 years followed a typical growth curve. On a metric-ton-per-hectare (mT/ha) basis, biomass production amounted to 0.2 mT/ha in 2007, 0.87 mT/ha in 2008, and 4.3 mT/ha in 2009. Growth curve extrapolation predicts 13.2 mT/ha during a fourth year and potentially 29.5 mT/ha during a fifth year. The most recent report concludes that the projected biomass yields suggest the trees could prove effective in removing the strontium-90 from the 100-NR-2 riparian zone (*100-N Area Strontium-90 Treatability Demonstration Project: Phytoextraction Along the 100-N Columbia River Riparian Zone—Field Treatability Study* [PNNL-19120]).

Phytoremediation was implemented at the DOE Idaho National Engineering and Environmental Laboratory OU 21 with limited effectiveness. Contaminants of concern in surface soil to be treated using phytoremediation included metals (mercury, zinc, chromium, and selenium) and cesium-137. Based on bench-scale testing, it was determined that phytoremediation would not be successful in meeting remedial action objectives in two areas of concern. Similarly, based on greenhouse experiments, it was determined that phytoremediation would take longer to achieve cleanup goals then what was estimated in the site Record of Decision.

J1.4.5.3 Evaluation and Screening Rationale

Implementability of phytoremediation is considered moderate. It is usually implemented over long time scales, such as years or decades. The sparse vegetation that naturally grows on the Hanford Site suggests that significant efforts and inputs (such as organic matter and water) would be required to establish a vigorous plant community. Accordingly, capital costs are moderate. Once the plants are established, O&M costs would be relatively low or moderate because requirements to sustain them are low (i.e., food and water). However, metals concentrations and radionuclide activities may accumulate in the plants to the point that they must periodically be disposed of in a secure facility, such as the ERDF. Ultimately, the plants would need to be disposed of (e.g., at the ERDF) to avoid returning contaminants to the soils from which they were originally extracted (as plants decompose) if phytoremediation is used for contaminants that are not transformed to innocuous forms by the plants or microorganisms.

Phytoremediation is effective only when the plants are active; therefore, the technology would not be effective during the winter. In addition, phytoremediation is only effective to the approximate depth of the plant roots; thus, only shallow soils would be treated. There are also concerns about contaminants entering the food chain as animals eat the vegetation or bees pollinate flowers.

In summary, the technology would be effective only for low concentrations of contaminants in shallow soils over long periods, and many metals and radionuclides would accumulate in the plants and not actually be treated, posing risks to ecological receptors. For these reasons, phytoremediation was not retained for further evaluation.

J1.5 Containment

Containment technologies that were not retained for treatment of soils contaminated with radionuclides and other COCs are presented below.

J1.5.1 Infiltration Reduction via Surface Barrier

All forms of hydraulic infiltration reduction via a variety of horizontal surface barriers were not retained as methods of reducing the rate of uranium flux into the groundwater beneath the 300 Area.

J1.5.1.1 Description

Horizontal surface barriers are engineered geotechnical structures covering the ground surface over a subsurface repository of contaminated sediment or waste. The barriers are generally designed to be impermeable to prevent surface water infiltration through the vadose zone and limit contaminant leaching to groundwater. The source of the water infiltration may be meteoric precipitation or surface runoff onto areas where subsurface contamination are located. Surface barriers are often constructed with topographical surfaces that direct precipitation off and to the sides of the cover. The barrier may also serve as a physical barrier to prevent penetration by roots, burrowing animals or human contact. Surface barriers or caps range in complexity, durability, and capability from simple compacted soil covers to multi-layer structures composed of barrier, drainage, and membrane components.

There are several types of surface barriers. A modified *Resource Conservation and Recovery Act of 1976* (RCRA) Subtitle C Barrier consists of at least three layers: a low hydraulic conductivity geomembrane/ soil layer, a drainage layer, and a top vegetation/soil layer. A RCRA Subtitle D Barrier for a site such as the 300 Area with no confining layer at the bottom would consist of a similar profile of compacted clay, flexible membrane liner, and top soil with no drainage layer. Asphalt/concrete caps consist of asphalt or concrete layers substituting clay and membrane sandwiched between the upper cover soil and an optional gravel bottom layer. Vegetative cap barriers (*Evapotranspiration Caps for the Idaho National Engineering and Environmental Laboratory: A Summary of Research and Recommendations* [STOLLER-ESR-56]) are specific for arid climates and are designed to promote evapotranspiration from deep soil layers that utilize native vegetation to remove moisture accumulations in the layer, thereby precluding deeper infiltration below into contaminated sediment. The design rather than using preventing infiltration by clay or membrane layers, manages the limited infiltration quantities of the arid climate over an annual period by temporarily storing moisture in an engineered soil layer and then using plants to remove that moisture before the moisture is able to penetrate the cap.

J1.5.1.2 Relevant Demonstration Projects

Several demonstration projects have been conducted on surface barriers or caps at the Hanford Site. A prototype Hanford barrier was constructed in 1994 over the 216-B-57 Crib. Ongoing monitoring of barrier stability, vegetative cover, evidence of plant and animal intrusion, and the main components of the water balance, including precipitation, runoff, storage, drainage, and deep percolation has been conducted to the physical and hydrological performance of the barrier (*200-BP-1 Prototype Hanford Barrier Annual Monitoring Report for Fiscal Years 2005 Through 2007* [PNNL-17176]). In addition, numerous pilot studies have been conducted on a variety of barrier configurations at various locations including other DOE facilities in arid climates ("The Prototype Surface Barrier Project" [PNNL-SA-35711]).

J1.5.1.3 Evaluation and Screening Rationale

Because the residual uranium contamination in the lower vadose zone enters groundwater by water table excursions in the fluctuating groundwater interface zone, all surface barrier configurations would have minimal effectiveness in mitigating uranium mobility into the aquifer. A surface barrier over a 300 Area source will have low effectiveness for mitigating uranium mobility in the deep vadose zone. Depending upon the degree of complexity, the various types of surface barriers have a range of implementability. A Hanford barrier would be moderately implementable while an asphalt/concrete cap would be relatively simple to construct using conventional paving techniques and equipment. The relative capital cost of a surface barrier ranges from high to low depending upon the complexity of its design. The O&M cost for all surface barriers would be relatively low, requiring annual inspection and occasional repair. Because surface barriers do not mitigate the primary mechanism of uranium mobilization to groundwater from the vadose zone, surface barrier technology is not considered further.

J2 Additional Information on Technologies Not Retained for Groundwater Treatment

Information is presented here regarding technologies that were not retained for further evaluation for treatment of groundwater contaminated with uranium and other COCs.

J2.1 Removal

Contaminated groundwater may be removed by either pumped extraction directly or in conjunction with the associated aquifer matrix of sediment with water, as in the extreme remedy of aquifer removal.

J2.1.1 Aquifer Excavation

Aquifer excavation was not retained for treatment of groundwater contaminated with uranium and other COCs.

J2.1.1.1 Description

Aquifer excavation involves the removal of groundwater during the process of excavating sediment in the upper levels of an aquifer. The technique is analogous to open pit mining below the surrounding water table. Overlying vadose zone sediments are removed to the fluctuating groundwater interface zone as well as a shallow (less than 0.5 m) extent of sediment within the excavation footprint into the saturated aquifer. In order to reach such depths, the excavation is designed to have setbacks, side slopes, and/or cutoff walls to safely retain the sides of the excavation and prevent slumping or side failures. The sidewall slopes may employ a variety of support techniques including sheetpile, concrete diaphragm walls, slurry cutoff trenches, injected grouts, or freezing depending upon conditions. In addition, multiple pumped extraction wells are used to reduce the hydraulic head behind the sidewall groundwater exclusion system. Depending upon the depth, excavation may employ backhoes, clam shovels, or drag lines. Excavated sediment, initially unsaturated, is transferred to either ex situ treatment or disposal. Excavated wet sediment may be placed into a temporary dewatering facility before ex situ processing. Contaminated waters draining from sediment, pumped water within and entering into the excavation, and effluent from dewatering wells are treated by an ex situ treatment process. Because of the complexity and risk associated with the excavation, this technology is generally applied only on highly concentrated, localized groundwater contamination situations where the contaminated groundwater is immediately associated with the uppermost aquifer sediment.

J2.1.1.2 Relevant Demonstration Projects

No known application of aquifer excavation for a uranium contamination site could be found in the literature. However, a review of case studies for remediation at 118 locations for dense nonaqueous phase liquid (DNAPL) indicates that 9 percent of the sites reviewed used source removal by soil excavation as a remedy (*Assessing the Feasibility of DNAPL Source Zone Remediation: Review of Case Studies* [CR-04-002-ENV]). At least one of the cases apparently excavated below the water table where difficulty was encountered in completing the desired excavation.

J2.1.1.3 Evaluation and Screening Rationale

As a groundwater remediation technology, aquifer excavation is marginally effective. Indirectly as a method of source removal in the wetted zone, excavation can be highly effective to the extent that the source of uranium is removed. The problem is finding and removing the bulk of the source. Implementation of aquifer excavation is very difficult. Although conventional exaction of the vadose zone sediment to reach aquifer sediment would use conventional equipment, the need to dewater or control groundwater as the excavation is extended into the aquifer over a large area is problematic. Cobbles and large gravel make driven sheet pile, curtain walls, and grout very difficult to install. The very high

permeability of the aquifer would require very high pumping rates. There are few if any successful precedents for aquifer excavation on the scale required for the 300 Area. Such excavation is rated as having relatively low implementability. The capital costs for excavation, dewatering with water treatment, materials handling, and successful reconstruction of the excavated aquifer is relatively high. Unless the excavation of the vadose zone and upper portion of the aquifer were to be combined with a presently unforeseen civil construction project such as a marina facility, the high cost and low implementability of aquifer excavation precludes further consideration of the technology.

J2.1.2 Aquifer Dredging

Aquifer dredging was not retained for treatment of groundwater contaminated with uranium and other COCs.

J2.1.2.1 Description

Aquifer dredging involves the removal of groundwater within the immediate sediment removed in the process of dredging sediment in the upper levels of an aquifer. The technique is similar to the previous technology of aquifer excavation except that at the level of the water table dredging, equipment such as draglines is utilized without concern for dewatering or controlling groundwater inflow to the excavation. Following removal of the overlying vadose zone sediments, contaminated sediment in the saturated zone is removed. In order to reach such depths, the excavation is designed to have setbacks, side slopes, and/or cutoff walls to safely retain the sides of the excavation and prevent slumping or side failures. Minimal effort to maintain sidewall stability would be conducted, although the operating area of the dredge equipment would need to be protected. Excavated sediment, initially unsaturated, would be transferred for either ex situ treatment or disposal. Wet sediment when excavated may be placed into a temporary dewatering facility before ex situ processing. Contaminated water draining from sediment may be returned to the excavation or treated by an ex situ treatment process.

J2.1.2.2 Relevant Demonstration Projects

No known examples of aquifer dredging for a uranium contamination site could be found in the literature. However, dredging is common technology used for navigation improvements along shorelines of lakes and harbors and deepening of ship channels and rivers. Dredging has been occasionally employed in cleanup of contaminated sediments in wetlands or shallow surface waters. Dredging is not generally deployed to remedy aquifer contamination.

J2.1.2.3 Evaluation and Screening Rationale

As a groundwater remediation technology, aquifer dredging would be marginally effective. Indirectly as a method of source removal in the wetted zone, dredging could be effective to remove uranium sorbed to sediment. The overall effectiveness of such sediment removal, even if located and completed is questionable. Removal of contaminated sediments with associated groundwater in the aquifer would address less than 6 to 8 percent of the total uranium contamination mass. Remediation of the source uranium in the fluctuating groundwater interface and vadose zone is far more efficient. Implementation of aquifer dredging would be a technical challenge. Although excavation of the vadose zone sediment to reach aquifer sediment would use conventional equipment, dredging within the excavation is problematic if the aquifer covers a large area. The depth of the excavation/dredging would require large setbacks or extensive shoring. There are few if any successful precedents for aquifer dredging within a previously excavated depression such as would be required for the 300 Area. Such dredging is rated as having relatively low implementability. The capital costs for excavation, dewatering with water treatment, materials handling, and successful reconstruction of the excavated aquifer is relatively high. Unless the excavation of the vadose zone and upper portion of the aquifer were to be combined with a presently

unforeseen civil construction project such as a marina facility, the high cost and low implementability of aquifer excavation precludes further consideration of the technology.

J2.1.3 Pump-and-Treat (Includes Hydraulic Containment via Extraction)

Pump-and-treat was not retained for treatment of groundwater contaminated with uranium and other COCs.

J2.1.3.1 Description

Pump-and-treat groundwater remediation consists of extracting groundwater from one or more wells to the surface, treating the water to remove contaminants, and then either recharging the treated water back into the aquifer or discharging the water to a surface water body or sewage treatment plant. On the surface, contaminants may be removed from the water to very low concentrations using a variety of established technologies. However, pumping contaminated groundwater does not guarantee complete removal of contamination from the aquifer. The solubility of the contaminants, location of contaminant residuals, recharge, or replenishment of contaminants, and the aquifer characteristics may adversely affect the removal process. Generally, multiple pore volumes relative to the contaminated aquifer must be removed even if rapid and complete solubilization of the contaminant applies. For aquifers with slowly mobile contaminant sources and contaminant recharge from infiltration through the vadose zone, tens to hundreds of pore volumes may be required to reduce groundwater concentrations to cleanup levels.

Pump-and-treat systems may be designed to meet one of two different objectives: (1) containment to prevent the contamination from spreading, and (2) restoration to remove the contaminant mass. This section focuses on the latter objective. Pump-and-treat systems designed for restoration generally significantly higher pumping rates than systems intended to contain. The costs of the two approaches vary corresponding to the pumping rate.

J2.1.3.2 Relevant Demonstration Projects

No pump-and-treat systems have been deployed in the 300 Area.

Pump-and-treat has been the principal method of groundwater remediation prior to the 21st century. At the Hanford Site, several pump-and-treat systems have been constructed and operated. Since the 1990s, several interim pump-and-treat systems have been deployed to contain groundwater contamination. Interim systems were installed near several of the Hanford Site's former plutonium production reactors and near processing facilities in the 200 Area. Currently, there are several interim remediation systems in operation, including five pump-and-treat systems. Over 151 million L (40 million gal) of groundwater are treated every month with these interim systems. This has helped to contain contamination plumes and in some cases, to shrink them.

J2.1.3.3 Evaluation and Screening Rationale

Effective pump-and-treat in the 300 Area will be very difficult in the very permeable Hanford aquifer. The permeability of the course sand and gravel formation exhibits hydraulic conductivity greater than 2,000 m/day (2.9×10^6 gal/day/ft^2). Depending upon hydraulic gradients, groundwater flow velocities as high as 15 m/day (50 ft/day) result. Contaminated groundwater extraction is ineffective in such a permeable aquifer. Long-term pumping from a well in the south portion of the 300 Area demonstrates this lack of effect. The water supply well (399-4-12 supplies water for aquariums in the 331 Building) has a pumping rate that typically varies in the range of 757 to 2,271 L/min (200 to 600 gal/min) and has been in operation since approximately 1982. Assuming an average pumping rate of 1,235 L (350 gal) per minute for 29 years, and an average uranium concentration of 30 µg/L during the period, approximately 490 kg (1,080 lb) of uranium has been withdrawn from this well. However, monitoring of uranium

concentrations of groundwater from this well has indicated no reduction of uranium concentration over the years of extraction. A pump-and-treat system is highly implementable using proven technology. Pump-and-treat systems are deployed and operating at other locations in the River Corridor. The relative capital cost of the wells and pumping system may be relatively high depending on the well density and total extraction rate that required ex situ treatment. The energy costs for operation and maintenance costs range from moderate to high depending upon the number of wells, pumping rates, and O&M duration. The potential for high long-term operating costs and low effectiveness because of the high aquifer permeability makes pump-and-treat unsuitable for remediation of groundwater in the 300 Area. Pump-and-treat has not been retained for further consideration.

J2.2 Ex Situ Treatment

Following extraction of groundwater via extraction wells, groundwater is treated with ex situ methods to remove COCs from the water stream, or to reduce COC concentrations prior to discharge. The ex situ treatment options that were not retained are discussed in this section.

J2.2.1 Chemical Reduction and Precipitation

Ex situ chemical precipitation was not retained for treatment of groundwater contaminated with uranium.

J2.2.1.1 Description

Ex situ chemical precipitation involves the introduction of chemicals to transform dissolved contaminants into insoluble solids, which are removed by sedimentation and filtration. Chemicals used can include ferrous chloride, ferrous sulfide, ZVI, sulfur dioxide, and various sulfites (Section 4.2 of *Remedial Process Optimization for the 100-D Area Technical Memorandum Document* [SGW-38338]). Ferrous iron is commonly used for industrial wastewaters, such as from metal plating. Effective post-treatment for solids removal and conditioning is required. Solids removal would likely include flocculation and/or coagulation, settling, and filtration. Sludge handling, dewatering, and disposal are also required. The volume and/or mass of the sludge generated can be extremely large and would need to be disposed of at the ERDF. Site-specific jar testing would be required to obtain design and operational parameters.

J2.2.1.2 Relevant Demonstration Projects

A remediation process optimization (RPO) evaluation was performed for the 100-D Area with a goal of reducing the cost and improving the performance of the existing ex situ ion exchange groundwater treatment systems (Section 6 of *Remedial Process Optimization for the 100-D Area Technical Memorandum Document* [SGW-38338]). Design criteria, preconceptual designs, and rough order-of-magnitude cost estimates were developed for three technologies: ion exchange with onsite regeneration, ion exchange with offsite regeneration, and ferrous chloride reduction. The technology with the lowest estimated O&M cost was ion exchange with onsite regeneration, followed by the ferrous chloride process, whose estimated O&M costs are approximately 20 percent higher. By far, the largest solid waste stream is generated by the ferrous chloride process, whose annual solid waste mass is approximately 4 times that of ion exchange with onsite regeneration, and more than 60 times that of ion exchange with offsite regeneration.

J2.2.1.3 Evaluation and Screening Rationale

Based on the RPO evaluation for the 100-D Area, chemical reduction using ferrous chloride would have a higher estimated operations cost than ion exchange with on-site regeneration. Chemical reduction would also generate a much larger waste stream compared to either ion exchange with onsite regeneration or ion exchange with offsite regeneration. For these reasons, chemical reduction was not retained for further evaluation.

J2.2.2 Electrocoagulation

Electrocoagulation was not retained for treatment of groundwater contaminated with uranium.

J2.2.2.1 Description

Electrocoagulation is a form of chemical reduction and precipitation. It is used to remove a variety of suspended solids and dissolved pollutants from aqueous solutions. An electric field is applied to metal plates, which release ions into the water. To remove oxidized species such as uranium, iron plates typically are used. The iron ions reduce uranium to insoluble uranous (U(IV)) forms, which co-precipitates with iron oxyhydroxide in a composite precipitate, which is subsequently removed from the water. However, the precipitate is not permanent because the reaction is reversed as the precipitate ages.

J2.2.2.2 Relevant Demonstration Projects

A 2007 treatability test evaluated the potential for this technology for the 100 D Area of the Hanford Site (*Treatability Test Report for the Removal of Chromium from Groundwater at 100-D Area Using Electrocoagulation* [DOE/RL-2008-13]). The test objectives were to: (1) determine the operability, robustness, and treatment efficiency of an electrocoagulation system; (2) characterize the volume and composition of the resulting waste; and (3) obtain design data for scaling the process from a 190 L/min (50 gal/min) to a 1,900 L/min (500 gal/min) system.

The test setup included an electrocoagulation unit and a downstream water treatment system that consisted of a clarifier, filters, and a filter press to dewater the sludge. The water passed through the electrocoagulation unit, precipitates were removed, and the water was re-oxygenated and then reinjected into the aquifer.

The performance objective of the treatability study was to determine Cr(VI) removal efficiency with the goal of decreasing Cr(VI) concentrations to 20 µg/L or less. The test consisted of a startup phase from May 3 to July 20, 2007; a continuous testing phase from July 23 to October 12, 2007; and a final testing phase conducted on October 16 and October 17, 2007, using groundwater augmented with higher concentrations of Cr(VI). Over the course of the test period, the test system treated 10.3 million L (2.8 million gal) of groundwater.

The data evaluation at the conclusion of the test suggested that electrocoagulation could achieve the treatment goal in more than 90 percent of the samples with one or more passes through the treatment system, but that the treatment system could not operate unattended. Therefore, it was concluded that cost and operational factors do not favor the use of this technology.

J2.2.2.3 Evaluation and Screening Rationale

The effectiveness of electrocoagulation for the 300 Area is anticipated to be low to moderate, particularly in light of the challenges encountered in the pilot test described previously. The technology is not widely used for uranium, and additional challenges may result from the fact that uranium reduction is reversible. Implementability is also considered low to moderate because further development of the process would be required and the process may render the treated water less suitable for re-injection. Capital costs are moderate or high, as are the O&M costs. Part of the high cost is due to the production of significant volumes of sludge that must be managed and disposed of. Because of poor performance and implementability, as well as high cost, the technology was not retained for further evaluation.

J2.2.3 Wetlands

Wetlands were not retained for treatment of groundwater contaminated with nitrate.

J2.2.3.1 Description

Constructed wetlands can be described as artificial swamps that act as biofilters for removing contaminants, and are common processes in wastewater treatment. A constructed wetland typically would require a much larger area and a much longer hydraulic retention time compared to a bioreactor, but it typically would not require added nutrients and would require less operational oversight. Wetlands can also be used to treat nitrate, petroleum, and TCE. Several removal mechanisms have been identified with biological treatment of nitrate in water such as decomposition, nitrification/ denitrification, settling, volatilization, adsorption, and nutrient uptake (*Literature Survey for Groundwater Treatment Options for Nitrate, Iodine-129, and Uranium, 200-ZP-1 Operable Unit, Hanford Site* [SGW-37783]). Biodegradation is an important mechanism for removal of petroleum hydrocarbons, and uptake by plants is an important mechanism for removal of TCE. Phytoremediation (one component of wetland treatment) has been used to treat strontium-90, but it is not known to treat other radionuclides (*Alternative Remediation Technology Study for Groundwater Treatment at 200-PO-1 Operable Unit at Hanford Site* [SGW-34562]).

J2.2.3.2 Relevant Demonstration Projects

A number of demonstration projects using wetlands to remove nitrate are reported in *Literature Survey for Groundwater Treatment Options for Nitrate, Iodine-129, and Uranium, 200-ZP-1 Operable Unit, Hanford Site* (SGW-37783), including a constructed wetland used to remove nitrate from the municipal drinking water supply in Orange County, California. Up to 1.5 m^3/s (33 million gal/day) were treated prior to groundwater recharge. The influent contained 3.1 to 10.9 mg/L of nitrate (as nitrogen). The average nitrate removal was 522 mg of nitrate (as nitrogen) per m^2/day (1.07×10^{-4} pounds of nitrate [as nitrogen] per ft^2/day), and exiting nitrate concentrations sometimes fell to as low as 0.1 mg/L nitrate (as nitrogen), with hydraulic detention times from 0.3 to 9.6 days. Bacterial denitrification was concluded to be the primary nitrate loss mechanism. A review of 19 surface flow wetlands showed that nearly all reduced total nitrogen. A comparison of surface and subsurface flow wetlands showed that subsurface flow wetlands outperformed surface flow wetlands and yielded lower effluent nitrate concentrations (ranging from less than 1 to less than 10 mg/L).

J2.2.3.3 Evaluation and Screening Rationale

The land area required for wetlands is likely to be very large for the volume of groundwater that will be treated at the 300 Area, even under favorable (warm) conditions. Even more area would be required for effective treatment in the winter, when plants and microorganisms in the wetland would be less active. Problems with freezing would be likely, as average minimum temperatures are below freezing more than half of the year (*Hanford Site National Environmental Policy Act (NEPA) Characterization* [PNNL-6415]). Therefore, the technology is not well suited to the climate at the Hanford Site. The effectiveness of this technology at the site is considered moderate and implementability is considered low to moderate. Construction of wetlands at the Hanford Site would require lining to prevent the infiltration of the water as well as provision of organic substrate to support wetland plants.

Although wetlands provide a potentially more sustainable (or greener) technology compared to other ex situ treatment technologies (in terms of energy use and because they are natural systems), the logistics would be difficult, especially during winter months, and land area requirements would be extensive. For these reasons, this technology was not retained for further evaluation.

J2.2.4 Ex Situ Bioreactors

Ex situ bioreactors were not retained for treatment of groundwater contaminated with nitrates and possibly uranium.

J2.2.4.1 Description

Ex situ bioreactors can be used to denitrify nitrate as well as possibly biologically reducing and precipitating uranium. For example, a fluidized bed bioreactor, much like that being constructed for the 200 West plant, could be used.

J2.2.4.2 Relevant Demonstration Projects

Bioreactors for nitrate removal have been pilot tested at the Hanford Site in the past (*Development of a Biological Treatment System for Hanford Groundwater Remediation: FY 1989 Status Report* [PNL-7290]). A pilot-scale test was conducted in 1989 using simulated Hanford Site groundwater with a continuous stirred-tank bioreactor (CSTR). The CSTR system was operated continuously for 5 months with a simulated groundwater influent containing 400 mg/L nitrate. Using acetate as the primary carbon source for microbial growth, a nitrate removal efficiency of greater than 99 percent was maintained at an influent flow rate of 6 L/hr (8-hour residence time).

The biological processes involved in biological treatment of reducible metals like Cr(VI) are similar to those involved in other bioreactor concepts used in the remediation industry, such as sulfate- reducing bioreactors (SRBs) that are used to treat acid mine drainage. Based on case studies for SRBs, the effectiveness of bioreactors has been demonstrated at temperatures between 2 and 16ºC ("Passive Treatment of Acid Mine Drainage in Bioreactors Using Sulfate-Reducing Bacteria: Critical Review and Research Needs" [Neculita et al., 2007]). Daily average low temperatures at the Hanford Site are typically below 0ºC during the winter months, which may necessitate heating/insulating portions of the ex situ bioreactor system to maintain the viability of the microbes.

J2.2.4.3 Evaluation and Screening Rationale

An ex situ bioreactor would be very similar to the system being constructed at 200 West (although nitrate concentrations are somewhat lower in the 300 Area than they are in 200 West). These systems can be rather complex because they will include the anaerobic bioreactor, substrate feed system, aerobic reactors to re-aerated the water, solids removal systems, and a biomass handling system. As a result, they can be relatively expensive to construct and operate. It is not likely that an ex situ bioreactor would be as implementable or cost effective as other ex situ treatment technologies. Therefore, ex situ bioreactors have not been retained for further evaluation.

J2.2.5 Phytoremediation

Phytoremediation was not retained for treatment of groundwater contaminated with nitrates and possibly uranium.

J2.2.5.1 Description

Phytoremediation is the use of plants and microorganisms associated with plant roots to extract, evapotranspire, immobilize, contain, or degrade contaminants. In the case of the radionuclides and metals, degradation would not be among the phytoremediation mechanisms, although it is conceivable that microorganisms could reduce reducible metals and radionuclides to some unknown extent. Phytoremediation is typically used as a polishing step and not for high concentrations of contaminants.

Phytoremediation is limited to the depth to which the plants can extract water. Water cannot be wicked and delivered vertically more than about 6 m (20 ft); thus, the potentiometric surface must be within 3 or 6 m (10 or 20 ft) of the bottom of the root mass for this system to be viable (*Enhanced Attenuation: Approaches to Increase the Natural Treatment Capacity of a System* [WSRC-TR-2005-00198]). Because of this limitation, unless groundwater was first extracted (by pumping) and then phytoremediated (i.e., the plants would be irrigated with the contaminated groundwater, phytoremediation would not be suitable for

groundwater remediation at the Hanford Site except immediately adjacent to the river. There are methods of encouraging plant roots to grow deeper, but not to the depths that would be required at most of the 300 Area of the Hanford Site. Phytoremediation systems (including by land application) are only operational when the soil is warm and plants are active, so treatment effectiveness would be reduced in the winter. The land requirements for phytoremediation are also relatively large.

J2.2.5.2 Relevant Demonstration Projects

Uptake of Cr(VI) by a variety of plants has been documented ("Enhancement of Cr(III) Phytoaccumulation," [Shahandeh and Hossner, 2000]). Cr(VI) can accumulate in the plants and may become toxic to them. A land application/irrigation system has been installed at a confidential site in California with groundwater containing Cr(VI). Subsurface application of the groundwater is conducted via a drip irrigation system and the Cr(VI) is primarily microbially reduced in the shallow soils.

Perhaps the best example of deep rooting of trees is at Argonne National Laboratory in Illinois. Hybrid poplars were deep rooted in tree wells (plastic-lined holes bored to a depth of 10 m ([30 ft]). Boreholes were filled with topsoil and then surface capped, which isolates the tree from surface water and forces the roots to utilize contaminated groundwater. Root extension of 3 m (10 ft) has been observed (*Enhanced Attenuation: Approaches to Increase the Natural Treatment Capacity of a System* [WSRC-TR-2005-00198]).

A treatability demonstration project is being conducted at the Hanford Site for treatment of strontium-90 in soil and groundwater along the banks of the Columbia River in the 100-N area using coyote willows. The coyote willow is considered the most suitable plant for use along the Columbia River shore. Known for its rapid and robust regrowth abilities, coyote willow is already used extensively along the Columbia and Yakima Rivers for bank stabilization and revegetation purposes. As part of a treatment train of remedial technologies aimed at treating strontium 90 in the 100-K Decision Unit, phytoremediation using coyote willow would be the final polishing step.

A pilot study began in the late spring of 2007, with the planting of 50 coyote willow starts in a fenced area at the 100-K Area of the Hanford Site (*100-N Area Strontium-90 Treatability Demonstration Project: Food Chain Transfer Studies for Phytoremediation Along the 100-N Columbia River Riparian Zone* [PNNL-18294]; *Project Work Plan 100-N Area Strontium-90 Treatability Demonstration Project: Phytoremediation Along the 100-N Columbia River Riparian Zone* [PNNL-SA-49953]). This part of the study targeted plant growth rather than phytoremediation capabilities because this location is not contaminated with strontium-90. Often flooded by the annual high Columbia River stage well into June, this site is a severe test of the willow shrubs' ability to survive realistic field conditions.

Greenhouse, laboratory (growth chamber), and field studies have shown that strontium-90 is a nutritional analog of calcium, a plant macronutrient. As such, the Coyote willows will actively accumulate strontium-90 in their leaves and stems to concentrations over 70 times those present in the soil pore water surrounding their roots. Given the steadily increasing growth rate of the trees at the 100-K Decision Unit following yearly harvests of their aboveground tissue, this type of plant can remove significant amounts of contamination from the shoreline area while not disturbing the natural sediment structure. Laboratory studies have also shown that herbivorous insects such as aphids or moth larvae would not be a source of strontium-90 offsite transport from the trees. Further, controlled harvesting schedules and engineered barriers (fencing and netting) would prevent animal intrusion and plant detritus release (*100-N Area Strontium-90 Treatability Demonstration Project: Food Chain Transfer Studies for Phytoremediation Along the 100-N Columbia River Riparian Zone* [PNNL-18294]).

The phytoremediation demonstration is ongoing at the 100-K Decision Unit. Biomass production over the first 3 years followed a typical growth curve. On a mT/ha basis, biomass production amounted to 0.2 mT/ha

in 2007, 0.87 mT/ha in 2008, and 4.3 mT/ha in 2009. Growth curve extrapolation predicts 13.2 mT/ha during a fourth year and potentially 29.5 mT/ha during a fifth year. The most recent report concludes that the projected biomass yields suggest the trees could prove effective in removing strontium-90 from the 100-NR-2 riparian zone (*100-N Area Strontium-90 Treatability Demonstration Project: Phytoextraction Along the 100-N Columbia River Riparian Zone—Field Treatability Study* [PNNL-19120]).

J2.2.5.3 Evaluation and Screening Rationale

Because of the large depth to groundwater at most of the Hanford Site, phytoremediation would only be feasible immediately adjacent to the river. Implementability of phytoremediation, therefore, is considered low. It is usually implemented over long time scales, such as years or decades. The sparse vegetation that naturally grows on the Hanford Site suggests that significant efforts and inputs (such as organic matter and water) would be required to establish a vigorous plant community. However, capital costs would still be relatively low. Once the plants are established, O&M costs would also be low because requirements to sustain them are low (i.e., food and water). However, metals concentrations and radionuclide activities may accumulate in the plants to the point that they must periodically be disposed of in a secure facility, such as the ERDF. Ultimately, the plants would need to be disposed of (e.g., at the ERDF) to avoid returning contaminants to the soils from which they were originally extracted (as plants decompose) if phytoremediation is used for contaminants that are not transformed to innocuous forms by the plants or microorganisms.

Phytoremediation is most effective when the plants are active and, thus, the technology would not be very effective during the winter; therefore, effectiveness is considered low to moderate. There are also concerns about contaminants entering the food chain as animals eat the vegetation or bees pollinate flowers. In summary, the technology would only be effective for low concentrations of contaminants where groundwater is shallow over long periods. Many metals and radionuclides would accumulate in the plants and not actually be treated, posing risks to ecological receptors. For these reasons, phytoremediation was not retained for further evaluation.

J2.2.6 Membrane-Based Separation (Reverse Osmosis, Coupled Transport, and Electrodialysis)

Membrane-based separation (includes reverse osmosis [RO], coupled transport, and electrodialysis) was not retained for treatment of groundwater contaminated with uranium and other COCs.

J2.2.6.1 Description

RO is a pressure-driven process that uses semipermeable membranes to purify water. The water that is being purified is passed through the membrane while the contaminants are contained within the membrane. The water that is allowed to pass through the membrane is called the permeate, and typically contains only a small fraction (less than 5 percent) of the ions in the feed solution. The water that does not pass through the membrane (containing the ions that do not pass through the membrane) is called the retentate or brine, concentrate, reject, or brine. It has a high total dissolved solids concentration and would contain most of the COCs being treated. With appropriately sized membranes and multiple stages of membranes, very low concentrations of ions can be achieved. In New Hampshire, the typical production efficiency of RO for nitrate removal is approximately 25 percent. That is, for every 15 L (4 gal) of untreated water entering the device, only 3.8 L (1 gal) of treated water is produced (*Nitrate/Nitrite in Drinking Water* [WD-WSEB-3-9]). This low efficiency is a result of New Hampshire's cold groundwater temperatures, which are likely similar to groundwater temperatures at the Hanford Site.

Membrane-based coupled transport is a process where inorganic ions are removed from groundwater utilizing a supported liquid membrane (SLM). Selected ions are transported from the bulk solution on one side of the SLM into a strip of solution on the other side of the SLM. The SLM is a micro-porous membrane with an organic extractant help in the pores by capillary forces. The strip solution is chemically formulated

to dissociate the ions from the extractant complex, in effect stripping the ion off the membrane. The coupled transport process results in a clean effluent stream, and a concentrate stream that will require further treatment prior to discharge. Membrane based coupled transport is a developing technology and is not yet in common use (*Phase I and II Feasibility Study for the 300-FF-5 Operable Unit* [DOE/RL-93-22]).

Electrodialysis uses a direct current electrical field and ion-exchange membranes to separate ionic species from solution. The electrodialysis process consists of an electrolytic cell containing an anode and cathode separated by cation- and anion-selective membranes. The feed water enters the cell between the two selective membranes. When a direct current charge is applied to the cell, cations are attracted to the cathode and anions to the anode. Ions pass through the appropriate membrane and are concentrated in two brine solutions. Electrodialysis has limited waste treatment applications because of the sensitivity of the membranes to fouling (*Phase I and II Feasibility Study for the 300-FF-5 Operable Unit* [DOE/RL-93-22]).

Brine production is a significant issue with membrane-based separation processes; the need to minimize and manage (e.g., evaporate) the brine can lead to significant increases in water treatment costs. Options for managing brine and other process residuals include discharge to a suitable surface water body, discharge to a sanitary sewer, deep well injection, land application, or treatment with supernatant recycle and solids disposal. The treatment processes can include clarification, sedimentation in lagoons, gravity thickening, centrifuging, belt filter pressing, and evaporation (*Membrane Filtration Guidance Manual* [EPA 815-R-06-009]).

J2.2.6.2 Relevant Demonstration Projects

A process was bench tested at the 200 West Area of the Hanford Site that combines three different membrane technologies (RO, coupled transport, and nanofiltration) to purify 72 L (19 gal) of groundwater while extracting and concentrating uranium, technetium, and nitrate into separate solutions. (Significant Cr(VI) concentrations were not present.) This separation allows for the future use of the radionuclides, if needed, and reduces the amount of waste that will need to be disposed of. This process has the potential to concentrate the contaminants into solutions with volumes in a ratio of 1/10,000 of the feed volume, compared to volume reductions of 10 to 100 for ion exchange and stand-alone RO (*Testing of a Benchscale Reverse Osmosis/Coupled Transport System for Treating Contaminated Groundwater* [WHC-SA-2755-FP]). The experiment demonstrated the effectiveness of the process as theorized for all ions except for technetium, suggesting that design modifications may be necessary.

The Effluent Treatment Facility in the 200 East Area of the Hanford Site treats liquid effluent to remove toxic metals, radionuclides, and ammonia, and to destroy organic compounds. The treatment process constitutes best available technology and includes pH adjustment, filtration, ultraviolet light, and hydrogen peroxide destruction of organic compounds, RO to remove dissolved solids, and ion exchange to remove the last traces of contaminants. The facility began operating in December 1995. The maximum treatment capacity of the facility is 570 L/min (150 gal/min) per minute (*Hanford Site Environmental Report for Calendar Year 2008* [PNNL-18427]).

A pilot test of RO with vibratory shear-enhanced processing (VSEP®) to minimize brine production was conducted at a Central Arizona Project water treatment plant (*Reverse Osmosis Treatment of Central Arizona Project Water—Brine Minimization Via Vibratory Shear-enhanced Processing* [Corral and Yenal, 2009]). Whereas brine production without VSEP® was approximately equal to 20 to 25 percent of the volume of the water being treated, VSEP® reduced brine production to 2 to 4 percent of the initial volume treated. The cost of VSEP® treatment was significant but less than the costs of RO without VSEP® associated with increased brine disposal and lost drinking water supply.

J2.2.6.3 Evaluation and Screening Rationale

The effectiveness of RO is considered high; however, implementability is considered low to moderate, and capital and O&M costs are high. Membrane based coupled transport is a developing technology and is not yet in common use. Electrodialysis has limited waste treatment applications because of the sensitivity of the membranes to fouling. A major disadvantage of these membrane-based separation processes is the large volume of brine that typically is generated. The volume will vary depending primarily on groundwater characteristics. The brine would contain uranium and other COCs, which would require further treatment and then disposal. It would also have a high concentration of total dissolved solids, which could be a problem for disposal. Brine production was the primary reason that membrane-based separation was not retained for this evaluation.

J2.2.7 Electrolysis

Electrolysis was not retained for treatment of groundwater contaminated with dissolved radionuclides and other metals.

J2.2.7.1 Description

Electrolysis of aqueous solutions is a separation process in which metal ions are electrochemically changed to their elemental form at a charged cathode immersed with the contaminated water. The process is generally applied to solutions with concentrations of metal salts that are high relative to most environmental situations. The process emanates from commercial, industrial applications in the metal plating industry. The captured metal is generally recycled or disposed of offsite. This process facilitates the electrochemistry of chromium. However, separation of uranium is not generally pursued.

J2.2.7.2 Relevant Demonstration Projects

No applications of electrolysis of aqueous metal contaminants in extracted groundwater at typical environmental concentrations are presently known. The process is used in industrial wastewater situations, particularly to reduce chromate reductions in cooling tower blow-down. Electric current is applied to iron electrodes to release ferrous ions into solution that in turn reduce Cr(VI) to Cr(III) and precipitate a sludge.

J2.2.7.3 Evaluation and Screening Rationale

Electrolysis can be moderately effective depending upon suitable water chemistry and the equipment design accounts for the relatively low environmental metal concentration to be treated. However, generally electrolysis has a low degree of implementability under most environmental conditions because high electric power consumption is required. The relative capital and O&M costs for electrolysis are high. Electrolysis with its limited applicability is not retained for further consideration.

J2.2.8 Evaporation/Distillation

Evaporation/distillation was not retained for treatment of groundwater contaminated with uranium and other COCs.

J2.2.8.1 Description

Distillation is a process in which a liquid or vapor mixture of two or more substances is separated into its component fractions by the application and removal of heat. Evaporation relates to the phase change of liquid water to water vapor by the application of heat. With the phase change of water in a solution, the solutes or dissolved contaminants may be separated from the water. When the water vapor condenses, the water condensate is purified. Evaporation/distillation requires very high quantities of energy relative to the mass of water treated. Distillation is a common chemical separation process used in industry.

Distillation of contaminated water often results in a more concentrated condensate waste effluent. The process is not typically employed in remediation processing of contaminated water.

J2.2.8.2 Relevant Demonstration Projects

No field-scale application of evaporation/distillation for environmental water remediation is known with the exception of evaporation ponds for salt production. However, in such batch solar evaporation processes the water is rarely retrieved except in the form of atmospheric precipitation.

J2.2.8.3 Evaluation and Screening Rationale

Distillation generally results in more concentrated contaminated solution, which may be treated by a follow-up process. However, as a single-step technology it relatively ineffective. The implementability of evaporation/distillation ranges from low to moderate. Evaporation ponds require large land areas, risk secondary release to the subsurface of contaminants, and therefore have low implementability. Distillation is a mature, commercial technology for the process industry, but of moderate implementability for environmental remediation. Because of the energy requirements and equipment or space requirements, relatively high capital and O&M costs constrain implementation of evaporation/distillation. Evaporation/distillation is not considered further.

J2.3 In Situ Treatment

J2.3.1 In Situ Chemical Reduction

In situ chemical reduction was not retained for treatment of groundwater contaminated with uranium.

J2.3.1.1 Description

Chemical reducing agents such as calcium polysulfide or dithionite are injected into the contaminated groundwater plume to promote the reduction of soluble uranium (VI) to less soluble uranium (IV), thereby facilitating lower concentrations of uranium in groundwater.

J2.3.1.2 Relevant Demonstration Projects

Corresponding to the discussion of in situ chemical reduction applied to the vadose zone in Section A1.2.4, considerable research has been conducted on reduction of radionuclides such as technetium-99 in the 200 Area. However, no attempts to reduce uranium or treat groundwater in situ by chemical reduction in the 300 Area have been conducted.

J2.3.1.3 Evaluation and Screening Rationale

The rapid reaction rate of chemical reducing agents makes effective treatment of groundwater difficult. In addition, the high groundwater velocities observed in the 300 Area aquifer lowers the effectiveness of chemical reduction. Most of the reducing reaction would occur rapidly near each injection well. Consequently, sustained application would be required through many closely positioned wells to affect significant aquifer volume. The high exchange rate of groundwater with aerated river water will also tend to reverse the reducing effectiveness and thereby reverse the uranium stabilization reaction. Chemical reduction is moderately implementable as it uses commercially available reducing agents and employs conventional injection well technology. However, the high density of wells reduces the ability implement the technology. Relative capital costs range from moderate to high depending upon the number and type of wells. Relative operation and maintenance costs are moderate and depend upon the frequency of reinjection required to maintain uranium remobilization. Chemical reduction of ground water in situ is not considered further because of the reversibility of the process.

J2.3.2 Water Flushing

Flushing the aquifer with injection of clean water was not retained as a treatment method for uranium and nitrate.

J2.3.2.1 Description

Uncontaminated water without reagents is injected through multiple wells in the attempt to enhance solubilization of sorbed contamination, increase mobilization of contaminants through the aquifer, and promote capture by optional extraction wells configured as a pump-and-treat system. The remediation technique would be somewhat analogous to in situ leaching but without the lixiviant. The recovery efficiency depends upon the aquifer groundwater flow conditions and the arrangement and withdrawal capability of the extraction wells. The process would have minimal effect on the principal sources of the groundwater contamination above the water table.

J2.3.2.2 Relevant Demonstration Projects

The ongoing dynamics of the groundwater under the 300 Area has been de facto a natural water flushing process. The transient water fluxes from and to the Columbia River in the relatively high porosity aquifer has been operative since the first contamination releases since the 1940s. The 1993 conceptual model of the uranium in groundwater interaction which was the basis of the 1995 interim Remedial Investigation/ Feasibility Study assumed that groundwater concentrations of uranium would decline to less than 20 µg/L in 3 to 10 years by natural flushing (*Uranium Reactive Transport in the Hanford 300 Area Vadose Zone-Aquifer-River System* [PNNL-SA-54465]). Actual uranium response in the aquifer has demonstrated that water flushing even on the large aquifer scale is inadequate to achieve a timely result.

J2.3.2.3 Evaluation and Screening Rationale

Water flushing is judged to have low effectiveness. The residual contamination on the aquifer sediments that would be addressed by flushing contributes a relatively small loading to the groundwater contamination problem. The flushing would affect the major source of contamination in the lower vadose zone and periodically wetted zone marginally as a function of the river induced groundwater elevation changes. Natural flushing has demonstrated a very slow removal process. Flushing has moderate implementability because standard vertical wells would be used for delivery. The system would require installation and operation of a groundwater extraction system to capture mobilized uranium. Capital costs for flushing related to an extensive pump-and-treat system and injection well array would be moderate. The relative O&M costs of a water flushing system would be moderate because of the long-term continuous operation required.

J2.3.3 Groundwater Circulation Wells

Groundwater circulation wells (GCWs) were not retained as a delivery method for treatment of groundwater contaminated with uranium and other COCs.

J2.3.3.1 Description

Groundwater circulation wells are installed as a single well with two isolated screened zones. Groundwater is typically hydraulically pumped or airlifted out of the formation from the lower screen, and reinjected into the formation at the upper screen. A three-dimensional flow pattern (circulation cell) is created in the formation. Depending on site-specific conditions, both upward (reinjection into the upper screen) and downward (reinjection into the lower screen) circulation modes can be used.

The recirculated groundwater can be aerated and reinjected into the formation to enhance aerobic biodegradation, stripped in-well to remove VOCs, treated with in-well reactive media, or amended in-well

with soluble biological or chemical reagents. The circulation of groundwater can also be used to enhance the distribution of amendments or reagent directly injected into the formation within the circulation cell.

The zone of influence that can be achieved with groundwater circulation wells are highly sensitive to site lithologic conditions. A viable circulation cell may not develop if vertical anisotropy in lithology (i.e., the presence of laterally extensive silty-clay layers) impedes the circulation flow path or if there is not enough anisotropy. Typically, this technology will not be successful when the ratio of horizontal to vertical hydraulic conductivity is greater than 10 (*Groundwater Circulating Well Technology Assessment* [NRL/PU/6115-99-384]). A single thin layer of low-permeability material can also prevent development of a recirculation cell. If the anisotropy is too low, the radius of the circulation cell will be very small. This could be the case at the Hanford Site. Other common problems include well clogging related to changing redox conditions within the GCW and down well equipment (e.g., packers) problems.

J2.3.3.2 Relevant Demonstration Projects

A summary and analysis of more than 50 GCW field demonstrations was provided in *Groundwater Circulating Well Technology Assessment* (NRL/PU/6115-99-384). One case study was a Department of Defense-sponsored GCW demonstration that was originally to be performed at the Hanford Site, but was relocated to Edwards Air Force Base, Operable Unit 1, Site 19. This site was selected based on its high hydraulic conductivity (KH=10 ft/d, KV=1 ft/d) and the presence of TCE contamination. One GCW was installed to 15 m (50 ft) bgs and operated for 191 days during the demonstration. Results of the demonstration indicate an ROI of approximately 9 m (30 ft), an asymmetrical circulation cell, and groundwater flow short-circuiting near the GCW. Post-operation data showed contaminant rebound in monitoring wells.

Of the remaining GCW case studies, there were few sites demonstrating clear success, and just as many sites where the technology failed to meet remedial objectives. Most of the case studies, however, indicated that the data collected were insufficient to demonstrate the efficacy of the GCW technology.

J2.3.3.3 Evaluation and Screening Rationale

It is likely that a large number of wells would be required to implement this technology at the Hanford Site because of the highly permeable nature of the site lithology, which would result in a small ROI. Even if implemented with tight well spacing, asymmetrical groundwater flow, groundwater flow short-circuiting, and contaminant rebound would ultimately limit the effectiveness of GCWs. Given the high cost of installing wells and the likelihood of limited treatment effectiveness, this technology was not retained for further evaluation.

J2.3.4 Horizontal Wells

Horizontal wells were not retained as a delivery method of treated groundwater that was contaminated with uranium or other COCs.

J2.3.4.1 Description

Horizontal wells are horizontally drilled or trenched screened borings installed along or across the plumes. Horizontal wells can be used to extract soil vapor and groundwater, or inject water, chemical reagents, or biological substrates. Horizontal well technology has been incorporated into many current environmental remediation applications (and associated contaminants), such as in situ bioremediation, air sparging, vacuum extraction, soil flushing, and free product recovery. This technology is most applicable to sites with relatively shallow soil and/or groundwater contamination, and can potentially enhance remediation efforts at sites with low hydraulic conductivities (*Horizontal Wells* [Miller, 1996]).

Horizontal wells have an advantage over vertical wells in that their long horizontal screens can contact a larger plume area, and may more effectively transmit amendments. Because of their superior alignment with natural lithologic stratigraphy, horizontal wells may also be more efficient recovering groundwater

or soil vapor. When installed with directionally drilling techniques, horizontal wells can be installed in areas where surface and subsurface obstructions would preclude other remediation alternatives.

Disadvantages of horizontal wells are primarily associated with the physical and operational limitation of directional drilling techniques.

J2.3.4.2 Relevant Demonstration Projects

An unsuccessful horizontal well technology demonstration was conducted at the Hanford Site 100-D Area from November 2009 through January 2010 (*Treatability Demonstration Report for Directional Drilling in the 100-D Area* [SGW-45974]). The scope of work consisted of two phases. First, a surface casing was installed at a 16-degree angle from horizontal through the Hanford formation to an estimated depth of 15 m (50 ft) bgs. The second phase was to drill through the Ringold Formation using horizontal directional drilling techniques and drilling mud. Once this drilling was complete, the drill bit was knocked off and the well screen installed inside the drill pipe.

Installation of surface casing was required to facilitate circulation of drilling mud in the porous Hanford formation. The casing was advanced with significant difficulty to approximately 6 m (20 ft) bgs (85 linear ft) when downward progress ceased because of inadequate force on the down hole hammer and difficulty removing cuttings from the inclined casing. Rotary mud directional drilling through the casing and into the Hanford formation was attempted but progress was slow and circulation was never established.

J2.3.4.3 Evaluation and Screening Rationale

Based on the unsuccessful technology demonstration at the Hanford Site, horizontal wells were not retained as a groundwater remediation delivery technology.

J2.4 Containment

J2.4.1 Containment Wall

A containment wall was not retained as a method of containing groundwater contaminated with uranium or other COCs.

J2.4.1.1 Description

Containment walls include soil bentonite slurry walls, grout walls, and sheetpile walls. Walls have been used successfully to assist with hydraulic containment of groundwater plumes at many hazardous waste sites. Groundwater pumping or diversion upgradient of the containing wall is required to prevent groundwater mounding and bypassing of the wall. Containing walls increase the potential to achieve effective hydraulic containment and they may reduce the amount of water that needs to be treated. Installation methods include conventional or continuous trenching with soil/bentonite slurry, vibrating beam cutoffs, mixed-in-place walls, tangent caisson walls, and driven sheetpiles.

J2.4.1.2 Relevant Demonstration Projects

"Action Memorandum: N-Springs Expedited Response Action Cleanup Plan, U.S. Department of Energy Hanford Site, Richland, Washington" (Ecology and EPA, 2004) was issued to initiate immediate groundwater remedial actions at the 100-N Area, including the design, construction, and operation of a pump-and-treat system and the construction of a sheetpile barrier wall at N-Springs. However, six months later, the Washington State Department of Ecology (Ecology) and EPA concurred with DOE that installation of the sheetpile wall could not be achieved in the manner specified, based on results of a construction test in late 1994. The two agencies subsequently directed DOE to proceed with the pump-and-treat system only (*Annual Summary Report Calendar Year 2000 for the 100-HR-3, 100-KR-4, and 100-NR-2 Operable Units and Pump-and-Treat Operations* [DOE/RL-2001-04]). A grouted-hinge

sheetpile barrier in the aquifer near the river's edge had been specified, but attempts to install a sheetpile barrier were unsuccessful (*Coordination of Groundwater Activities in the 100 N Area* [WHC-EP-0878]).

J2.4.1.3 Evaluation and Screening Rationale

Most of the installation methods would be technically challenging at the Hanford Site because of the depths of the unconfined aquifer and the presence of cobbles and coarse gravels. Cobbles will prevent or deflect most insertion methods or items such as sheetpiles, vibrating beams, and drilled caissons. While conventional trenches can likely be kept open in this formation, slurry loss may be excessive in zones of clean coarse cobbles or gravels. Sudden loss of slurry due to penetration into such a zone could lead to trench instability.

Effectiveness of this technology is considered moderate for several reasons: (1) it depends on the ability to key into a low-permeability unit; (2) it does not treat contamination; and (3) groundwater upgradient of the wall must be removed. Implementability is low, as evidenced by failed attempts to install a sheetpile wall at N-Springs. Capital costs would be high and O&M costs would be low or moderate. Because of installation challenges and high costs, containing walls were not retained for further evaluation.

J2.4.2 Reactive Chemical Barrier

Reactive chemical barriers were not retained for containment of groundwater contaminated with uranium or nitrate.

J2.4.2.1 Description

Reactive chemical barriers involve the subsurface delivery and/or recirculation of chemicals along cross-gradient rows transecting the plume. Residual reducing chemicals are retained in the aquifer matrix so that COCs are passively treated or sequestered removed as groundwater moves through the treatment zone barriers. ZVI, zeolite, and apatite may be used as chemicals.

J2.4.2.2 Relevant Demonstration Projects

Potential reactive materials for chemical barriers that have been tested in the laboratory and/or field for uranium remediation include apatite, ZVI, and amorphous ferric oxyhydroxide (AFO) (*Field Demonstration Of Permeable Reactive Barriers To Remove Dissolved Uranium From Groundwater, Fry Canyon, Utah: September 1997 through September 1998 Interim Report* [EPA 402-C-00-001]). Studies have shown that uranium sequestration using apatite occurs primarily via adsorption of uranium-carbonate complexes onto the surfaces of apatite ("Remediation of Uranium-contaminated Ground Water at Fry Canyon, Utah" [Fuller et al., 2003]). As a result, uranium in groundwater treated by a reactive barrier constructed using apatite would be susceptible to re-release due to changes in groundwater chemistry. The use of ZVI relies on chemical reduction and precipitation of uranium. Given the highly oxygenated groundwater near the river, passivation of the iron grain surfaces would occur quickly within a ZVI reactive barrier, necessitating amendment of reductive chemicals to maintain reducing conditions. The high oxygen levels would also increase the chances for uranium to re-oxidize and remobilize. The use of AFO relies on uranium complexing and adsorbing onto the AFO surfaces. Effective adsorption of uranium within an AFO reactive barrier would be highly dependent on uniform placement of AFO (and therefore uranium sorption sites) in the subsurface. Effective sorption of uranium onto AFO is also sensitive to changes in pH.

PNNL conducted a study in 2010 to evaluate water jet injection of phosphate and apatite into subsurface sediments in the Hanford Site 100-N Area (*Hanford 100-N Area In Situ Apatite and Phosphate Emplacement by Groundwater and Jet Injection: Geochemical and Physical Core Analysis* [PNNL-19524]). Sediments that were jet injected with sodium phosphate or fishbone apatite (or both) showed high phosphate concentrations with multiple (six), closely spaced (approximately 1.5 m [5 ft]

spacing) injection points. However, with samples taken very close to injection points, it was difficult to assess the relevant areal extent at greater distance (i.e., 1.5 to 6 m [5 to 20 ft]) and to make recommendations regarding future injection point spacing greater than 1.5 m (5 ft) apart. In addition, jet injection also appeared to deposit more phosphate in finer grained sediments, so the spatial variability of the phosphate mass was much greater compared to groundwater injections.

The use of a ZVI barrier has been field testing in the 100-D area for the treatment of Cr(VI). A calcium polysulfide reductive barrier was implemented to passively treat Cr(VI) contamination in the 100-D southern plume and prevent the discharge of elevated levels of Cr(VI) to the Columbia River (*U.S. Department of Energy Hanford Site – 100 Area Benton County, Washington Amended Record of Decision, Decision Summary and Responsiveness Summary (100-HR-3 Operable Unit Interim Remedial Action)* [EPA et al., 1999]). When performance monitoring data indicated that Cr(VI) was breaking through the reductive barrier treatment zone, scientists proposed that fortifying the barrier with additional reduced iron would increase the long-term effectiveness of the barrier. Consequently, a treatability study was conducted to evaluate whether augmentation of the ISRM barrier with NZVI would be an effective approach to augmenting the performance and longevity of this passive treatment system. The field injection test was conducted in August 2008 at 100-D. Over a period of approximately 5 days, 370,970 L (98,000 gal) of the RNIP-M2 solution was injected into the Ringold Formation aquifer at a rate of 53 L/min (14 gal/min). The ZVI was communicated at least 3 m (9.8 ft) away from the injection well. A borehole was drilled 7 m (23 ft) from the injection well in March 2009 to evaluate the ROI. Analysis of aquifer materials showed that approximately 4 weight percent ZVI was present in the targeted permeable layer near the bottom of the aquifer. This verified that the goal of emplacing ZVI at least 7 m (23 ft) into the aquifer was successfully accomplished. Monitoring has shown the area near the test is strongly reducing, and Cr(VI) has been reduced to immobile trivalent chromium.

J2.4.2.3 Evaluation and Screening Rationale

Effectiveness is deemed low to moderate. Given the highly oxic groundwater flowing at relatively high rates, amendment of reductive chemicals would likely need to be frequent to maintain reducing conditions. Maintaining reducing conditions is especially critical for uranium, which can re-oxidize if reducing conditions are not maintained. For sequestering chemicals, the long-term stability of uranium sequestered via apatite is also dependent on the chemical speciation of uranium, surface speciation of apatite, and the mechanism of retention, which are all highly dependent on the changes in geochemical conditions. For these reasons, reactive chemical barriers were not retained for further evaluation.

J2.4.3 Reactive Biological Barrier

Reactive biological barriers were not retained as a method of containing groundwater contaminated with uranium and nitrate.

J2.4.3.1 Description

Reactive biological barriers involve the subsurface delivery and/or recirculation of biological substrate along cross-gradient rows transecting the plume. Residual reducing byproducts and biomass are retained in the aquifer matrix so that uranium, nitrate, and organics like TCE are passively removed as groundwater moves through the treatment zone. Biological barriers would operate much like the ISRM. Rejuvenation of the barrier by reinjection of biological substrate will be required periodically to maintain reducing power. Commons substrates include acetate, molasses, cow manure, fruit juice, lactate, whey, polylactate and sulfur-containing products (e.g., Metals Remediation Compound), and waste organic material (e.g., from beer manufacturing) (*Chromium Treatment Technology Information Exchange for Remediation of Chromium in Groundwater at the Department of Energy Hanford Site* [SGW-38255]).

The indigenous organisms utilize the substrate as a carbon source for biomass generation and as an electron donor for energy production through a number of metabolic processes.

J2.4.3.2 Relevant Demonstration Projects

A field experiment was conducted at the Hanford Site using hydrogen release compound (HRC®), a slow-release glycerol polylactate, to bioimmobilize Cr(VI) (*In Situ Long-Term Reductive Bioimmobilization of Cr(VI) in Groundwater Using Hydrogen Release Compound* [Faybishenko, 2009]). The results of this experiment show that a single HRC® injection into groundwater stimulated an increase in biomass, a depletion of terminal electron acceptors oxygen, nitrate, and sulfate, and an increase in ferrous iron, resulting in a significant decrease in soluble Cr(VI). The Cr(VI) concentration remained below the background concentration in the downgradient pumping/monitoring well and below the detection limit in the injection well for at least three years after the HRC® injection. The degree of sustainability of hexavalent reductive bioimmobilization under different redox conditions at this and other contaminated sites was currently under study as of the publication date.

Molasses and lactate were injected at a Cr(VI)-contaminated site near Flanders, Belgium, in 2005 to 2006 ("Stimulation of In Situ Bioprecipitation for the Removal of Cr(VI) from Contaminated Groundwater" [Vanbroekhoven et al., 2007]). Frequent reinjections were important to maintain reduced conditions. Results of this pilot test showed efficient Cr(VI) removal from the groundwater for the lactate injection zone within 200 days, while for the molasses zone-efficient removal was observed only after approximately 400 days. Based on the success of this pilot test, a full-scale process was planned.

A recent study evaluated a biological barrier comprised of sand and sawdust that had been treating nitrate for 15 years ("Nitrate Removal Rates in a 15-Year-Old Permeable Reactive Barrier Treating Septic System Nitrate" [Robertson et al., 2008]). Sediment cores were retrieved and reaction rates were measured in column tests and compared to rates measured in year one using the same reactive mixture. The rates after 15 years were within about 50 percent of the year one rates. Near the end of the year 15 column test, wood particles were removed from the reactive media, and nitrate removal subsequently declined by about 80 percent, indicating that the wood particles were principally responsible for denitrification. The authors concluded from this work that some denitrifying biological barriers could remain maintenance free and be adequately reactive for decades.

J2.4.3.3 Evaluation and Screening Rationale

In addition to consuming dissolved oxygen, bioreducing barriers have the potential to result in unwanted dissolved biodegradation byproducts such as ferrous iron, manganese, and arsenic. As a consequence, they should not be placed too close to the river (or extraction wells), unless re-oxygenation systems (such as sparging wells) are installed downgradient of the biobarrier.

Effectiveness is deemed low to moderate. Given the highly oxic groundwater flowing at relatively high rates, amendment would likely need to be frequent to maintain reducing conditions. Maintaining reducing conditions is especially critical for uranium, which can re-oxidize if reducing conditions are not maintained. Furthermore, barriers do not support the cleanup of the entire plume. For these reasons, reactive biological barriers were not retained for further evaluation.

J2.4.4 Hydraulic Containment via Injection

Hydraulic containment via injection was not retained as a method of containing groundwater contaminated with uranium or other COCs.

J2.4.4.1 Description

Hydraulic containment via injection involves injecting water into a line of closely spaced injection wells or a trench installed close to and parallel to the river. A groundwater mound would be created under the injection points, which would result in an inward gradient and stop the migration of groundwater to the river. This injection would mimic the natural conditions encountered during periods of high river stage. Some extraction of groundwater upgradient of the barrier, with discharge into wells side gradient, would be required to maintain the water balance. Source of water for injection could be from existing permitted Columbia River supply and/or groundwater.

J2.4.4.2 Relevant Demonstration Projects

Fresh water injection systems used to prevent saltwater intrusion along coastlines are conceptually similar to injection of water to contain COCs hydraulically. Saltwater intrusion barriers consist of a line of injection wells paralleling the coast to inject water into a fresh water aquifer to create and maintain a "fresh water ridge," which produces an outward gradient to stop the migration of salt water into the aquifer (*The Class V Underground Injection Control Study*, "Volume 20: Salt Water Intrusion Barrier Wells" [EPA/816-R-99-014t]). There are 315 saltwater intrusion barrier wells documented in the United States. Well clogging is a common issue with operating these injection wells. Maintaining high-quality waters and chlorination of injection water are methods employed to reduce the frequency of well clogging. However, even when using high-quality waters, clogging is inevitable. When clogging occurs and the injection head has increased above acceptable levels, redevelopment of the injection wells is necessary (approximately every three years when using high-quality injectate water). Injection wells also need to be supplied with pressure either individually or in small groups to prevent the complete collapse of the pressure ridge barrier in cases of system shutdowns.

J2.4.4.3 Evaluation and Screening Rationale

The primary disadvantage of hydraulic containment via injection is that the injection locations will need to be some distance from the river because of logistics issues. Therefore, the COCs that are currently downgradient of the injection points would be flushed into the river without control. Based on extensive experience with saltwater intrusion barriers, operational complexity associated injection well clogging rehabilitation would likely be encountered. For these reasons, hydraulic containment via injection was not retained for further evaluation.

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Appendix K

Cost Estimate

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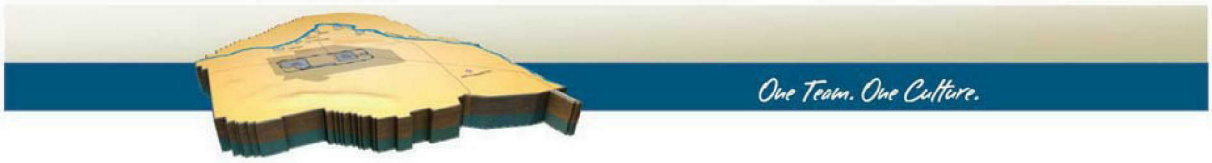
ECF-300FF5-11-0171. *300 Area Cost Estimate Input* K-55



ENVIRONMENTAL COST ESTIMATE

ECE-300FF511-00011

Environmental Cost Estimate for 300 Area Waste Sites and Groundwater RI/FS

Revision 4

Date: October 11, 2012

Project: CH2M HILL Plateau Remediation Company

Topic: Cost Analysis

Lead Estimator: S. Ferries

Senior Review: K. Klink

Administrative Use

CHPRC ENVIRONMENTAL COST ESTIMATE COVER PAGE

Part 1: To be completed by the ER&QA Lead Cost Estimator

Project: 300 Area RI/FS	**Date:** 10/10/2012
Calculation Title & Description: Environmental Cost Estimate for 300 Area Waste Sites and Groundwater RI/FS	
S. Ferries **Project Cost Estimator(s)**	**Basis of Qualification:** Geologist with 27 years of experience in environmental remediation, 15 years in cost estimating, and 13 years of RACER experience.
B. Ostapkowicz **Cost Estimate Checker**	**Basis of Qualification:** Civil Engineer with 8 years of experience in hazardous waste site characterization/remediation and process design.
K. Klink **ER & QA Lead Cost Estimator**	**Basis of Qualification:** Chemical Engineer with 31 years of experience; including 20 years of hazardous and radioactive waste site characterization and remediation and cost estimating, including development and application leading parametric models, CORA, RACER, and private corporate models.

Part 2: To be completed by Project Cost Estimator

Calculation No.: ECE-300FF511-00011 **Revision No.:** 3

Revision History:

Revision No.	Description	Date	Affected Pages
0	ECE for 300 Area Waste Sites and Groundwater RI/FS	09/22/11	All
1	ECE for 300 Area Waste Sites and Groundwater RI/FS	12/26/11	All
2	ECE for 300 Area Waste Sites and Groundwater RI/FS	05/15/12	All
3	ECE for 300 Area Waste Sites and Groundwater RI/FS	10/10/12	All

Part 3: Document Review & Approval

Project Cost Estimator:	S. Ferries/Sr. Cost Estimator NAME/POSITION SIGNATURE	10/10/12 DATE
Cost Estimate Checker:	B. Ostapkowicz/Engineer NAME/POSITION Brad Ostapkowicz Digitally signed by Brad Ostapkowicz DN: cn=Brad Ostapkowicz, o=CH2M Hill, ou, email=Brad.Ostapkowicz@ch2m.com, c=US Date: 2012.10.10 08:07:52 -07'00' SIGNATURE	10/10/12 DATE
ER & QA Lead Cost Estimator:	K. Klink/Sr. Engineer NAME/POSITION SIGNATURE	10/10/2012 DATE
Project Manager:	M. Doornbos/Project Manager NAME/POSITION SIGNATURE	10/11/12 DATE

ECE-300FF511-00011 10/11/2012

CHPRC ENVIRONMENTAL COST ESTIMATE COVER PAGE

Responsible Manager:	R. Brunke/Manager Environmental Integration NAME/POSITION	
	SIGNATURE	10/11/12 DATE

Terms

AACE	Association for the Advancement of Cost Engineering International
CHPRC	CH2M HILL Plateau Remediation Company
COCs	Contaminant of Concern
DD/G&A	Direct Distributable/General and Administrative
DOE	U.S. Department of Energy
ECE	Environmental Cost Estimate
ECF	Environmental Calculation File
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FICA	Federal Insurance Contributions Act
FP	Fixed-price
HSSA	Hanford Site Stabilization Agreement
IC	Institutional Controls
MNA	Monitored Natural Attenuation
MS Excel™	Microsoft Excel
O&M	Operation and Maintenance
OMB	Office of Management and Budget
PRC	Plateau Remediation Company
PRZ	Phoretic Reduction Zone
PV	Present Value
RACER™	Remedial Action Cost Engineering and Requirements System (Cost Estimating Software)
RAO	Remedial Action Objective
RCTs	Radiological Control Technicians
TRACE	Tool for Response Action Cost Estimating, version 3.0, 2012.

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Introduction

CHPRC has prepared this Environmental Cost Estimate (ECE) to support the evaluation of remedial action alternatives to be documented in the *Remedial Investigation/ Feasibility Study: 300 Area, DOE/RL-2010-99*.

This cost estimate was developed in accordance with EPA/540/R-00/002, A Guide to Developing and Documenting Cost Estimates During the Feasibility Study, OSWER 9355.0-75 (EPA, 2000), and PRC-PRO-EP-40282 Cost Estimating Procedure for Response Action Decision-Making (PRC, 2010).The cost estimates for each waste site, presented in this ECE, have been prepared using the information available from the 300 Area Project at the time of preparation. The cost estimates reflect specific response action approaches, and scope assumptions and exclusions as well as cost estimating methodologies. The response action cost estimates have expected ranges of accuracy described in the "Estimate Classification" section. The final costs of the selected response alternative(s) will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, and other factors.

1 Purpose of Estimate

This ECE and backup material supports the response action alternatives analysis for the 300 Area Feasibility Study project.

The purpose of this ECE is to:

- Describe the methodology applied in performing the cost estimates.
- Describe the general and response action-specific assumptions and cost inputs applied to the subject cost estimates.
- Summarize the response action alternative cost estimates.

This ECE also documents the references that provide additional scope and cost estimate information used to prepare these estimates.

2 General Project Description

Hanford Site and 300 Area Background

The Hanford Site, managed by U.S. Department of Energy (DOE), encompasses approximately 1,517 km2 (586 mi^2) in the Columbia Basin of south-central Washington State. In 1942, the Hanford Site was selected as the site for building nuclear reactors to produce plutonium for nuclear weapons. The Site was chosen because of its remoteness, the availability of water from the Columbia River, and access to electricity from hydropower plants. The Hanford Site's plutonium production mission continued until the early 1990s.

Various areas within the Hanford Site were originally given designations that pertained to the work performed (PNNL-20548, Section 1.0.2). The '300 Area,' located in the southeast corner of the Hanford Site (see Figure 1), was where nuclear fuel was fabricated for the plutonium production reactors, and also where research on processing irradiated fuel was conducted. As defined for this document, '300 Area' refers to a somewhat larger geographic region that includes the original facilities and associated waste sites, now referred to as the 300 Area Industrial Complex; the 618-10 and 618-11 burial grounds; and four

waste sites in the 400 Area, which is home to the former Fast Flux Test Facility. Some portions of the 600 Area, i.e., the area between the designated operable units, are excluded from consideration in this report, i.e. land associated with the Hanford Patrol operations and land under the administrative control of Energy Northwest. Groundwater contamination associated with 300 Area waste sites co-mingles with groundwater contaminants that have sources in the 200 East Area.

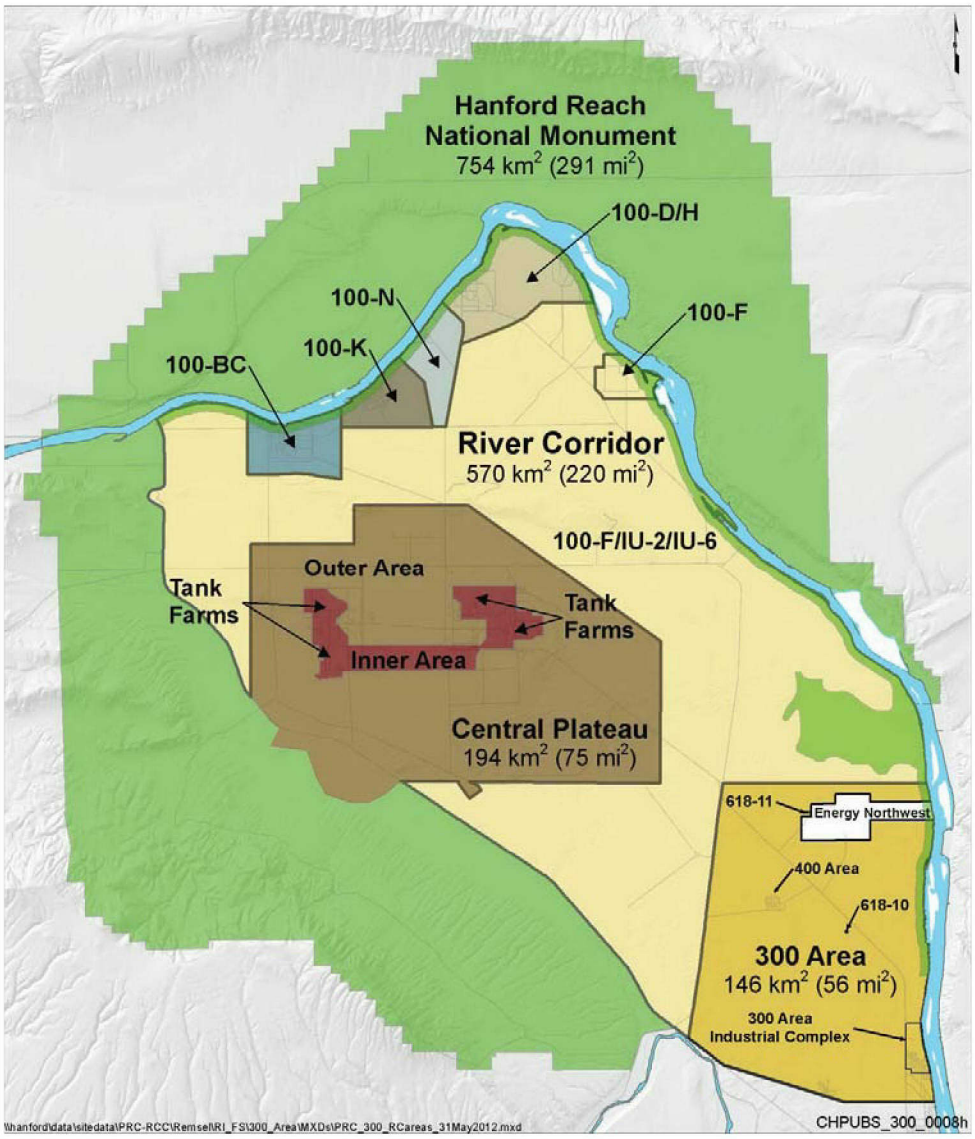

Figure 1 - River Corridor Areas and 300 Area

The 300 Area Industrial Complex (Figure 2) includes the fuel fabrication buildings, raw material storage, waste storage, finished product storage, technical support, service support, and research and development (R&D) related to fuel fabrication and other Hanford Site processes. It includes the buildings, facilities, and process units where the majority of uranium fuel production and R&D activities took place.

Liquid wastes consisting of sanitary wastes and various radiochemical and radio-metallurgical process wastes were discharged via the Process Sewer System (300-15) to open ponds and trenches during most of the 300 Area's operational history. The process sewer system consists of an extensive network of

underground piping where liquid wastes were conveyed to the North and South Process Ponds (316-1 and 316-2) between 1943 and 1975. Both ponds received upwards of 1.5 to 11.4 million L/day (400,000 to 3 million gal/day) of liquids from the fuel fabrication facilities until they were phased out of service in 1974 and 1975. The 300 Area Process Trenches (316-5) replaced the ponds in 1975 and were used for disposal until 1994.

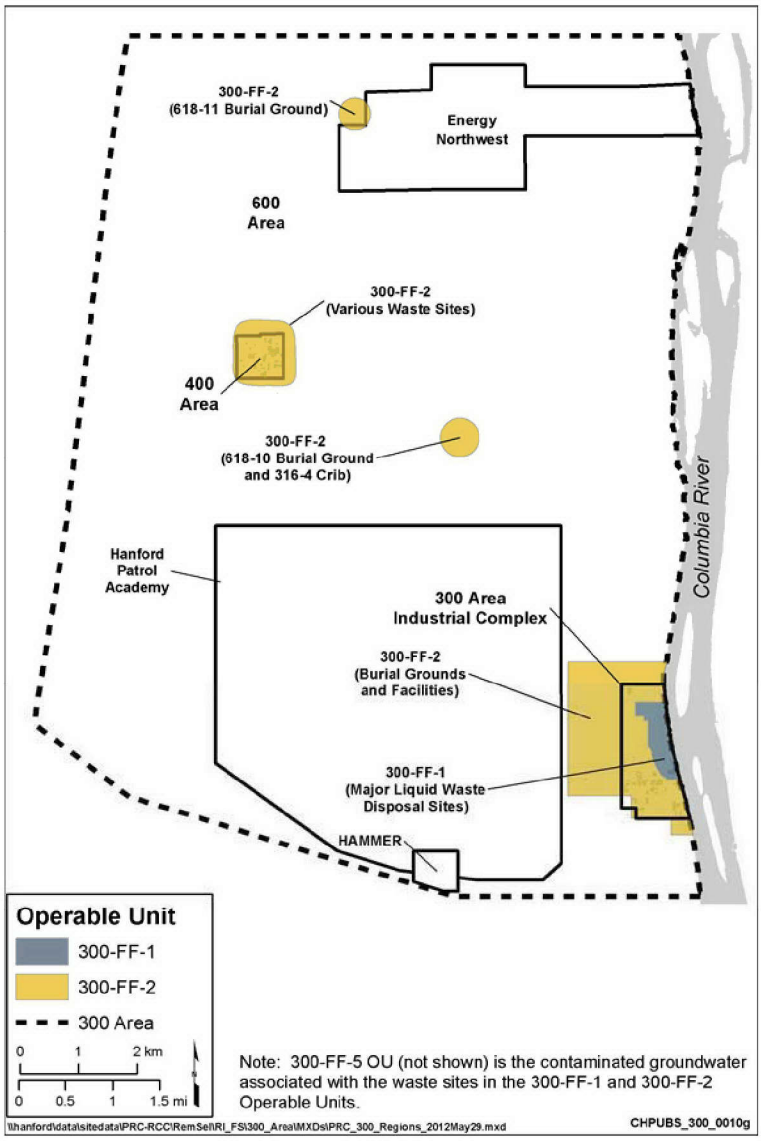

Figure 2 - 300 Area Boundaries

A complex series of waste streams were disposed to these facilities, including process waste from nuclear fuel fabrication (the primary waste stream), radioactive liquid waste, sewage, laboratory waste, and coal power plant waste. The waste from nuclear fuel fabrication included basic sodium aluminate solutions and acidic copper/uranyl nitrate solutions. Primary chemical contaminants disposed to North and South Process Ponds included uranium (33,565 to 58,967 kg [74,000 to 130,000 lb]), copper (241,311 kg

[532,000 lb]), fluoride (117,026 kg [258,000 lb]), aluminum (113,398 kg [250,000 lb]), nitrate (2,060,670 kg [4,543,000 lb]), and large volumes of nitric acid and base (NaOH).

Other liquid waste handling facilities include the Sanitary Sewer System (300-276), 340 Complex (340 Complex), 300 Area Retention Process Sewer (300-214), 300 Area Radioactive Liquid Waste System (300 RLWS), 307 Process Trenches (316-3), the 307 Retention Basins (307 RB), Tank Farm (311-TF), Waste Acid Treatment System (WATS) (300-224), and the outlying 316-4 Cribs.

Solid wastes initially were disposed in burial grounds and shallow landfills between 1943 through the 1950s. In later years, highly radioactive wastes, including wastes with transuranic constituents were disposed in outlying 600 Area Burial Grounds. The primary burial grounds are: 300-7, 300-9, 300-10, 618-1, 618-2, 618-3, 618-4, 618-5, 618-7, 618-8, 618-9, 618-12, and 618-13, and outlying waste sites 618-10 and 618-11.

The 400 Area contains the Fast Flux Test Facility (FFTF) Reactor, its support facilities, and four waste sites. The FFTF is a sodium-cooled research reactor. Because the design, construction, and operation of the FFTF differed from that of the Hanford Site production reactors, the type and extent of contamination associated with FFTF also differed. All interfacing equipment and systems are sealed in an inert atmosphere to prevent adverse reactions with the liquid sodium. As a result, the FFTF is radiologically clean. The FFTF reactor is not within the scope of this RI/FS and is addressed under a separate regulatory process. The four waste sites considered in this RI/FS are:

- 400 Area Process Pond and Sewer System (400 PPSS),
- Storage Tank 400-37,
- Storage Tank 400-38, and
- 437 Maintenance and Storage Facility

The 618-10 and 618-11 Burial Grounds received solid waste from operations in the 300 Area Industrial Complex. The 618-10 Burial Ground, which operated between 1954 and 1963, consists of 12 trenches and 94 vertical pipe units (VPUs). Each VPU consists of five 210 L (55 gal) drums with tops and bottoms removed that are stacked vertically, tack welded together, and placed on a concrete footing with the bottom left open to the soil column. The VPUs were used to dispose of containers holding moderate- to high-activity solid wastes. Wastes include radiologically contaminated laboratory instruments, bottles, boxes, filters, aluminum cuttings, irradiated fuel element samples, metallurgical samples, electrical equipment, lighting fixtures, barrels, laboratory equipment and hoods, and low- and high-activity liquid waste sealed in containers. The site is expected to contain hazardous wastes, radiological wastes, and mixed wastes (including waste with TRU constituents). The volume of waste with TRU constituents in the 618-10 Burial Ground is estimated to be 417 m^3 (14,726 ft^3).

The 618-11 Burial Ground, which operated between 1962 and 1967, consists of 3 slope-sided trenches, 50 VPUs, and 3 to 5 large caissons. VPUs and caissons were used for disposal of high dose rate waste and materials. The caissons are constructed of 2.4 m (8 ft) diameter by 3.1 m (10 ft) tall, corrugated metal cylinders that are buried vertically with their tops about 4.6 m (15 ft) below grade. A 0.9 m (3 ft) diameter angled chute extends from grade to the top of the caisson through a concrete slab lid.

As the Hanford Site production reactors were being shut down, fuel fabrication activities in the 300 Area decreased and R&D activities increased. The newer buildings in the 300 Area primarily housed laboratory operations and large-scale test facilities. R&D activities focused on peaceful uses of plutonium, reactor fuels development, liquid metal technology, FFTF support, gas cooled reactor development, and life science research. Industrial activities continue today in the 300 Area that are associated with ongoing

R&D, electrical power generation (Energy Northwest), training activities (Hazardous Materials Management and Emergency Response [HAMMER]), and security (Hanford Patrol Academy).

This cost estimate encompasses the cost of the three alternatives evaluated in the 300 Area Feasibility Study, Alternative 1 – No Action; Alternative 2 – RTD at Waste Sites, Groundwater Monitoring, and ICs; and Alternative 3 – RTD at Waste Sites, Uranium Sequestration in the Vadose Zone and Top of the Aquifer, Groundwater Monitoring, and ICs; Alternative 4 – RTD at Waste Sites, Focused Deep RTD in the Vadose Zone, Uranium Sequestration in the Vadose Zone and Top of the Aquifer, Groundwater Monitoring, and ICs; Alternative 5 – Expanded RTD at Waste Sites and in the Vadose Zone, Groundwater Monitoring, and ICs.

The five FS alternatives are being considered for remediation of the following 40 sites within the 300 area, and associated groundwater:

Table 1-List of 40 Sites Included in Estimate

300-175	300-289	316-2	618-2
300-265	300-290	316-3	618-3
300-269	300-291	316-4	618-11
300-277	300-293	316-5	UPR-300-10
300-279	300-294	331 LSLT1	UPR-300-12
300-280	300-296	331 LSLT2	UPR-300-2
300-281	300-32	400 PPSS	UPR-300-48
300-283	300-4	400-37	
300-286	300-7	400-38	
300-287	300-9	600-367	
300-288	316-1	618-1	

3 Scope of Work

Quantities used in the creation of this estimate were based on the information provided by the technical project manager in the Environmental Calculation File (ECF) document, ECF-300FS-11-0171, Rev 1. September 26, 2012. The ECF defines the project assumptions and cost quantity inputs for the following three response action alternatives:

3.1 Waste Site and Groundwater Alternatives

3.1.1 Alternative 1—No Action Alternative

The NCP (40 CFR 300.430(e)(6)) requires consideration of a No Action Alternative. The No Action Alternative, which serves as a baseline for evaluating other remediation action alternatives, is retained throughout the FS process. No action means that no remediation would be implemented to alter the existing conditions. For this alternative, it has been assumed that all site remedial activities and interim actions (with the possible exception of backfilling any open excavations that are not safe) will be discontinued in December 2012. No conceptual designs or cost estimates are prepared for Alternative 1 because no actions are proposed.

3.1.2 Alternative 2— RTD at Waste Sites; MNA; Groundwater Monitoring; and ICs

Alternative 2 uses primarily shallow RTD (less than 4.6 m [15 ft] bgs) for 300-FF-2 OU waste sites, MNA for tritium, TCE, and cis- 1,2-DCE in groundwater, and monitoring and ICs for uranium and other COCs and COPCs in groundwater. For residual soil contamination at remediated 300-FF-2 OU waste sites that are evaluated in the FS because of PRG exceedances, the RTD components of this alternative replaces the RTD components of the 300-FF-2 interim ROD (EPA/ROD/R10-01/119), using the PRGs developed in this FS. For waste sites that have not undergone interim actions, the actions will vary depending on the nature and extent of contamination at the waste site. The actions will include one or more of the following:

- RTD of the contaminated soil and debris with concentrations above PRGs for direct exposure (human and ecological), treatment as necessary to meet disposal facility requirements, and disposal at the Environmental Restoration Disposal Facility (ERDF) or another facility approved by EPA. It is anticipated that all the RAOs would be achieved at depths of less than 4.6 m (15 ft). Contaminated non-pipeline engineered structures (e.g., burial ground trenches, drums, caissons, and VPUs) present at greater depths will also be removed.
- RTD of the pipelines that are shallower than or at 4.6 m (15 ft) bgs for the protection of human health and ecological receptors from direct exposure.
- RTD of the contaminated pipelines at waste site 300-15 to variable depths to achieve human health and ecological direct exposure and groundwater protection PRGs. For preliminary design and costing purposes, the depth of excavation across the entire waste site will be assumed to be 4.6 m (15 ft) bgs. During remedial implementation, soil and pipelines will be only be excavated if contamination exceeds the direct exposure PRGs for human health and ecological receptors in the upper 4.6 m (15 ft) and for groundwater protection throughout the soil column. To facilitate remediation, an approach similar to that being used for the ongoing interim action may be deployed. This approach excavates the pipeline to a depth of 3 m (10 ft) bgs, and then makes a determination whether the HHE direct exposure and groundwater protection PRGs have been achieved. Additional excavation to a maximum of 4.6 m (15 ft) bgs will be performed if HHE direct exposure PRGs and the groundwater protection PRGs have not been achieved. Excavation of soil and pipelines below 4.6 m (15 ft) bgs will only be performed if groundwater protection PRGs have not been achieved.
- MNA for tritium, TCE, and cis-1,2-DCE in groundwater.
- Groundwater monitoring and ICs for uranium, tritium, TCE, cis-1,2-DCE, nitrate, and groundwater COPCs.
- ICs will be implemented for the protection of human health and ecological receptors during the timeframe of this remedial alternative.

Temporary surface caps will be installed over the waste sites that are adjacent to the 300 Area facilities and utilities that will remain in operation through at least 2027 (long-term facilities). In addition, pipelines inaccessible for the RTD remedy because of their close proximity to long-term facilities will be interim void filled, as necessary, to immobilize uranium waste in pipelines for groundwater protection. When the long-term facilities are no longer in use and removed, the waste sites and pipelines will be remediated as described above.

3.1.3 Alternative 3— RTD at Waste Sites; Phased Implementation of Uranium Sequestration in the Vadose Zone, PRZ, and Top of the Aquifer; MNA; Groundwater Monitoring; and ICs

Alternative 3 uses primarily shallow RTD (less than 4.6 m [15 ft] bgs) for 300-FF-2 OU waste sites, uranium sequestration for deep uranium contamination in the vadose zone and top of aquifer, MNA for

tritium, TCE, and cis-1,2-DCE in groundwater, and monitoring and ICs for uranium and other COCs and COPCs in groundwater. For residual soil contamination at remediated 300-FF-1 and 300-FF-2 waste sites being evaluated in the FS because of PRG exceedances, this alternative builds off the interim actions previously completed using the PRGs developed in this FS. For 300-FF-2 waste sites that have not undergone interim actions, the actions will vary depending on the nature and extent of contamination at the waste site. The actions will include one or more of the following:

- RTD - Same as Alternative 2.
- Phased implementation of uranium sequestration in the vadose zone and PRZ using a combination of surface infiltrations and deep injection techniques into the PRZ for the waste sites with uranium contamination deeper than 4.6 m (15 ft) bgs.
- Phased implementation of uranium sequestration at the top of the aquifer using injection wells at and downgradient of the primary liquid waste disposal sites. The primary purpose of injecting phosphate at the top of the aquifer will be to sequester any untreated uranium that may be mobilized from the vadose zone during surface infiltration and injection into the PRZ. Phosphate solutions injected at the top of the aquifer also will contact the lower portion of the PRZ when the water table rises.
- MNA for tritium, tritium, TCE, and cis-1,2-DCE in groundwater.
- Groundwater monitoring and ICs for uranium, tritium, TCE, cis-1,2-DCE, nitrate, and groundwater COPCs.
- ICs will be implemented for the protection of human health and ecological receptors during the timeframe of this remedial alternative.

Temporary surface caps and interim void filling for pipelines will be implemented for long-term facilities, as described for Alternative 2. When the long-term facilities are no longer in use and removed, the waste sites and pipelines will be remediated as described above.

3.1.4 Alternative 4 – RTD at Waste Sites; Focused Deep RTD in the Vadose Zone and PRZ; Uranium Sequestration in the Vadose Zone, PRZ, and Top of the Aquifer; MNA; Groundwater Monitoring; and ICs.

Alternative 4 uses primarily shallow RTD (less than 4.6 m [15 ft] bgs) for 300 FF-2 OU waste sites, focused deep RTD and uranium sequestration for deep uranium contamination in the vadose zone and top of aquifer, MNA for tritium TCE, and cis-1,2-DCE in groundwater, and monitoring and ICs for uranium and other COCs and COPCs . For residual soil contamination at remediated waste sites that are evaluated in the FS because of PRG exceedances, this alternative builds off the interim actions previously completed using the PRGs developed in this FS. For waste sites that have not undergone interim actions, the actions will vary depending on the nature and extent of contamination at the waste site. The actions will include one or more of the following:

- RTD - Same as Alternative 2.
- Focused deep RTD in areas of higher uranium mass in the vadose zone deeper than 4.6 m (15 ft) bgs.
- Uranium sequestration in the vadose zone using a combination of surface infiltration and deep injection techniques into the PRZ in areas of lower uranium mass deeper than 4.6 m (15 ft) bgs.
- Uranium sequestration at the top of the aquifer using injection wells at and downgradient of the primary liquid waste disposal sites. The primary purpose of injecting phosphate at the top of the aquifer will be to sequester any untreated uranium that may be mobilized from the vadose zone

during surface infiltration and injection into the PRZ. Phosphate solutions injected at the top of the aquifer also will contact the lower portion of the PRZ when the water table rises.

- MNA for tritium, tritium, TCE, and cis-1,2-DCE in groundwater.
- Groundwater monitoring and ICs for uranium, tritium, TCE, cis-1,2-DCE, nitrate, and groundwater COPCs.
- ICs will be implemented for the protection of human health and ecological receptors during the timeframe of this remedial alternative.

Temporary surface caps and interim void filling for pipelines will be implemented for long-term facilities, as described for Alternative 2. When the long-term facilities are no longer in use and removed, the waste sites and pipelines will be remediated as described above.

3.1.5 Alternative 5 – RTD at Waste Sites; Extensive Deep RTD in the Vadose Zone and PRZ; MNA; Groundwater Monitoring; and ICs.

Alternative 5 uses RTD almost exclusively for 300-FF-2 OU waste sites and for deep uranium contamination in the vadose zone and PRZ contributing to the uranium groundwater plume. It also relies on MNA for tritium, TCE, and cis-1,2-DCE in groundwater, and monitoring and ICs for uranium and other COCs and COPCs. For residual soil contamination at remediated 300-FF-2 OU waste sites that are evaluated in the FS because of PRG exceedances, this alternative builds off the interim actions previously completed using the PRGs developed in this FS. For 300-FF-2 OU waste sites that have not undergone interim actions, the actions will vary depending on the nature and extent of contamination at the waste site. The actions will include one or more of the following:

- RTD - Same as Alternative 2.
- Expanded deep RTD in areas of higher uranium mass in the vadose zone deeper than 4.6 m (15 ft) bgs.
- MNA for tritium, tritium, TCE, and cis-1,2-DCE in groundwater.
- Groundwater monitoring and ICs for uranium, tritium, TCE, cis-1,2-DCE, nitrate, and groundwater COPCs.
- ICs will be implemented for the protection of human health and ecological receptors during the timeframe of this remedial alternative.

Temporary surface caps and interim void filling for pipelines will be implemented for long-term facilities, as described for Alternative 2. When the long-term facilities are no longer in use and removed, the waste sites and pipelines will be remediated as described above.

4 Overall Costs

Table 2 sums up the costs for the waste sites, Uranium Sequestration, and the groundwater remediation for each alternative. The cost summary lists total capital, annual, and periodic costs along with a non-discounted total for these three cost components. Total discounted costs, the discount rate used, and the corresponding order-of-magnitude discounted cost range are presented for each alternative as well.

Table 2-Summary of Total Costs (in $millions)

Summary of Total Costs (in $ Millions)					
	Capital Cost	**Total Annual Cost**	**Total Periodic Cost**	**Non-Discounted Cost**	**Total Present Value of Alternative**
Alternative 2					
Waste Sites	$244.590	$25.876	$10.522	$280.988	**$229.751**
U Sequestration Sites	$0	$0	$0	$0	**$0**
Groundwater Monitoring	$0.822	$2.363	$1.335	$4.519	**$3.260**
Alt 2 Total	$245.412	$28.239	$11.857	$285.507	**$233.011**
Alternative 3					
Waste Sites	$244.590	$25.876	$10.522	$280.988	**$229.751**
U Sequestration Sites	$31.433	$90.619	$7.913	$129.965	**$125.608**
Groundwater Monitoring	$3.544	$7.242	$1.941	$12.727	**$11.480**
Alt 3 Total	$279.567	$123.737	$20.376	$423.680	**$366.839**
Alternative 4					
Waste Sites	$462.210	$25.876	$10.522	$498.608	**$440.511**
U Sequestration Sites	$21.830	$59.636	$5.074	$86.540	**$85.080**
Groundwater Monitoring	$3.544	$7.010	$1.870	$12.423	**$11.410**
Alt 4 total	$487.584	$92.522	$17.466	$597.571	**$537.001**
Alternative 5					
Waste Sites	$1,308.630	$25.876	$10.522	$1,345.028	**$1,260.477**
U Sequestration Sites	$0	$0	$0	$0	**$0**
Groundwater Monitoring	$0.822	$1.317	$0.600	$2.738	**$2.450**
Alt5 Total	$1,309.452	$27.193	$11.122	$1,347.766	**$1,262.927**
Note: These alternative costs estimate totals are based on Order-of-Magnitude cost estimates with expected accuracy of +50%/-30% per EPA guidance.					

The waste site alternatives cost estimate for the 300 Area RI/FS was created by combining costs estimated by PRC and costs from WCH. WCH provided costs for the following sites:

Table 3-List of Sites where WCH-Estimated Costs were used

316-4	300-279	300-32	618-11
300-265	300-296	300-7	316-3 (Alts 2 and 3)
300-9			

Table A-1a (see Appendix) presents site specific capital, annual, periodic, total non-discounted, and total discounted (present value) costs for each of the forty 300 Area waste sites. Table A-1b (see Appendix) presents the Uranium Sequestration costs associated with waste sites Alternatives 3 and 4. Table A-2 (see Appendix) presents the total Groundwater zone costs. Totals are presented at the bottom of each of the tables for the specific capital, annual, periodic, total non-discounted, and total discounted (present value) costs for the combined waste sites and for the groundwater alternatives, and then separate site-specific subtotals are presented for each of the waste sites and for each of the key groundwater components.

5 Major Assumptions

There are two different types of assumptions and inputs for cost estimation; general and response-activity specific.

5.1 General Assumptions and Inputs

General assumptions apply to all response action cost estimates. The general assumptions discussed in the sections below include direct and indirect cost assumptions and other general pricing assumptions.

5.1.1 General Direct Cost Assumptions

Direct costs include all costs that can be directly attributed to a particular construction activity or item of work required to accomplish the project. Typical direct cost items include: labor, material, equipment and subcontract items. Direct cost assumptions for this estimate include:

- Scope and Bid Contingencies, see Section 8.
- Project management, remedial design, and construction management capital costs, see Section 9.
- Construction labor is discussed in Section 15.
- Material such as: backfill soil, grout, worker health and safety protective items, HDPE pipe, and phosphate chemicals are included in the estimates. Material costs were based on historical Hanford systems costs, and RS Means 2012, *Building Construction Cost Data*; *and* 2012, *Heavy Construction Cost Data*.
- Equipment such as: trucks, backhoes, drill rigs, tanks, pumps, mixers, process treatment panels and controls are included in the estimates. Equipment units were estimated based on standard commercial estimating resources and databases: Means 2012, *Building Construction Cost Data*; *and* 2012, *Heavy Construction Cost Data*.
- The units may have been factored or adjusted by the estimator as appropriate to reflect influences by contract, work site, or other identified project or special conditions.
- Site preparation costs such as site access enhancements and controls, utility connections, site clearing and leveling, were included as allowances based on estimator judgment.

- Cost impacts for performing work under specific levels of worker health safety protection:
    - Work assumed to be performed under worker health and safety level D was assumed to be at the standard TRACE V3 unit cost rates.
    - Worker health and safety levels beyond level D were assumed to be not needed for any of the remediation activities in this estimate.

5.1.2 General Indirect Cost Assumptions

Indirect costs are costs not directly attributable to the completion of an activity. Indirect costs are typically allocated or spread across all activities on a predetermined basis. Indirect costs items can include the following job-related overhead items: taxes; project-specific insurance; bonds; permits and licenses; general supervision; temporary office personnel; schedules; preparatory work and testing services; temporary project facilities; temporary utilities; operations and maintenance of temporary project-site facilities; project vehicles; personal protective equipment and OSHA requirements; quality controls; mobilization and demobilization; and site security.

General indirect cost assumptions for this estimate include:

- Markups are included for overhead profit and DD/G&A, see Section 7.
- Mobilization/demobilization and bonding/insurance – a standard TRACE V3 percentage allowance was used based on project size and using the high percentage value from the low, medium, and high percentages presented by TRACE V3 for the project size.

5.2 Response Activity-Specific Assumptions and Inputs

Assumptions specific (see Appendix) to the proposed remedial activities for this cost estimate are described below. Quantity inputs used in the TRACE V3 cost estimating workbook are summarized for the waste sites, groundwater and uranium sequestration estimates in Tables A-3, A-4, and A-5 respectively.

Remedial action assumptions and cost inputs used in this cost estimate were provided by the technical team in the Environmental Calculation File, (ECF-300FF5-0171-September 26, 2012) important quantities and calculations for feasibility study alternative costing. Any changes from the original quantities and any additional cost estimate basis assumptions are documented below.

5.2.1 Summary of Cost by Site:

The costs for the three 300 Area remedial action alternatives were calculated both individually and combined as a total cost, with itemized waste site costs and itemized groundwater remediation costs included in each alternative. Costs for each of the forty waste sites and groundwater zone were calculated and summarized separately from the alternative total costs by:

- Breaking out and summing each of the site-specific costs for each site.
- Allocating a portion of the overall mobilization/demobilization/bonding/insurance, site preparation, and alternative markup costs to each specific site based on the site subtotal cost of the overall alternative cost.

5.2.2 Modified Standard TRACE V3 Unit Costs and User-Supplied Unit Costs

The following unit costs were used in the cost estimate and were modified from or added to the original TRACE V3 default costs. The source of the unit cost is listed beside the item in the list below:

Capital Costs

- Phosphate Infiltration and Injection Development and Implementation Plans (for 316-1, 316-2, 316-3, 316-5 and for combined 618-1, 618-2, and 618-3) - A $100,000 allowance per area was used to allow for innovative technology development in addition to standard design costs.
- Phosphate Sequestration Infiltration System Costs (for 316-1, 316-2, 316-3, 316-5 and for combined 618-1, 618-2, and 618-3) – Vendor quotes were received for the drip/emitter systems and allowances added for trenching/installation.
- 40’ Soil Boring and sample for Uranium – RACER 2011 and WSCF lab costs
- Miscellaneous Phosphate System Mechanical, Electrical & I&C (for 316-1, 316-2, 316-3, 316-5 and combined, 618-1, 618-2, and 618-3) – A process allowance of $150,000 per area each for miscellaneous mechanical, electrical, and Instrumentation & Control that would be needed for a complete system installation.

O&M Costs

- Capping (Barrier) O&M Annual Maintenance Cost – A unit cost of $1,920 per year has been calculated using the RACER 2011 estimating system.
- Aquifer injection chemistry for 0.5 MG per well per injection – A unit cost of $27,852 was used for injecting 521,233 gallons of 1,000 mg/L orthophosphate solution, based on Hanford site experience.
- Aquifer injection non-chemistry O&M – An allowance of $12,500 was used, based on estimator experience, for labor, equipment, and materials needed per well per injection to inject 521,233 gallons of 1,000 mg/L orthophosphate solution.
- Phosphate System Decommissioning and Removal (for 316-1, 316-2, 316-3, 316-5, and for combined 618-1, 618-2, and 618-3) – these costs were based on 30% of the original construction cost for each system.
- Decommissioning and removal of groundwater monitoring pumps - A process allowance of 33% of the installed monitoring well pump cost was used.
- Annual Inspection of waste sites – Historical Hanford cost

5.2.3 Specific assumptions

The following specific assumptions were included in the cost estimates:

- Excavation – density of soil, assumed 1.5 tons per bank cy.
- Site Preparation – estimator’s judgment at $5,000 to $100,000 for each individual vadose zone estimate which may include establishing the site cleanup boundaries, evaluation of the physical characteristics of the site, assessing surfaces and land areas of interest, it may also include removing

equipment and materials that restrict access to surfaces, etc.; and $100,000 for the larger, multi-acre phosphate systems for uranium sequestration in the vadose zone.

- A single mobilization/demobilization for the waste site remediation, for uranium sequestration remediation, and for the groundwater remediation.
- All waste site estimates assume ERDF disposal of contaminated soil/material and replacement of uncontaminated soil back in the excavation. Extra soil needed to fill in excavation will come from the Hanford site.
- Pipe grouting assumes that the grout can be pumped 200 feet. A 10 foot by 10 foot excavation is assumed to be at the beginning of the pipe run, and again at every 200 feet and at the end. The cost consists of a 10 person crew, concrete pump, 2 sets of flexible hose for grout placement, and a plug at each end and at every 200 feet of excavation. Any contaminated material is assumed to be sent to ERDF for disposal. The excavated sites are backfilled at completion.
- Each excavation cost contains sampling of the soil and surrounding air during excavation as it is excavated, as well as sampling of the ERDF soil per 1,330 tons per Hanford guidance.
- The clean soil costs contain verification sampling per ton.
- RTD Process – The waste site is stripped of overburden soil by a hydraulic excavator and stockpiled near the waste site. Contaminated soil, demolition debris, and pipelines are removed from the waste site by a hydraulic excavator and direct loaded in to the ERDF disposal containers. After the excavation process has been completed and site sampling has been performed, the site is backfilled. The stockpiled overburden is placed back into the waste excavation and additional soil from an onsite borrow source is used to replace the volume of contaminated soil. Re-contouring and re-vegetation will be performed as needed.
- Contingency for Waste Site Remediation Initiated under IROD – as described in ECF-300FF5-11-0171 – September 26, 2012, Waste sites currently being remediated under the interim action ROD or are anticipated to begin remediation by the time the ROD is signed. For the 300 Area cost estimate, it is expected that interim actions will achieve the required cleanup levels for most of these sites and that no additional actions will be required. To account for the possibility that the cleanup levels are not achieved during the interim action, it is assumed that 20 percent of the waste sites that have uranium as a COPC will require additional remediation under the new ROD. The waste sites included in the cost evaluation are 300 RLWS, 300 RRLWS, 300-16, 300-219, 300-224, 300-24, 300-249, 300-251, 300-268, 300-270, 300-276, 300-28, 300-40, 300-43, 313 ESSP, 333 WSTF, 3712 USSA, UPR-300-38, UPR-300-39, UPR-300-40, and UPR-300-45. Estimated RTD costs for each of these sites were provided by WCH. For the purposes of the 300 Area accost estimate, 20 percent of the total estimated RTD costs for these sites ($1.59M) was used the contingency cost.
- Barrier Construction Process – The design of the ET Mono Fill barrier will be similar to a RCRA D Cap. The construction process will start with clearing the site of debris and vegetation. Then a leveling fill of local soil that is a minimum of eight inches deep is constructed. A silt layer 1m deep is spread over the leveling fill. The side slopes of the barrier are covered with 4” minus gravel for erosion protection. The cap is then re-vegetated with native grass and other vegetation. The leveling fill, silt and gravel will all come from Hanford site borrow sites.
- Drip infiltration systems were assumed to be 1-acre modules with drip lines on one-foot centers, and drip lines and emitters in 1 foot-deep trenches. The infiltration solution was assumed to be 1,500 mg/L phosphate solution with 80%/20% orthophosphate/polyphosphate. It was assumed that 20% of

the targeted infiltration areas would not be suitable for infiltration and that PRZ zone injection wells on 50-foot centers would be used in these areas.

- PRZ injection wells were assumed at 50 foot centers in selected areas. The PRZ injection wells were assumed at 40-feet deep, and 83,397 gallons of 1,500 mg/L phosphate solution with 80%/20% orthophosphate/polyphosphate and xanthan gum per injection per well at once per year.
- Eighteen aquifer injection wells were assumed at 60 foot depth. Aquifer injections are assumed at twice per year per well, with 521,233 gallons of 1,000 mg/L orthophosphate per injection.
- The estimated costs for providing the sitewide or programmatic ICs including site access, personnel badging, real estate and deeds, warning signs along the Columbia River bank and other access points, maintaining a current site wide institutional controls plan, controls for excavating soil, accessing and using groundwater, and irrigation restrictions are also included in the costs developed for each alternative:
    - These costs were assembled and where appropriate a 50% adjustment was made to represent CERCLA cleanup as a portion of the current Hanford Site mission. The TPA currently identifies 22 CERCLA Records of Decision, so each ROD would be allocated an equal portion of the CERCLA programmatic ICs costs. The programmatic ICs costs are projected for the next 150 years. In 2068 ICs costs are reduced by 50% to reflect removal of the 100 area reactors, as the more active programmatic controls, like site access, would be likewise reduced.
    - The total non-discounted cost for the ICs for 150 years is estimated to be $563,000,000 for the Hanford site (about $26,000,000 per ROD). The total discounted cost for the ICs at Hanford are estimated at $221,000,000 (about $10,000,000 per ROD).
    - The total non-discounted cost for the 5-Year Reviews for 150 years is estimated to be $14,000,000 (about $630,000 per ROD). The total discounted cost for the 5-Year Reviews for 150 years is estimated to be $4,000,000 (about $190,000 per ROD).

6 Exclusions

This section identifies costs that have not been included in the estimate. The following items have been excluded from the estimate:

- Future Escalation – Separate future escalation has not been included in these calculations. All capital, annual, and periodic costs are present day (fiscal year 2012), and from this basis the PV analysis is performed as described in Section 10.
- Costs for remediating the sites individually under separate contracts. The costs in this estimate assume that the sites are remediated under one contract corresponding to the specific alternative, or at most one waste site and one groundwater contract. If the sites are remediated separately, the individual site costs would be expected to be higher than shown for the individual sites in Table 1A (see appendix), since certain fixed costs would not be spread over a group of sites, and certain project efficiencies would not be realized.

7 Markups

The following markups have been included in the Cost Estimate:

- Contractor Overhead at 10 percent.

- Contractor Profit at 8 percent.
- PRC DD/G&A costs have been applied at a rate of 30.241 percent to all PRC labor, material, and equipment. G&A is also applied to the FP contractor costs. This markup includes a number of job-related overhead items:
  - Taxes
  - Project-specific insurance
  - Bonds
  - Permits and licenses
  - General supervision
  - Temporary office personnel
  - Schedules
  - Preparatory work and testing services
  - Temporary project facilities and O&M of these facilities
  - Temporary utilities (e.g. phone, electrical)
  - Project vehicles
  - Personal protective equipment and Occupational Health and Safety requirements
  - Quality controls
  - Mobilization and demobilization
  - Site security

8 Contingencies

Contingency is factored into a cost estimate to cover unknowns, unforeseen circumstances, or unanticipated conditions that are not possible to evaluate from the available data at the time the estimate is prepared. It is used to reduce the risk of possible cost overruns.

- Scope Contingency. Contingency rates have been applied to the capital costs based on consideration of the range of 15 to 55 percent as per EPA/540/R-00/002, Section 5.4 for soil excavation. The scope contingencies for this estimate for Alternatives 2 through 5 were set at 55% for the waste site estimates, at 25% for the Alternative 3 and 4 uranium sequestration estimates, and at 35% for the groundwater estimates.
- Bid Contingency. The range for bid contingency is typically from 10 to 20 percent. The bid contingency for this estimate for Alternatives 2 through 5 has been set at 20% for the waste site estimates, sequestration estimates, and for the groundwater estimates.
- O&M Contingency. The O&M contingency has been estimated for Alternatives 2 through 5 to be 30% for the waste site estimates and for the groundwater estimates, and at 20% for the uranium sequestration estimates.

9 Project Management, Remedial Design, and Construction Management Costs

Project management, remedial design, and construction management capital costs are estimated using factors based on EPA/540/R-00/002, Exhibit 5-8:

[1] DD/G&A rate is obtained from CH2M Hill Plateau Remediation Company (DRAFT) FY 2011 Rates a 7 year average was taken and 30.24% was used.

- For projects with construction costs less than $100,000 – remedial design is planned at 20 percent, project management is planned at 10 percent, and construction management is planned at 15 percent of the construction cost.
- For projects with construction costs from $100,000 to $500,000 – remedial design is planned at 15 percent, project management is planned at 8 percent, and construction management is planned at 10 percent of the construction cost.
- For projects with construction costs from $500,000 to $2 million – remedial design is planned at 12 percent, project management is planned at 6 percent, and construction management is planned at 8 percent of the construction cost.
- For projects with construction costs from $2 million to $10 million – remedial design is planned at 8 percent, project management is planned at 5 percent, and construction management is planned at 6 percent of the construction cost.
- For projects with construction costs greater than $10 million – remedial design is planned at 6 percent, project management is planned at 5 percent, and construction management is planned at 6 percent of the construction cost.

Since capital costs for vadose zone Alternatives 2, 3, 4, and 5 all have estimated construction costs greater than $10 million, the following percentages were used in these estimates:

- Remedial Design at 6%
- Project Management at 5%
- Construction Management at 6 %

O&M line item costs for vadose zone alternatives 2, 3, 4 and 5 have differing costs and range from 6 to 10% for project management, 12 to 20% for remedial design and 8 to 15% for construction management.

Since capital costs for uranium sequestration Alternatives 3 and 4 all have estimated construction costs greater than $10 million, the following percentages were used in these estimates:

- Remedial Design at 6%
- Project Management at 5%
- Construction Management at 6 %

O&M line item costs for uranium sequestration alternatives 3 and 4 have differing costs and range from 5 to 10% for project management, 8 to 20% for remedial design and 6 to 15% for construction management.

For groundwater, Alternatives 2 and 5 have estimated construction costs in the range of $100,000 to $500,000, and the following percentages were used in these estimates:

- Remedial Design at 12%
- Project Management at 6%
- Construction Management at 8%

O&M line item costs for groundwater alternatives 2 and 5 have differing costs and range from 8 to 10% for project management, 15 to 20% for remedial design and 10 to 15% for construction management

For groundwater, Alternatives 3 and 4 have estimated construction costs in the range of $500,000 to $2,000,000, and the following percentages were used in these estimates:

- Remedial Design at 8%
- Project Management at 5%
- Construction Management at 6%

O&M line item costs for groundwater alternatives 3 and 4 have differing costs and range from 6 to 10% for project management, 12 to 20% for remedial design and 8 to 15% for construction management

10 Present Value

As per EPA Guidance, EPA/540/R-00/002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, OSWER 9355.0-75 (EPA, 2000) the estimate includes present value calculations for work performed in out years.

The costs are presented as present value costs. The present value method establishes a common baseline for evaluating costs that occur during different time periods, thus allowing for direct cost comparisons between different alternatives. The present value represents the dollars that would need to be set aside today, at the defined real discount rate, to ensure that funds would be available in the future as they are needed to perform the response action alternative.

Present value costs were estimated using the real discount rate published in Appendix C of the Office of Management and Budget (OMB) Circular No. A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, effective through January 2013* (OMB, 2011). Based on this guidance and a duration of 14 years for vadose zone alternatives 2, through 5, a real discount rate of 1.6 percent was used in cost estimate present value calculations for all five alternatives. Based on this guidance and the following durations the discount rates used for the groundwater cost estimates were:

- For Alternative 2, at 34 years: 2.0%
- For Alternative 3, at 22 years: 1.8%
- For Alternative 4, at 18 years: 1.6%
- For Alternative 5, at 16 years: 1.5%
- For the sequestration cost estimates for sites 316-1,2,3, &5 and 618-1,2,&3, Alternative 3 has a duration of 9 years and uses a real discount rate of 0.9%, and Alternative 4 has a duration of 7 years and uses a real discount rate of 0.7%.

11 Estimate Classification

This estimate was prepared in accordance with the guidelines of "*A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, EPA 540-R-00-002, OSWER 9355.0-75, July 2000. It's important to remember that at the FS stage, the design for the response action project is still

conceptual, not detailed, and the cost estimate is considered to be "order-of-magnitude." The expected accuracy range of the cost estimate at this stage is approximately plus 50 percent, minus 30 percent.

The expected accuracy range is an indication of the degree to which the final cost outcome for a given project could vary from the estimated cost. Accuracy is traditionally expressed as a +/- percentage range around the point estimate after application of contingency, with a stated level of confidence that the actual cost outcome would fall within this range (+/- measures are a useful simplification, given that actual cost outcomes have different frequency distributions for different types of projects). Typically, this results in a 90% confidence that the actual cost will fall within the bounds of the low and high ranges.

The accuracy range of an estimate is dependent upon a number of characteristics of the estimate input information and the estimating process. The extent and the maturity of the input information as measured by percentage completion (and related to level of project definition) is an important determinant of accuracy. However, there are factors besides the available input information that also greatly affect estimate accuracy measures. Primary among these are the state of technology in the project and the quality of reference cost estimating data.

The accuracy of any given estimate is not fixed or determined by its classification category. Significant variations in accuracy from estimate to estimate are possible if any of the determinants of accuracy, such as technology, quality of reference cost data, quality of the estimating process, and skill and knowledge of the estimator vary. Accuracy is also not necessarily determined by the methodology used or the effort expended. Estimate accuracy must be evaluated on an estimate-by estimate basis, usually in conjunction with some form of risk analysis process.

12 Cost Resources

The following is a list of the cost resources used in the development of the cost estimate.

- TRACE V3 (ECF-Hanford-11-0098 through 0107 and ECF-Hanford-11-0164)
- RS Means
- Hanford historical actual costs
- Estimator Judgment

13 Estimate Methodology

The cost estimate for the 300 Area project was developed in accordance with EPA/540/R-00/002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, OSWER 9355.0-75 (EPA, 2000), and PRC-PRO-EP-40282 *Cost Estimating Procedure for Response Action Decision-Making* (PRC, 2011). The TRACE V3 cost estimating workbook in conjunction with the RACER™ Cost Estimator software were used to develop the cost estimate for each of the removal action alternatives.

This cost estimate has been prepared for guidance in project evaluation from the information available at the time of the estimate. The final cost of the project will depend on final design, selected scope of work, actual labor and material costs, competitive market conditions, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimate presented here. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

14 Sensitivity Analysis

Sensitivity analysis for this cost estimate was not performed. The following factors might cause the estimate to significantly change.

- *Levels of contamination.*
- *Depth and extent of contamination encountered during RTD of vadose zone sites.*
- *Duration and actual operations and maintenance requirements for phosphate infiltration and injection systems for uranium sequestration.*
- *Less favorable working conditions and/or increased monitoring requirements that would significantly increase the impact of working in health and safety protection and/or increase the health and safety protection requirements.*

15 Labor Costs

Fixed-price (FP) construction craft labor rates are those listed in Appendix A of the Site Stabilization Agreement for All Construction Work for the U.S. Department of Energy at the Hanford Site (commonly known as the Hanford Site Stabilization Agreement [HSSA]). The HSSA rates include base wage, fringe benefits, and other compensation as negotiated between CH2M HILL Plateau Remediation Company (CHPRC) and the National Building and Construction Trades Department American Federation of Labor-Congress of Industrial Organizations (AFL-CIO). Other factors that account for additional costs (Workman's Compensation, Federal Insurance Contributions Act (FICA), and state and Federal unemployment insurance) to develop a fully burdened rate by craft, have been incorporated. The labor rates used are for 2012.

Plateau Remediation Contractor (PRC) labor rates for management, engineering, safety oversight, and technical support are based on the PRC-approved planning rates for fiscal year 2012.

16 Sales Tax

Washington State sales tax has been applied to materials and equipment purchases, which are assumed to be 30% of the construction subtotal cost with mobilization/demobilization/bonding/insurance, at 8.3 percent and is included in the PRC direct distributable/general and administrative (DD/G&A) percentage discussed in section 7.

17 References

EPA 540-R-00-002, 2000, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, OSWER 9355.0-75, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

PRC-PRO-EP-40282, 2010, *Cost Estimating Procedure for Response Action Decision-Making*, Rev. 0, Chg. 0, CH2M HILL Plateau Remediation Company, Richland, Washington.

Means, R. S., 2001, ECHOS *Environmental Remediation Cost Date Unit Price*, Robert S. Means Company, Kingston, Massachusetts.

Means, R. S., 2010a, *Building Construction Cost Book*, 68th annual ed., Robert S. Means Company, Kingston, Massachusetts.

Means, R. S., 2010b, *Heavy Construction Cost Data,* 24th annual ed., Robert S. Means Company, Kingston, Massachusetts.

OMB Circular No. A-94, 2011, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs" (memorandum for Heads of Executive Departments and Establishments), Appendix C, "Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses," as revised, Office of Management and Budget, Washington, D.C.

Site Stabilization Agreement for All Construction Work for the U.S. Department of Energy at the Hanford Site, 1984, as amended, commonly known as the Hanford Site Stabilization Agreement (HSSA)(original title, *Site Stabilization Agreement, Hanford Site, between J.A. Jones Construction Services Company and Morrison-Knudsen Company, Inc., and the Building and Construction Trades Department of the AFL-CIO and its affiliated international unions, and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America.*

ECF-Hanford-11-0098, Environmental Calculation File for TRACE V3 Overall-Overview

ECF-Hanford-11-0099, Environmental Calculation File for TRACE V3-Actual Costs

ECF-Hanford-11-0100, Environmental Calculation File for TRACE V3- RACER Costs

ECF-Hanford-11-0101, Environmental Calculation File for TRACE V3-Calculations

ECF-Hanford-11-0102 Environmental Calculation File for TRACE V3- Unit Costs

ECF-Hanford-11-0103, Environmental Calculation File for TRACE V3-Capital Cost

ECF-Hanford-11-0104, Environmental Calculation File for TRACE V3-O&M Cost

ECF-Hanford-11-0105, Environmental Calculation File for TRACE V3-O&M Distribution

ECF-Hanford-11-0106, Environmental Calculation File for TRACE V3-Present Value

ECF-Hanford-11-0107, Environmental Calculation File for TRACE V3-Totals

ECF-Hanford-11-0164, Tool for Response Action Cost Estimating (TRACE), TRACE V3 – Site Cost Distribution

Appendix

Table A-1a – Waste Site Costs

Table A-1a

	Waste Site		WCH	CHPRC Alt 2	CHPRC Alt 3	CHPRC Alt 4	CHPRC Alt 5
		ND = Non Discounted	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS
WCH	316-4	Individual Site (non discounted)		$1.60	$1.60	$1.60	$1.60
WCH	316-4	Discounted (PV)		$1.57	$1.57	$1.57	$1.57
PRC	300-175						
			Capital Cost	$0.00	$0.00	$0.00	$0.00
			Annual	$0.02	$0.02	$0.02	$0.02
			Periodic	$0.46	$0.46	$0.46	$0.46
			Individual Site (non discounted)	$0.49	$0.49	$0.49	$0.49
			Discounted (PV)	**$0.38**	**$0.38**	**$0.38**	**$0.38**
WCH	300-265	Individual Site (non discounted)	$0.10	$0.10	$0.10	$0.10	$0.10
WCH	300-265	Discounted (PV)	**$0.08**	$0.08	$0.08	$0.08	$0.08
PRC	300-269						
			Capital Cost	$1.69	$1.69	$1.69	$1.69
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$1.69	$1.69	$1.69	$1.69
			Discounted (PV)	**$1.63**	**$1.63**	**$1.63**	**$1.63**
PRC	300-277						
			Capital Cost	$6.52	$6.52	$6.52	$6.52
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$6.52	$6.52	$6.52	$6.52
			Discounted (PV)	**$6.32**	**$6.32**	**$6.32**	**$6.32**
WCH	300-279	Individual Site (non discounted)	$0.05	$0.05	$0.05	$0.05	$0.05
WCH	300-279	Discounted (PV)	**$0.05**	$0.05	$0.05	$0.05	$0.05
PRC	300-280						
			Capital Cost	$1.74	$1.74	$1.74	$1.74
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$1.74	$1.74	$1.74	$1.74
			Discounted (PV)	**$1.68**	**$1.68**	**$1.68**	**$1.68**
PRC	300-281						
			Capital Cost	$0.42	$0.42	$0.42	$0.42
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.42	$0.42	$0.42	$0.42
			Discounted (PV)	**$0.41**	**$0.41**	**$0.41**	**$0.41**
PRC	300-283						
			Capital Cost	$0.50	$0.50	$0.50	$0.50
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.50	$0.50	$0.50	$0.50
			Discounted (PV)	**$0.48**	**$0.48**	**$0.48**	**$0.48**
PRC	300-286						
			Capital Cost	$0.44	$0.44	$0.44	$0.44
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.44	$0.44	$0.44	$0.44
			Discounted (PV)	**$0.42**	**$0.42**	**$0.42**	**$0.42**
PRC	300-287						
			Capital Cost	$0.37	$0.37	$0.37	$0.37
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.37	$0.37	$0.37	$0.37
			Discounted (PV)	**$0.36**	**$0.36**	**$0.36**	**$0.36**

	Waste Site		WCH	CHPRC Alt 2	CHPRC Alt 3	CHPRC Alt 4	CHPRC Alt 5
		ND = Non Discounted	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS
PRC	300-288						
			Capital Cost	$0.38	$0.38	$0.38	$0.38
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.38	$0.38	$0.38	$0.38
			Discounted (PV)	**$0.37**	**$0.37**	**$0.37**	**$0.37**
PRC	300-289						
			Capital Cost	$0.54	$0.54	$0.54	$0.54
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.54	$0.54	$0.54	$0.54
			Discounted (PV)	**$0.53**	**$0.53**	**$0.53**	**$0.53**
PRC	300-290						
			Capital Cost	$0.46	$0.46	$0.46	$0.46
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.46	$0.46	$0.46	$0.46
			Discounted (PV)	**$0.45**	**$0.45**	**$0.45**	**$0.45**
PRC	300-291						
			Capital Cost	$0.30	$0.30	$0.30	$0.30
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.30	$0.30	$0.30	$0.30
			Discounted (PV)	**$0.29**	**$0.29**	**$0.29**	**$0.29**
PRC	300-293						
			Capital Cost	$1.34	$1.34	$1.34	$1.34
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$1.34	$1.34	$1.34	$1.34
			Discounted (PV)	**$1.30**	**$1.30**	**$1.30**	**$1.30**
PRC	300-294						
			Capital Cost	$0.48	$0.48	$0.48	$0.48
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.48	$0.48	$0.48	$0.48
			Discounted (PV)	**$0.46**	**$0.46**	**$0.46**	**$0.46**
WCH	300-296		*these numbers came from WCH baseline SS (32 MSR_RCC_IPB_CPR_by_WBSL2WG567) 2011*				
			Capital Cost				
			Annual				
			Periodic				
			Individual Site (non discounted)	$60.00	$60.00	$60.00	$60.00
			Discounted (PV)	**$47.29**	**$47.29**	**$47.29**	**$47.29**
WCH	300-32	Individual Site (non discounted)	$0.09	$0.09	$0.09	$0.09	$0.09
WCH	300-32	Discounted (PV)	**$0.09**	$0.09	$0.09	$0.09	$0.09
PRC	300-4						
			Capital Cost	$0.06	$0.06	$0.06	$0.06
			Annual	$0.11	$0.11	$0.11	$0.11
			Periodic	$1.30	$1.30	$1.30	$1.30
			Individual Site (non discounted)	$1.47	$1.47	$1.47	$1.47
			Discounted (PV)	**$1.16**	**$1.16**	**$1.16**	**$1.16**
WCH	300-7	Individual Site (non discounted)		$5.68	$5.68	$5.68	$5.68
		Discounted (PV)		$5.59	$5.59	$5.59	$5.59
WCH	300-9	Individual Site (non discounted)		$5.68	$5.68	$5.68	$5.68
		Discounted (PV)		$5.59	$5.59	$5.59	$5.59

	Waste Site		WCH	CHPRC Alt 2	CHPRC Alt 3	CHPRC Alt 4	CHPRC Alt 5
		ND = Non Discounted	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS
PRC	331-LSLT1						
			Capital Cost	$0.00	$0.00	$0.00	$0.00
			Annual	$0.02	$0.02	$0.02	$0.02
			Periodic	$0.44	$0.44	$0.44	$0.44
			Individual Site (non discounted)	$0.46	$0.46	$0.46	$0.46
			Discounted (PV)	**$0.36**	**$0.36**	**$0.36**	**$0.36**
PRC	331-LSLT2						
			Capital Cost	$0.00	$0.00	$0.00	$0.00
			Annual	$0.02	$0.02	$0.02	$0.02
			Periodic	$0.44	$0.44	$0.44	$0.44
			Individual Site (non discounted)	$0.46	$0.46	$0.46	$0.46
			Discounted (PV)	**$0.36**	**$0.36**	**$0.36**	**$0.36**
PRC	400 PPSS						
			Capital Cost	$0.00	$0.00	$0.00	$0.00
			Annual	$0.02	$0.02	$0.02	$0.02
			Periodic	$4.86	$4.86	$4.86	$4.86
			Individual Site (non discounted)	$4.89	$4.89	$4.89	$4.89
			Discounted (PV)	**$3.79**	**$3.79**	**$3.79**	**$3.79**
PRC	400-37						
			Capital Cost	$0.00	$0.00	$0.00	$0.00
			Annual	$0.02	$0.02	$0.02	$0.02
			Periodic	$0.48	$0.48	$0.48	$0.48
			Individual Site (non discounted)	$0.51	$0.51	$0.51	$0.51
			Discounted (PV)	**$0.39**	**$0.39**	**$0.39**	**$0.39**
PRC	400-38						
			Capital Cost	$0.00	$0.00	$0.00	$0.00
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.53	$0.53	$0.53	$0.53
			Individual Site (non discounted)	$0.54	$0.54	$0.54	$0.54
			Discounted (PV)	**$0.42**	**$0.42**	**$0.42**	**$0.42**
PRC	600-367						
			Capital Cost	$69.38	$69.38	$69.38	$69.38
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$69.38	$69.38	$69.38	$69.38
			Discounted (PV)	**$67.21**	**$67.21**	**$67.21**	**$67.21**
PRC	618-1						
			Capital Cost	$0.00	$0.00	$0.00	$28.93
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.00	$0.00	$0.00	$28.93
			Discounted (PV)	**$0.00**	**$0.00**	**$0.00**	**$28.03**
PRC	618-2						
			Capital Cost	$0.00	$0.00	$0.00	$42.38
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.00	$0.00	$0.00	$42.38
			Discounted (PV)	**$0.00**	**$0.00**	**$0.00**	**$41.06**
PRC	618-3						
			Capital Cost	$0.00	$0.00	$0.00	$34.31
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.00	$0.00	$0.00	$34.31
			Discounted (PV)	**$0.00**	**$0.00**	**$0.00**	**$33.24**
WCH	618-11	Individual Site (non discounted)	$82.13	$82.13	$82.13	$82.13	$82.13
	618-11	Discounted (PV)	**$64.73**	$64.73	$64.73	$64.73	$64.73

	Waste Site		WCH	CHPRC Alt 2	CHPRC Alt 3	CHPRC Alt 4	CHPRC Alt 5
		ND = Non Discounted	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS
PRC	UPR-300-10	$0.28					
			Capital Cost	$0.00	$0.00	$0.00	$0.00
			Annual	$0.02	$0.02	$0.02	$0.02
			Periodic	$0.94	$0.94	$0.94	$0.94
			Individual Site (non discounted)	$0.96	$0.96	$0.96	$0.96
			Discounted (PV)	**$0.75**	**$0.75**	**$0.75**	**$0.75**
PRC	UPR-300-12	$0.21		*No cost, it's assumed tha*	*NO COST*	*NO COST*	*NO COST*
PRC	UPR-300-2						
			Capital Cost	$1.03	$1.03	$1.03	$1.03
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$1.03	$1.03	$1.03	$1.03
			Discounted (PV)	**$1.00**	**$1.00**	**$1.00**	**$1.00**
PRC	UPR-300-48	$0.13					
			Capital Cost	$0.00	$0.00	$0.00	$0.00
			Annual	$0.02	$0.02	$0.02	$0.02
			Periodic	$0.44	$0.44	$0.44	$0.44
			Individual Site (non discounted)	$0.46	$0.46	$0.46	$0.46
			Discounted (PV)	**$0.36**	**$0.36**	**$0.36**	**$0.36**
PRC	316-1						
			Capital Cost	$0.00	$0.00	$70.97	$355.20
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.00	$0.00	$70.97	$355.20
			Discounted (PV)	**$0.00**	**$0.00**	**$68.76**	**$344.10**
PRC	316-2						
			Capital Cost	$0.00	$0.00	$0.00	$220.03
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.00	$0.00	$0.00	$220.03
			Discounted (PV)	**$0.00**	**$0.00**	**$0.00**	**$213.16**
PRC	316-3 (phos & GW source RTD)			WCH Cost	WCH Cost		
			Capital Cost	$2.02	$2.02	$24.89	$155.21
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$2.02	$2.02	$24.89	$155.21
			Discounted (PV)	**$2.02**	**$2.02**	**$24.11**	**$150.36**
PRC	316-5						
			Capital Cost	$0.00	$0.00	$123.78	$229.99
			Annual	$0.00	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.00	$0.00	$123.78	$229.99
			Discounted (PV)	**$0.00**	**$0.00**	**$119.91**	**$222.81**
WCH	Contingency			Pre ROD sites presumed to fail contingency			
			Capital Cost	$1.59	$1.59	$1.59	$1.59
				$1.57	$1.57	$1.57	$1.57
	Institutional Controls	5-Year Review (300 Area) 150 yrs	**Total Non-Discounted**	**$0.63**	**$0.63**	**$0.63**	**$0.63**
			Total Discounted (PV)	**$0.19**	**$0.19**	**$0.19**	**$0.19**
	Institutional Controls	Programmatic ICs (300 Area) 150 Yrs	**Total Non-Discounted**	**$25.60**	**$25.60**	**$25.60**	**$25.60**
			Total Discounted (PV)	**$10.10**	**$10.10**	**$10.10**	**$10.10**
			Total Capital (Non-discounted)	$244.588	$244.588	$462.212	$1308.626
			Total Annual (Non-discounted)	$25.876	$25.876	$25.876	$25.876
			Total Periodic (Non-discounted)	$10.522	$10.522	$10.522	$10.522
			Total Non-Discounted	$280.987	$280.987	$498.610	$1345.025
			Total Discounted (PV)	**$229.751**	**$229.751**	**$440.511**	**$1260.477**

Table A-1b – Uranium Sequestration Costs

Table 1-2 - Totals

COMPARISON OF TOTAL COST OF RESPONSE ACTION ALTERNATIVES*		
Site:	Area 300 GW	Base Year: 2013
Location:	Hanford, WA	Date: June 27, 2012
Phase:	FS	Rev:

	Alternative 3	Alternative 4
	ALT 3 - U Sequestration Sites	ALT 4 - U Sequestration Sites
Cost Summary		
Capital Cost	$31,433,000	$21,830,000
% of Total Non-discounted cost	24.19%	25.23%
Total Annual Cost	$90,619,000	$59,636,000
% of Total Non-discounted cost	69.73%	68.91%
Total Periodic Cost	$7,913,000	$5,074,000
% of Total Non-discounted cost	6%	6%
Non-Discounted	**$129,965,000**	**$86,540,000**
Real Discount Rate	**0.9%**	**0.7%**
Total Present Value of Alternative (Discounted)	**$125,608,000**	**$85,080,000**
***Expected Accuracy Range for total present value is +50%/-30%**		
-30%	**$87,926,000**	**$59,556,000**
50%	**$188,412,000**	**$127,620,000**

*Notes:
Range of accuracy is expected to be +50%/-30%

Table A-2 – Groundwater Monitoring Costs

Table 1-2 - Totals

	B	D	E	F	G
2	**COMPARISON OF TOTAL COST OF RESPONSE ACTION ALTERNATIVES***				
4	**Site:**	Area 300 GW		**Base Year:**	2013
5	**Location:**	Hanford, WA		**Date:**	June 27 2012
6	**Phase:**	FS		**Rev:**	0
7					
8		**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
9		**Alt 2 Groundwater Monitoring**	**Alt 3 Groundwater Monitoring**	**Alt 4 Groundwater Monitoring**	**Alt 5 Groundwater Monitoring**
10	Total Duration (years)	**34**	**22**	**18**	**16**
11	Time to MCLs, years	**28**	**16**	**12**	**10**
12	General OU Monitoring Wells	**6**	**6**	**6**	**6**
13	Monitoring Duration for General MWs, years	**33**	**21**	**17**	**15**
14	Additional MWs for Phosphate Sequestration	**NA**	**25**	**25**	**NA**
15	Monitoring Duration for Phosphate Sequestration MWs, years	**NA**	**9**	**9**	**NA**
36	**Cost Summary**				
37	Capital Cost	$822,000	$3,544,000	$3,544,000	$822,000
38	% of Total Non-discounted cost	18.19%	27.85%	28.53%	30.02%
39	Total Annual Cost	$2,363,000	$7,242,000	$7,010,000	$1,317,000
40	% of Total Non-discounted cost	52.29%	56.90%	56.43%	48.10%
41	Total Periodic Cost	$1,335,000	$1,941,000	$1,870,000	$600,000
42	% of Total Non-discounted cost	30%	15%	15%	22%
43	**Non-Discounted**	**$4,519,000**	**$12,727,000**	**$12,423,000**	**$2,738,000**
44	**Real Discount Rate**	**2.0%**	**1.8%**	**1.6%**	**1.5%**
45	**Total Present Value of Alternative (Discounted)**	**$3,260,000**	**$11,480,000**	**$11,410,000**	**$2,450,000**
46	**Expected Accuracy Range for total present value is +50%/-30%**				
47	**-30%**	**$2,282,000**	**$8,036,000**	**$7,987,000**	**$1,715,000**
48	**50%**	**$4,890,000**	**$17,220,000**	**$17,115,000**	**$3,675,000**
49					
50	*Notes:				
51	Range of accuracy is expected to be +50%/-30%				
52					

Table A-3 – Waste Site Quantity Inputs

Table A-8 - Waste Site Quantity Inputs

IMPORTANT QUANTITIES (not linked to Totals)

Alternative Name	Alt 2 (VZ)	Alt 3 (VZ)	Alt 4 (VZ)	Alt 5 (VZ)
Excavation				
Site Name/Number				
300 RLWS	WCH costs used	WCH costs used	WCH costs used	WCH costs used
300 RRLWS	WCH costs used	WCH costs used	WCH costs used	WCH costs used
300-11	WCH costs used	WCH costs used	WCH costs used	WCH costs used
300-15 Pipeline 2 (2013)				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft	37488	37488	37488	37488
Width, ft	3	3	3	3
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	NA	NA	0	0
Expected Safety Level	NA	NA	D	D
Manual Product Removal	NA	NA	NO	NO
Existing Cover (ft)	NA	NA	Sand/gravel	Sand/gravel
Replacement Cover	NA	NA	Sand/seeding	Sand/seeding
Dewatering Required	NA	NA	NO	NO
Waste Site Base Area (sf)	112464	112464	112464	112464
Waste Site Ground Surface Area (sf)	1801584	1801584	1801584	1801584
Total Volume of Excavation (cy)	611432	611432	611432	611432
Total Volume Contaminated (cy)	9580	9580	9580	9580
300-15 Pipeline (2027)				
Start Date	Jan. 2027	Jan. 2027	Jan. 2027	Jan. 2027
Length, ft	10560	10560	10560	10560
Width, ft	3	3	3	3
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	NA	NA	0	0
Expected Safety Level	NA	NA	D	D
Manual Product Removal	NA	NA	NO	NO
Existing Cover (ft)	NA	NA	Sand/gravel	Sand/gravel
Replacement Cover	NA	NA	Sand/seeding	Sand/seeding
Dewatering Required	NA	NA	NO	NO
Waste Site Base Area (sf)	31680	31680	31680	31680
Waste Site Ground Surface Area (sf)	31680	31680	31680	31680
Total Volume of Excavation (cy)	20240	20240	20240	20240
Total Volume Contaminated (cy)	20240	20240	20240	20240
300-175				
Start Date	Jan. 2027	Jan. 2027	Jan. 2027	Jan. 2027
Length, ft	10	10	10	10
Width, ft	10	10	10	10
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	100	100	100	100
Waste Site Ground Surface Area (sf)	3025	3025	3025	3025
Total Volume of Excavation (cy)	998	998	998	998
Total Volume Contaminated (cy)	64	64	64	64
300-2				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft	14	14	14	14
Width, ft	14	14	14	14
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	196	196	196	196
Waste Site Ground Surface Area (sf)	3481	3481	3481	3481
Total Volume of Excavation (cy)	1175	1175	1175	1175
Total Volume Contaminated (cy)	125	125	125	125
300-214	WCH costs used	WCH costs used	WCH costs used	WCH costs used
300-22	WCH costs used	WCH costs used	WCH costs used	WCH costs used
300-255	WCH costs used	WCH costs used	WCH costs used	WCH costs used
300-257	WCH costs used	WCH costs used	WCH costs used	WCH costs used
300-263	WCH costs used	WCH costs used	WCH costs used	WCH costs used
300-265	WCH costs used	WCH costs used	WCH costs used	WCH costs used
300-269				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft	102	102	102	102
Width, ft	49	49	49	49
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel

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Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	5004	5004	5004	5004
Waste Site Ground Surface Area (sf)	13819	13819	13819	13819
Total Volume of Excavation (cy)	6013	6013	6013	6013
Total Volume Contaminated (cy)	3197	3197	3197	3197
300-283				
Start Date	**Jan. 2013**	NA	**Jan. 2013**	NA
Length, ft	27	27	27	27
Width, ft	27	27	27	27
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	C	C	C	C
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	729	729	729	729
Waste Site Ground Surface Area (sf)	5184	5184	5184	5184
Total Volume of Excavation (cy)	1889	1889	1889	1889
Total Volume Contaminated (cy)	466	466	466	466
300-277				
Start Date	Jan. 2013	NA	Jan. 2013	NA
Length, ft	420	420	420	420
Width, ft	420	420	420	420
Depth, ft	3	3	3	3
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	176400	176400	176400	176400
Waste Site Ground Surface Area (sf)	184041	184041	184041	184041
Total Volume of Excavation (cy)	23028	23028	23028	23028
Total Volume Contaminated (cy)	22540	22540	22540	22540
300-279	WCH costs used	WCH costs used	WCH costs used	WCH costs used
300-280				
Start Date	Jan. 2013	NA	Jan. 2013	NA
Length, ft	98	98	98	98
Width, ft	56	56	56	56
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	5285	5285	5285	5285
Waste Site Ground Surface Area (sf)	13853	13853	13853	13853
Total Volume of Excavation (cy)	6113	6113	6113	6113
Total Volume Contaminated (cy)	3377	3377	3377	3377
300-281				
Start Date	Jan. 2013	NA	Jan. 2013	NA
Length, ft	13	13	13	13
Width, ft	6	6	6	6
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	70	70	70	70
Waste Site Ground Surface Area (sf)	2908	2908	2908	2908
Total Volume of Excavation (cy)	951	951	951	951
Total Volume Contaminated (cy)	45	45	45	45
300-282	still on list but should have no cost, part of site 300-15			
300-284				
Start Date	Jan. 2013	NA	Jan. 2013	NA
Length, ft	63	63	63	63
Width, ft	39	39	39	39
Depth, ft	2	2	2	2
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	2478	2478	2478	2478
Waste Site Ground Surface Area (sf)	3128	3128	3128	3128
Total Volume of Excavation (cy)	239	239	239	239
Total Volume Contaminated (cy)	211	211	211	211
300-286				

Start Date	Jan. 2013	NA	Jan. 2013	NA
Length, ft	10	10	10	10
Width, ft	10	10	10	10
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	100	100	100	100
Waste Site Ground Surface Area (sf)	3025	3025	3025	3025
Total Volume of Excavation (cy)	998	998	998	998
Total Volume Contaminated (cy)	64	64	64	64
300-287				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft	9	9	9	9
Width, ft	9	9	9	9
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	22	22	22	22
Waste Site Ground Surface Area (sf)	2547	2547	2547	2547
Total Volume of Excavation (cy)	821	821	821	821
Total Volume Contaminated (cy)	14	14	14	14
300-288				
Start Date	Jan. 2013	NA	Jan. 2013	NA
Length, ft	23	23	23	23
Width, ft	16	16	16	16
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	355	355	355	355
Waste Site Ground Surface Area (sf)	4103	4103	4103	4103
Total Volume of Excavation (cy)	1424	1424	1424	1424
Total Volume Contaminated (cy)	227	227	227	227
300-289				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft	20	20	20	20
Width, ft	12	12	12	12
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	242	242	242	242
Waste Site Ground Surface Area (sf)	3712	3712	3712	3712
Total Volume of Excavation (cy)	1263	1263	1263	1263
Total Volume Contaminated (cy)	155	155	155	155
300-290				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft	24	24	24	24
Width, ft	26	26	26	26
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	612	612	612	612
Waste Site Ground Surface Area (sf)	4864	4864	4864	4864
Total Volume of Excavation (cy)	1749	1749	1749	1749
Total Volume Contaminated (cy)	391	391	391	391
300-291				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft	151	151	151	151
Width, ft	20	20	20	20
Depth, ft	4	4	4	4
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO

Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	2970	2970	2970	2970
Waste Site Ground Surface Area (sf)	5161	5161	5161	5161
Total Volume of Excavation (cy)	693	693	693	693
Total Volume Contaminated (cy)	506	506	506	506
300-292				
Start Date	Jan, 2013	Jan, 2013	Jan, 2013	Jan, 2013
Length, ft	3280	3280	3280	3280
Width, ft	3	3	3	3
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	NA	NA	0	0
Expected Safety Level	NA	NA	D	D
Manual Product Removal	NA	NA	NO	NO
Existing Cover (ft)	NA	NA	Sand/gravel	Sand/gravel
Replacement Cover	NA	NA	Sand/seeding	Sand/seeding
Dewatering Required	NA	NA	NO	NO
Waste Site Base Area (sf)	9840	9840	9840	9840
Waste Site Ground Surface Area (sf)	159600	159600	159600	159600
Total Volume of Excavation (cy)	54127	54127	54127	54127
Total Volume Contaminated (cy)	6287	6287	6287	6287
300-293				
Start Date	Jan, 2013	Jan, 2013	Jan, 2013	Jan, 2013
Length, ft	5400	5400	5400	5400
Width, ft	3	3	3	3
Depth, ft	3	3	3	3
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	NA	NA	0	0
Expected Safety Level	NA	NA	D	D
Manual Product Removal	NA	NA	NO	NO
Existing Cover (ft)	NA	NA	Sand/gravel	Sand/gravel
Replacement Cover	NA	NA	Sand/seeding	Sand/seeding
Dewatering Required	NA	NA	NO	NO
Waste Site Base Area (sf)	16200	16200	16200	16200
Waste Site Ground Surface Area (sf)	64908	64908	64908	64908
Total Volume of Excavation (cy)	5182	5182	5182	5182
Total Volume Contaminated (cy)	2070	2070	2070	2070
300-294				
Start Date	Jan, 2013	Jan, 2013	Jan, 2013	Jan, 2013
Length, ft	54	54	54	54
Width, ft	54	54	54	54
Depth, ft	4	4	4	4
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	2905	2905	2905	2905
Waste Site Ground Surface Area (sf)	4343	4343	4343	4343
Total Volume of Excavation (cy)	617	617	617	617
Total Volume Contaminated (cy)	495	495	495	495
300-295	Re-estimate!!	see notes in word		
Start Date	Jan, 2013	Jan, 2013	Jan, 2013	Jan, 2013
Length, ft	3280	3280	3280	3280
Width, ft	3	3	3	3
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	NA	NA	0	0
Expected Safety Level	NA	NA	D	D
Manual Product Removal	NA	NA	NO	NO
Existing Cover (ft)	NA	NA	Sand/gravel	Sand/gravel
Replacement Cover	NA	NA	Sand/seeding	Sand/seeding
Dewatering Required	NA	NA	NO	NO
Waste Site Base Area (sf)	9840	9840	9840	9840
Waste Site Ground Surface Area (sf)	159600	159600	159600	159600
Total Volume of Excavation (cy)	54127	54127	54127	54127
Total Volume Contaminated (cy)	6287	6287	6287	6287
300-296	these numbers came from WCH baseline $$ (32 MSR_ROC_IPB_CPR_by_WESL2WG567) 2011			
300-32	WCH costs used			
300-34	No cost, this site is considered part of site 300-15		part of 300-15	
300-39	WCH costs used			
300-4				
Start Date	Jan, 2027	Jan, 2027	Jan, 2027	Jan, 2027
Length, ft	66	66	66	66
Width, ft	69	69	69	69
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	4520	4520	4520	4520
Waste Site Ground Surface Area (sf)	12597	12597	12597	12597

Total Volume of Excavation (cy)	5468	5468	5468	5468
Total Volume Contaminated (cy)	2888	2888	2888	2888
300-5	WCH cost s used			
300-7	these numbers came from WCH baseline $$ (32 MSR_ROC_IPB_CPR_by_WBSL2WG567) 2011			
300-9	these numbers came from WCH baseline $$ (32 MSR_ROC_IPB_CPR_by_WBSL2WG567) 2011			
309-WS-1	combined with 300-39			
309-WS-2	combined with 300-39			
309-WS-3	combined with 300-39			
316-1				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft				
Width, ft				
Depth, ft			40	40
Area, ac			3	15
Depth, ft				
Depth of Excavation below Water Table (ft)				
Expected Safety Level				
Manual Product Removal				
Existing Cover (ft)				
Replacement Cover				
Dewatering Required				
Waste Site Base Area (sf)			117015	645157
Waste Site Ground Surface Area (sf)			213513	852929
Total Volume of Excavation (cy)			281561	1275636
Total Volume Contaminated (cy)			199359	1099156
316-2				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft				
Width, ft				
Depth, ft				40
Area, ac				10
Depth, ft				
Depth of Excavation below Water Table (ft)				
Expected Safety Level				
Manual Product Removal				
Existing Cover (ft)				
Replacement Cover				
Dewatering Required				
Waste Site Base Area (sf)				430492
Waste Site Ground Surface Area (sf)				602961
Total Volume of Excavation (cy)				879637
Total Volume Contaminated (cy)				739491
316-3				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft				
Width, ft				
Depth, ft			40	40
Area, ac			1	6
Depth, ft				
Depth of Excavation below Water Table (ft)				
Expected Safety Level				
Manual Product Removal				
Existing Cover (ft)				
Replacement Cover				
Dewatering Required				
Waste Site Base Area (sf)			40418	271907
Waste Site Ground Surface Area (sf)			103068	411454
Total Volume of Excavation (cy)			122229	582123
Total Volume Contaminated (cy)			68860	463249
316-5				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft				
Width, ft				
Depth, ft			40	40
Area, ac			6	12
Depth, ft				
Depth of Excavation below Water Table (ft)				
Expected Safety Level				
Manual Product Removal				
Existing Cover (ft)				
Replacement Cover				
Dewatering Required				
Waste Site Base Area (sf)			279549	537022
Waste Site Ground Surface Area (sf)			420843	727298
Total Volume of Excavation (cy)			596630	1077014
Total Volume Contaminated (cy)			476269	914926
323 TANK 1	WCH cost s used			
323 TANK 2	WCH cost s used			
323 TANK 3	WCH cost s used			
323 TANK 4	WCH cost s used			
325 WTF				
Start Date	Jan. 2027	Jan. 2027	Jan. 2027	Jan. 2027
Length, ft	116	116	116	116
Width, ft	116	116	116	116
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	13456	13456	13456	13456

Waste Site Ground Surface Area (sf)	25921	25921	25921	25921
Total Volume of Excavation (cy)	12579	12579	12579	12579
Total Volume Contaminated (cy)	8597	8597	8597	8597
331 LSLT1				
Start Date	Jan. 2027	Jan. 2027	Jan. 2027	Jan. 2027
Length, ft	7	7	7	7
Width, ft	7	7	7	7
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	49	49	49	49
Waste Site Ground Surface Area (sf)	2704	2704	2704	2704
Total Volume of Excavation (cy)	879	879	879	879
Total Volume Contaminated (cy)	31	31	31	31
331 LSLT2				
Start Date	Jan. 2027	Jan. 2027	Jan. 2027	Jan. 2027
Length, ft	7	7	7	7
Width, ft	7	7	7	7
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	49	49	49	49
Waste Site Ground Surface Area (sf)	2704	2704	2704	2704
Total Volume of Excavation (cy)	879	879	879	879
Total Volume Contaminated (cy)	31	31	31	31
340 Complex				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft	263	263	263	263
Width, ft	263	263	263	263
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	68906	68906	68906	68906
Waste Site Ground Surface Area (sf)	94556	94556	94556	94556
Total Volume of Excavation (cy)	52217	52217	52217	52217
Total Volume Contaminated (cy)	44023	44023	44023	44023
400 PPSS				
Start Date	Jan. 2027	Jan. 2027	Jan. 2027	Jan. 2027
Length, ft	180	180	180	180
Width, ft	180	180	180	180
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	32400	32400	32400	32400
Waste Site Ground Surface Area (sf)	50625	50625	50625	50625
Total Volume of Excavation (cy)	26522	26522	26522	26522
Total Volume Contaminated (cy)	20700	20700	20700	20700
400-37				
Start Date	Jan. 2027	Jan. 2027	Jan. 2027	Jan. 2027
Length, ft	24	24	24	24
Width, ft	24	24	24	24
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	557	557	557	557
Waste Site Ground Surface Area (sf)	4706	4706	4706	4706
Total Volume of Excavation (cy)	1681	1681	1681	1681
Total Volume Contaminated (cy)	356	356	356	356
400-38				
Start Date	Jan. 2027	Jan. 2027	Jan. 2027	Jan. 2027
Length, ft	15	15	15	15
Width, ft	15	15	15	15
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA

Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	225	225	225	225
Waste Site Ground Surface Area (sf)	3600	3600	3600	3600
Total Volume of Excavation (cy)	1222	1222	1222	1222
Total Volume Contaminated (cy)	144	144	144	144
600-367	post_ROD-to to site			
Start Date	2013	2013	2013	2013
Length, ft				
Width, ft				
Depth, ft				
Area, ac	9	9	9	9
Depth, ft	15	15	15	15
Depth of Excavation below Water Table (ft)				
Expected Safety Level				
Manual Product Removal				
Existing Cover (ft)				
Replacement Cover				
Dewatering Required				
Waste Site Base Area (sf)				
Waste Site Ground Surface Area (sf)	434064	434064	434064	434064
Total Volume of Excavation (cy)	259024	259024	259024	259024
Total Volume Contaminated (cy)	240730	240730	240730	240730
600-2902				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft	0	0	0	0
Width, ft	0	0	0	0
Depth, ft	0	0	0	0
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	0	0	0	0
Waste Site Ground Surface Area (sf)	0	0	0	0
Total Volume of Excavation (cy)	0	0	0	0
Total Volume Contaminated (cy)	0	0	0	0
600-58	This site is a RCRA site which is cost uder the RCRA closure program			
600-59	This site is a RCRA site which is cost uder the RCRA closure program			
600-60	This site is a RCRA site which is cost uder the RCRA closure program			
600-62	This site is a RCRA site which is cost uder the RCRA closure program			
600-63	This site is a RCRA site which is cost uder the RCRA closure program			
618-1				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft				
Width, ft				
Depth, ft				40
Area, ac				1
Depth, ft				
Depth of Excavation below Water Table (ft)				
Expected Safety Level				
Manual Product Removal				
Existing Cover (ft)				
Replacement Cover				
Dewatering Required				
Waste Site Base Area (sf)				37930
Waste Site Ground Surface Area (sf)				99072
Total Volume of Excavation (cy)				116709
Total Volume Contaminated (cy)				64621
618-10	No cost, currently remediating			
618-11	WCH costs used			
618-2				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft				
Width, ft				
Depth, ft				40
Area, ac				2
Depth, ft				
Depth of Excavation below Water Table (ft)				
Expected Safety Level				
Manual Product Removal				
Existing Cover (ft)				
Replacement Cover				
Dewatering Required				
Waste Site Base Area (sf)				84020
Waste Site Ground Surface Area (sf)				167987
Total Volume of Excavation (cy)				214673
Total Volume Contaminated (cy)				143145
618-3				
Start Date	Jan. 2013	Jan. 2013	Jan. 2013	Jan. 2013
Length, ft				
Width, ft				
Depth, ft				40
Area, ac				1
Depth, ft				
Depth of Excavation below Water Table (ft)				

Expected Safety Level				
Manual Product Removal				
Existing Cover (ft)				
Replacement Cover				
Dewatering Required				
Waste Site Base Area (sf)				58620
Waste Site Ground Surface Area (sf)				131128
Total Volume of Excavation (cy)				161637
Total Volume Contaminated (cy)				99871
UPR-300-10				
Start Date	Jan. 2027	Jan. 2027	Jan. 2027	Jan. 2027
Length, ft	50	50	50	50
Width, ft	50	50	50	50
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	2500	2500	2500	2500
Waste Site Ground Surface Area (sf)	9025	9025	9025	9025
Total Volume of Excavation (cy)	3682	3682	3682	3682
Total Volume Contaminated (cy)	1597	1597	1597	1597
UPR-300-2				
Start Date	Jan. 2013	NA	Jan. 2013	NA
Length, ft	51	51	51	51
Width, ft	51	51	51	51
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	2591	2591	2591	2591
Waste Site Ground Surface Area (sf)	9197	9197	9197	9197
Total Volume of Excavation (cy)	3765	3765	3765	3765
Total Volume Contaminated (cy)	1655	1655	1655	1655
UPR-300-48				
Start Date	Jan. 2027	Jan. 2027	Jan. 2027	Jan. 2027
Length, ft	20	20	20	20
Width, ft	20	20	20	20
Depth, ft	15	15	15	15
Area, ac	NA	NA	NA	NA
Depth, ft	NA	NA	NA	NA
Depth of Excavation below Water Table (ft)	0	0	0	0
Expected Safety Level	D	D	D	D
Manual Product Removal	NO	NO	NO	NO
Existing Cover (ft)	Sand/gravel	Sand/gravel	Sand/gravel	Sand/gravel
Replacement Cover	Sand/seeding	Sand/seeding	Sand/seeding	Sand/seeding
Dewatering Required	NO	NO	NO	NO
Waste Site Base Area (sf)	400	400	400	400
Waste Site Ground Surface Area (sf)	4225	4225	4225	4225
Total Volume of Excavation (cy)	1477	1477	1477	1477
Total Volume Contaminated (cy)	256	256	256	256
UPR-300-5	No cost, it's assumed that this site is part of site 305			
Void Fill Grouting				
300-35				
Pipe Diameter, in	2"	2"	2"	2"
Length, feet	10560	10560	10560	10560
Depth to invert, feet	15	15	15	15
Expect Safety Level	D	D	D	D
Capping/Barrier				
300-4				
Cap Type	RCRA D	RCRA D	RCRA D	RCRA D
Area, (ac)	0	0	0	0
Safety Level	D	D	D	D
Notes	Maintain cap until 2027	Maintain cap until 2027	Maintain cap until 2027	Maintain cap until 2027
Area, sf	4521	4521	4521	4521

Table A-4 – Groundwater Monitoring Quantity Inputs

	TRACE V3 Setup			
SCOPE PARAMETER	ALTERNATIVE 2	ALTERNATIVE 3	ALTERNATIVE 4	ALTERNATIVE 5
GROUNDWATER				
Groundwater Monitoring Wells - Overall OU	6	6	6	6
GW MW Depth, feet	60	60	60	60
Time to Reach MCLs, years	28	16	12	10
Verification Monitoring After MCLs Reached, years	5	5	5	5
Total GW Monitoring Duration, years	33	21	17	15
Annual Monitoring Frequency Per Well - 1st year	4	4	4	4
Annual Monitoring Frequency Per Well - from 2nd year to year MCLs met	1	1	1	1
Annual Monitoring Frequency Per Well - post MCL verification monitoring period	2	2	2	2
Groundwater Monitoring Wells - Phosphate Sequestration Zones	NA	25	25	NA
GW MW Depth, feet	NA	60	60	NA
Monitoring Period, years	NA	4	4	NA
Verification Monitoring After MCLs Reached, years	NA	5	5	NA
Total GW Monitoring Duration, years	NA	9	9	NA
Annual Monitoring Frequency Per Well - 1st year	NA	4	4	NA
Annual Monitoring Frequency Per Well - from 2nd year to end of sequestration	NA	4	4	NA
Verification Monitoring After MCLs Reached, per well	NA	2	2	NA
MW Replacement Period, years	30	30	30	30
MW Pump Replacement Period, years	5	5	5	5

Table A-5 - Uranium Sequestration Quantity Inputs

TABLE 1-1 - Setup

TRACE V3 Setup Parameters: 300 Area FS - U Sequestration Sites			
SCOPE PARAMETER	GENERAL PARAMETERS	ALTERNATIVE 3	ALTERNATIVE 4
Square feet per acre	43,560		
Excavation Depth, ft	40		
Phosphate Infiltration Depth, ft	40		
PRZ In jection Well Depth	40		
Aquifer Injection Well Depth	60		
Infiltration Design Flow, gpm/acre	150		
PRZ per Well per injection, gallons (@ 200 gpm)	83,397		
PRZ chemistry cost per well per injection	$38,000		
Aquifer per Well per injection, gallons (@ 100 gpm)	521,233		
Aquifer chemistry cost per well per injection	$27,852		
SITE/AREA, PARAMETER			
316-1		ALT 3	ALT 4
Phosphate infiltration area, ft2		645,157	528,142
Phosphate infiltration area, acres		14.8	12.1
Phosphate infiltration depth, ft		40	40
Infiltration treatment volume, ft3		25,806,280	21,125,680
Infiltration Design Flow Rate, gpm		2,222	1,819
Process systems building, ft2		3000	3000
Phosphate tank size, gal		16000	13000
# Phosphate tanks		4	4
Equalization tank size, gal		25000	20000
# Equalization tanks		4	4
Pump size, gpm		750	750
# Pumps		4	3
Phosphate infiltration timeframe, yrs		2	2
PRZ Injection area, ft2		222,643	105,628
PRZ Injection wells		90	43
Ave. Area per PRZ injection well,ft2		2474	2,456
Avg. injection well depth, ft		40	40
Injection well diameter, in		8	8
Injections per year		1	1
Injection timeframe, yrs		2	2
U source RTD area, ft2		NA	0
U source area depth		NA	0
Contaminated volume, ecy		NA	0
Uncontaminated backfill, ecy		NA	0
Surface restoration area, acres		NA	0.0
Health & Safety Level for Excavation		NA	D
316-2		ALT 3	ALT 4
Phosphate infiltration area, ft2		430,492	430,492
Phosphate infiltration area, acres		9.88	9.88
Phosphate infiltration depth, ft		40	40
Infiltration treatment volume, ft3		17,219,680	17,219,680
Infiltration Design Flow Rate, gpm		1,482	1,482
Process systems building, ft2		3000	3000
Phosphate tank size, gal		11000	11000
# Phosphate tanks		4	4
Equalization tank size, gal		17000	17000
# Equalization tanks		4	4
Pump size, gpm		500	500
# Pumps		4	4
Phosphate infiltration timeframe, yrs		2	2
PRZ Injection area, ft2		86,098	86,098
PRZ Injection wells		35	35
Ave. Area per PRZ injection well,ft2		2,460	2,460
Avg. injection well depth, ft		40	40
Injection well diameter, in		8	8
Injections per year		1	1
Injection timeframe, yrs		2	2
U source RTD area, ft2		NA	NA
U source area depth		NA	NA
Contaminated volume, ecy		NA	NA
Uncontaminated backfill, ecy		NA	NA
Surface restoration area, acres		NA	NA
Health & Safety Level for Excavation		NA	NA
316-3		ALT 3	ALT 4
Phosphate infiltration area, ft2		271,907	231,489
Phosphate infiltration area, acres		6.24	5.31
Phosphate infiltration depth, ft		40	40
Infiltration treatment volume, ft3		10,876,280	9,259,560
Infiltration Design Flow Rate, gpm		936	797
Process systems building, ft2		2000	2000
Phosphate tank size, gal		7500	6000
# Phosphate tanks		4	4
Equalization tank size, gal		11000	9000
# Equalization tanks		4	4
Pump size, gpm		300	250
# Pumps		4	4
Phosphate infiltration timeframe, yrs		2	2
PRZ Injection area, ft2		86,716	46,298
PRZ Injection wells		36	19
Ave. Area per PRZ injection well,ft2		2,409	2,437
Avg. injection well depth, ft		40	40
Injection well diameter, in		8	8
Injections per year		1	1
Injection timeframe, yrs		2	2
U source RTD area, ft2		NA	0
U source area depth		NA	0

TABLE 1-1 - Setup

Contaminated volume, ecy	NA	0
Uncontaminated backfill, ecy	NA	0
Surface restoration area, acres	NA	0
Health & Safety Level for Excavation	NA	D
316-5	ALT 3	ALT 4
PHI- Phosphate infiltration area, ft2	116,702	257,473
PHI- Phosphate infiltration area, acres	2.7	5.9
PHI- Phosphate infiltration depth, ft	40	40
PHI- Infiltration treatment volume, ft3	4,668,080	10,298,920
PHII- Phosphate infiltration area, ft2	420,320	NA
PHII- Phosphate infiltration area, acres	9.6	NA
PHII- Phosphate infiltration depth, ft	40	NA
PHII- Infiltration treatment volume, ft3	16,812,800	NA
Infiltration Design Flow Rate, gpm	1,447	887
Process systems building, ft2	2,000	2000
Transfer piping length, ft		
Transfer piping diameter, in		
Phosphate tank size, gal	11,000	6000
# Phosphate tanks	4	4
Equalization tank size, gal	17,000	9000
# Equalization tanks	4	4
Pump size, gpm	500	250
# Pumps	4	4
Infiltration Design Flow Rate, gpm	0	NA
Process systems building, ft2	0	NA
Phosphate tank size, gal	11000	NA
# Phosphate tanks	0	NA
Equalization tank size, gal	17000	NA
# Equalization tanks	0	NA
Pump size, gpm	500	NA
# Pumps	0	NA
PHI - Phosphate infiltration timeframe, yrs	2	2
PHII - Phosphate infiltration timeframe, yrs	2	NA
PHI - PRZ injection area, ft2	116,702	51,495
PHI - PRZ injection wells	47	21
PHI - Ave. Area per PRZ injection well,ft2	2483	2,452
PHI - Avg. injection well depth, ft	40	40
PHI - Injection well diameter, in	80	80
PHI - Injections per year	1	1
PHI - Injection timeframe, yrs	2	2
PHII - PRZ injection area, ft2	214,942	NA
PHII - PRZ injection wells	87	NA
PHII - Ave. Area per PRZ injection well,ft2	2464	NA
PHII - Avg. injection well depth, ft	40	NA
PHII - Injection well diameter, in		NA
PHII - Injections per year	1	NA
PHII - Injection timeframe, yrs	2	NA
U source RTD area, ft2		0
U source area depth	NA	0
Contaminated volume, ecy	NA	0
Uncontaminated backfill, ecy	NA	0
Surface restoration area, acres	NA	0
Health & Safety Level for Excavation	NA	D
618-1	ALT 3	ALT 4
Phosphate infiltration area, ft2	37,932	37,932
Phosphate infiltration area, acres	0.87	0.87
Phosphate infiltration depth, ft	40	40
Infiltration treatment volume, ft3	1,517,280	1,517,280
Infiltration Design Flow Rate, gpm	622	622
Process systems building, ft2	2000	2,000
Phosphate tank size, gal	5000	5,000
# Phosphate tanks	4	4
Equalization tank size, gal	7000	7,000
# Equalization tanks	4	4
Pump size, gpm	200	200
# Pumps	4	4
Phosphate infiltration timeframe, yrs	2	2
PRZ injection area, ft2	7,586	7,586
PRZ injection wells	4	4
Ave. Area per PRZ injection well,ft2	1897	1897
Injections per year	1	1
Injection timeframe, yrs	2	2
618-2	ALT 3	ALT 4
Phosphate infiltration area, ft2	83,980	83,980
Phosphate infiltration area, acres	1.93	1.93
Phosphate infiltration depth, ft	40	40
Infiltration treatment volume, ft3	3,359,200	3,359,200
Process systems building, ft2		
Transfer piping length, ft		
Transfer piping diameter, in		
Phosphate tank size, gal		
# Phosphate tanks		
Equalization tank size, gal		
# Equalization tanks		
Pump size, gpm		
# Pumps		
Phosphate infiltration timeframe, yrs	2	2
PRZ injection area, ft2	16,796	16,796
PRZ injection wells	7	7
Ave. Area per PRZ injection well,ft2	2,399	2399
Injections per year	1	1

TABLE 1-1 - Setup

Injection timeframe, yrs	2	2
618-8	ALT 3	ALT 4
Phosphate infiltration area, ft2	58,652	58,652
Phosphate infiltration area, acres	1.35	1.35
Phosphate infiltration depth, ft	40	40
Infiltration treatment volume, ft3	2,346,080	2,346,080
Process systems building, ft2		
Transfer piping length, ft		
Transfer piping diameter, in		
Phosphate tank size, gal		
# Phosphate tanks		
Equalization tank size, gal		
# Equalization tanks		
Pump size, gpm		
# Pumps		
Phosphate infiltration timeframe, yrs	2	2
PRZ injection area, ft2	11,730	11,730
PRZ injection wells	5	5
Ave. Area per PRZ injection well,ft2	2,346	2346
Injections per year	1	1
Injection timeframe, yrs	2	2
Aquifer injection for Sequestration	ALT 3	ALT 4
Aquifer Injection Wells - Phase I	6	18
Aquifer Injection Wells - Phase II	12	NA
Injections per Year	1	1

CH2MHILL Plateau Remediation Company

Environmental Calculation Cover Page

Part 1: Completed by the Responsible Manager

Project: 300 Area

Date: 09/26/2012

Calculation Title & Description: 300 Area Cost Estimate Input. The calculation describes the methodology and results for providing the cost estimators with input values for their cost estimates.

Preparer: Gene Ng	**Basis of Qualification:** Project Engineer for Feasibility Study
Checker: Tom Mooney	**Basis of Qualification:** Document Lead for 300 Area RI/FS
Senior Reviewer: Marty Doornbos	**Basis of Qualification:** CHPRC RI/FS Reviewer

Part 2: Completed by Preparer

Calculation No.: ECF-300FF5-11-0171

Revision No.: 0

Revision History:

Revision No.	Description	Date	Affected Pages

Part 3: Document Review & Approval:

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Terms

CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
COPC	Chemical of Potential Concern
DOE	U.S. Department of Energy
ECF	Environmental Calculation File
ft	Feet
ft^2	Square Feet
ft3	Cubic Feet
FS	Feasibility Study
IC	Institutional Control
O&M	Operations and Maintenance
OU	Operable Unit
PP	Proposed Plan
PRZ	Periodically Re-wetted Zone
RTD	Removal, Treatment, Disposal
WCH	Washington Closure Hanford
WIDS	Waste Information Data System

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1 Purpose

The purpose of this calculation is to document and describe cost estimate inputs and key assumptions that support the Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units (OU) (DOE/RL-2010-99). The feasibility study (FS) cost inputs are derived from features, physical parameters, and characteristics of the 300 Area source OUs and 300 Area groundwater OU. The FS cost estimates will be prepared to an accuracy of +50%/-30%, and used as part of the detailed comparative analysis or remedial action alternatives under Comprehensive Environmental Response, Compensation, and Liability Act of 1980, (CERCLA). The cost estimating process will be documented in a separate calculation brief. This analysis ultimately leads to recommendation of a preferred alternative in the proposed plan (PP).

2 Background

This calculation brief supports development of remedial alternative cost estimates for the identified 300 Area source OU waste sites and the 300 Area groundwater OU plumes. A range of alternatives was developed in the FS, for each target area based on the type of Preliminary Remediation Goal (PRG) exceeded.

The following remedial action alternatives were developed for consideration in the FS:

Waste Site and Groundwater Alternatives:

Alternative 1 - No Action. The NCP (40 CFR 300.430(e)(6)) requires consideration of a No Action Alternative. The No Action Alternative, which serves as a baseline for evaluating other remediation action alternatives, is retained throughout the FS process. No action means that no remediation would be implemented to alter the existing conditions. For this alternative, it has been assumed that all site remedial activities and interim actions (with the possible exception of backfilling any open excavations that are not safe) will be discontinued in December 2012. No conceptual designs or cost estimates are prepared for Alternative 1 because no actions are proposed.

Alternative 2 – RTD at Waste Sites; MNA; Groundwater Monitoring; and ICs. Alternative 2 uses primarily shallow RTD (less than 4.6 m [15 ft] bgs) for 300-FF-2 OU waste sites, MNA for tritium, TCE, and cis- 1,2-DCE in groundwater, and monitoring and institutional controls (ICs) for uranium and other COCs and COPCs in groundwater. For residual soil contamination at remediated 300-FF-2 OU waste sites that are evaluated in the FS because of PRG exceedances, the RTD components of this alternative replaces the RTD components of the 300-FF-2 interim ROD (EPA/ROD/R10-01/119), using the PRGs developed in this FS. For waste sites that have not undergone interim actions, the actions will vary depending on the nature and extent of contamination at the waste site. The actions will include one or more of the following:

- RTD of the contaminated soil and debris with concentrations above PRGs for direct exposure (human and ecological), treatment as necessary to meet disposal facility requirements, and disposal at the Environmental Restoration Disposal Facility (ERDF) or another facility approved by EPA. It is anticipated that all the RAOs would be achieved at depths of less than 4.6 m (15 ft). Contaminated non-pipeline engineered structures (e.g., burial ground trenches, drums, caissons, and VPUs) present at greater depths will also be removed.
- RTD of the pipelines that are shallower than or at 4.6 m (15 ft) bgs for the protection of human health and ecological receptors from direct exposure.

- RTD of the contaminated pipelines at waste site 300-15 to variable depths to achieve human health and ecological direct exposure and groundwater protection PRGs. For preliminary design and costing purposes, the depth of excavation across the entire waste site will be assumed to be 4.6 m (15 ft) bgs. During remedial implementation, soil and pipelines will be only be excavated if contamination exceeds the direct exposure PRGs for human health and ecological receptors in the upper 4.6 m (15 ft) and for groundwater protection throughout the soil column. To facilitate remediation, an approach similar to that being used for the ongoing interim action may be deployed. This approach excavates the pipeline to a depth of 3 m (10 ft) bgs, and then makes a determination whether the HHE direct exposure and groundwater protection PRGs have been achieved. Additional excavation to a maximum of 4.6 m (15 ft) bgs will be performed if HHE direct exposure PRGs and the groundwater protection PRGs have not been achieved. Excavation of soil and pipelines below 4.6 m (15 ft) bgs will only be performed if groundwater protection PRGs have not been achieved.
- MNA for tritium, TCE, and cis-1,2-DCE in groundwater.
- Groundwater monitoring and ICs for uranium, tritium, TCE, cis-1,2-DCE, nitrate, and groundwater COPCs.
- ICs will be implemented for the protection of human health and ecological receptors during the timeframe of this remedial alternative.

Temporary surface caps will be installed over the waste sites that are adjacent to the 300 Area facilities and utilities that will remain in operation through at least 2027 (long-term facilities). In addition, pipelines inaccessible for the RTD remedy because of their close proximity to long-term facilities will be interim void filled, as necessary, to immobilize uranium waste in pipelines for groundwater protection. When the long-term facilities are no longer in use and removed, the waste sites and pipelines will be remediated as described above.

Alternative 3 – RTD at Waste Sites; Phased Implementation of Uranium Sequestration in the Vadose Zone, PRZ, and Top of the Aquifer; MNA; Groundwater Monitoring; and ICs. Alternative 3 uses primarily shallow RTD (less than 4.6 m [15 ft] bgs) for 300-FF-2 OU waste sites, uranium sequestration for deep uranium contamination in the vadose zone and top of aquifer, MNA for tritium, TCE, and cis-1,2-DCE in groundwater, and monitoring and ICs for uranium and other COCs and COPCs in groundwater. For residual soil contamination at remediated 300-FF-1 and 300-FF-2 waste sites being evaluated in the FS because of PRG exceedances, this alternative builds off the interim actions previously completed using the PRGs developed in this FS. For 300-FF-2 waste sites that have not undergone interim actions, the actions will vary depending on the nature and extent of contamination at the waste site. The actions will include one or more of the following:

- RTD - Same as Alternative 2.
- Phased implementation of uranium sequestration in the vadose zone and PRZ using a combination of surface infiltrations and deep injection techniques into the PRZ for the waste sites with uranium contamination deeper than 4.6 m (15 ft) bgs.
- Phased implementation of uranium sequestration at the top of the aquifer using injection wells at and downgradient of the primary liquid waste disposal sites. The primary purpose of injecting phosphate at the top of the aquifer will be to sequester any untreated uranium that may be mobilized from the vadose zone during surface infiltration and injection into the PRZ. Phosphate solutions injected at the top of the aquifer also will contact the lower portion of the PRZ when the water table rises.
- MNA for tritium, tritium, TCE, and cis-1,2-DCE in groundwater.

- Groundwater monitoring and ICs for uranium, tritium, TCE, cis-1,2-DCE, nitrate, and groundwater COPCs.
- ICs will be implemented for the protection of human health and ecological receptors during the timeframe of this remedial alternative.

Temporary surface caps and interim void filling for pipelines will be implemented for long-term facilities, as described for Alternative 2. When the long-term facilities are no longer in use and removed, the waste sites and pipelines will be remediated as described above.

Alternative 4 – RTD at Waste Sites; Focused Deep RTD in the Vadose Zone and PRZ; Uranium Sequestration in the Vadose Zone, PRZ, and Top of the Aquifer; MNA; Groundwater Monitoring; and ICs. Alternative 4 uses primarily shallow RTD (less than 4.6 m [15 ft] bgs) for 300 FF-2 OU waste sites, focused deep RTD and uranium sequestration for deep uranium contamination in the vadose zone and top of aquifer, MNA for tritium TCE, and cis-1,2-DCE in groundwater, and monitoring and ICs for uranium and other COCs and COPCs . For residual soil contamination at remediated waste sites that are evaluated in the FS because of PRG exceedances, this alternative builds off the interim actions previously completed using the PRGs developed in this FS. For waste sites that have not undergone interim actions, the actions will vary depending on the nature and extent of contamination at the waste site. The actions will include one or more of the following:

- RTD - Same as Alternative 2.
- Focused deep RTD in areas of higher uranium mass in the vadose zone deeper than 4.6 m (15 ft) bgs.
- Uranium sequestration in the vadose zone using a combination of surface infiltration and deep injection techniques into the PRZ in areas of lower uranium mass deeper than 4.6 m (15 ft) bgs.
- Uranium sequestration at the top of the aquifer using injection wells at and downgradient of the primary liquid waste disposal sites. The primary purpose of injecting phosphate at the top of the aquifer will be to sequester any untreated uranium that may be mobilized from the vadose zone during surface infiltration and injection into the PRZ. Phosphate solutions injected at the top of the aquifer also will contact the lower portion of the PRZ when the water table rises.
- MNA for tritium, tritium, TCE, and cis-1,2-DCE in groundwater.
- Groundwater monitoring and ICs for uranium, tritium, TCE, cis-1,2-DCE, nitrate, and groundwater COPCs.
- ICs will be implemented for the protection of human health and ecological receptors during the timeframe of this remedial alternative.

Temporary surface caps and interim void filling for pipelines will be implemented for long-term facilities, as described for Alternative 2. When the long-term facilities are no longer in use and removed, the waste sites and pipelines will be remediated as described above.

Alternative 5 – RTD at Waste Sites; Extensive Deep RTD in the Vadose Zone and PRZ; MNA; Groundwater Monitoring; and ICs. Alternative 5 uses RTD almost exclusively for 300-FF-2 OU waste sites and for deep uranium contamination in the vadose zone and PRZ contributing to the uranium groundwater plume. It also relies on MNA for tritium, TCE, and cis-1,2-DCE in groundwater, and monitoring and ICs for uranium and other COCs and COPCs. For residual soil contamination at remediated 300-FF-2 OU waste sites that are evaluated in the FS because of PRG exceedances, this alternative builds off the interim actions previously completed using the PRGs developed in this FS. For 300-FF-2 OU waste sites that have not undergone interim actions, the actions will vary depending on the nature and extent of contamination at the waste site. The actions will include one or more of the following:

- RTD - Same as Alternative 2.
- Expanded deep RTD in areas of higher uranium mass in the vadose zone deeper than 4.6 m (15 ft) bgs.
- MNA for tritium, tritium, TCE, and cis-1,2-DCE in groundwater.
- Groundwater monitoring and ICs for uranium, tritium, TCE, cis-1,2-DCE, nitrate, and groundwater COPCs.
- ICs will be implemented for the protection of human health and ecological receptors during the timeframe of this remedial alternative.

Temporary surface caps and interim void filling for pipelines will be implemented for long-term facilities, as described for Alternative 2. When the long-term facilities are no longer in use and removed, the waste sites and pipelines will be remediated as described above.

3 Methodology

Development of the cost inputs for the 300 Area alternatives generally requires simple calculations performed in Microsoft Excel (MS Excel)™ spreadsheets. Examples of the types of calculations included in this calculation brief include:

- Area of treatment (ft2) = Length of excavation (ft) x width of excavation (ft)
- Volume of treatment (ft3) = Area of treatment (ft2) x depth (ft)

Due to the basic nature of these calculations, development of a detailed methodology for each calculation is not necessary. Section 4 provides the key inputs and assumptions that support each calculation and section 6 provides a summary of the spreadsheet calculations.

™ Microsoft Excel (MS Excel) is a trademark of Microsoft Corporation.

4 Assumptions and Inputs

This section describes the overall assumptions applicable to the 300 Area alternatives. Information used in the input forms primarily came from Chapters 8, 9, 10 and Appendix I of the FS Report (DOE/RL-2010-99). Information from the FS report is summarized in Attachment 1- Summary of Cost Estimate Inputs.

Key Assumptions:

1. Phosphate application for uranium sequestration
    a. The Alternative 3 and 4 target remediation areas and quantities for uranium sequestration (phosphate infiltration, PRZ injection, and aquifer injection) are presented in Figures 1 and 2.
    b. The costs of the Alternative 3 and 4 surface infiltration systems are based on a 2008 design by Alexco Resources, and a 2012 cost quotation for piping and leachfield systems from Ore-Max (Attachment 2). The base system was assumed to cover one acre of land. Costs for different size systems were assumed to be linear since the majority of the costs are for materials.
    c. The length of piping for Alternative 3 and 4 was measured from the Conceptual Design Figures prepared for the FS, and presented in the 2012 cost quotation from Ore-Max (Attachment 2).
    d. PRZ injection wells installed to a depth of 40 feet at 50 foot centers in selected areas are assumed for Alternative 3 and 4 (Figures 1 and 2). The PRZ injections are assumed to include annual injections of 41,699 gallons of phosphate solution per injection per well, over 2 years.
    e. Eighteen aquifer injection wells installed to a depth of 60 feet are assumed for Alternative 3 and 4 (Figures 1 and 2). Aquifer injections are assumed to include annual injections of 521,233 gallons of phosphate solution per injection well, over 2 years.
2. Phosphate chemical costs
    a. A $0.13 per cubic foot is the amount applied to determine the phosphate infiltration chemical costs. The phosphate chemical blend for infiltration is assumed to be a 1,500 mg/L solution of 80 percent orthophosphate and 20 percent polyphosphate. Volume of treatment via phosphate infiltration was determined by multiplying the surface area by depth to groundwater. This cost does not include O&M.
    b. A cost of $38,000 per injection well per event was used for PRZ phosphate injection chemical costs, including phosphate and xanthan gum. The phosphate chemical blend for PRZ injection is assumed to be a 1,500 mg/L solution of 80 percent orthophosphate and 20 percent polyphosphate. This cost does not include O&M.
    c. A cost of $27,852 per injection well per event was used for aquifer phosphate injection chemical costs. The phosphate chemical blend for aquifer injection is assumed to be a 1,000 mg/L solution of 100 percent orthophosphate. This cost does not include O&M.
3. Continued Monitoring
    a. Continued Monitoring for groundwater COCs includes the cost to sample the new wells at the same frequency as the existing monitoring network.

4. Areas of contamination

   a. Dimensions for contamination at some waste sites were supplied by Washington Closure Hanford (WCH).

   b. When no dimensions were supplied by WCH, the historical waste site dimension from Waste Information Data System (WIDS) was used.

   c. In the cases where no dimensions for the waste sites or diameters of pipe were available, assumptions based on waste site type and previous knowledge from 100-K and 100-H/D cost estimates were utilized to approximate dimensions.

5. Contingency for Waste Site Remediation Initiated under IROD

   Waste sites currently being remediated under the interim action ROD or are anticipated to begin remediation by the time the ROD is signed. For the 300 Area cost estimate, it is expected that interim actions will achieve the required PRGs for most of these sites and that no additional actions will be required. To account for the possibility that the PRGs are not achieved during the interim action, it is assumed that 20 percent of the waste sites that have uranium as a COPC will require additional remediation under the new ROD. The waste sites included in the cost evaluation are 300 RLWS, 300 RRLWS, 300-16, 300-219, 300-224, 300-24, 300-249, 300-251, 300-268, 300-270, 300-276, 300-28, 300-40, 300-43, 313 ESSP, 333 WSTF, 3712 USSA, UPR-300-38, UPR-300-39, UPR-300-40, and UPR-300-45. Estimated RTD costs for each of these sites were provided by WCH. For the purposes of the 300 Area accost estimate, 20 percent of the total estimated RTD costs for these sites ($1,594,000) was used the contingency cost.

6. Sitewide or Programmatic Institutional Controls (ICs)

   The estimated costs for providing the sitewide or programmatic ICs including site access, personnel badging, real estate and deeds, warning signs along the Columbia River bank and other access points, maintaining a current site wide institutional controls plan, controls for excavating soil, accessing and using groundwater, and irrigation restrictions are also included in the costs developed for each alternative:

   a. These costs were assembled and where appropriate a 50% adjustment was made to represent CERCLA cleanup as a portion of the current Hanford Site mission. The TPA currently identifies 22 CERCLA Records of Decision, so each ROD would be allocated an equal portion of the CERCLA programmatic ICs costs.

   b. The programmatic ICs costs are projected for the next 150 years. In 2068 ICs costs are reduced by 50% to reflect removal of the 100 area reactors, as the more active programmatic controls, like site access, would be likewise reduced.

   c. The total non-discounted cost for the ICs for 150 years is estimated to be $563,000,000 for the Hanford site (about $26,000,000 per ROD). The total discounted cost for the ICs at Hanford are estimated at $221,000,000 (about $10,000,000 per ROD).

   d. The total non-discounted cost for the 5-Year Reviews for 150 years is estimated to be $14,000,000 (about $630,000 per ROD). The total discounted cost for the 5-Year Reviews for 150 years is estimated to be $4,000,000 (about $190,000 per ROD).

Waste Site	Phase	Area Color	Area m^2 (ft^2)[a]	PRZ Injection Wells (311 Total)
316-1	2	Brown	10,871 (117,015)	47
	2	Blue	49,066 (528,142)	43
316-2	2	Blue	39,994 (430,492)	35
316-3	2	Brown	3,755 (40,418)	17
	2	Blue	21,506 (231,489)	19
316-5	1	Brown	10,842 (116,702)	47
	2	Brown	15,129 (162,847)	66
	2	Blue	23,920 (257,473)	21
618-1	2	Blue	3,524 (37,932)	4
618-2	2	Blue	7,802 (83,980)	7
618-3	2	Blue	5,449 (58,652)	5

Notes:
a - Waste site areas were determined using ArcGIS software and available geospatial data.

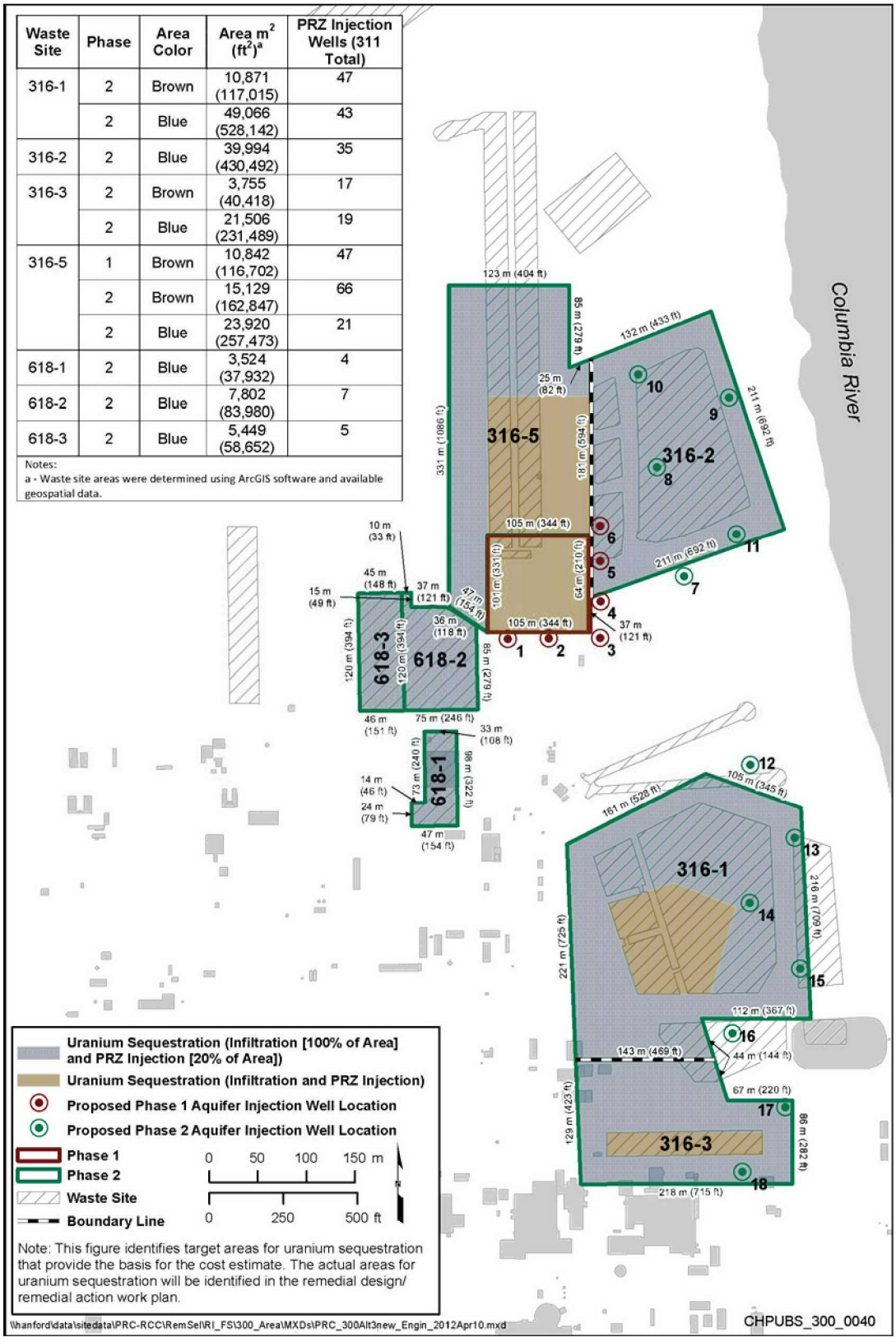
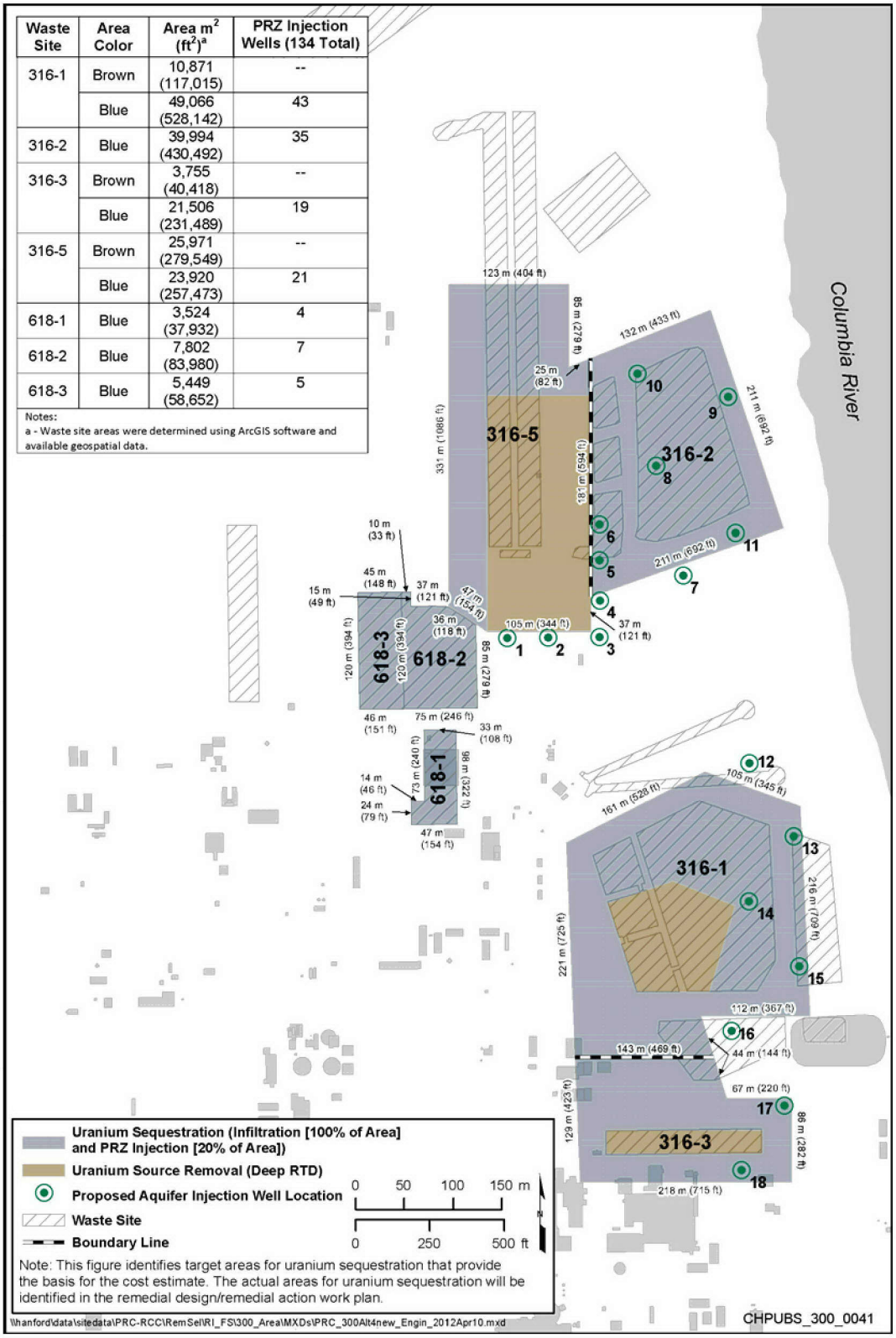


Figure 1. Alternative 3 Target Remediation Areas for Uranium Sequestration



Waste Site	Area Color	Area m^2 (ft^2)[a]	PRZ Injection Wells (134 Total)
316-1	Brown	10,871 (117,015)	--
	Blue	49,066 (528,142)	43
316-2	Blue	39,994 (430,492)	35
316-3	Brown	3,755 (40,418)	--
	Blue	21,506 (231,489)	19
316-5	Brown	25,971 (279,549)	--
	Blue	23,920 (257,473)	21
618-1	Blue	3,524 (37,932)	4
618-2	Blue	7,802 (83,980)	7
618-3	Blue	5,449 (58,652)	5

Notes:
a - Waste site areas were determined using ArcGIS software and available geospatial data.

Figure 2. Alternative 4 Target Remediation Areas for Uranium Sequestration

5 Software Applications

Microsoft Office Excel 2007 was used to perform the calculations. Excel is a "Site Licensed Client Software" and is exempt from formal control requirements of PRC-PRO-IRM-309, Controlled Software Management.

6 Calculations

This section provides calculations for cost estimate inputs for selective alternatives. The following calculations were performed in support of cost estimating for waste site excavations.

1. Volume of treatment for phosphate infiltration for Alternative 3 and 4: The treatment volume for phosphate infiltration was calculated by multiplying the surface area of waste sites (ft^2) by the depth to groundwater (assumed to be 40 ft).
2. PRZ Injection well numbers for Alternative 3 and 4: For the brown regions shown in Figure 1 and 2, the PRZ injections well numbers of were calculated by dividing the areas (ft^2) by the assumed PRZ injection well treatment area of 2,500 ft^2. For the blue regions shown in Figure 1 and 2, the PRZ injection well numbers were calculated by dividing the areas (ft^2) by the assumed PRZ injection well treatment area of 2,500 ft^2, and multiplying by 20 percent.
3. Injection volume for phosphate injection in the PRZ (per injection well): PRZ well injection volumes were scaled down from the injection volume used during the phosphate injection pilot study (262,000 gallons, PNNL-18529), assuming a treatment area of 2,500 ft^2 over a 10 ft injection interval for each PRZ injection well.
4. Injection volume for phosphate injection in the aquifer (per injection well): Aquifer well injection volumes were scaled up from the injection volume used during the phosphate injection pilot study (262,000 gallons, PNNL-18529), assuming a treatment area of 31,250 ft^2 over a 10 ft injection interval for each aquifer injection well.

7 Results/Conclusions

The cost inputs, assumptions, and calculations presented in the previous sections were used to develop detailed descriptions for each alternative, and document cost estimate assumptions in standard estimating forms to be used by the estimator. Attached tables include the important details for waste site and groundwater alternatives submitted to the cost estimators.

8 References

DOE/RL-2010-97, Rev. 0, *Remedial Investigation/Feasibility Study for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units*. CH2M Hill Plateau Remediation Company, Richland, Washington

ECE-300FF511-00011, Rev.0, *Environmental Cost Estimate for 300 Area Waste Sites & Groundwater RI/FS*, CH2M Hill Plateau Remediation Company, Richland, Washington

Attachment 1- Summary of Cost Estimate Inputs

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Attachment 1. Summary of Cost Estimate Inputs

General Waste Site Information				Information for Development of Alternatives						
Waste Site	**Site History**	**Feasibility Study Designation**	**Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
300 RLWS	The 300 Area Radioactive Liquid Waste Sewer (RLWS) consists of a network of underground, double-encased, stainless-steel pipe (encased in reinforced-fiberglass or plastic pipe as secondary containment) that transfers radioactive liquid wastes from the generating facilities (324, 325, 325-A, 326, 327, and 329 Buildings) to the 340 Complex. The system was retired in 1998. Contaminants would include uranium, acids, bases, metals, solvents, and fission products. Contaminated soil and piping is estimated to be 8,000 m^3 (280,000 ft^3).	"Accepted" - Remediation Initiated under IROD	Pipeline	6.43 acres	6.4 m (21 ft)	Uranium, radionuclides, metals, organics	1) RTD 6.43 acres of pipeline to 6.4 m (21 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 6.43 acres of pipeline to 6.4 m (21 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 6.43 acres of pipeline to 6.4 m (21 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 6.43 acres of pipeline to 6.4 m (21 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.
300 RRLWS	A network of single-walled, stainless-steel piping and carbon-steel fittings buried between 3 and 6 m (10 and 20 ft) below grade. Received radioactive wastes from various 300 Area facilities including the fuel fabrication and R&D laboratories. Wastes discharged to the sewer included water and small quantities of chemicals, decontamination solutions, aqueous fuel fabrication solutions, acids, and bases. Contaminants of potential concern would include uranium, mercury, acids, bases, fission products, metals, and solvents.	"Accepted" - Remediation Initiated under IROD	Pipeline	20 cm (8 in.) 457 m (1,500 ft)	6 m (20 ft)	Uranium, radionuclides, metals, organics	1) RTD pipeline length of 457 m (1,500 ft) to 6 m (20 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 457 m (1,500 ft) to 6 m (20 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 457 m (1,500 ft) to 6 m (20 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 457 m (1,500 ft) to 6 m (20 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.
300-11	The unmarked site is comprised of gasoline-impacted, subsurface soil from a gasoline UST. The release was discovered after leak test failure in 1992. The UST was removed. Contaminated remains unremediated.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	7.43 m^2 (80 ft^2)	Ranges from to 1.6 m to 6.25m (5.4 to 20.5 ft)	Petroleum hydrocarbons	1) RTD area of 7.43 m2 (80 ft2) to 6.25 m (20.5 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.43 m2 (80 ft2) to 6.25 m (20.5 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.43 m2 (80 ft2) to 6.25 m (20.5 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.43 m2 (80 ft2) to 6.25 m (20.5 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-121	The site received condensate from the air receivers inside the 3621D Building. It may also have received spills that reached the floor drains. Petroleum and ethylene glycol contamination is possible.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	9.29 m^2 (100 ft^2)	Soil beneath foundation removal to 4.6 m (15 ft)	Petroleum hydrocarbons, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-123	The site is a French drain that received steam condensate from the 366 Building fuel oil bunker loading station. The French drain is a vertical, metal culvert covered with a 0.7 m (2.25 ft) diameter, diamond plate, metal cover.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Petroleum hydrocarbons	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.

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Attachment 1. Summary of Cost Estimate Inputs

General Waste Site Information			Information for Development of Alternatives							
Waste Site	**Site History**	**Feasibility Study Designation**	**Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
300-15	This underground, process sewer extends throughout the 300 Area. Transfers process wastes (potable water, cooling water, precipitation runoff, waste brine solution [NaCl with Mg salts], Cr, Cu, U, nitrate, sulfate, and fluoride ions with Pb, Ag, acetone, and cyanide. The sewer network includes the original system (20 cm [8 in.] diameter vitrified clay piping with acid-proof joints) which directed liquid waste eastward to the 316-1 and 316-2 Process Pond until 1975, then to the 300 Area Trenches from 1975 to 1994. Starting in 1994, the discharges utilized a new pipeline to the 300 Area TEDF for treatment and release to the Columbia River. Initially, the system received low-level liquid wastes from the 313 and 314 Buildings, and later from the 3706 and 321 Laboratories. The 321 Building connected to the main 20 cm (8 in.) diameter lines through a combination of 8 cm (3 in.) diameter stainless-steel, 20 cm (8 in.) diameter wrought iron, and 15 cm (6 in.) diameter earthenware pipes, all of acid-proof construction. By 1994, more than 50 facilities were connected to the process sewer. As the system was updated and expanded, pipe materials included the original vitrified clay, and iron, steel, concrete, PVC, and stainless steel piping.	"Accepted" - Remediation Initiated under IROD	Site exceeds groundwater protection criteria for total uranium isotopes and ecological risk criteria for Arochlor-1248. (Chapter 5 and 7). However, portions of the site remain unremediated (which will be remediated after the ROD is signed).	Pipeline length of 14,645 m (48,048 ft)	variable	Metals, cyanide, organics	1) RTD pipeline length of 14,645 m (48,048 ft) to variable depths. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 14,645 m (48,048 ft) to variable depths. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 14,645 m (48,048 ft) to variable depths. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 14,645 m (48,048 ft) to variable depths. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.
300-16	On three occurrences, radioactive contamination (yellow cake uranium) was discovered on the bottom ends of several utility poles that had been removed.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-175	The site is a concrete French drain, with a metal lid, that received non-dangerous/nonradioactive steam condensate. The operational flow rate was <0.04 L/min (0.01 gal/min).	"Accepted" - to be Remediated after ROD signed	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	9.29 m2 (100 ft2)	soil beneath foundation removal to 4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) after demolition of structure. Remediate after 2027 with building 325. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) after demolition of structure. Remediate after 2027 with building 325. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) after demolition of structure. Remediate after 2027 with building 325. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) after demolition of structure. Remediate after 2027 with building 325. 2) Disposal at ERDF or other approved disposal facility.
300-2	About 189,250 L (50,000 gal) of secondary cooling water and other contaminated water containing 33 mCi of I-133 and 12 mCi of I-131 were discharged to the ground. About 10 µCi of alpha emitters (calculated as Pu-239) and about 40 mCi of non-volatile beta emitters, plus rutheniums, were transferred to the trench during the first 36 hours of the incident. A small number of short pumpings were made after that. However, the total volume and radioisotopic inventory are insignificant in comparison to those during the first 36 hours.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	18 m2 (194 ft2)	4.6 m (15 ft)	Radionuclides	1) RTD area of 18 m2 (194 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 18 m2 (194 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 18 m2 (194 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 18 m2 (194 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.

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Attachment 1. Summary of Cost Estimate Inputs

General Waste Site Information			Information for Development of Alternatives							
Waste Site	**Site History**	**Feasibility Study Designation**	**Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
300-214	The site is a subsurface, carbon-steel and PVC pipeline that transfers liquid waste from the 308, 324, 325, 326, 327, and 329 Buildings to the 307 Retention Basins. The waste discharged to the RPS is nonhazardous, potentially radioactive waste (not to exceed 5,000 pCi/L). In FY 1998, approximately 12 million L (3 million gal) flowed through the RPS to the 307 Retention Basins.	"Accepted" - Remediation Initiated under IROD	Pipeline	1,344 m (4,409 ft) in length	4.6 m (15 ft)	Radionuclides	1) RTD pipeline length of 1344 m (4,409 ft) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 1344 m (4,409 ft) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 1344 m (4,409 ft) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipeline length of 1344 m (4,409 ft) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-218	This building is one of the original World War II-era 300 Area, Manhattan Engineering District/DuPont structures. Exterior walls and partitions are concrete block. The floor is reinforced-concrete with test pits and a basement room at the west end. A small second floor or mezzanine exists at the west end of the building.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-219	Includes transfer lines connecting components of the 300 Area Waste Acid Treatment System (WATS) and the Uranium Recovery Operations (URO). Piping, located in Pipe Trench 300-224, includes: 1) 333 N Fuels process transfer lines to process acid waste solution storage tanks in 333 and 334-A Facilities; 2) waste transfer lines to waste treatment facilities in 313 Uranium Recovery/WATS Neutralization Room; 3) transfer lines to/from 313 Building to neutralized acid waste storage tanks in 311 Tank Farm, 4) ethylene glycol supply and return lines in Pipe Trench between 333 and 313 Buildings used to heat this portion of Pipe Trench; 5) fresh nitric and sulfuric acid lines from 334 Tank Farm to 333 Building; and 6) caustic lines from Tank Farm to 313 WATS/URO Room. As of 11/1/1998, all process and waste piping inside associated facilities had been disconnected from the Pipe Trench. Only piping inside the Pipe Trench or outside the facilities (e.g., tank farm piping) remains for pipes associated with the 300 Area WATS/URO Acid Treatment System.	"Accepted" - Remediation Initiated under IROD	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides, metals, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-22	The site is a UPR from a parted hose coupling that contaminated the ground outside the emergency airlock of the 309 Building on 9/20/1962. The site is covered with new asphalt. The asphalt area is roped off and trucks are not allowed on the asphalt. The rupture loop annex is present below ground at the site.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	15 m2 (162 ft2)	4.6 m (15 ft)	Radionuclides	1) RTD area of 15 m2 (162 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 15 m2 (162 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 15 m2 (162 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 15 m2 (162 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-224	The site is a subsurface, concrete pipe trench with concrete block and metal plate covers. The pipe trench has several sections that allow piping connections to be made between process operations in the 313 Building, the 303 -F Building, the 311 Tank Farm, the 333 Building, the 334-A Building, and the 334 Tank Farm. The pipe trench and subsurface soil have become contaminated due to multiple releases into the trench. Releases included acids, bases, and solvents. Some of released acids contained dissolved uranium.	"Accepted" - Remediation Initiated under IROD	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-24	This site is contaminated soil near the 314 Building. Mostly uranium and a trace of Cs-137 were detected in soil samples from the trench near the 314 Building at a gross alpha count of 896 pCi/g.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, Cesium-137	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.

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General Waste Site Information			Information for Development of Alternatives							
Waste Site	**Site History**	**Feasibility Study Designation**	**Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
300-249	This site is the residual, radioactive contamination, remaining from former operations at the 304 Building, that was not closed out as part of 304 Uranium Concretion Facility closure.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-251	Uranium contaminated soil around and under the 303-K Building (aka, the 303-K CWS). The 303-K Building was removed and clean closed on 7/22/2002.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-255	Soil contamination exists inside the 309 Building Tank Farm fenced area. The source of the contamination was probably the piping related to tanks 309-TW-1, -2 and -3. Potential radioactive contaminants are Cs-137, Co-60, and Am-241. Potential hazardous contaminants are Ba, Cd, Cr, Pb, and Se.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	528 m2 (5,683 ft2)	4.6 m (15 ft)	Radionuclides and metals	1) RTD area of 528 m2 (5,683 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 528 m2 (5,683 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 528 m2 (5,683 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 528 m2 (5,683 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.
300-257	The site is process sewer piping that originally discharged radioactive, liquid waste from the 309 Building's Rupture Loop Holding Tank to the Columbia River. The waste is the process sewer piping. The tank was removed in the late 1970s. Concurrently, the Rupture Loop Holding Tank was removed to a 200 Area burial ground, and the RLWS connections were severed and plugged. The former Rupture Loop Holding Tank area is not a parking lot.	"Accepted" - Remediation Initiated under IROD	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0.9 m (2.95 ft) diameter, 451 m (1,480 ft)	5.9 m (19.3 ft)	Radionuclides	1) RTD length of 451 m (1,480 ft) to 5.9 m (19.3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD length of 451 m (1,480 ft) to 5.9 m (19.3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD length of 451 m (1,480 ft) to 5.9 m (19.3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD length of 451 m (1,480 ft) to 5.9 m (19.3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-258	The site is an abandoned, subsurface, concrete, pipe trench that housed acid transfer piping from the 334 Tank Farm to the 306E Building chemical processing bay in the facility's northeastern corner. From about 1972 to1975, waste etch solution may have been transferred from the 306E Building chemical bay to the 333/334 WATS.	"Accepted" - Remediation Initiated under IROD	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-263	The site is an inactive, unused catch tank. Hazardous or radioactive waste was never transferred from the 324 Building to the tank, which is isolated, and the pipelines are capped. Sample results indicated Cs-137 to be 509 pCi/L. Gross beta was 1,700 pCi/L. During sampling, 15.2 cm (6 in.) of rainwater had accumulated in the sample area. The water is believed to have come from intrusion because many of the flange bolts were missing. The contamination may have been from surface contamination.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	38 m2 (409 ft2)	4.6 m (15 ft)	Cesium-137	1) RTD area of 38 m2 (409 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 38 m2 (409 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 38 m2 (409 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 38 m2 (409 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-265	The transfer line carried liquid High-Level Waste from spent nuclear fuel processing.	"Accepted" - to be Remediated after ROD signed	Pipeline	The pipes are 3/8 and 3/4" and are encased within a 2" which is encased in a 4" pipe. There are 2 pipelines laid in parallel that would be excavated with 1 trench or 328 m (1,076 ft).	2.29 m (7.5 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	1) RTD 328 m (1,076 ft) length to 2.29 m (7.5 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 328 m (1,076 ft) length to 2.29 m (7.5 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 328 m (1,076 ft) length to 2.29 m (7.5 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD 328 m (1,076 ft) length to 2.29 m (7.5 ft) bgs. Remediate after 2027. 2) Disposal at ERDF or other approved disposal facility.

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300-268	The contamination related to this building were a result of passive dust from machining irradiated uranium, graphite, and other metallic samples from the 305 Test Pile. The contamination, if remaining, would be associated with any remaining concrete foundation.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-269	The site is a rectangular concrete building foundation. The 331-A Building was used for biological research and demolished in 2000. Residual contamination may be on the pad from past releases at the building.	"Accepted" - to be Remediated after ROD signed	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	465 m2 (5,005 ft2)	Soil beneath foundation removal to 4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB, TPH	1) RTD area of 465 m2 (5,005 ft2) to 4.6 m (15 ft) bgs, after demolition of structure	1) RTD area of 465 m2 (5,005 ft2) to 4.6 m (15 ft) bgs, after demolition of structure	1) RTD area of 465 m2 (5,005 ft2) to 4.6 m (15 ft) bgs, after demolition of structure	1) RTD area of 465 m2 (5,005 ft2) to 4.6 m (15 ft) bgs, after demolition of structure
300-270	The UPR is a milky-white flow of water discharged from a pipe located below the loading dock on the east side of the 313 Building. The dock is used by Richland Specialty Extrusions to store metal (e.g., aluminum) cylinders. The pipe drains stormwater from the 313 Building roof. The release was to the compacted gravel and soil ground surface. The stormwater is non-dangerous and nonradioactive. Soil collected from the area near the pipe showed elevated Pb levels. The contaminated soil was not caused by the milky-white liquid. The Pb source was not documented.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Lead	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-273	The encased pipeline contains two, 7.6 cm (3 in.) diameter stainless-steel lines. The underground pipeline transferred fuel oil from the 366 Fuel Oil Bunkers (300-6) to the underground Fuel Oil Day Tanks (300-223) to run the 384 Powerhouse.	"Accepted" - Remediation Initiated under IROD	Pipeline	0	0	Petroleum hydrocarbons, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-274	Transite pipe, treated wood, insulation, and various forms of transite were identified during the OU walk down. The debris was potential asbestos-containing material.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Asbestos, metals, PCBs	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-276	The site includes the surface and subsurface sewer system. The original 300 Area Sanitary Sewer System serviced all existing 300 Area Buildings and a process line from the 313 Building with vitrified clay sanitary sewer pipes. The 1943 system fed into a large septic tank with a connection to a tile drainage field. In 1947, a new tile field, overflow ditch, and connecting ditch were added to increase capacity. During that construction, uranium contamination was discovered in the sanitary sewer sludge and water. The system was expanded again in 1951, to cope with the increasing number of 300 Area facilities by adding two more septic tanks and north and south leaching trenches to replace the old tile field. The system continued to be used until 1996, when the 300 Area SSS was connected to the City of Richland's municipal water treatment system. The SSS potentially contains radioactive and chemical contaminants.	"Accepted" - Remediation Initiated under IROD	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.

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300-277	Unplanned Release. Truck being screened with instruments in the queue leaving the IRA area for ERDF.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	16,248 m2 (174,892 ft2)	1 m (3 ft)	Radionuclides, metals, VOC, SVOC, PCB, asbestos, TPH	1) RTD area of 16,248 m2 (174,892 ft2) to 1 m (3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 16,248 m2 (174,892 ft2) to 1 m (3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 16,248 m2 (174,892 ft2) to 1 m (3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 16,248 m2 (174,892 ft2) to 1 m (3 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-279	This feature consists of the historical location of underground diesel and gasoline storage tanks that were located to the north of the original 313 Bldg. (M-2885, Sheet 1), and east of the original 3716 Automotive Repair Bldg. location. The northern expansion of the 313 Bldg. was over this area where the tanks were located.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	37 m2 (398 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 37 m2 (398 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37 m2 (398 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37 m2 (398 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37 m2 (398 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-28	The site is contaminated asphalt and soil beneath Gingko Street. New asphalt patches are visible where utility trenches were excavated. The oxide burner operations caused contamination to spread around the 314 Building area. Uranium metal dust from the fuel fabrication activities provided a pathway for heavy metal dust to become airborne and accumulate in soil throughout the northern portion of the 300 Area.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-280	The construction debris disposal pit was a rectangular 13 m by 38 m (42 ft by 124 ft) pit aligned northwest to southeast with a 6 m (20 ft) wide gravel road ramping into the northwest end of the pit (M-3904, Sheet 16).	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	491 m2 (5,285 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB, asbestos, TPH	1) RTD area of 491 m2 (5,285 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 491 m2 (5,285 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 491 m2 (5,285 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 491 m2 (5,285 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-281	This is the suspected site of a septic tank that was shown on a drawing (H-3-45154). The drawing calls for removal of the septic tank. However, the entire drawing was placed on hold for future construction and it is unclear if the septic tank was ever removed. The drawing was for a facility that was never built.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	7.1 m2 (76.4 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC	1) RTD area of 7.1 m2 (76.4 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.1 m2 (76.4 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.1 m2 (76.4 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 7.1 m2 (76.4 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-283	The site is a suspected release to soil. The site is currently used as an entry road/parking lot for 300 Area D4 activities.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	68 m2 (729 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB	1) RTD area of 68 m2 (729 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 68 m2 (729 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 68 m2 (729 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 68 m2 (729 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-284	This feature is the historical location of the sand blasting area associated with the former 3221 building location.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	229 m2 (2,465 ft2)	0.6 m (2 ft)	Radionuclides and metals suspected	1) RTD area of 229 m2 (2,465 ft2) to 0.6 m (2 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 229 m2 (2,465 ft2) to 0.6 m (2 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 229 m2 (2,465 ft2) to 0.6 m (2 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 229 m2 (2,465 ft2) to 0.6 m (2 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.

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300-286	This site consists of three discrete locations and the underlying soil of a potentially contaminated French drain and drywells and their associated below grade piping components. A drywell and a French drain were discovered during the Orphan Site Evaluation (OSE) historical review, and the remaining drywell was discovered during a field walkdown of the area under investigation. Each of the facilities that the French drains and drywells are associated with, were identified and process or function of the facilities determined. Details of inlet pipes, French drains, drywells and source facilities are provided when available. Drain number 1 (FD-1) (Orphan site feature 300-FF2-019) is a 61 cm (24 in.) diameter drywell constructed in accordance with Hanford standard AC-4-30 (H-3-14950 & H-3-14947). The drain received liquids from two 0.3 m x 0.3 m x 0.3 m (1 ft x 1 ft x 1ft) sumps located in the 309 Building exhaust filter pit. A 2.5 cm (1 in.) schedule 40 steel drain line from each sump joined a (2 in.) schedule 40 steel line that drained to the French drain. There is a locked metal cover over the drywell. Drain number 2 (FD-28) is a stormwater catch basin and 4 in. slotted drain pipe (corrugated polyethylene with a smooth interior). It is not visible in the field. Drain number 3 (FD-33) is a French drain with a 15.2 cm (6 in.) pipe that empties into it. The pipe was traced 11 meters due west using geophysics. The traced end of the pipe is 3 meters (10 ft) east of FD-21 (NFE), which was associated with the 3701-N guardhouse.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	9.29 m^2 (100 ft^2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB, TPH	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 9.29 m2 (100 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-287	This feature consists of broken corrugated transite in a pile approximately 0.5 m by 1.5 m.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	2 m^2 (21.5 ft^2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB, asbestos, TPH	1) RTD area of 2 m2 (21.5 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 2 m2 (21.5 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 2 m2 (21.5 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 2 m2 (21.5 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-288	This feature consists of two piles of garnet sand within a 5 m (16.4 ft) diameter area. The total volume is approximately 15 m^3 (20 yd^3), and each pile is estimated to be 5% garnet sand and 95% soil.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	34 m^2 (368 ft^2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB, asbestos, TPH	1) RTD area of 34 m2 (368 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 34 m2 (368 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 34 m2 (368 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 34 m2 (368 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-289	This feature consists of bare ground, with crusting and two drum bung plugs.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	22 m^2 (240 ft^2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 22 m2 (240 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 22 m2 (240 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 22 m2 (240 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 22 m2 (240 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.

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300-290	The site is a posted RMA (Radiological Materials Area) approximately 64 square meters. The material in the RMA consisted mostly of rusted metal automotive parts, scraps of crumpled sheet metal, electrical wire debris and engine gaskets.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	58 m^2 (624 ft^2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, PCB, asbestos, TPH	1) RTD area of 58 m2 (624 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58 m2 (624 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58 m2 (624 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58 m2 (624 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-291	This feature consists of garnet sand on a gravel road bed.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	270 m^2 (2,906 ft^2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-293	The subsite consists of underground utility lines (UGL) in the 300 Area that has been identified as being greater than 2.5 ft below ground surface (bgs). The UGLs without an approximate depth were also assigned to this subsite.	"Accepted" - to be Remediated after ROD signed	Pipeline	1,646 m (5,400 ft)	0.75 m (2.5 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD pipe length of 1,646 m (5,400 ft) to 0.75 m (2.5 ft) after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipe length of 1,646 m (5,400 ft) to 0.75 m (2.5 ft) after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipe length of 1,646 m (5,400 ft) to 0.75 m (2.5 ft) after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD pipe length of 1,646 m (5,400 ft) to 0.75 m (2.5 ft) after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.
300-294	This feature consists of garnet sand on a gravel road bed.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	270 m^2 (2,906 ft^2)	1.2 m (4 ft)	Radionuclides, metals, SVOC, PCB, asbestos	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 270 m2 (2,906 ft2) to 1.2 m (4 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-296	Unplanned Release. Soil below building 324 B Cell. Very high contamination with rads (14K rad per hour). 9000 rad per hour in soil under building. Assume building 324 D&D'ed.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	501 m^2 (5,393 ft^2)	assume to 4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	Internal Government Cost Estimate (IGCE) used for cost estimate	IGCE used for cost estimate	IGCE used for cost estimate	IGCE used for cost estimate
300-32	The site is the remaining contaminated components of the former 333 Building, including the concrete pad, any subgrade soils and piping. Chemical wastes included nitric, sulfuric, hydrofluoric, chromic-nitric-sulfuric, and other acids, along with degreasers TCE in the 1960s and early 1970s, and PCE and 111-TCA in the 1970s and 1980s. Heat treatment salts included sodium nitrate, sodium and potassium nitrite, and sodium and potassium chloride. Additionally, many alcohol and acetone cleansers were used throughout the building's history.	"Accepted" - to be Remediated after ROD signed	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	3,655 m^2 (39,342 ft^2)	soil beneath foundation removal to 4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, asbestos, TPH	1) RTD area of 3,655 m2 (39,342 ft2) to 4.6 m (15 ft) bgs, after demolition of structure 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 3,655 m2 (39,342 ft2) to 4.6 m (15 ft) bgs, after demolition of structure 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 3,655 m2 (39,342 ft2) to 4.6 m (15 ft) bgs, after demolition of structure 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 3,655 m2 (39,342 ft2) to 4.6 m (15 ft) bgs, after demolition of structure 2) Disposal at ERDF or other approved disposal facility.
300-34	An unplanned release to soil was discovered during excavation to install a new manhole (PS-87). Radioactive-contaminated soil was found at ~3.65 m (12 ft) below ground surface. Maximum contamination levels were beta/gamma 10,000 dpm. Soil samples emitted 525 pCi/g total beta and 91 pCi/g total alpha.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	9.3 m^2 (100 ft^2)	3.7 m (12 ft)	Radionuclides	Included with 300-15	Included with 300-15	Included with 300-15	Included with 300-15

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300-4	The site consists of uranium-contaminated soil inside the southwest corner of the fenced (active) electrical substation. A potential exists for PCB impact to soil from substation equipment, based on soil samples that contained PCBs at concentrations from 1 to 3 mg/kg.	"Accepted" - to be Remediated after ROD signed	Adjacent to long-term facility Human Health Direct Contact and/or Ecological risk likely in shallow soil	420 m^2 (4,521 ft^2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, asbestos, TPH	1) Temporary Surface Barrier until 2027. 2) RTD area of 420 m2 (4,521 ft2) to 4.6 m (15 ft) bgs [after 2027]. 3) Disposal at ERDF or other approved disposal facility.	1) Temporary Surface Barrier until 2027. 2) RTD area of 420 m2 (4,521 ft2) to 4.6 m (15 ft) bgs [after 2027]. 3) Disposal at ERDF or other approved disposal facility.	1) Temporary Surface Barrier until 2027. 2) RTD area of 420 m2 (4,521 ft2) to 4.6 m (15 ft) bgs [after 2027]. 3) Disposal at ERDF or other approved disposal facility.	1) Temporary Surface Barrier until 2027. 2) RTD area of 420 m2 (4,521 ft2) to 4.6 m (15 ft) bgs [after 2027]. 3) Disposal at ERDF or other approved disposal facility.
300-40	This section of piping that was isolated from the rest of the 300 Area process sewer collected rainwater drainage from the 311 Tank Farm and the 303-F Floor Drains. The piping also collected effluent from the 311 Stillhouse. Potential wastes received in this piping system would consist of chemicals (These include nitric acid, NaOH, alcohol, TCE, phosphoric acid, Duponol-M-3, hydrofluorosilicic acid, thorium, uranium, and cutting oils) used in the 313 Building fuels manufacturing process.	"Accepted" - Remediation Initiated under IROD	Pipeline	0	0	Radionuclides, metals, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-43	The waste is uranium-contaminated soil remaining after washdown activities inside the 304 CF and 304 SA facilities had leaked through building wall cracks to the outdoor periphery. Sampling and analysis during TSD closure activities for the 304 CF and 304 SA showed uranium contamination at levels up to 256 µg/g for shallow soils at the exterior storage pad.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-46	Contamination of the area surrounding the 3706 Building may have been caused by operations, and associated spills and releases. Subsurface contamination is suspected, although radiological surveys near and around the 3706 Building have not detected radiologically contaminated soil.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides and metals suspected	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-48	The handling of thorium powder targets spread fine and particulate contamination throughout the 3732 Building. Decontamination practices included hosing down the facility floors and walls, allowing contaminated liquid to be released to the surrounding soil.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-5	The site was two underground fuel tanks, the pump island, ancillary piping, and contaminated soil. An unknown quantity of contaminated soil, under the fuel dispensing island at the 3709-A Building (300 Area Fire Station) was discovered on 4/10/1992. These tanks were removed on 4/14/1992.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	58.3 m^2 (628 ft^2)	4.6 m (15 ft)	Petroleum hydrocarbons, metals	1) RTD area of 58.3 m2 (628 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58.3 m2 (628 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58.3 m2 (628 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 58.3 m2 (628 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
300-6	In summer 2001, four concrete bunkers (USTs) were removed. In September 2001, excavated, sidewall soil was segregated and stockpiled at the site, based on visible evidence of petroleum contamination. The stockpiled soil awaits characterization and disposition.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Petroleum hydrocarbons, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.

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300-7	The vegetated site contains solid construction debris (concrete, metallic waste, asbestos, and uranium contamination). Surface debris piles are visible. Subsurface disturbances have been identified with GPR.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	6,225 m^2 (67,005 ft^2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, asbestos, TPH	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes
300-80	The site is a square concrete structure adjacent to the 314 Building and next to a fenced stairway leading down. The site is covered by a steel plate marked with a sign "Radioactive material, internally contaminated." The purpose of this structure in not clear. The site appears to have become contaminated.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
300-9	This "Early Burial Ground" and its burial inventory are not well documented. Uranium-contaminated aluminum shavings are scattered on the ground surface. Other surface contaminants may include aluminum-silicon alloy and beryllium-contaminated aluminum. Process knowledge suggests the waste would consist of the uranium-contaminated waste from very early 300 Area experimental processes.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	462 m^2 (4,973 ft^2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, asbestos, TPH	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes	At DOEs request, WCHs costs have been applied for cost estimating purposes
313 ESSP	The area was used to stage mixed waste including byproduct waste materials from the fuels fabrication process and neutralized solids from the 313 Recovery Operations process.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
316-1	The original unlined percolation pond surface area was 45,522 m^2 (490,000 ft^2), at 1.5 m (5 ft) deep, and was separated into five sections. It originally received cooling water and low-level liquid wastes from fuel fabrication facilities and early laboratories (313, 314, 3706, and 321 Buildings). Facilities contaminants included U, Cu, Co, and small amounts of Pu. Combined process wastes discharged from the fuel fabrication facilities to the South and North Process Ponds ranged from 1.5 to 11.4 Million L/day (400,000 to 3 Million gal/day). In August 1945, the pond overflowed eastward toward the Columbia River. A crushed-rock and earthen dike was built in September 1945. Accumulation of aluminum/uranium hydroxide precipitate had affected the infiltration rate. In October 1948, the SPP dike breached on the northwest side, releasing the bulk of the pond's contents including 5.4 to 27.7 kg (12 to 61 lb) or uranium into the Columbia River. The breach was attributed aluminum/uranium hydroxide precipitate accumulated on the pond bottom. The 316-2 North Process Pond was built as a substitute for the SPP, while repairs were made, and the bottom was dredged. Afterward, the ponds were regularly maintained by dredging. Dredge sediments were deposited on the surrounding dikes and on the scrapings disposal area. The site was Closed Out under EPA/ROD/R10-96/143. Approximately 234,000 metric tons (257,000 US tons) of material were removed from the site.	Residual source mass causing uranium groundwater plume	Residual source mass causing uranium groundwater plume	59,937 m2 (645,157 ft2)	12 m (40 ft) bgs	Uranium	No Action	1) Phased uranium sequestration via phosphate infiltration and injection over 10,871 m2 (117,015 ft2) 2) Phased uranium sequestration via phosphate infiltration and injection (20 % of area) over 49,066 m2 (528,142 ft2)	1) Focused deep RTD area of 10,871 m2 (117,015 ft2)10,540 m2 (113,450 ft2) to 12 m (40 ft) bgs 2) Uranium sequestration via phosphate infiltration and injection (20 % of area) over 49,066 m2 (528,142 ft2)	Expanded deep RTD area of 59,937 m2 (645,157 ft2) to 12 m (40 ft) bgs

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316-2	Seven sections separated by 3.7-m (12-ft-) wide dikes, with the entire 40,000 m^2 (10-acre) area surrounded by a dike 4.6 m (15 ft) wide and ~3 m (10 ft) high. It was built to receive waste in 1948, after a dike failure at the SPP. The site originally received cooling water and low-level liquid process wastes from the fuel fabrication facilities and the early laboratories (313, 314, 3706, and 321 Buildings). In 1955, the 316-2 North Process Pond was taken out of service for 14 months to manage accumulated uranium-bearing. Dredging recovered 4,672 kg (10,300 lb) of uranium from deposits up to 22.9 cm (9 in.) thick in two locations in the southwest region of the pond. Pre-1954, ~21,955 L (5,800 gal) per month of sodium aluminate containing 22.7 kg (50 lb) of uranium, was released to the 316-1 and 316-2 ponds, resulting in 2,722 kg (6,000 lb) of uranium. An estimated 8,684 kg (19,145 lb) of mostly depleted U-235 was discharged to the ponds from the 321 Building. By 1956, sodium aluminate was included in the 313 Building waste stream instead of being discharged to the ponds. The South and North Process Ponds were phased out in 1974 and 1975. The North Process Pond was Closed Out under EPA/ROD/R10-96/143.	Residual source mass causing uranium groundwater plume	Residual source mass causing uranium groundwater plume	39,994 m2 (430,492 ft2)	12 m (40 ft) bgs	Uranium	No Action	Phased uranium sequestration via phosphate infiltration and injection (20 % of area) over 39,994 m2 (430,492 ft2)	Uranium sequestration via phosphate infiltration and injection (20 % of area) over 39,994 m2 (430,492 ft2)	Expanded deep RTD area of 39,994 m2 (430,492 ft2) to 12 m (40 ft) bgs
316-5	Served as the discharge site for the 300 Area Process Sewer System. The 468-m (1,535-ft) long, 3-m (10-ft) wide ponds, spaced 15 m (50 ft) apart were constructed to receive the low-level waste that had previously gone to the South and North Process Ponds (316-1 and 316-2). The two trenches operated alternately with one being filled to a predetermined level before switching to the other one, usually every 2 to 6 months. The site received approximately 9.8 million L/day (2.6 million gal/day) of water. This water was chlorinated by the water filter plant for the 300 Area and contained minerals added to the water during use. Water discharged to the process sewer was used primarily for cooling and was not modified. Other discharge sources included steam condensates, floor washing/waxing janitorial solutions, water treatment (primarily salt), laboratories, process water from fuel fabrication, and other aqueous solutions not designated as dangerous wastes (WAC 173-303). In 1991, an Expedited Response Action removed contaminated soil and sludge from the trenches sides and bottoms. Excavated sediments were used to fill the north end of the trenches and were immobilized in the Process Trench Spoils Area. Excavation activities removing lifts of 0.3 m (1 ft) of contaminated soil from the sides and 1.3 m (4 ft) from the bottom of each trench. The 300 Area Process Trenches Waste Site was closed out under EPA/ROD/R10-96/143.	Residual source mass causing uranium groundwater plume	Residual source mass causing uranium groundwater plume	49,891 m2 (537,022 ft2	12 m (40 ft) bgs	Uranium	No Action	1) Phased uranium sequestration via phosphate infiltration and injection over 25,971 m2 (279,549 ft2) 2) Phased uranium sequestration via phosphate infiltration and injection (20 % of area) over 23,920 m2 (257,473 ft2)	1) Focused deep RTD area of 25,971 m2 (279,549 ft2) to 12 m (40 ft) bgs 2) Uranium sequestration via phosphate infiltration and injection (20 % of area) over 23,920 m2 (257,473 ft2)	Expanded deep RTD area of 49,891 m2 (537,022 ft2) to 12 m (40 ft) bgs

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316-3	The site received wastes from the 300 Area Laboratory expansion facilities (329 Biophysics Laboratory, 327 Radiometallurgy Building, 324 Radiochemistry Building, 326 Pile Technology Building, and 329 Mechanical Development Building). The wastes first went through the 307 Retention Basins. Retention Basin waste below discharge limits was released to the trenches.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil Groundwater/surface water protection risk likely for uranium and other COCs.	25,261 m2 (271,907 ft2)	12 m (40 ft) bgs	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	At DOEs request, WCHs costs have been applied for cost estimating purposes for the shallow RTD component.	1) Phased uranium sequestration via phosphate infiltration and injection over 3,755 m2 (40,418 ft2) 2) Phased uranium sequestration via phosphate infiltration and injection (20 % of area) over 21,506 m2 (231,489 ft2) 3) At DOEs request, WCHs costs have been applied for cost estimating purposes for the shallow RTD component.	1) Focused deep RTD area of 3,755 m2 (40,418 ft2) to 12 m (40 ft) bgs 2) Uranium sequestration via phosphate infiltration and injection (20 % of area) over 21,506 m2 (231,489 ft2)	Expanded deep RTD area of 25,261 m2 (271,907 ft2) to 12 m (40 ft) bgs
316-4	The site received hexone-bearing uranium waste and limited amounts of other uranium-bearing waste from the 321 Building. Calculations through July 1955, indicate liquid wastes containing 550 kg (1,230 lb) of uranium were discharged to this site. In 1962, 12,040 L (3,182 gal) of liquid, organic waste was transported to the 300 North Cribs. The crib tanks were removed in 2004.	"Accepted" - to be Remediated after ROD signed	Groundwater/Surface water protection risk likely for Uranium	0	0	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
331 LSLT1	The Life Sciences Laboratory Trench received sanitary wastewater and animal waste from the animal waste pit. Since most of the animal studies involved the use of radio isotopes, animal waste was segregated by activity. Solid animal waste, exceeding 200 pCi/g specific activity, was transported to 100-F trenches regularly. All other solid animal waste (<200 pCi/g specific activity) was flushed into the 331 Waste System. Specific contamination cases occurred at the 331 Complex.	"Accepted" - to be Remediated after ROD signed	Underneath long-term facility (no temporary barrier needed) Human Health Direct Contact and/or Ecological risk likely in shallow soil	4.41 m2 (47.5 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, TPH	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.
331 LSLT2	The Life Sciences Laboratory Trench received liquid animal waste from the animal waste pit. Animal wastes were the most prominent wastes, in terms of volume, generated by the 331 Complex. Originally, liquid animal wastes from the complex including wash downs from the "hog and dog runs", were disposed to a large, unlined pit, east of the 331-D Building. Sewers carrying animal waste from the 331 Complex were also connected to this pit.	"Accepted" - to be Remediated after ROD signed	Underneath long-term facility (no temporary barrier needed) Human Health Direct Contact and/or Ecological risk likely in shallow soil	4.41 m2 (47.5 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, TPH	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 4.41 m2 (47.5 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.
333 WSTF	The White Sands Test Facility tank stored used, non-PCB oil from the extrusion press sump. The oil was not ignitable before removal. No known releases were documented. The Uranium Bearing Acid tanks stored spent-acid-containing uranium. The uranium was a recoverable asset for recycling.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Petroleum hydrocarbons, uranium	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.

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General Waste Site Information		Information for Development of Alternatives								
Waste Site	**Site History**	**Feasibility Study Designation**	**Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
340 Complex	The 340 Complex consists of Buildings 340, 340-A, 340-B, 3707-F, office trailers, 307 Retention Basins, two vaulted underground tanks, six 340A tanks, underground transfer pipes, load-out and decontamination equipment, instrumentation, and before 1963, the 316-3 Trenches, which disposed of retention process waste that met release criteria. The site supported the 325, 326, 237, and 329 Buildings, relieved stress on the 316-1 and 316-2 Process Ponds, and received potentially contaminated "retention" waste liquids. Waste liquids passed through the RPS line to the 307 Retention Basins to reduce radioactivity to less than threshold values before transfer to the 307 Trenches. Threshold-exceeding liquid was transferred to 56,780-L (15,000-gal) capacity collection tanks in the 340 Building before disposal at the 200 Area. Discharge to the basins was 4 g/L gross beta and 0.5 g/L plutonium, later changed to 50,000 pCi/L. The RLWS collected liquid process waste from the laboratories and the 308, 309, and 324 Buildings, and transferred the wastes to the 340 Building tanks. The 307 Trenches received 1 Million L (264,172 gal) of uncontaminated low-level radioactive waste liquid from the 307 Retention Basins once the waste streams were less than discharge limits. After 1963 removal from service, the 307 Trenches waste liquids were transferred to the process sewer for disposal in the Process Ponds. The 307 Trenches were excavated, and contaminated soil was transported to the 618-10 Burial Ground. In 1965, the trenches were backfilled with 7,645 m^3 (25,082 ft^3) of uranium-contaminated sediment from the SPP and fly ash. A leak test in 1976, of the single-walled RLWS network showed widespread system leaks. The system was replaced in 1978 to 1979, with double-walled, stainless steel pipes and a leak detection system. During replacement, contaminated soil was removed, but the RLWS piping and low radioactive level soil remains.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	6,403 m2 (68,921 ft2)	soil beneath foundation removal to 4.6 m (15 ft)	Radionuclides	1) RTD area of 6,403 m2 (68,921 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 6,403 m2 (68,921 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 6,403 m2 (68,921 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 6,403 m2 (68,921 ft2) to 4.6 m (15 ft) bgs, after demolition of structure. 2) Disposal at ERDF or other approved disposal facility.
3712 USSA	The 3712 Uranium Scrap Storage Area (USSA) Building stores uranium fuel elements, fuel fabrication components, and uranium scraps from 313 and 333 fuel fabrication activities.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
400 PPSS	This site is the 400 Area Secondary Cooling Water (400 Area Process Pond and Sewer System). The unit consists of underground piping, a control structure, and the 4608B and 4608C percolation ponds. The process sewer, which empties into the process ponds, is for discharging water from cooling systems, and non-sanitary drains and sumps in the 400 Area facilities, including the FFTF. Water from the FFTF and FMEF cooling towers contains non-regulated quantities of algaecides and other treatment chemicals, including a biocide (Dearcide 702), microbiocide (sodium hypochlorite), and softening agent (Dearborn 878). Chemicals used for secondary cooling water testing (Dearborn Code 550, 562, 595, 899, 904) are present in unregulated quantities.	"Accepted" - to be Remediated after ROD signed	Pipeline with Human Health Direct Contact and/or Ecological risk likely in shallow soil	3,006 m2 (32,356 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 3,006 m2 (32,356 ft2) to 4.6 m (15 ft) bgs, after demolition of structure in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 3,006 m2 (32,356 ft2) to 4.6 m (15 ft) bgs, after demolition of structure in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 3,006 m2 (32,356 ft2) to 4.6 m (15 ft) bgs, after demolition of structure in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 3,006 m2 (32,356 ft2) to 4.6 m (15 ft) bgs, after demolition of structure in 2027. 2) Disposal at ERDF or other approved disposal facility.

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General Waste Site Information				Information for Development of Alternatives						
Waste Site	Site History	Feasibility Study Designation	Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS	Alternative 2	Alternative 3	Alternative 4	Alternative 5
400-37	The site is an underground fuel oil tank. No visual evidence of the tank exists on the surface. The tank supplied diesel fuel to a standby electric generator. Drawing H-4-152061 has a written notation that the fuel oil tank was abandoned in place and that the exact location of the fuel line is unknown. It is believed to have been filled with sand.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	51.83 m2 (557.9 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, TPH	1) RTD area of 51.83 m2 (557.9 ft2) to 4.6 m (15 ft) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 51.83 m2 (557.9 ft2) to 4.6 m (15 ft) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 51.83 m2 (557.9 ft2) to 4.6 m (15 ft) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 51.83 m2 (557.9 ft2) to 4.6 m (15 ft) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.
400-38	The site is an underground fuel tank that supported 4722A. There is no visual evidence of the tank on the surface. Drawing H-4-152061 has a notation reading "buried fuel tank." It is possible the tank has been filled with sand, but documentation has not been found.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	21 m2 (225 ft2)	4.6 m (15 ft)	Radionuclides, metals, SVOC, TPH	1) RTD area of 21 m2 (225 ft2) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 21 m2 (225 ft2) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 21 m2 (225 ft2) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 21 m2 (225 ft2) bgs. Remediation to start in 2027. 2) Disposal at ERDF or other approved disposal facility.
600-290	The site was a contaminated pad and loading dock near the 618-13 soil mound that was used for loading waste drums. Rust-colored drum ring patterns on the concrete suggest temporary storage of 208-L (55-gal) drums.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	110 m2 (1184 ft2); 110 m3 (35 ft3) of concrete	soil beneath foundation removal to 4.6 m (15 ft)	Metals, organics suspected	No Alternative; addressed with sub-sets (600-290:1 and -290:2)	No Alternative; addressed with sub-sets (600-290:1 and -290:2)	No Alternative; addressed with sub-sets (600-290:1 and -290:2)	No Alternative; addressed with sub-sets (600-290:1 and -290:2)
600-367	The site is a large, open field with a high soil mound in the center. Several pipes extend vertically through the soil surface in some areas. A small pallet containing damaged bags of bentonite is located in the southeast corner of the area adjacent to some vertical pipes. Two steel-hinged plates cover access holes to underground culverts used as monitoring stations for buried waste tests. Only simulated buried waste was placed at this test site.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	35,000 m2 (376,736 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, TPH	1) RTD area of 35,000 m2 (376,736 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 35,000 m2 (376,736 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 35,000 m2 (376,736 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 35,000 m2 (376,736 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.
600-63	The site includes potentially contaminated soil and equipment, and is enclosed within barbed, chain-link fencing with a locking gate. A considerable amount of surface debris is observed outside the fenced area. A trace amount of Co-60 was mixed in 1 cm (0.4 in.) of soil and placed 60 cm (24 in.) below the surface of two of the drainage lysimeters. Trace amounts of tritium were placed in two other lysimeters. Contaminant migration was monitored. Buried equipment, including caissons, lysimeters, associated instrumentation, and solar panels are noted, and may be contaminated with Co-60 and tritium.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	1,600 m2 (17,222 ft2)	4.6 m (15 ft)	Cobalt-60 and tritium	BPA lease site. Site will be remediated after ROD, but costs are not included in FS.	BPA lease site. Site will be remediated after ROD, but costs are not included in FS.	BPA lease site. Site will be remediated after ROD, but costs are not included in FS.	BPA lease site. Site will be remediated after ROD, but costs are not included in FS.
618-1	Two trenches received waste from early 300 Area facility operations, including the 305 Reactor, 3706 Laboratory, and 3741 Building. The site contains large quantities (14,500 kg [~16 tons]) of uranium from fuel fabrication activities, and small quantities of plutonium and fission products from laboratory operations. Radiological readings indicated 6,000 dpm alpha and 15 mr/hr beta/gamma. An August 1946, monthly report mentions burial of a bronze crucible that read 170 mR/hr (179 mrads/hr) and 5.5 mR/hr (5.5 mrads/hr) at 10.2 cm (4 in.).	Risk Exceedance	Groundwater Protection risk for Total Uranium Isotopes in deep soil	3,524 m2 (37,932 ft2)	12 m (40 ft)	Uranium	No Action	Phased uranium sequestration via phosphate infiltration and injection (20 % of area) over 3,524 m2 (37,932 ft2)	Uranium sequestration via phosphate infiltration and injection (20 % of area) over 3,524 m2 (37,932 ft2)	Expanded deep RTD area of 3,524 m2 (37,932 ft2) to 12 m (40 ft) bgs

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General Waste Site Information			Information for Development of Alternatives							
Waste Site	**Site History**	**Feasibility Study Designation**	**Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
618-10	The site consists of 12 trenches and 94 vertical pipe units (VPUs). The site contains a broad spectrum of low- to high-level dry wastes, primarily fission products and some TRU from the 300 Area. Low-level wastes are buried in trenches, and medium- to high-level beta/gamma wastes are mostly in the vertical pipe units. Some higher activity wastes were placed in concrete-shielded drums and disposed in the trenches. The site was surface stabilized with clean backfill material in 1983. This burial ground is currently undergoing remediation.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides and TRU	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
618-11	The site consists of three V-shaped trenches, two large-diameter caissons, and 50 VPUs. The burial ground received a variety of waste from the 300 Area operations. Low-level activity waste and large items were placed into the burial trenches. Some high-activity liquid waste or plutonium contaminated liquid was placed inside barrels and sealed with concrete. The burial ground was surface stabilized with additional clean soil and planted with wheat grass in 1983.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	62,012 m2 (667,489 ft2)	variable	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	1) RTD area of 62,012 m2 (667,489 ft2) to variable depths. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 62,012 m2 (667,489 ft2) to variable depths. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 62,012 m2 (667,489 ft2) to variable depths. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 62,012 m2 (667,489 ft2) to variable depths. 2) Disposal at ERDF or other approved disposal facility.
618-2	The waste site consisted of three east-west trenches. In 1995, GPR identified three distinct trenches. Historical documents stated that there were either three or four trenches. The discrepancy of whether there are three or four trenches could be because the geometry of the middle trench is broken into two pieces at the east end. The unit was used for disposal of uranium-contaminated equipment and materials, plutonium, and fission products. The uranium waste was typically solid metallic uranium oxides in the form of metal cuttings from Reactor Fuel Fabrication facilities in the 300 Area. Plutonium and fission products came from 300 Area laboratory facilities that began to operate in 1953. The burial ground may also contain tin from the triple dip canning process and lead from the lead dip process. In December 2004, during remedial excavation, bottles with liquid were found in a combination lock safe.	Risk Exceedance	Groundwater Protection risk for Total Uranium Isotopes in deep soil	7,802 m2 (83,980 ft2)	12 m (40 ft)	Uranium	No Action	Phased uranium sequestration via phosphate infiltration and injection (20 % of area) over 7,802 m2 (83,980 ft2)	Uranium sequestration via phosphate infiltration and injection (20 % of area) over 7,802 m2 (83,980 ft2)	Expanded deep RTD area of 7,802 m2 (83,980 ft2) to 12 m (40 ft) bgs
618-3	The site consists of uranium-contaminated waste, primarily building materials from the remodeling of the 313 Building. It may also contain waste from the 303-J and K upgrades. In 1986, the volume of contaminated soil was estimated to be 12,549 m^3 (443,160 ft^3), with 12,643 m^3 (446,480 ft^3) of overburden.	Risk Exceedance	Human Health Direct Contact and Groundwater Protection risk for Uranium in deep soil	5,449 m2 (58,652 ft2)	12 m (40 ft)	Uranium	No Action	Phased uranium sequestration via phosphate infiltration and injection (20 % of area) over 5,449 m2 (58,652 ft2)	Uranium sequestration via phosphate infiltration and injection (20 % of area) over 5,449 m2 (58,652 ft2)	Expanded deep RTD area of 5,449 m2 (58,652 ft2) to 12 m (40 ft) bgs

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Waste Site	**Site History**	**Feasibility Study Designation**	**Type of Exceedances (assumed for Waste Sites to be Remediated after the ROD is Signed)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS**	**Alternative 2**	**Alternative 3**	**Alternative 4**	**Alternative 5**
UPR-300-1	The site was a release to soil between the 307 Retention Basins and the 340 Building. The discharged waste consisted of process effluent contaminated by TRU fission products including 900 Ci of short-lived radionuclides (mainly promethium-147) and 10 Ci each of Sr-90 and Cs-137. The top 0.61 m (2 ft) of the contaminated drummed and transported to a 200 Area burial ground. Further removal of contaminated soil was considered a threat to adjacent structures. There is no readily apparent sign of subsurface contamination beneath the gravel-covered area. More than 90% of the contamination is confined to an area 3.7 m (12 ft) in diameter and 7.6 m (25 ft) deep.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides and TRU	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-10	The site was a UPR to the soil beneath the northwest corner of the 325 Building. UPR-300-10 occurred in the radioactive waste sewer line that served the 325-B Hot Cells, between the 325 Building's west basement wall of Room 32 and the north foundation wall of Room 202. The release included waste from dissolution of highly radioactive samples including irradiated reactor fuels.	"Accepted" - to be Remediated after ROD signed	Underneath long-term facility (no temporary barrier needed) Human Health Direct Contact and/or Ecological risk likely in shallow soil	232 m2 (2,497 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	1) RTD area of 232 m2 (2,497 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 232 m2 (2,497 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 232 m2 (2,497 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 232 m2 (2,497 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.
UPR-300-11	The site was a release to the soil that involved a 1.2-m (4-ft)-diameter column of gravel-covered soil in the 340 Complex yard. The release occurred around and below a leaking, flanged tee that connected the RRLWS to the 340 Vault. Soil samples from near the broken pipe yielded detectable concentrations of Sr-90, Eu-155, Ce-144, Pu-239/240, Am-241, and Pu-238. Approximately 1 Ci of contamination was left in place.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-12	UPR-300-12 occurred in the basement floor of the 325-A Building. The waste migrated through cracks in the floor to the soil beneath the building. The site received radioactive rinse water overflow containing nitrate ions, Pm-147, fission products, and TRU nuclides. Total rinse water activity was estimated at 70 Ci (95% Pm-147). The rinse water contained nitrate ions, Pm-147, fission products, and TRU radionuclides. Nitrate ions, but no radionuclides, were detected in samples from a nearby groundwater monitoring well. PNNL sampled the underlying soil in January 1979. Decontamination efforts on Room 50-A were completed. Removal of the contaminated soil under the building was considered a threat to the integrity of the 325 Building.	"Accepted" - to be Remediated after ROD signed	Underneath long-term facility (no temporary barrier needed) Human Health Direct Contact and/or Ecological risk likely in shallow soil	3.6 m2 (38.75 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	Shallow soil contamination under building will be removed during 325-A Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 325-A Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 325-A Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 325-A Building demolition. Costs are not included in FS.
UPR-300-2	Multiple releases occurred from ongoing decontamination and waste handling activities starting in January 1954. It is unknown if this was related to a single event or all events over the period (1954 to date). An estimated 10 mCi of Cs-137 may have been released.	"Accepted" - to be Remediated after ROD signed	Human Health Direct Contact and/or Ecological risk likely in shallow soil	241 m2 (2,594 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	1) RTD area of 241 m2 (2,594 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 241 m2 (2,594 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 241 m2 (2,594 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 241 m2 (2,594 ft2) to 4.6 m (15 ft) bgs. 2) Disposal at ERDF or other approved disposal facility.

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UPR-300-38	The site is the contaminated, concrete foundation and underlying soil beneath the 313 Building from multiple UPR events. The full contamination extent is pending 313 Building foundation removal. Materials released to soil beneath the building may have included uranium-bearing acid (nitric and sulfuric acid with uranium in solution), neutralized acid waste (typically sodium fluoride, sodium nitrate, sodium dichromate, and sodium sulfate in solution with precipitates of uranium, chromium, copper, and zirconium), etch acids (nitric, hydrofluoric, sulfuric, and chromic acids), TCE, PCE, sodium hydroxide solutions, and contaminated water.	"Accepted" - Remediation Initiated under IROD	Structure with Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals, organics	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-39	The release site was to the soil adjacent to the caustic storage tanks in the 311 Tank Farm. The waste consisted of caustic solution containing 50% sodium hydroxide solution. If the sodium hydroxide were exposed to uranium contamination (likely the case), the resultant contamination would be sodium diuranate ("yellow cake"). In February 2006, the 311 Tank Farm and concrete containment were demolished. Before demolition, the two, sodium hydroxide tanks were labeled "Empty."	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-4	The site is the soil beneath and south of the 321 Building. The site represents a number of releases that occurred from 1945 to 1988. Complete contaminated soil removal was not attempted because of possible threat to the integrity of the 321 Building. No specific occurrence reports have been documented. The contaminated soil extent is not documented.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides suspected	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-40	The release site was to the soil between the 311 Tank Farm and the 303-F Building. Piping connections were repaired, but contaminated soil was not removed. The waste consisted of uranium-bearing acid waste containing nitric and sulfuric acid with uranium in solution and chromic acids with copper and zinc in solution. A comparison of WIDS Sites UPR-300-31 and UPR-300-40 and their reference documents was performed, and the conclusion was that they both represented the same event. It was decided to join them under WIDS Site UPR-300-40.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-42	The release was an overflow of 750-1,135 L (200-300 gal) No. 6 fuel oil onto the ground adjacent to the #2 Day Tank, a UST. The adjacent day tanks (300-223) have been remediated, but this release was not removed because of concerns regarding the foundation of the 384 Powerhouse. The surface area around the day tanks was paved with asphalt. This release is not visible.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Petroleum hydrocarbons, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.

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UPR-300-45	The release site was to the soil beneath the transfer piping, adjacent to the 303-F Building. The leak contained uranium-bearing waste acid identified as nitric and sulfuric with uranium in solution. Analysis showed the solution to contain 3,480, 6,960, and 920 ppm of nitrate, sulfate, and uranium, respectively. Some soil from the release site was exhumed, packaged, and sent to the Low-Level Burial Grounds for disposal. Cleanup effectiveness is not documented. The remaining soil beneath the pipe trench and around the processing facilities is expected to be addressed separately after the RCRA closure plan activities are completed.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Uranium, metals	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.
UPR-300-48	The site received radioactive liquid from a leak in the process sewer drainpipe. The site was discovered during dye testing of drains during development of the Facility Effluent Monitoring Plan development for the 325 Building. The contamination may have resulted from routine releases and accumulated in the soil under the crack. Radioactivity up to 1,700 dpm alpha was detected. The TCLP results were below regulatory limits. Radioactivity levels were sufficiently low to permit fixing the contamination in place. This activity was reported as an off normal occurrence in October 1991 (RL-PNL-325-1991-1023).	"Accepted" - to be Remediated after ROD signed	Underneath long-term facility (no temporary barrier needed) Human Health Direct Contact and/or Ecological risk likely in shallow soil	37.3 m2 (400 ft2)	4.6 m (15 ft)	Radionuclides, metals, VOC, SVOC, PCB, cyanide, hexavalent chromium, normal paraffin hydrocarbons, TPH	1) RTD area of 37.3 m2 (400 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37.3 m2 (400 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37.3 m2 (400 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.	1) RTD area of 37.3 m2 (400 ft2) to 4.6 m (15 ft) bgs [after 2027]. 2) Disposal at ERDF or other approved disposal facility.
UPR-300-5	The site was a release that contaminated the storage basin area, the filter vault, the stack base, the truck stall, and the truck ramp outside the 309 Building. The waste was low-level radioactive water. The primary isotope was Cs-137.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	7.32 m^2 (78.8 ft^2)	4.6 m (15 ft)	Cesium-137, radionuclides	Shallow soil contamination under building will be removed during 309 Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 309 Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 309 Building demolition. Costs are not included in FS.	Shallow soil contamination under building will be removed during 309 Building demolition. Costs are not included in FS.
UPR-600-22	The site consists of a series of small, parallel berms. Before 1972, the area was contaminated with particulate fallout (windblown) from burial activities in the 618-11 Burial Grounds. The contaminated area was covered by scraping the affected ground into windrows. The windrows were cut by backhoe on 10/24/1972. Radiological surveys were made of all removed soil and the walls of each cut. No beta, gamma, or alpha radioactivity was detected above the normal background of 100 counts/min.	"Accepted" - Remediation Initiated under IROD	Human Health Direct Contact and/or Ecological risk likely in shallow soil	0	0	Radionuclides, metals suspected	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.	Not evaluated. Site assumed to pass PRGs.

Note: A list of complete citations for references from this table are provided in the main text of Appendix I.

Attachment 2- Infiltration System Cost Quotation from Ore-Max

Controlled Percolation Systems for Heap Leach Mining

U.S. Patents: 5,005,806 - 5,030,279 - 4,960,584 - Australia Patent: 600,086
Canada 1,293,521 - U.S and International Patents Pending

March 31, 2012

CH2M HILL
9193 South Jamaica Street
Englewood, CO 80112
Attn: Gene Ng, P.E.
e-mail: Gene.Ng@CH2M.com
Phone: 720 286 2967 Fax: 720 286 9345 Cell: 720 425 3929

RFQ	Quotation
	CH310312

Contact: B. Beard/J. Bolaños
Phone: 520-548-1737/51 95
Fax: 503-692-5358
cc: Cori Harvey

Item	Qty	Description	$/Unit	Amount
		OREMAX MAX-EMITTER SYSTEM: 130 GPM/Acre (24"x32")		
		LEACH SYSTEM FOR 14 MODULES: 210' x 210'		
1	14	Butterfly Valve 4", Lever Operation, Epoxy Coated Body, 316 Stainless	149.00	2,086.00
		Steel Stem, Nylon 11 Disk, EPDM Seat, Wafer Style, **BLO4W**		0.00
2	14	Bolts and Nuts for 4" Valve, Grade 5 Zinc Plated (set of 8, 5/8"x5.5"), **FB4**	34.95	489.30
3	14	HDPE 4710, 4-inch Stub End Flange Adapter, **OP04FA11**	24.79	347.06
4	14	Backing Ring, 4" Flange, ANSI B16.5, 150-psi, Ductile Iron, **BR04DI**	17.95	251.30
5	14	Pressure Gauge 1/4", 0-5 BAR, liquid filled, 100% 316 Stainless, **OPG04A**	36.75	514.50
6	14	Branch Saddle for Air Valve, 4"x2", HDPE 4710 resin, DR-11, **OP0402BS11**	21.95	307.30
7	14	Air Control Valve 2", with Insulation, **ACV200P**	99.50	1,393.00
8	28	HDPE 4710 Resin, 4-inch Elbow x 37-degree, **OP04EL1137**	32.79	918.12
9	3280	Ft. HDPE Pipe 4", 4710 or PE100 Resin, SDR 11, **OP041140**	3.09	10,135.20
10	14	HDPE 4710 Resin, 4-inch End Cap, SDR 11, **OP04EC11**	17.95	251.30
11	1550	Mini-Valve from HDPE pipe to Pressure Regulator, **O685MV**	3.99	6,184.50
12	1550	Ore-Max Pressure Regulator Assembly, 10-psi, 20-mm fittings, **OLPRM1020**	7.29	11,299.50
13	1550	Emitter Line Figure 8 End Closure, 20 mm, **OF8900**	0.23	356.50
14	700	Coupling, 20-mm x 20-mm with Locking Caps, Heavy Duty, **O685SC**	0.75	525.00
15	400	Ore'Max Max-Emitter Drip Line, 20-mm, 4-liter per hour: **OL42032MY**	123.75	49,500.00
		Max-Emitter: 330 degree filter inlet and 330 degree flowpath, dual or quad		
		solution exit points 180 or 90 degrees apart, 4-lph x 20-mm x 24"		
		spacing, rolls of 1000-feet (305-meters)		
				$84,558.58
		MAIN LINES (approx.)		
1	2340	Ft. HDPE Pipe 10", 4710 or PE100 Resin, SDR 11, **OP0101140**	17.57	41,113.80
2	10	HDPE 4710, 10x3-inch Reducing tee, **OP0103FA11**	325.00	3,250.00
3	14	HDPE 4710, 3-inch Stub End Flange Adapter, **OP03FA11**	22.79	319.06
4	14	Backing Ring, 3" Flange, ANSI B16.5, 150-psi, CS Epoxy Coated, **BR03SS**	17.95	251.30
5	1	HDPE 4710 Resin, 10-inch End Cap, SDR 11, **OP010EC11**	119.00	119.00
6	520	Ft. HDPE Pipe 6", 4710 or PE100 Resin, SDR 11, **OP061140**	6.67	3,468.40
7	3	HDPE 4710, 6x3-inch Reducing tee, **OP063RT11**	129.00	387.00
8	1	HDPE 4710 Resin, 6-inch End Cap, SDR 11, **OP06EC11**	45.95	45.95
9	360	Ft. HDPE Pipe 4", 4710 or PE100 Resin, SDR 11, **OP041140**	3.09	1,112.40
10	1	HDPE 4710, 4x3-inch Reducing tee, **OP043FA11**	49.50	49.50
11	1	HDPE 4710 Resin, 4-inch End Cap, SDR 11, **OP04EC11**	17.95	17.95
				$50,134.36
		Prices: Ex-Works, EXW, Fresno, California, USA 93721		
		Offer Validity: 30-days		
		Delivery: Normally 7 to 10 days after receipt of Purchase Order		

Controlled Percolation Systems for Heap Leach Mining

Division of Wade Rain, Inc.
P.O. Box 23666
Portland, OR 97281
503-692-5353
Fax 503-692-5358
www.ore-max.com
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Appendix L

Nonoperational Evaluation

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L1 Introduction

This appendix presents information that supports the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) RI/FS for the 300 Area NPL Site. Most of the waste sites in this area are located close to former industrial facilities. Large land areas beyond the industrial areas and their associated facilities and waste sites have little or no subsurface infrastructure or indication of past or present releases of hazardous constituents. This land is referred to as nonoperational property. This appendix presents an evaluation of the nonoperational property (NPE) specific to the 300 Area NPL Site.

L1.1 Scope of the Nonoperational Property Evaluation

This NPE is not directly part of the CERCLA RI/FS process, in that it has no role in determining the basis for remedial action or in evaluating remedial alternatives for contaminated soils or groundwater. The National Contingency Plan ("National Oil and Hazardous Substances Pollution Contingency Plan" [40 CFR 300]) requires that the nature and extent of contamination is evaluated and that appropriate remedial actions are taken. Two important outputs from the NPE are evidence that effort has been taken to identify where waste may be present outside of operational areas and, where appropriate, the inclusion of NPE waste sites that may warrant further consideration as part of the RI/FS. The NPE also documents nonoperational conditions for use in risk communication and for informing stakeholders.

There are fate and transport mechanisms that could potentially distribute contaminants to nonoperational areas. The most credible are human disposal, windblown dust dispersion, air emissions from stacks during active operations, overland flow, and biological vectors (intrusion by plants and animals). Multiple lines of evidence were developed to assess these fate and transport mechanisms and the potential for contamination to exist outside known operational areas. Areas of focus in developing the lines of evidence include:

- **Review of existing programs, data, and information with a nonoperational area focus:** Decades of environmental monitoring and surveillance were conducted and reported at the Hanford Site. In addition to general (routine) monitoring that has included nonoperational areas, special studies were commissioned and conducted that assess broad-area evidence of emissions and releases from facilities and waste sites.
- **Results of orphan sites evaluations:** The orphan sites evaluation (OSE) is a program, designed primarily to support cleanup and long-term stewardship activities in the River Corridor. It provides a detailed understanding of disturbed areas (contaminated or not). Review of historical records and imagery, combined with on-the-ground walkdowns and field investigations; provide a comprehensive evaluation of current conditions in nonoperational areas.
- **Statistical analyses:** Two statistical analyses were conducted as adjuncts to environmental monitoring, data review, and field investigations. The first analysis was developed and applied to enhance efforts for systematically and rigorously locating potential waste disposal sites. The second analysis evaluated radionuclide distribution (based on available soil concentration data and aerial radiological surveys) to quantify and understand relationships with known waste sites and examine the potential for unidentified sites to exist outside operational areas.

L1.2 300 Area NPL Site Description

The 300 Area NPL Site is situated at the southern portion of the River Corridor and extends from north of Energy Northwest to south of the 300 Area Industrial Complex and from the west bank of the Columbia

River to the west to Horn Road. There are three subregions with facilities and waste sites related to Hanford Site operations the 300 Area industrial complex, and the 400 and 600 Areas. The 300 Area consists of the buildings, facilities, and process units located in the industrial complex located north of Richland, Washington, where the vast majority of uranium fuel production and R&D activities took place. The 400 Area consists of the FFTF and associated facilities. The 600 Area subregion consists of the 618-10 and 618-11 Burial Grounds, the 316-4 Crib, and various burial grounds not categorized as being within the 300 Area (industrial complex) or 400 Area, plus the groundwater impacted by releases from those waste sites. A major portion of the 600 Area is historically unused land with no known waste sites and facilities (*300 Area Decision Unit Remedial Investigation/Feasibility Study Work Plan for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units* [DOE/RL-2009-30], hereinafter called the 300 Area RI/FS Work Plan). This area was addressed as part of *100-F/IU-2/IU-6 Area – Segment 5 Orphan Sites Evaluation Report* (OSR-2011-0002).

The upland environment of the 300 Area NPL Site can be divided into three general regions: a central disturbed region, and northern and southern vegetated regions. The central portion of the 300 Area NPL Site consists of disturbed areas adjacent to buildings and facilities. The upland environment within the northern region is dominated by a bitterbrush/bunchgrass mosaic cover type. The upland environment within the southern region is primarily big sagebrush/bunchgrass mosaic with smaller areas of Sandberg's bluegrass-cheatgrass and gray rabbitbrush/Sandberg's bluegrass-cheatgrass. The vegetation to the north of the 300 Area NPL Site boundary is a continuation of the northern region's bitterbrush/bunchgrass mosaic cover type. The vegetation to the west of the 300 Area NPL Site boundary consists primarily of two cover types: snow buckwheat/bunchgrass mosaic and bunchgrass mosaic. Scattered within these two dominant cover types are small areas of gray rabbitbrush/cheatgrass, snow buckwheat-bitterbrush/bunchgrass, Indian ricegrass, and Sandberg's bluegrass-cheatgrass (*Literature Review of Environmental Documents in Support of the 100 and 300 Area River Corridor Baseline Risk Assessment* [PNNL-SA-41467]).

L2 Nonoperational Property Evaluation Approach

River Corridor cleanup efforts have focused on known waste sites located within operational areas (often within perimeter fences) and on a limited number of known sites outside these boundaries. Where surveillance monitoring or focused investigative activities have identified previously unknown sites, they were identified and evaluated for inclusion within the scope of the cleanup efforts. Operational areas comprise a small fraction of the total land surface in the River Corridor. Outside of the operational areas is the nonoperational property area. For purposes of this appendix, the nonoperational property area in the River Corridor is defined as that area beyond the boundaries of waste sites listed in the WIDS database. The nonoperational area is considered not to be directly associated with a Hanford Site process or operational activity known or suspected to contribute CERCLA hazardous constituents to the environment.

The approach to the NPE for the River Corridor is to develop a conceptual model of the fate and transport mechanisms that could distribute contaminants from Hanford Site operations that would warrant further evaluation in the nonoperational areas, and then apply multiple lines of evidence to examine the likelihood that such contamination is present. The lines of evidence include the following:

- Results from long-term surveillance and monitoring programs and other studies
- Results from a spatial model for predicting the location of artificial features (including waste sites) based on proximity to artificial and topographic features

- A spatial model for predicting where elevated radionuclide concentrations (specifically Cs-137) are present in soil based on aerial radiological survey results
- Results from the OSE program

Section L2.1 presents a brief description of potentially significant contaminant fate and transport pathways. Summary descriptions of the key surveillance and monitoring programs and other studies for the nonoperational area in the 300 Area NPL Site are presented in Section L2.2. Brief descriptions of the statistical analyses are presented in Section L2.3. A brief description of the OSE program is presented in Section L2.4.

L2.1 Nonoperational Contaminant Transport Pathways

The nonoperational property area, having no history of releases of hazardous or radioactive substances, is presumed to have a low likelihood of contamination that would require a response action under CERCLA. The principal objective of this evaluation is to examine multiple lines of evidence to confirm that hazardous or radioactive substance releases are not present in the nonoperational property area. An outcome of this evaluation could be the identification of areas where releases, or contaminant transport, may have occurred.

A select set of contaminant release pathways apply when evaluating the potential for contaminant transport into nonoperational areas. They include:

- **Anthropogenic contaminant sources.** Contaminants from facilities or known waste sites may have been physically transported by human actions to shallow soils outside of waste site boundaries. Several activities and programs at the Hanford Site identify waste sites that have resulted from these types of activities. Section L2.2 presents an overview of these activities and programs.
- **Transport via windblown dust.** Hazardous and radioactive substances in surface soils and materials can become suspended into the air, dispersed to downwind locations, and subsequently deposited onto the ground. Approximately 6 percent of the 1,518 km^2 (586 mi^2) Hanford Site (about 83 km^2 [32 mi^2], or 8,909 ha [20,000 ac]) has been actively disturbed or used. Potential fugitive dust emission sources are located in the five operations areas within this actively disturbed area: the 100, 200 East, 200 West, 300, and 400 Areas. The potential for fugitive dust emissions from these sources is generally conceived to occur subsequent to disturbance, erosion, or removal of soil covers over waste sites or through plant or animal biointrusion. These events can expose erodible material that contains contamination. Engineering controls (e.g., surface soil stabilization, dust suppression water, work cessation because of wind conditions) can be, and are, applied to mitigate or eliminate this transport pathway. However, there are contaminated areas posted as Radiologically Controlled Areas or Soil Contamination Areas that could contain erodible material that could produce fugitive emissions from resuspension of windblown dust (*Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 2009* [DOE/RL-2010-17]). Figure L-1 depicts a conceptual model of windblown dust transport.
- **Emissions from facility stacks.** Hazardous and radioactive substances emitted into the air from former and currently operating facility stacks and vents can be dispersed to downwind locations and subsequently deposited onto the ground. Three groups of sources of Hanford Site stack air emissions had the potential to affect the River Corridor by air deposition. Two of the groups, which represent by far the greatest potential contributors, are stack emissions that occurred during active operations between 1944 and 1972. The two groups are examined separately based on their physical location and type of contamination. The first group is stack emissions from 200 Area operations that separated plutonium and uranium from irradiated reactor fuel. The second group is stacks in the 100 Area that

exhausted ventilation air from the working areas of the nine production reactor facilities. The 100 Area sources were minor emissions compared with those from 200 Area facilities. The third group is nonradionuclide emissions resulting from coal-fired power plants used to generate steam for heating and process operations. There were two large power plants in the 200 Area that operated until the mid-1990s: 284-E Power Plant in the 200 East Area and 284-W Power Plant in the 200 West Area (*Facility Effluent Monitoring Plan for the 284-E and 284-W Power Plants* [WHC-EP-0472-1]). Nonradionuclide toxic air pollutants that could be emitted from coal-fired power plants are principally trace metals, but also include traces of volatile organic compounds such as formaldehyde, and polycyclic organic matter. The polycyclic aromatic organic matter and certain trace metals, in particular arsenic, cadmium, lead and antimony, adhere to the fine particulate matter emitted from a power plant stack. Figure L-2 presents the conceptual model of transport from stack emissions.

- **Overland transport.** Hazardous and radioactive substances in surface materials can be transported away from facilities or known waste sites by surface run-off (overland flow). This could conceivably occur following precipitation events or, as has been documented, from releases (or "spillage") of process liquid waste that had been discharged to liquid waste disposal sites. Overland flow potentially results in the transport of contaminated sediments or water away from a waste site. Factors that affect overland flow include slope of the ground surface, soil texture, and vegetative cover, and frequency of precipitation.

  The Hanford Site is in a semiarid region and precipitation is more than balanced by evaporation and transpiration such that substantial overland flow from precipitation is an unlikely occurrence. A more likely source for overland flow is spills or releases from liquid waste disposal facilities during historical active operations. In general, these leaks were infrequent and documented through written and photographic records. Most resulted in localized contamination in and around the disposal sites. A number of these sites have been remediated under the Interim Action RODs.

- **Biointrusion.** Hazardous and radioactive substances in shallow soil can be transported to plants at ground surface through their roots or, disturbed and transported to the soil surface by burrowing animals or insects. Plants extend roots into the soil to extract nutrients and water. Most of the mass of plant roots is concentrated within the shallow soil; however, some deep-rooted plant species are found at the Hanford Site. Unless actively managed and controlled, deep-rooted vegetation (e.g., tumbleweeds, sagebrush) growing over underground sources of contamination may selectively uptake contaminants, particularly radionuclides, into their tissues. When radionuclides are transported from roots to aerial portions of the plant, surface contamination may result. Desert animals and insects burrow for shelter from the heat, cold, or predators; reproduction; feeding; and water conservation. Most wildlife burrow no more than a few feet in depth; however, some macroinvertebrates (harvester ants) have been reported to burrow to depths of up to 2.4 m (8 ft) in soil at the Hanford Site. Animals that burrow into contaminated soils could unearth contaminants and disperse them on the soil surface. The conceptual model of biointrusion is depicted on Figures L-3 and L-4.

L2.2 Surveillance and Monitoring Programs

Several programs at the Hanford Site collect environmental surveillance and monitoring data. Many of these programs collect data to address regulatory requirements for emissions, effluent discharges, or DOE Orders regarding radiological control. Other programs perform environmental monitoring of soil, water, air, or vegetation. Most of these programs are summarized in the Annual Environmental Report for the Hanford Site (see *Hanford Site Environmental Report for Calendar Year 2009* [PNNL-19455], hereinafter called the 2009 Sitewide Environmental Report, for an example of an environmental report).

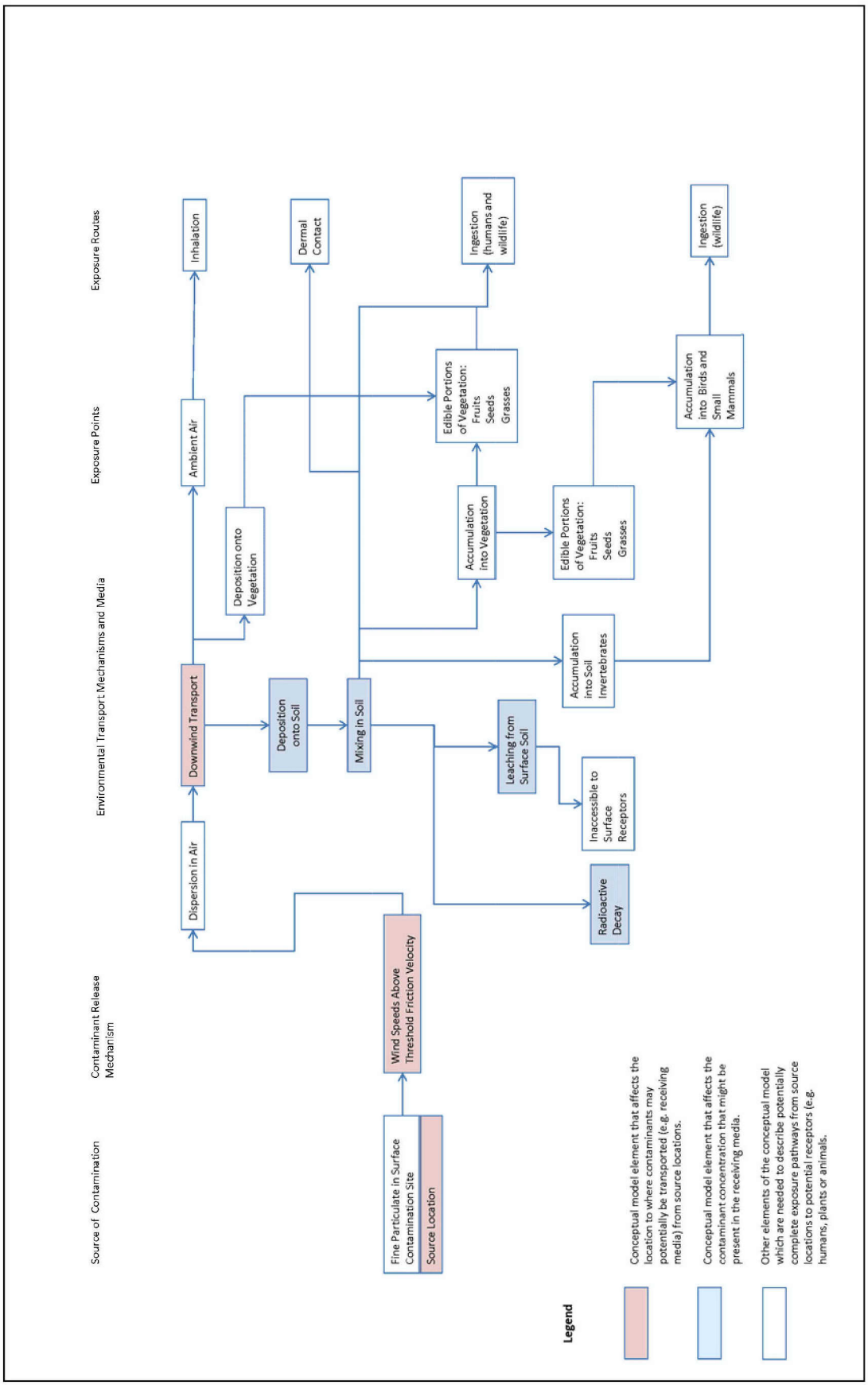

Figure L-1. Nonoperational Area Conceptual Model of Contaminant Fate and Transport Pathways—Transport of Windblown Dust

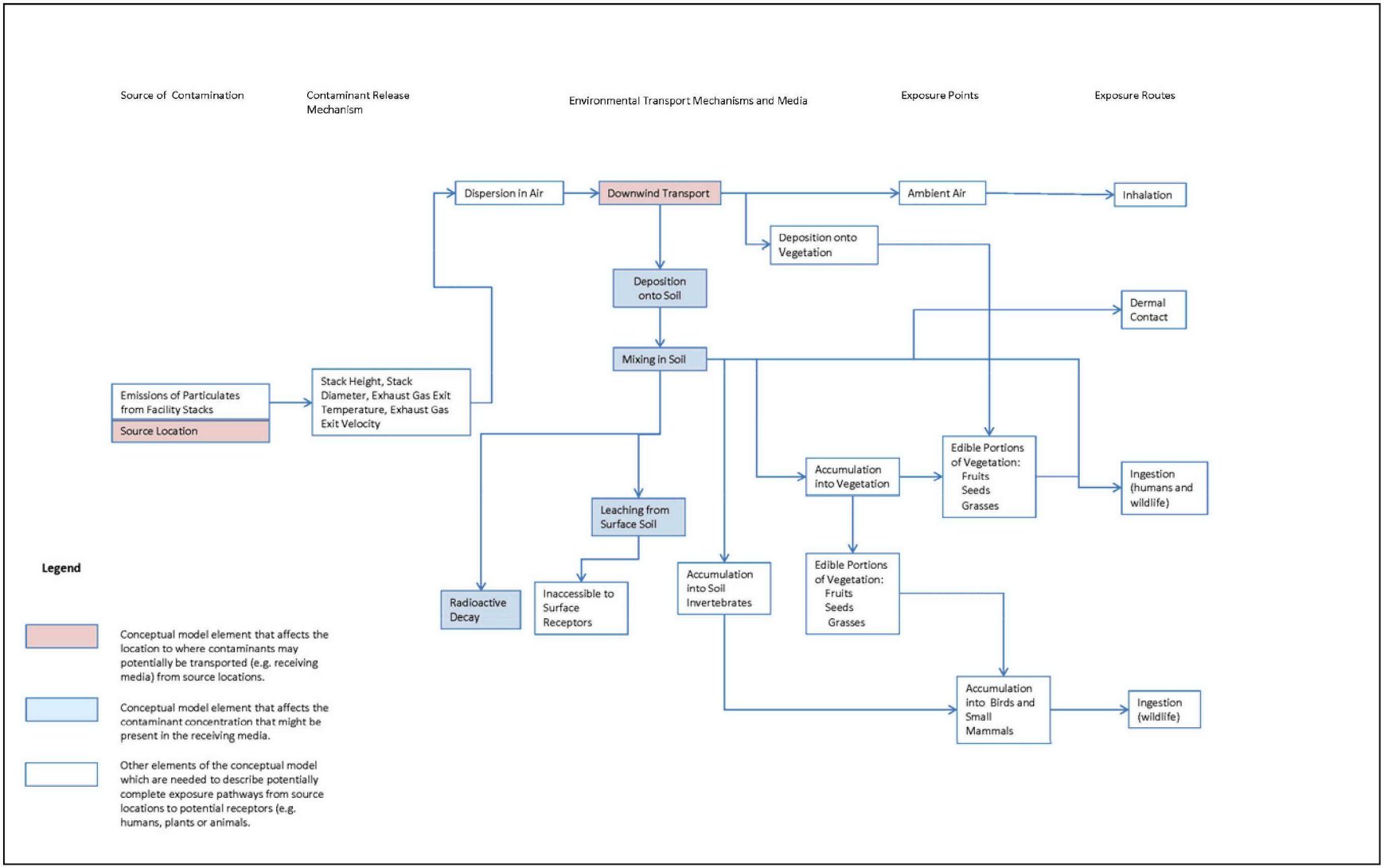

Figure L-2. Nonoperational Area Conceptual Model of Contaminant Fate and Transport Pathways—Transport via Emissions from Facility Stacks

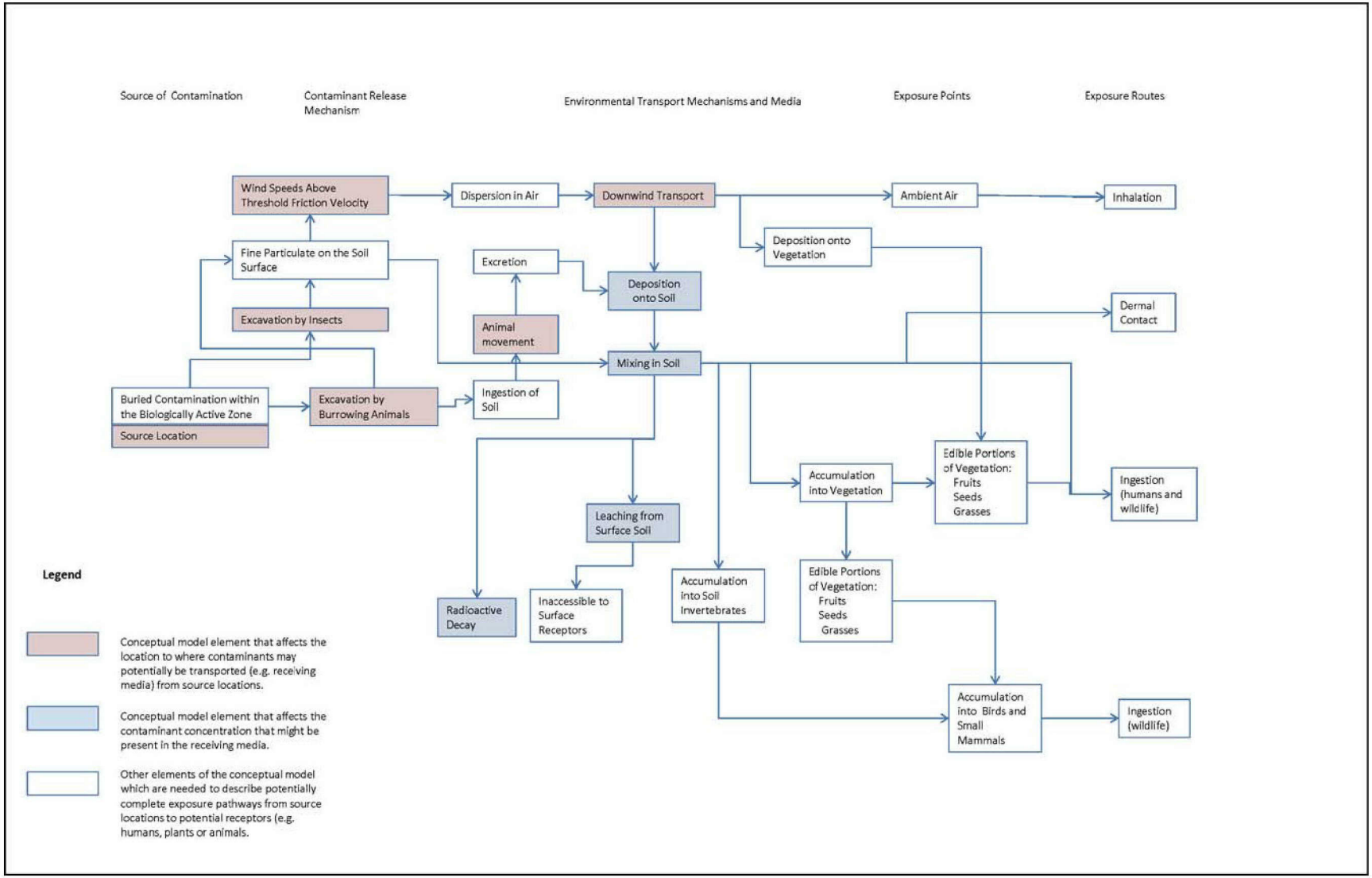

Figure L-3. Nonoperational Area Conceptual Model of Contaminant Fate and Transport Pathways—Transport via Animal Intrusion of Buried Contaminants

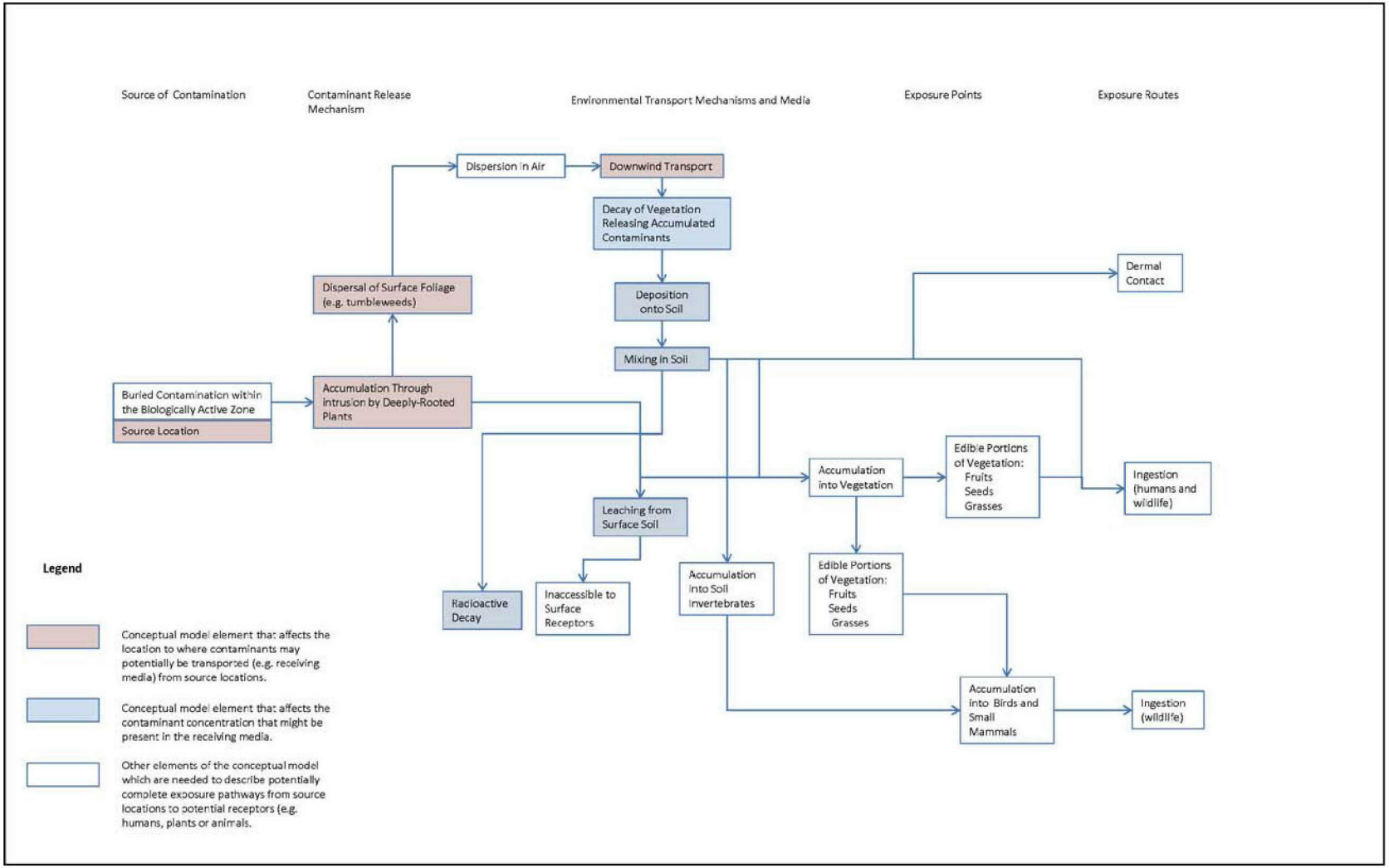

Figure L-4. Nonoperational Area Conceptual Model of Contaminant Fate and Transport Pathways—Transport via Intrusion of Deep-Rooted Plants

Fifteen Hanford Site programs that identify waste sites and/or collect environmental monitoring and surveillance data are listed in Table L-1. In addition, Table L-1 identifies five other sources of information and data applicable to a nonoperational area evaluation. Information and data from these programs were evaluated to identify trends in how hazardous substances or radionuclides may have been transported from operational areas or waste sites to nonoperational areas within the River Corridor. Information from the programs involved with soil, air, or vegetation monitoring, or with radiological control, were of most use in the NPE. The evaluation of the results from these programs as they pertain to the 300 Area NPL Site is summarized in Section L3.1.

Table L-1. Existing Hanford Site Programs Related to Environmental Data and Monitoring

Ongoing Hanford Site Programs	
Air Emissions Monitoring	Liquid Effluent Monitoring
Ambient Air Monitoring near Hanford Site Facilities and Operations	Sitewide and Offsite Ambient Air Monitoring
Soil Monitoring near Hanford Site Facilities and Operations	Sitewide and Offsite Soil Monitoring
Vegetation Monitoring near Hanford Site Facilities and Operations	Sitewide and Offsite Vegetation Monitoring
Radiological Dose Measurement near Hanford Site Facilities and Operations	Radiological Surface Surveys near Hanford Site Facilities and Operations
Groundwater Monitoring	Radiation Area Remedial Action Project
Waste Information Data System	Spill and Release Reporting
Vegetation Control Activities	
Additional Information and Data Sources	
Aerial Radiological Surveys	River Corridor Baseline Risk Assessment (DOE/RL-2007-21)
Aerial Photography (includes LIDAR)	Emissions Estimation and Dose Assessments Conducted as Part of the Hanford Environmental Dose Reconstruction (HEDR) Project
Hanford Site Background Studies	

L2.3 Statistical Analyses

The statistical analyses focused on:

- Developing and applying a predictive model for waste site locations
- Establishing association between Cs-137 measured directly in soil and high resolution aerial survey results
- Developing a sitewide model of soil Cs-137 using lower resolution sitewide aerial surveys

The results of these analyses were used to model the likelihood of finding previously undiscovered waste sites in the nonoperational areas as a function of artificial and topographic features, and model the potential for radionuclide concentrations (specifically Cs-137) in surface soil to be higher than selected threshold concentrations.

The following subsections describe these lines of investigation. Section L3.2 discusses the results from these analyses.

L2.3.1 Predictive Modeling of Waste Site Locations

The predictive model is based on the conceptual model that waste sites are located in proximity to anthropogenic features such as roads or existing operational areas, or flat or low-lying topography. The distributions of these geographic variables, measured at WIDS sites, were compared with the distribution of the same variables calculated at an unbiased set of locations systematically distributed across the Hanford Site. A quantitative model was developed to show the probability of a waste site being located at any location not sampled within the Hanford Site as a function of these geographic measures. Factors considered in developing geographic variables for known waste sites and sources included distance to operational areas; distance to roads, railroad grades, utility rights-of-way (e.g., power lines) and roads; and topography, including slope aspect elevation, and curvature. These models were used to rank areas based on the relative probability that a previously undiscovered waste site might exist.

L2.3.2 Aerial Surveys and Soil Radionuclides

Measurements of the presence of radionuclides were available from direct soil measurements, as well as from laterally extensive aerial radiological surveys. Soil measurements were expressed as activities per unit mass (pCi/g), suitable for estimation of exposure for risk assessment, whereas data obtained from aerial surveys were expressed as gross counts for gamma emitting radionuclides. Aerial survey data could be used to estimate exposure if it could be calibrated with soil Cs-137 activity data. Predictive models and maps of the probability that Cs-137 levels would be expected to exceed screening levels could be prepared based on the statistical relationship between soil activity measurements and aerial survey gross counts.

A detailed investigation in the BC Controlled Area (BCCA), which included collecting high-resolution aerial survey data and relatively high-density soil sampling, provided data to perform a detailed geostatistical analysis. The analysis of the BCCA data supported development of a sitewide model based on less resolved, but more laterally extensive, aerial surveys of all of the Hanford Site. The results of the sitewide model were used to draw conclusions specific to the River Corridor. The results of both analyses support the utility of aerial radiological surveys for estimating concentrations in soil for unsampled areas.

L2.4 Orphan Sites Evaluation

The OSE is a systematic approach to evaluate land parcels in the River Corridor to ensure that all waste sites or releases requiring characterization and cleanup were identified. Information collected through these evaluations also supports elements of the CERCLA Section 120(h)(4), “Federal Facilities,” “Property Transferred by Federal Agencies,” “Identification of Uncontaminated Property” requirements for review and identification of uncontaminated property at federal facilities. The OSE supplemented past systematic efforts that identified source waste sites, including the following:

- TPA-MP-14 (*Tri-Party Agreement Handbook Management Procedures* [RL-TPA-90-0001]) discovery process for identifying known and potential waste sites

- The CERCLA hazard ranking conducted in 1985 and 1986 to place the Hanford Site on the 40 CFR 300, Appendix B, "National Priorities List," hereinafter called the NPL

Two of the key elements of an OSE include a historical review and a field investigation. Review of historical information was conducted to identify potential orphan sites and to target areas for further evaluation during the course of conducting the associated field investigation. Historical research focused on identifying specific items or features typically associated with a waste site. The most common features associated with a waste site in reactor areas include drains, cribs, drywells/French drains, burial grounds, pipelines, above ground and below ground storage tanks, septic systems, drain fields, burn pits, trenches, ditches, pits, spills, sumps, vaults, ash pits, disposal areas, pumps, and buildings and facilities that contain chemicals and radiological contaminants. Information obtained and used in the historical review included the following resource types:

- Maps
- Construction and operations drawings
- Technical and operations documents
- Construction and operations photographs
- Aerial photographs
- Geophysical survey results
- Cleanup verification packages
- Sampling logbooks
- Personnel interviews

Field investigation activities were used to provide another level of assurance by conducting systematic walking surveys to document potential orphan sites and to follow up on potential orphan sites identified from historical review. Three primary tools provided the media to record the information observed in the field including hand-held Trimble GeoXT™ GPS units, digital cameras, and field logbooks. Geophysical survey instrumentation was used to supplement these tools in selected areas of suspect subsurface features identified during the historical review or field investigation.

To ensure a systematic approach for area coverage, standardized 30 × 30 m (98.4 × 98.4 ft) conceptual grids were established over the investigation areas. The grid and existing known features in the areas were loaded onto the GeoXT GPS units, which were used in the field to monitor progress and record information. Walking surveys were typically performed in pairs with approximately 15 m (49.2 ft) spacing between individuals. Features encountered during this investigation were recorded using the GPS unit, digital camera, and field logbook.

The field investigation for regions of the River Corridor used a graded approach. High resolution, four-band (red, green, blue, and near-infrared) orthophotography imagery and LIDAR topography data were collected for approximately 57,468 ha (142,000 ac) of the River Corridor in April 2008. The data were collected in the early spring when foliage and undergrowth obscuring the ground surface was at a minimum. The orthophotography and LIDAR data were used to conduct "virtual walkdowns" of the areas. Based on results of these "virtual walkdowns," areas were selected to conduct walking surveys (30 × 30 m [98.4 × 98.4 ft] reference grid system). Vehicle surveys along accessible roads and utility easements were also part of the field investigation. In addition, standard walking surveys were conducted throughout the River Corridor along the Columbia River, based on the level of interest in the shoreline

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area and its inclusion as part of the Hanford Reach National Monument ("Establishment of the Hanford Reach National Monument" [65 FR 37253]).

The results from historical research, field walkdowns, GIS mapping and geophysical surveys for the 300 Area are summarized in *300 Area Orphan Sites Evaluation Report* (OSR-2010-0002). The 300 Area OSE encompasses much of the 300-FF-2 OU, including the 300 Area and an expanded field walkdown area primarily to the west. In addition, the 300-FF-1 OU was reevaluated as part of the field walkdown. The total coverage area was approximately 829 ha (2,048 ac). Eighteen orphan features were identified during the OSE and submitted for acceptance into WIDS. There were 13 features categorized as miscellaneous restoration items and documented as part of the OSE.

The OSE for Segment 5, presented in *100-F/IU-2/IU-6 Area – Segment 5 Orphan Sites Evaluation Report* (OSR-2011-0002), covers the largely nonoperational portion of the 300 Area NPL Site. Historical activities that occurred within this area prior to 1943 (pre-Hanford) consisted of farm/homesteads that were mainly confined to the south end of Segment 5 and near the 300 Area. The remaining portion of Segment 5 consists of mainly dune formations. All railroad features in Segment 5 were constructed after 1943 to support Hanford Site operations. The Segment 5 area included one 1950s-era historical military radar site (H-43-R) that was located within the current Hanford Patrol Training Area Firing Range, just north of Horn Rapids Road. The Segment 5 area also included one "Arc" road that supported air diffusion experiments that occurred on the Hanford Site from 1959 through 1974. Segment 5 contains a number of facilities associated with known Site operations. These known operations include the 400 Area (former FFTF site), Energy Northwest (ENW) nuclear reactor complex, HAMMER and associated Hanford Patrol Training Academy, and two active substations. The 400 Area was previously investigated using the OSE process (*400 Area Orphan Sites Evaluation Report* [OSR-2010-0003]), and the remaining areas were excluded from this investigation. Other previously identified WIDS sites associated with Hanford Site-related activities within the Segment 5 investigation area prior to conducting the OSE included sites such as burial ground sites (618-10 and 618-11 waste sites), debris pits, gravel pits, test burial caissons, demolition sites, soil lysimeters, and a contaminated soil dump (unplanned release). The 618-10 and 618-11 waste sites are associated with the 300-FF-2 OU and were not included as part of this evaluation. The coverage for the Segment 5 OSE includes an area of approximately 14,178 ha (35,033 ac) including approximately 4,222 ha (10,432 ac) that was excluded from the OSE process. The areas excluded include the Hanford Patrol Training Area Firing Range, Energy Northwest, HAMMER, and three active electrical substations (HJ Ashe, White Bluffs, and Benton). One orphan site and 17 miscellaneous restoration features were identified in the OSE for Segment 5.

L3 Evaluation Results

This chapter summarizes the results of the NPE in the 300 Area NPL Site based on the approach presented in Chapter L2. The NPE is based on multiple lines of evidence, including the results from surveillance and monitoring programs, and other studies conducted in the River Corridor; the results from statistical analyses performed to identify the potential presence of waste sites and to evaluate the spatial distribution of selected radionuclides in soil; and the results from the OSE.

L3.1 Results from Surveillance and Monitoring Programs

Hanford Site programs, which provided information characterizing conditions in the nonoperational areas in and around the 300 Area NPL Site, included the soil, air, and vegetation sampling conducted as part of the Near Facility Monitoring program and the SESP. The radiological control program with emphasis on radiological surveys and activities for identifying and controlling biological vectors (biointrusion from plants and animals), and external radiation monitoring conducted as part of the SESP.

Other activities that contribute to characterizing conditions in the nonoperational areas include the waste site discovery process under TPA-MP-14 (*Tri-Party Agreement Handbook Management Procedures*[RL-TPA-90-0001]), which results in identified waste sites being inventoried in WIDS and, as discussed in Section K3.3, the OSE. Historically, interim actions conducted under the Radiation Area Remedial Action (RARA) project contributed to stabilizing and controlling releases from waste sites. The results from these programs have been discussed using the framework of the conceptual model described in Section L2.1.

L3.1.1 Anthropogenic Disposal Activities

Past and present investigation activities provide confidence that waste site locations within the River Corridor are known. Waste site identification activities in the River Corridor fall into two categories: systematic and observational. Various systematic programs have been conducted at different times since the beginning of Hanford Site transition from production to cleanup in the 1980s, with the most recent being the OSE program that was initiated in 2004 (Section KL.3). An inventory of known and potential waste sites has been maintained in the WIDS database since the early 1980s, and is continually maintained through the TPA-MP-14 (*Tri-Party Agreement Handbook Management Procedures* [RL-TPA-90-0001]) discovery process. Between 1985 and 1988, preliminary assessment/site inspection activities were completed to identify waste sites and prioritize the relative hazards. Waste disposal information was collected through exhaustive reviews of literature and maps, employee interviews, and visual inspection of all sites and unplanned releases. Results were organized and sites were ranked with respect to potential environmental impacts in accordance with a slightly modified version of the CERCLA hazard ranking system. The results from this process provided information to support addition of the 100 and 300 Areas to the NPL and subsequent listing of waste sites in Appendix C of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989).

A variety of characterization activities conducted as part of the RI/FS process has further characterized potential release and disposal activities in the 100 Area. These historical activities are summarized in the 300 Area RI/FS Work Plan (DOE/RL-2009-30).

L3.1.2 Windblown Dust Emissions

Emission sources, which could release contaminants through windblown dust, are described variously as "fugitive," "diffuse," or "nonpoint" emissions sources (*Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 2009* [DOE/RL-2010-17]). The Hanford Site consists of 1,518 km^2 (586 mi^2) of semiarid shrub-steppe land, of which approximately 6 percent (about 83 km^2 [32 mi^2], or 8,909 ha [20,000 ac]) has been actively disturbed or actively used. This 6 percent of land is distributed into large operational and support areas where almost all fugitive emissions sources are located: the 100, 200 (which include 200 East and 200 West), 300, and 400 Areas.

The potential for fugitive dust emissions from waste sites (prior to their cleanup) is generally characterized as occurring subsequent to erosion of soil covers or plant or animal biointrusion, which may expose erodible material containing concentrations of radionuclides. Contaminated areas posted as Radiologically Controlled Areas or Soil Contamination Areas also could contain erodible material that is radiologically contaminated, and that could produce fugitive emissions from resuspension of windblown dust (*Radionuclide Air Emissions Report for the Hanford Site, Calendar Year 2009* [DOE/RL-2010-17]).

The RARA program is responsible for the interim stabilization, surveillance, and maintenance of the inactive waste sites at the Hanford Site. Interim stabilization measures to control fugitive dust have historically been performed on inactive waste sites prior to their cleanup. Stabilization measures included consolidation of surface contamination within the waste site from which it originated, then covering the waste with a layer of soil or other material (such as cobbles). Waste sites were then revegetated or treated

as needed with a nonselective herbicide. Following stabilization, quarterly surveillance, annual radiological surveys, annual herbicide applications, removal of deep-rooted vegetation, and occasional corrective action for small areas of surface contamination that appeared continued. Interim stabilization reduced sources of windblown dust potentially originating from contaminated soils.

The potential magnitude of windblown dust transport can be evaluated from the frequency of restrictions to visibility and ambient air monitoring for particulate matter and radionuclides in air. Dust, blowing dust, and smoke from field burning are described as phenomena causing restrictions to visibility (i.e., visibility less than or equal to 9.6 kg [6 mi]). Reportedly, there are few such days at the Hanford Site (*Hanford Site National Environmental Policy Act (NEPA) Characterization* [PNNL-6415]). Particulate air monitoring shows that annual average PM_{10} (particulate matter finer than 10 cm in diameter) concentrations at the Hanford Meteorological Station are similar to PM_{10} concentrations at the Benton Clean Air Agency in Kennewick.

L3.1.3 Stack Emissions

Radionuclide emissions formerly from stacks in the 200 and 100 Areas had the potential to affect the River Corridor through deposition from the air. Based on studies conducted as part of the Hanford Environmental Dose Reconstruction (HEDR) project, most of the emissions occurred between 1944 and 1972 from facilities in the 200 Area that separated plutonium and uranium from irradiated reactor fuel (*Radionuclide Releases to the Atmosphere from Hanford Operations, 1944-1972* [PNWD-2222 HEDR]). The largest releases from these facilities occurred in 1945, before effective collection devices were installed ahead of the stacks to prevent the discharge of volatile and particulate radionuclides. Most of the inventory emitted consisted of gaseous and/or short-lived radionuclides, which would be unlikely to result in measurable concentrations in soil in Hanford Site nonoperational areas. The nine production nuclear reactors in the 100 Area had stacks to exhaust ventilation air from the working areas of the reactor facilities. These were minor sources of emissions compared to the 200 Area facilities. No significant stack releases from 300 Area operations were reported in the documents that evaluated soil sampling and monitoring. The 300 Area primarily supported fuel fabrication processes and research activities that were not expected to have contributed to radioactive airborne emissions released on the Hanford Site (*RCBRA Stack Air Emissions Deposition Scoping Document* [DOE/RL-2005-49]).

Releases of long-lived radionuclides, including Am-241, Cs-137, I-129, Sr-90, Pu-238, Pu-239/240, and Pu-241, from the 200 East and 200 West Areas major stacks, were a very small fraction of the total inventory emitted into the air. A review of dose reconstruction information indicates that most of the total releases of long-lived radionuclides consist of Cs-137 and Sr-90, with a minor contribution of the other radionuclides.

Potential long-term impacts from these emissions within the Hanford Site were assessed through air and soil sampling conducted as part of the Near Facility Monitoring and SESP programs (2009 Sitewide Environmental Report [PNNL-19455]). Near-facility ambient air monitoring was conducted in 2007, 2008, and 2009 at seven locations in the 300 Area, for gross alpha, gross beta, and plutonium and uranium isotopes. U-234 and U-238 were the only radionuclides detected consistently in the near-facility air samples. These detected concentrations did not approach EPA's action levels for compliance with the radionuclide NESHAPS (*Hanford Site Environmental Report for Calendar Year 2007* [PNNL-17603]; *Hanford Site Environmental Report for Calendar Year 2008* [PNNL-18427]; and 2009 Sitewide Environmental Report [PNNL-19455]). In 2007, Sr-90 was detected in one near-facility sampler at a concentration elevated above historic levels, but less than 10 percent of the EPA action levels in air (based on 10 mrem/yr) for compliance with the radionuclide NESHAPS (*Hanford Site Environmental Report for Calendar Year 2007* [PNNL-17603]). The Annual Environmental Reports state that in general, air samples collected from locations at or directly adjacent to Hanford Site facilities had higher

radionuclide concentrations than samples collected farther away. However, reported concentrations fall below the EPA action levels in air (based on 10 mrem/yr) for compliance with the radionuclide NESHAPs. Direct measurements of gamma doses made at this station with a thermoluminscent detector since 1970 have shown background levels of radioactivity. The Annual Environmental Reports describe the general trends in radionuclide concentrations measured in soil. While concentrations at some near-facility sampling locations are higher than offsite locations, average concentrations are low and show no changes in trends over several years (2009 Sitewide Environmental Report [PNNL-19455]). In general, concentrations of sampled radionuclides, including Cs-137, Sr-90, Pu-239/240, U-235, and U-238, resemble Hanford Site background concentrations in soil.

L3.1.4 Overland Flow

The Hanford Site is in a semiarid region and thus experiences many dry periods. January, March, and December are the only months that have always received measurable precipitation, reported from 1946 through 2004. Normal annual precipitation at the Hanford Site is 17.7 cm (6.98 in.) (*Hanford Site Climatological Summary 2004 With Historical Data* [PNNL-15160]). In the Hanford Site's semiarid climate, precipitation is balanced by evaporation, transpiration, and vegetative uptake such that substantial overland flow from precipitation is an unlikely occurrence.

A more likely source for overland flow is historical spills or releases from liquid waste disposal facilities during active operational periods. Liquid effluents generated as a direct result of reactor operations consisted primarily of reactor cooling water, fuel storage basin water, and decontamination solutions.

Leaks are more likely to have occurred from the liquid waste disposal sites in the 100 Area that resulted in overland flow are described in the report of the 1975 sampling event (*Radiological Characterization of the Retired 100 Areas* [UNI-946]). In general, these leaks were infrequent, well documented, and resulted in localized contamination around the periphery of the disposal sites. The leaks were characterized historically or as part of the current RI/FS. The majority were cleaned up and interim closed out, in accordance with the interim action RODs. The identification of leaks or spills from waste sites is incorporated into the procedure for maintaining WIDS in accordance with TPA-MP-14 (*Tri-Party Agreement Handbook Management Procedures* [RL-TPA-90-0001]). Based on the available information, overland flows from liquid waste disposal facilities are limited in lateral extent, with unplanned liquid release sites identified through existing programs such as WIDS. The factors considered in this evaluation indicate that contamination in nonoperational areas through overland transport is unlikely to occur.

L3.1.5 Biointrusion

Biointrusion episodes in the 300 Area have not been described in radiological survey reports for the past three years. Radiological surveillance monitoring or vegetation sampling conducted as part of the Near-Facility Monitoring Program (2009 Sitewide Environmental Report [PNNL-19455]) has not identified contaminated vegetation episodes around the 300 Area.

L3.2 Statistical Evaluations

The statistical evaluations provide estimates of the likelihood of finding previously undiscovered waste sites in the nonoperational property areas and the potential for exposure to Cs-137 exceeding selected threshold concentrations in surface soils.

L3.2.1 Relative Probability of Missing an Existing Waste Site

Known waste sites have largely been located in proximity to anthropogenic features and relatively particular topographic conditions. For example, most waste sites found to date tended to be close to roads, in low-lying areas such as ditches or ponds, or proximate to operational areas. The spatial distributions of

these geographic variables, measured at known WIDS sites, were compared with the distribution of the same variables calculated at an unbiased set of locations systematically distributed across the Hanford Site. A statistical relationship was established to rank the likelihood that an available location might contain a previously unknown waste site. Logistic regression was used to develop the statistical relationship between waste site locations and geographic variables.

Factors considered in developing geographic variables expected to predict locations of known waste sites and sources included: distance to operational areas; distance to roads, railroad grades, lakes, streams, utility rights-of-way (e.g., power lines); and topography.

The geographic characteristics of the known waste sites were investigated to determine if their locations exhibited predictable spatial patterns. The purpose of this analysis was to develop a quantitative predictive model describing relationships so that areas within the River Corridor could be prioritized based on the relative probability that a previously unidentified waste site might be present. This analysis does not provide an absolute probability that a waste site exists, but rather provides a relative probability that allows locations to be ranked to identify the more likely location for a waste site—after all there may be no additional waste sites in the River Corridor that have not been found. The predictive model provides direction to the most likely places for a waste site to occur if indeed one exists.

The predictive model was developed based on a set of known waste site locations obtained from WIDS (referred to as a “training set”). The results of this model were used to predict the relative probability of encountering a potential waste site at areas that had may not have been investigated in the field. This provided a ranking of locations within the NPE that could then be investigated in the field, compared with previous field or desktop investigation results to determine the potential that additional previously undetected waste sites may remain within the NPE. In the River Corridor area, the modeled predictions were compared with information generated from the OSE. The modeled predictions were compared with miscellaneous remediation points and waste site points observed during observations of aerial photography and LIDAR imagery, field walkdowns, and vehicular road surveys conducted as part of the OSE. These comparisons provided independent validation of the predictive model.

The waste site probability map is plotted on Figure L-5 showing the 300 Area NPL Site with an inset map for the area surrounding the FFTF Reactor. The probability model plotted illustrates the dependence of modeled probability of finding a waste site on proximity to and density of local road networks. The map also shows some road highlighted with heavy red solid lines indicating that road surveys were conducted in these areas as part of the OSE. Road surveys were also conducted in the other decision units but do not stand out as prominently in previous figures. A more complete discussion of these road surveys will follow in subsequent sections.

Ground surveys were conducted near the FFTF area as indicated by the red dashed line. No miscellaneous remediation or waste-site points were identified in this area, and the probability of identifying waste sites in this area was extremely low, primarily because of the lack of secondary roads from which to access the area. The inset shows that the probability levels are higher in and around the FFTF buildings and some waste site points are located in this area. Nearly all of these locate openings for French drains.

Figure L-6 shows a close-up view of the 300 Area Industrial Complex. This area contained a large number of known waste sites, so it was predicted to be a likely area to find additional waste sites. As predicted, many waste site points were found in this area. The boundaries of the field walkdown efforts fully contained all of the areas predicted to contain additional waste sites. Areas outside the field walkdown polygons were inspected using aerial photography and LIDAR as well as road surveys (heavy red solid lines). No additional miscellaneous remediation points or waste site points were identified.

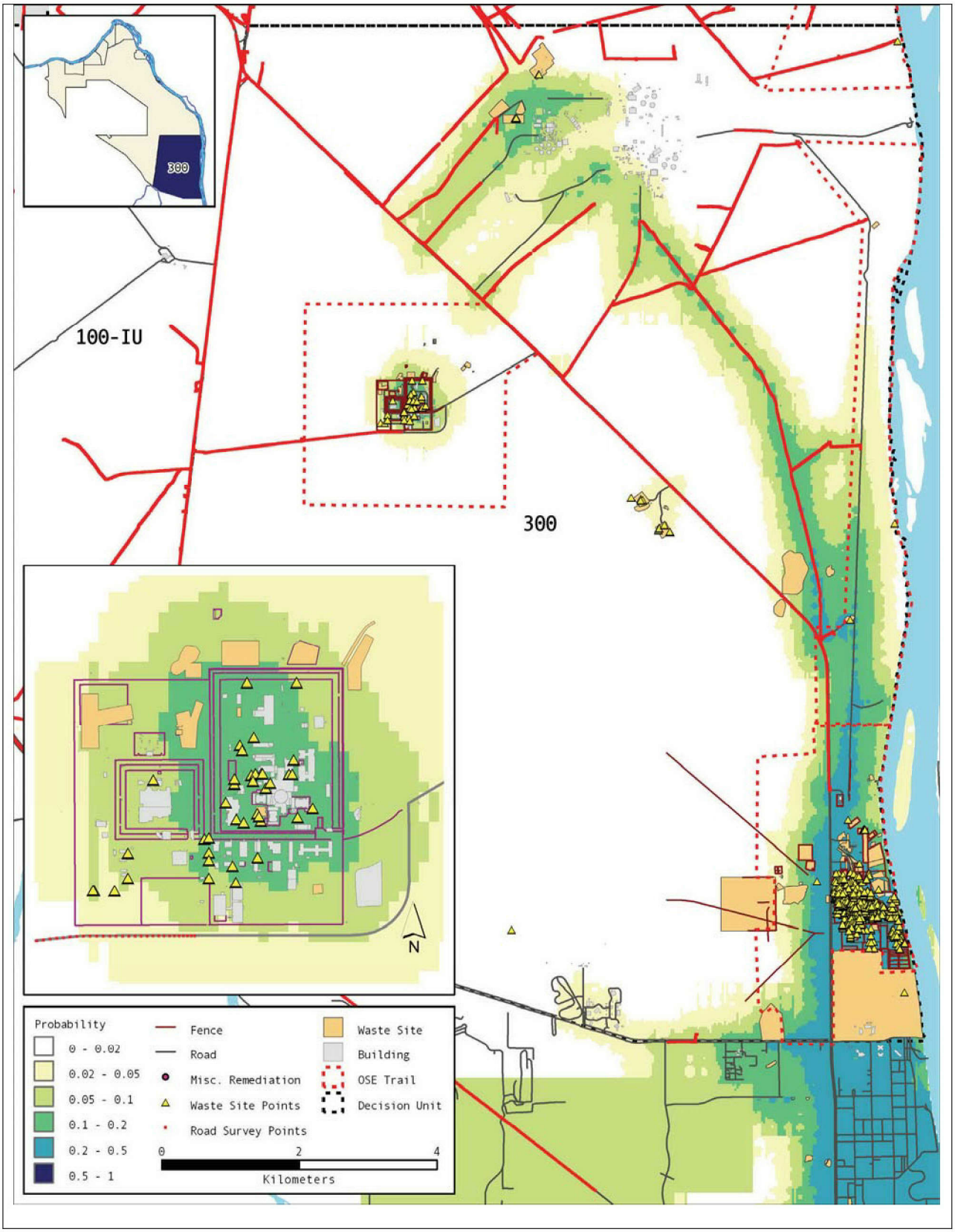

Figure L-5. Relative Probability of Waste Site Locations in the 300 Area NPL Site

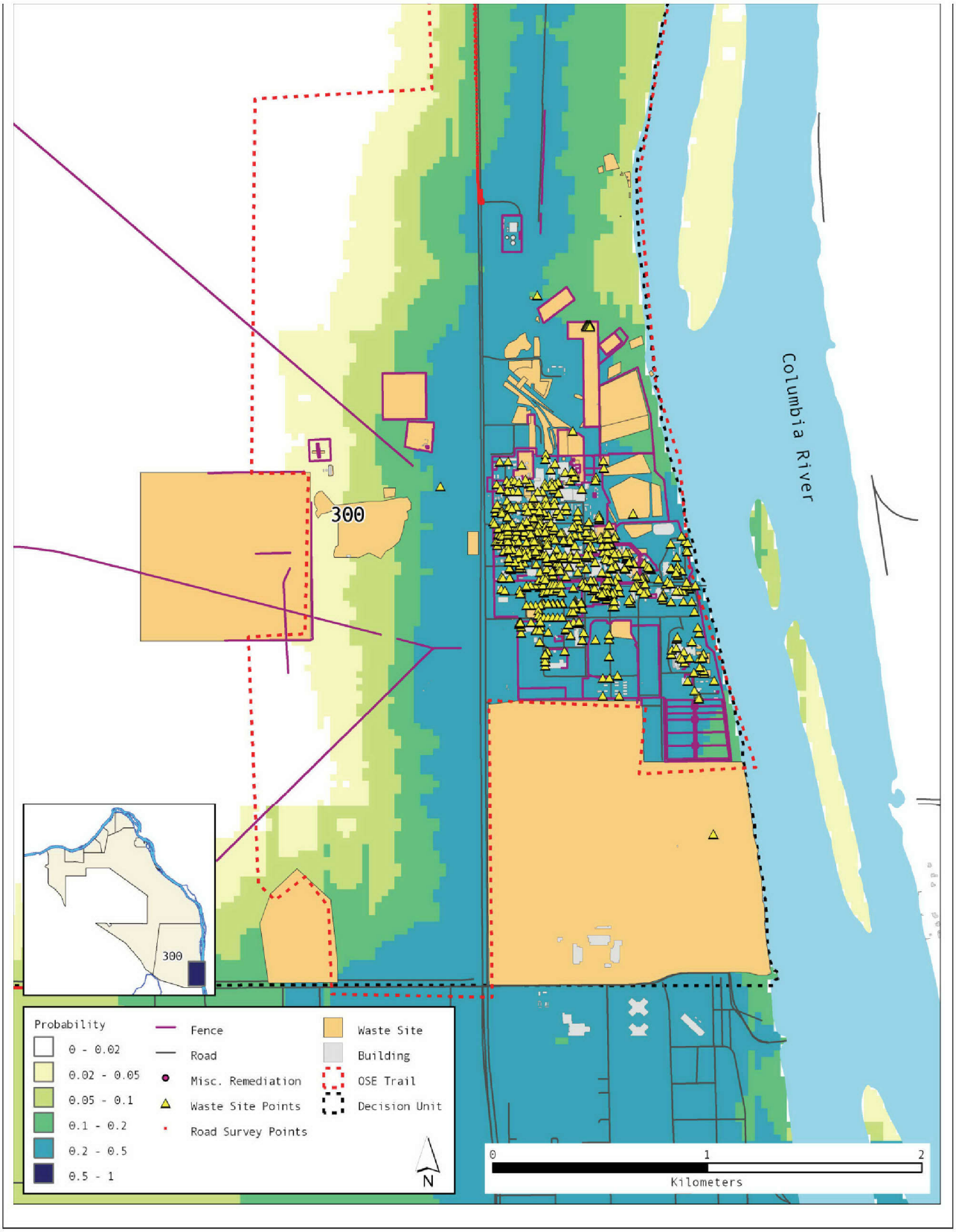

Figure L-6. Relative Probability of Waste Site Locations in the 300 Area Industrial Complex (South)

L3.2.2 Spatial Analysis of Soil Radionuclides and Aerial Surveys

Measurements of the presence of radionuclides were available from direct soil measurements, as well as from laterally extensive radiological aerial surveys. Soil measurements were expressed as activities per unit mass (pCi/g) suitable for estimation of exposure for risk assessment, but provide only limited understanding of the spatial distribution of concentrations. Data obtained from aerial surveys interrogates much larger areas, but expressed as gross counts for gamma emitting radionuclides. The aerial survey data were not directly applicable to estimation of potential exposure without calibration to directly measured soil concentrations.

For purposes of the NPE, aerial survey data were calibrated against measured soil Cs-137 activity data. Geostatistical methods were used in a preliminary study to develop a spatially explicit relationship between soil activity measurements and aerial survey gross counts within the BCCA. Detailed geostatistical analysis was conducted within the BCCA because high-resolution aerial survey data and relatively high-density soil sampling were available for this area. The preliminary analysis of the BCCA data was used as a pilot study to support determination to proceed with development of a more extensive sitewide model based on less resolved, but more laterally extensive aerial surveys of all of the Hanford Site. The results of the sitewide model were used to draw conclusions regarding the distribution of Cs-137 (a contaminant of potential concern related to Hanford Site operations) specific to the nonoperational area.

Aerial surveys conducted in 1996 (*An Aerial Radiological Survey of the Hanford Reservation Richland Washington, Date of Survey: February 29 to March 21, 1996* [DOE-0335]) and 2009 (*An Aerial Radiological Survey of the Hanford BC Controlled Area and West Lake Area Survey Data – September 22 to 30, 2009* [SGW-45563]) were combined with ground radiological surveys, and soil sampling and analytical data for Cs-137 in the BCCA to establish a relationship to the aerial survey results and measured concentrations in soil. A statistical model of the probability that soil Cs-137 levels exceed selected threshold levels (1.05, 1.5, 3.1, and 6.2 pCi/g) was developed as a function of gross counts of gamma emitting radionuclides using sitewide aerial survey results. The statistical model was validated against a set of waste sites in the 200-MG-1 OU, where radiological surveys and soil sampling and analysis had been conducted as part of interim remedial actions.

The logistic regression models provide estimates of the probability of exceeding threshold levels, which can be interpreted as estimates of the proportion of an area that would be expected to exceed those levels if one were to sample them. Figure L-7 provides a map corresponding to the fitted probability model for the 1.05 pCi/g threshold level for the entire Hanford Site and for the 300 Area NPL Site, respectively. It can be seen that probabilities reflect the gross patterns of variation seen in aerial survey gross counts. The highest probabilities are clearly in proximity to known radiological sources. Figure L-8 shows the spatial distribution of the probability of exceeding 6.2 pCi/g threshold level, with the same color scale as that used for the 1.05 pCi/g threshold level, and it can be seen that nearly all of the nonoperational area have less than 2.5 percent probability of exceeding the 6.2 pCi/g threshold level. The nearly uniformly dark color of the map shows the much lower probability that surface soil samples are expected to exceed 6.2 pCi/g as compared to the probability of exceeding 1.05 pCi/g shown on Figure L-8. This illustrates the high degree of sensitivity to the selection of threshold levels regarding the area of the site that might be expected to exceed them.

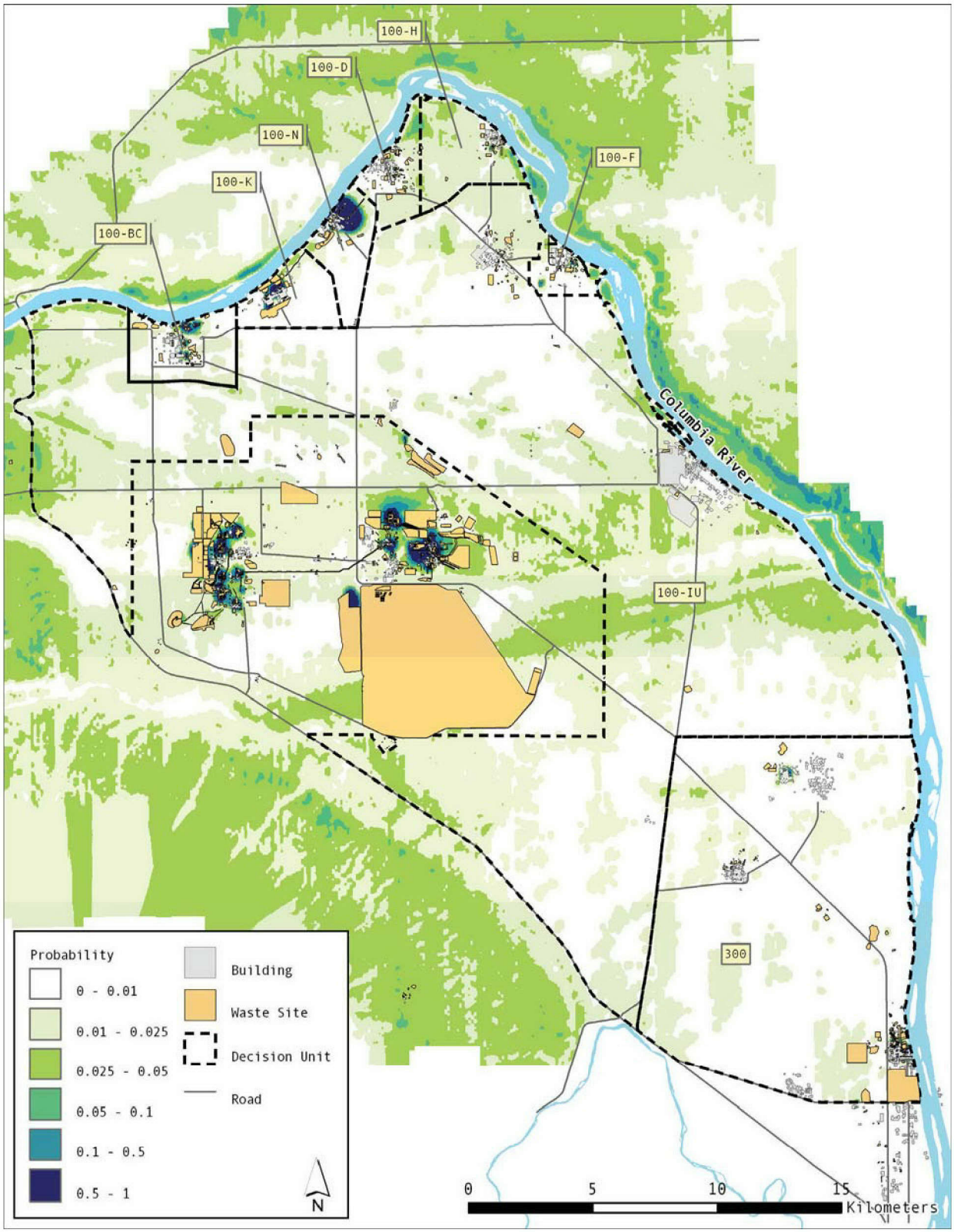

Figure L-7. Modeled Probability that Soil Cs-137 Exceeds 1.05 pCi/g in the Hanford Site

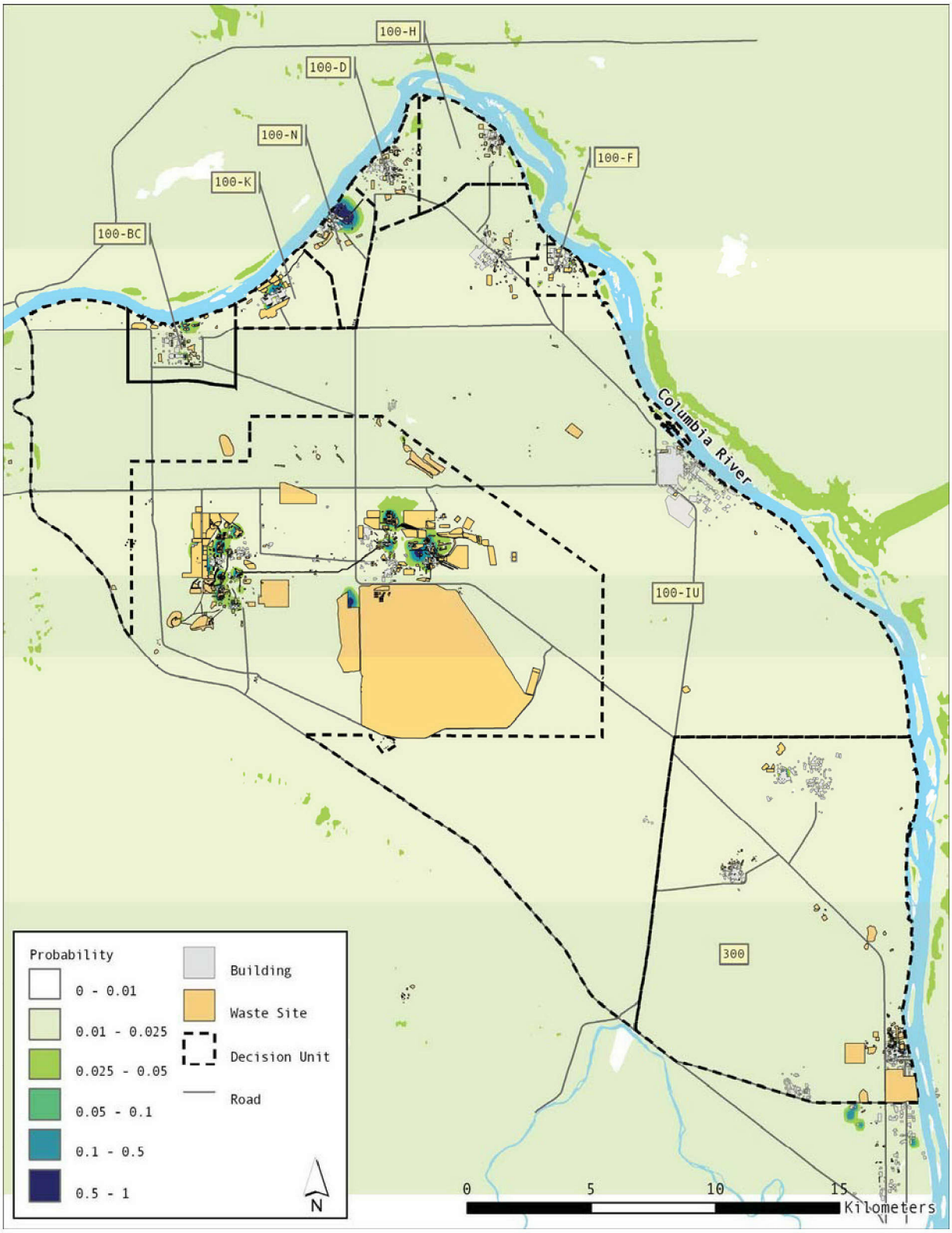

Figure L-8. Modeled Probability that Soil Cs-137 Exceeds 6.2 pCi/g in the Hanford Site

L3.3 Orphan Sites Evaluation

The results from historical research, field walkdowns, GIS mapping and geophysical surveys for the 300 Area are summarized in *300 Area Orphan Sites Evaluation Report* (OSR-2010-0002). The OSE encompasses much of the 300-FF-2 OU, including the 300 Area and an expanded field walkdown area primarily to the west. In addition, the 300-FF-1 OU was reevaluated as part of the field walkdown. The total coverage area was approximately 829 ha (2,048 ac). Eighteen orphan features were identified during the OSE and submitted for acceptance into WIDS. There were 13 features categorized as miscellaneous restoration items and documented as part of the OSE.

The coverage for the Segment 5 OSE includes an area of approximately 14,178 ha (35,033 ac) including approximately 4,222 ha (10,432 ac) that was excluded from the OSE process. The areas excluded include the Hanford Patrol Training Area Firing Range, Energy Northwest, HAMMER, and three active electrical substations (HJ Ashe, White Bluffs, and Benton). One orphan site and 17 miscellaneous restoration features were identified in the OSE for Segment 5.

L4 Conclusions

Multiple lines of evidence were reviewed to evaluate conditions in the 300 Area NPL Site nonoperational area (and the River Corridor more generally) based on potential release and transport mechanisms. Surveillance and monitoring programs, in combination with the OSE, have comprehensively identified all waste sites within the 300 Area NPL Site. In addition, the surveillance and monitoring programs, in combination with studies conducted as part of the HEDR, have demonstrated that emissions to the air either from windblown dust or from stack emissions have not affected nonoperational area soils with radionuclides. The surveillance and monitoring programs also have verified that biointrusion has not resulted in a spread of contamination into the nonoperational areas.

Statistical analysis of the geographical distribution of waste sites based on artificial features and topography describes the likely locations of waste sites near the 300 Area. The results from this analysis reinforce the findings from the OSE, which has systematically identified the remaining waste sites within 300 Area NPL Site. Statistical analysis of the distribution of radionuclide concentrations observable from aerial surveys has confirmed that the probability of detecting elevated radionuclide concentrations in nonoperational area soils is very small.

Based on the evaluation of these multiple lines of evidence, the probability of identifying waste sites or contaminant dispersal from Hanford Site operations in 300 Area NPL Site nonoperational areas is considered negligible.

L5 References

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Appendix M

Riparian Area

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Terms

BCG	biota concentration guide
BHC	benzene hexachloride
COEC	contaminant of ecological concern
COI	contaminant of interest
COPEC	contaminant of potential ecological concern
CRC	Columbia River Component
CRDL	contract required detection limit
CSM	conceptual site model
CTE	Central Tendency Estimate
DOE	U.S. Department of Energy
Ecology	Washington State Department of Ecology
ESL	ecological screening level
EPA	U.S. Environmental Protection Agency
FS	feasibility study
HEIS	Hanford Environmental Information System
HQ	hazard quotient
HRM	Hanford river marker
K_{oc}	organic carbon partition coefficient
LOAEL	lowest observed adverse effect level
MDL	method detection limit
MIS	MULTI INCREMENT® sampling
ORNL	Oak Ridge National Laboratory
OU	operable unit
PCB	polychlorinated biphenyl
PNNL	Pacific Northwest National Laboratory
PRG	preliminary remediation goal
PVC	polyvinyl chloride
QC	quality control

R&D	research and development
RAG	remedial action goal
RCBRA	River Corridor Baseline Risk Assessment
ROD	record of decision
SESP	Surface Environmental Surveillance Program
SSL	soil screening level
TEDF	Treated Effluent Disposal Facility
TPH	total petroleum hydrocarbon
VOC	volatile organic compound
WDOH	Washington State Department of Health

M1 Introduction

This document presents a conceptual site model (CSM) of the riparian and nearshore environment along 300 Area at the Hanford Site, Washington. The 300 Area is located along the Columbia River and includes the 300-FF-1 and 300-FF-2 Source Operable Units (OUs), the 300-FF-5 Groundwater OU and the adjacent surface water, saturated sediment and aquatic biota. This CSM has been developed to evaluate concentrations of nonradiological substances and radionuclides detected in soil, water, and sediments further and to determine if potential transport pathways exist to these media from Hanford Site sources. The supporting evaluation of analytical data also determines if there is the potential for exposure to aquatic receptors.

M1.1 Background

Remediation of waste sites in the 300 Area has been ongoing since 1997 (*300 Area Decision Unit Remedial Investigation/Feasibility Study Work Plan* [hereinafter called 300 Area RI/FS Work Plan] [DOE/RL-2009-30]) based on interim action records of decision (RODs) (*Action Memorandum: 316-5 Process Trenches, U.S. Department of Energy (DOE) Hanford Site, Richland* [EPA, 1991]; *Interim Action Record of Decision for the 300-FF-2 Operable Unit, April 2001* [EPA, 2001]). Remediation has been implemented using remedial action goals (RAGs) for protection of human health and protection of groundwater and the Columbia River (*Remedial Design Report/Remedial Action Work Plan for the 100 Area* [DOE/RL-96-17]; *Remedial Design Report/Remedial Action Work Plan for the 300 Area* [DOE/RL-2001-47]). Remediation of contaminated groundwater also has been ongoing at the 300-FF-5 OU under an interim action ROD (*Action Memorandum: 316-5 Process Trenches, U.S. Department of Energy (DOE) Hanford Site, Richland* [EPA, 1991]). A key component needed to support development of final remedies is a baseline risk assessment. The River Corridor Baseline Risk Assessment (RCBRA) was initiated in 2004 to characterize current and potential threats to human health and the environment (*Risk Assessment Work Plan for the 100 Area and 300 Area Component of the RCBRA* [DOE/RL-2004-37]; *River Corridor Baseline Risk Assessment, Volume I: Ecological Risk Assessment*, hereinafter called RCBRA Report [DOE/RL-2007-21]). In addition to waste sites located in upland areas and groundwater, the RCBRA evaluated soil, sediment, and water located in riparian and nearshore areas. The RAGs used in the interim actions addressed risks to human health from direct contact with soil and threats to groundwater from leaching from soil, but did not directly address risks to ecological receptors. The ecological risk assessment conducted as part of the RCBRA addresses residual contaminant concentrations at remediated waste sites in the upland zones and the transport of contaminants from waste sites to the Columbia River riparian and nearshore zones (300 Area RI/FS Work Plan [DOE/RL-2009-30]).

The RCBRA evaluated ecological risks at representative riparian study sites across the River Corridor located adjacent to, or where they may be directly affected by, known contaminated media (groundwater seeps, soil, or sediment). The RCBRA concluded that six of the 22 contaminants of potential ecological concern (COPECs) (arsenic, chromium, lead, mercury, zinc, and total petroleum hydrocarbon [TPH]-diesel) identified for the riparian environment may present some level of risk for one or more of the assessment endpoint entities, based on soil bioassays, comparison of COPEC concentrations to plant or terrestrial invertebrate toxicity benchmarks, or the results of wildlife exposure analyses. The RCBRA evaluated ecological risks at nearshore study sites potentially affected by contamination from Hanford Site sources in comparison to reference sites. Study sites were selected in areas where known contaminated groundwater plumes enter the Columbia River and in areas between the plumes. The RCBRA concluded that five of the 22 COPECs (cadmium, chromium, hexavalent chromium [Cr(VI)], manganese, and uranium) identified for the nearshore environment might present some level of risk for

one or more of the assessment endpoint entities. Relevant risk results are the comparisons of COPEC concentrations to toxicity benchmarks or the results of wildlife exposure analyses (RCBRA Report [DOE/RL-2007-21]).

The five contaminants of ecological concern (COECs) identified by the RCBRA in riparian and nearshore media were mostly metals and TPH-diesel. With few exceptions (notably chromium and Cr(VI)), there are ambient sources for the constituents in soil, sediment and water that are unrelated to the Hanford Site. The CSM describes the interrelationships between sources, transport mechanisms, exposure pathways and receptors When the principal threat constituents in soil and groundwater at the 300 Area were compared with the contaminants identified by the RCBRA as posing ecological risks in riparian and nearshore media, additional work was warranted to better understand the CSM in the riparian and nearshore environment.

M1.2 Description of the 300 Area

The 300 Area, roughly rectangular and covering approximately 149.7 ha (369.9 ac), was where the manufacturing of fuel rods took place—the first of the three-step plutonium production process. The rods were then shipped to the 100 Area reactors for irradiation (*Literature Review of Environmental Documents in Support of the 100 and 300 Area River Corridor Baseline Risk Assessment*, hereinafter called RCBRA Literature Review [PNNL-SA-41467]). In the early 1950s, laboratories were constructed to support research and development (R&D) activities. As the Hanford Site production reactors shut down, fuel fabrication in the 300 Area ceased. Research and development activities expanded over the years. Many of the uranium production facilities and R&D laboratories have been demolished and several others are scheduled for demolition. Currently, the 300 Area contains a number of support facilities for R&D, environmental restoration, deactivation, decontamination, decommissioning, and demolition activities (300 Area RI/FS Work Plan [DOE/RL-2009-30]).

A portion of the 300 Area consists of disturbed areas adjacent to buildings and facilities. The upland environment to the north of the built-up areas is dominated by a bitterbrush/bunchgrass mosaic cover. The upland environment to the south of the built-up areas is primarily big sagebrush/bunchgrass mosaic with smaller areas of Sandberg's bluegrass-cheatgrass and gray rabbitbrush/Sandberg's bluegrass-cheatgrass. To the west of the 300 Area, the vegetation consists of snow buckwheat/bunchgrass and bunchgrass. Scattered within these two dominant cover types are small areas of gray rabbitbrush/cheatgrass, snow buckwheat-bitterbrush/bunchgrass, Indian ricegrass, Sandberg's bluegrass-cheatgrass and nonvegetated disturbed cover types. There is no upland vegetation east of the 300 Area boundary because it abuts, and often includes, the riparian zone (RCBRA Literature Review [PNNL-SA-41467]).

The eastern boundary of the 300 Area extends to the river shoreline and includes most of the riparian environment, which consists of a narrow band usually less than 40 m (131 ft) wide stretching north and south along the river. Much of the southern half of the riparian zone is characterized by steep banks dominated by riparian shrub (chokecherry, Wood's rose, and clematis) and exotic weed (knapweed) cover types. In the northern half, the bank is less steep and is characterized by the wormwood (Artemisia species) and perennial grass cover type. Close to the shoreline the riparian shrub, exotic weed, and wormwood cover types grade into a low shrub/forb/cobble association interspersed with patches of willow that continue to the river edge. In the southeastern corner of the 300 Area, a black locust tree grove occupies approximately 0.4 ha (1 ac). Associated with the tree grove, along the river edges, is a gently sloping area of bare cobble that is used as a primitive boat launch. A water outflow channel is located immediately east of the 331 Building, whose banks consist of dense chokecherry, willow, and reed canary grass (RCBRA Literature Review [PNNL-SA-41467]).

M1.3 Review of Previous Riparian/Nearshore Studies

Investigations, which were historically conducted in the riparian and nearshore areas of the 300 Area, are summarized below and detailed in RCBRA Literature Review (PNNL-SA-41467). Most recently, investigations of riparian and nearshore areas were conducted as part of the RCBRA (RCBRA Report [DOE/RL-2007-21]; *100 Area and 300 Area Component of the RCBRA Sampling and Analysis Plan* [hereinafter called RCBRA SAP [DOE/RL-2005-42]).

M1.3.1 Historical Studies

Investigation of Groundwater Seepage from the Hanford Shoreline of the Columbia River (PNL-5289) identified riverbank springs and groundwater seeps along the length of the Hanford Site shoreline and presented analytical results for tritium detected in groundwater, riverbank springs, and adjacent surface water in the 300 Area. Contaminant data specific to the 300 Area are provided, with elevated concentrations of uranium (maximum concentration 19.0 pCi/L) and nitrate (maximum concentration 12,600 µg/L) reported.

A Pacific Northwest National Laboratory (PNNL) study was conducted to characterize the concentrations of radionuclides and chemicals in riverbank springs (i.e., groundwater seepage) entering the Columbia River along the Hanford Site (*1988 Hanford Riverbank Springs Characterization Report* [PNL-7500]). Riverbank spring water was collected at two locations (Hanford river marker [HRM] 42.1 and 42.3) with elevated concentrations of gross alpha (maximum concentration 8.0 pCi/L), gross beta (maximum concentration 11.6 pCi/L), and uranium isotopes (maximum concentration 9.5 pCi/L). Concentrations of other radionuclides in riverbank spring water (e.g., tritium and cesium-137) were generally low or below detection. Nitrate (maximum concentration 9,183 µg/L), chloroform (maximum concentration 24 µg/L), zinc (maximum concentration 23 µg/L), and copper (maximum concentration 34 µg/L) were reported above the analytical detection limits in 300 Area riverbank spring water.

M1.3.2 Survey of Radiological and Chemical Contaminants in Nearshore Environment at the 300 Area

During 2001, the U.S. Department of Energy (DOE) and the Washington State Department of Health (WDOH) led a study to characterize radiological and chemical conditions existing in the nearshore environment of the 300 Area (*Survey of Radiological and Chemical Contaminants in the Near-Shore Environment at the Hanford Site 300 Area*, hereinafter called Survey of Contaminants in the 300 Area Near-Shore [PNNL-13692]). The study was conducted during August through October and coincided with the expected low river stage, which facilitated locating and sampling water from riverbank springs and other media along the shoreline. Shallow groundwater, riverbank spring water, near-river water, sediment, and biota were sampled in this study. Split sampling was performed to provide comparison between WDOH and PNNL laboratory results.

This study involved the collection of samples of shallow groundwater beneath the riverbed, riverbank spring water, river water, sediment, aquatic biota, riparian biota, and measured external radiation levels at the 300 Area and a control location near the Vernita Bridge upriver from the Hanford Site production area and approximately 68 km (42 mi) upriver from the 300 Area.

Shallow groundwater samples were collected from temporary drive points. Tritium, technetium-99 (Tc-99), and uranium concentrations were elevated in shallow groundwater compared with 300 Area river water and background river water samples at Vernita Bridge. However, concentrations of tritium, Tc-99, and uranium in shallow groundwater were similar to concentrations detected in riverbank spring water samples from the same locations. Concentrations of total uranium (reported in pCi/L) were reportedly

above ambient water quality criteria. Concentrations of tritium and Tc-99 reportedly were below ambient water quality criteria. All gamma-emitting radionuclides were below detection limits in shallow groundwater. No chemical analyses were reported for shallow groundwater samples.

Radionuclides detected in riverbank spring water samples included gross alpha, gross beta, tritium, Tc-99, iodine-129 (I-129), uranium isotopes, and thorium isotopes. Ambient surface water quality criteria levels ("Water Quality Standards for Surface Waters of the State of Washington" [WAC 173-201A] and "Group A Public Water Supplies" [WAC 246-290]) were exceeded for gross alpha and total uranium (uranium-234 [U-234] + U-235 + U-238) in riverbank spring water samples. Tritium concentrations were higher in 300 Area spring water samples compared to Vernita Bridge. Concentrations of Tc-99, thorium isotopes, and I-129 in 300 Area spring water were elevated relative to spring water samples at the Vernita Bridge, but were reported to be below ambient water quality criteria. Cobalt-60 (Co-60), cesium-137 (Cs-137), and strontium-90 (Sr-90) were not detected in riverbank spring water samples from the 300 Area. Metals concentrations in riverbank spring water samples were higher than average concentrations in Vernita Bridge samples. However, concentrations of all metals were below ambient water quality criteria. Total chromium, selenium, and aluminum were the metals most substantially elevated above levels in spring water at the Vernita Bridge.

Radionuclides consistently detected in nearshore river water included gross alpha, gross beta, tritium, Tc-99, and uranium. Total uranium and gross alpha exceeded the state ambient water quality criteria at one sampling location; however, these criteria were only exceeded at the location nearest to the shore (0.25 m depth), which was in the immediate vicinity of a riverbank spring. All other measured river water concentrations were less than ambient surface water quality criteria. Co-60, Sr-90, and Cs-137 were all below minimum detectable levels in the 300 Area nearshore river water samples. Metals that were detected in 300 Area nearshore river water samples at concentrations above the Vernita Bridge background included chromium, manganese, zinc, arsenic, selenium, barium, and thallium. However, all concentrations were reportedly below ambient water quality criteria.

Sediment samples for the major spring locations and the background location (Vernita Bridge) were analyzed for gross beta, gamma-emitting isotopes, Sr-90, Tc-99, isotopic uranium, and isotopic thorium. Concentrations in Sr-90, Cs-137, and isotopic uranium were elevated in 300 Area sediments when compared with Vernita Bridge sediments. The values for Sr-90 and Cs-137 all were well within the range reported for background sediment collected from the Priest Rapids Dam reservoir during 1995 to 2001. Concentrations of Tc-99 and thorium isotopes were similar between 300 Area nearshore sediments and sediment sampling locations near the Vernita Bridge. Concentrations of uranium isotopes (U-234, U-235, and U-238) at 300 Area sediment sampling locations were elevated compared with Vernita Bridge. The highest total uranium concentration in sediment in the 300 Area nearshore was 4.4-fold higher than sediment near the Vernita Bridge. The total uranium concentration in the farthest downstream location was only 1.6-fold higher than the Vernita Bridge value.

Sediment samples for the major spring locations and the background location (Vernita Bridge) were analyzed for antimony, arsenic, beryllium, cadmium, chromium, copper, lead, mercury, nickel, selenium, silver, thallium, and zinc. Most results were similar to or below concentrations reported for the Vernita Bridge sediments and were similar to those reported in previous studies of the 300 Area. Cadmium and zinc concentrations in 300 Area sediments were less than two-fold higher than the Vernita Bridge sediment. Concentrations of all other metals in 300 Area nearshore sediment were similar to or lower than the Vernita Bridge sediment. At the time of this study, there were no freshwater sediment quality criteria available from the U.S. Environmental Protection Agency (EPA) or Washington State. Sediment quality guidelines developed by the Ontario Ministry of Environment and Energy, and interim sediment guidelines developed by Environment Canada were used for evaluation of maximum metals

concentrations detected in 300 Area sediments. All metal concentrations in the 300 Area nearshore sediment were below both the Ontario severe effect level and the Environment Canada probable effect level. Metals concentrations of arsenic, cadmium, chromium, copper, lead, nickel, and zinc were above or similar to the Ontario lowest effect level and the Environment Canada threshold effect level.

Low concentrations of Cs-137 and uranium isotopes were detected in both riparian plant and animal tissue samples. Tritium, Sr-90, and Tc-99 also were detected in a limited number of plant samples. Sr-90 was detected at low levels in some aquatic invertebrate and fish samples. Concentrations of arsenic, beryllium, chromium, selenium, zinc, and uranium were elevated in one or more biota samples at the 300 Area shoreline study sites, relative to the Vernita Bridge study site.

In this study, a pilot effort was conducted to examine individual-level health of crayfish and sculpin. Uranium, selenium, and chromium reportedly accumulated in clam soft tissue to levels in excess of those collected at the reference site. The authors concluded that what is not known is whether these levels of exposure and accumulation in tissue have an adverse impact on clams or other 300 Area aquatic biota. The authors concluded that gross and histopathological examination performed on organs from crayfish and sculpin did not suggest any abnormal frequency of lesions in target tissues that was indicative of chemical or radiological toxicity.

M1.3.3 Surface Environmental Surveillance Program

In addition to the historical investigations stated above, other sampling and analytical data have been collected from riparian and nearshore areas as part of the Surface Environmental Surveillance Program (SESP). The SESP is responsible for site-wide and offsite environmental surveillance at the Hanford Site. Surface environmental surveillance at the Hanford Site is a multimedia environmental monitoring effort conducted to assess onsite and offsite human health exposures to radionuclides and chemicals and to evaluate the effect of Hanford Site operations on the environment.

Under the SESP, Columbia River water, shoreline spring water, and sediment sampling are conducted along the 300 Area. River water and sediment sampling also is conducted at Richland, downstream from the 300 Area.

Radionuclide concentrations monitored in Columbia River water were low throughout 2009. Tritium, U-234, U-238, and naturally occurring potassium-40 (K-40) were measured consistently in river water at levels greater than their reported minimum detectable concentrations. Sr-90, U-235, plutonium-238 (Pu-238), and Pu-239/240 were occasionally detected, but all values were near the minimum detectable concentrations. Concentrations of all other radionuclides were typically less than the minimum detectable concentrations. Tritium, Sr-90, and plutonium exist in worldwide fallout from historical nuclear weapons testing as well as in effluent from Hanford Site facilities. Tritium and uranium occur naturally in the environment in addition to being present in Hanford Site effluent.

The 2009 average radionuclide concentrations (including gross alpha and gross beta concentrations, tritium, Sr-90, and isotopic radium measured upstream and downstream of the Hanford Site were similar to those observed during recent years. The average gross alpha and gross beta concentrations in Columbia River water at the city of Richland during 2009 were less than the Washington State ambient surface water quality criteria.

Concentrations of radionuclides in shoreline spring water throughout the River Corridor have been highly variable over the years, but have remained below drinking water and ambient water quality standards. Trichloroethene has been consistently detected at trace concentrations in 300 Area shoreline spring water, which is a result of contaminated groundwater in the shallowest part of the unconfined aquifer near the river. Relatively high concentrations recently discovered at depth in the unconfined aquifer, which greatly

exceeded regulatory standards (*Limited Field Investigation Report for Uranium Contamination in the 300-FF-5 Operable Unit at the 300 Area, Hanford Site, Washington* [PNNL-16435]), were not observed in the riverbank springs. For most locations, the 2009 chemical sample results (principally metals) were similar to those reported in previous years (*Hanford Site Environmental Report for Calendar Year 2009* [PNNL-19455]).

M1.3.4 Groundwater and Aquifer Tube Monitoring Programs

DOE monitors groundwater at the Hanford Site to fulfill a variety of state and federal regulations, including the *Atomic Energy Act of 1954*, the *Resource Conservation and Recovery Act of 1976*, the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, and, "Model Toxics Control Act—Cleanup" (WAC 173-340). The groundwater monitoring data relevant to the 300 Area riparian/nearshore environment are discussed further in Chapter M3 of this appendix.

DOE monitors groundwater quality along the Columbia River by collecting samples from aquifer tubes and riverbank seeps (springs). The rise and fall of the Columbia River create a zone of interaction that influences contaminant concentrations and groundwater flow patterns. Water samples from aquifer tubes and riverbank seeps nearly always represent a mixture of river water and approaching groundwater. In general, the degree of dilution by river water decreases with depth in the aquifer near the river shoreline. The degree of dilution also varies by location and with seasonal river cycles (*Zone of Interaction Between Hanford Site Groundwater and Adjacent Columbia River: Progress Report for the Groundwater/River Interface Task Science and Technology Groundwater/Vadose Zone Integration Project* [PNNL-13674]). The aquifer tube and seep data relevant to the 300 Area riparian/nearshore environment are discussed further in Chapter M3 of this appendix.

M1.4 Approach to CSM Development

As previously described, the objective for developing this CSM is to provide a tool for evaluating the potential for contaminants in riparian and nearshore media to be associated with releases from Hanford Site-related sources. The foundation for developing the CSM begins with the following definitions of environmental zones presented in the RCBRA (RCBRA Report [DOE/RL-2007-21]):

- **Nearshore aquatic zone:** the nearshore aquatic zone includes the surface water of the Columbia River from the area that is permanently inundated by river water (i.e., the low-water mark, commonly referred to as the "green line," where the periphyton remain green year-round) up to the riparian zone.
- **Riparian zone:** the riparian zone is a transition area between the aquatic environment in the nearshore zone and the upland zone. The riparian zone extends from the shoreline of the Columbia River to the point on the riverbank where upland vegetation becomes dominant. The riparian zone typically is narrow and varies in width depending on the slope of the riverbank.
- **Upland zone:** the upland zone consists of land that extends inland from the riparian zone. It is situated approximately 3 m (10 ft) above the river high-water mark. The upland zone generally is dry and not readily influenced by river flow. Recharge to groundwater in this zone occurs largely from precipitation. The upland zone includes operational areas in the 300 Decision Area and generally is where waste sites are located.

These environmental zones are depicted in Figures M-1 and M-2.

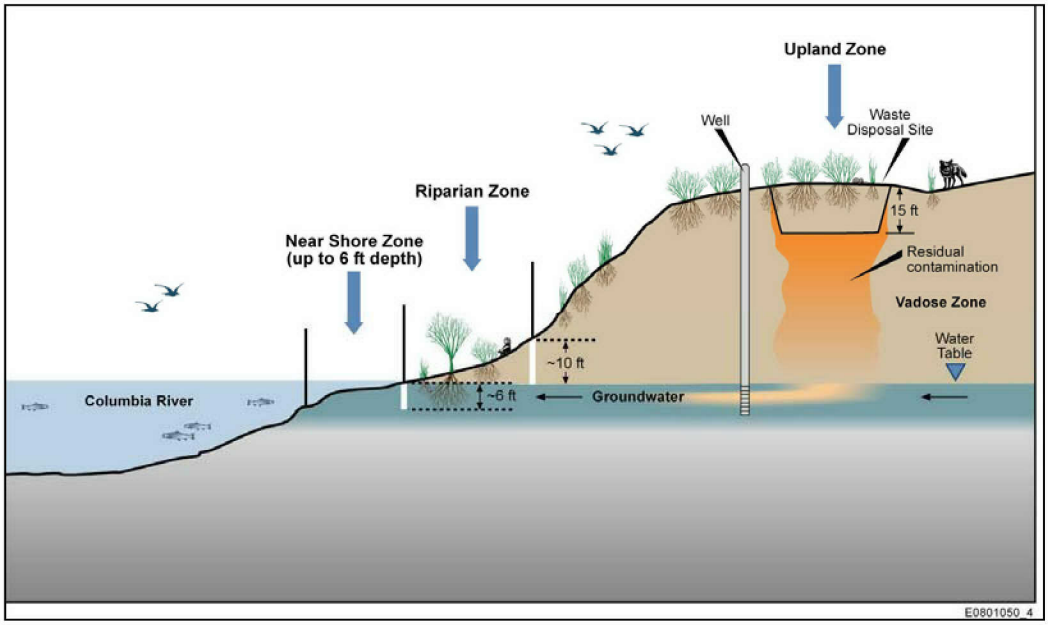

Figure M-1. Environmental Zones in the Riparian/Nearshore Area

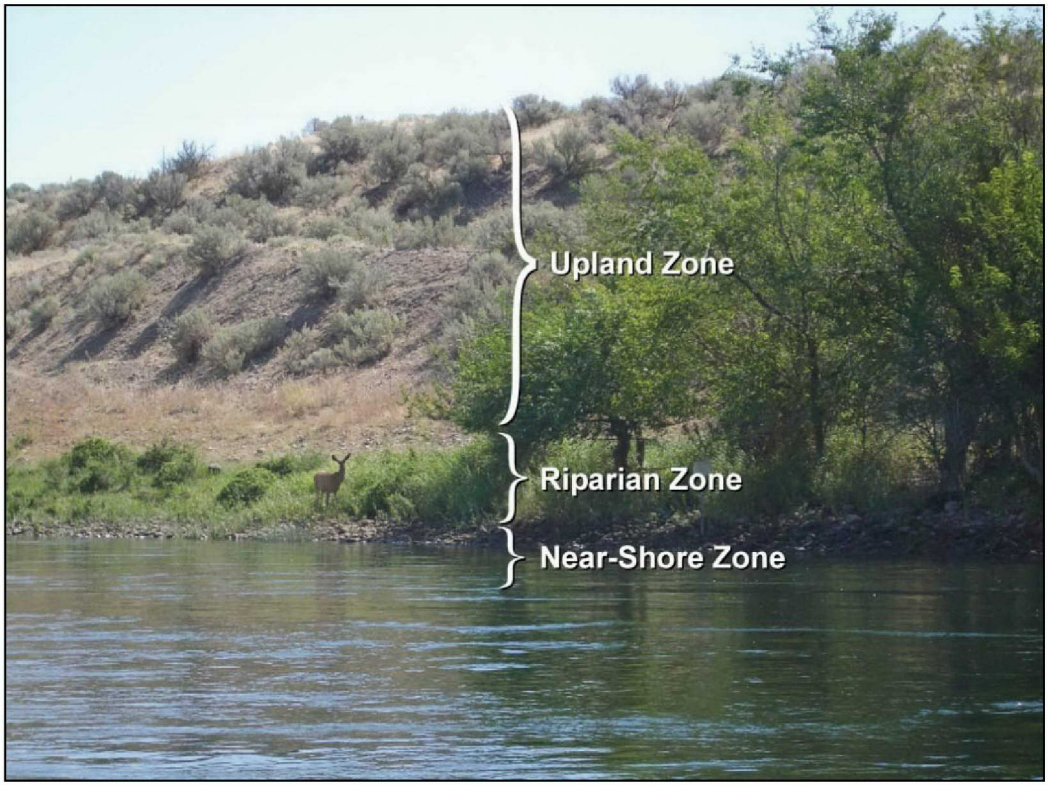

Figure M-2. Photograph Depicting the Environmental Zones

Potential exposure pathways from source OUs and the underlying groundwater OU located in the upland zone have been traced to media in the riparian and nearshore zones. An exposure pathway can be described as the physical course that a contaminant takes from the point of release to a receptor. The route of exposure is the means by which a contaminant encounters a receptor. For an exposure pathway to be complete, all of the following components must be present:

- A source
- A mechanism of contaminant release and transport
- An environmental transport medium
- An exposure point
- An exposure route
- A receptor or exposed population

In the absence of any one of these components, an exposure pathway is considered incomplete; therefore, it creates no risk or hazard.

An additional consideration for contaminants detected in riparian and nearshore zones is a contaminant source, or sources, unrelated to Hanford Site operations that have been transported and deposited via the river. These other sources also are discussed as part of this CSM. Identification of potential exposure pathways in the riparian and nearshore zones is described in Chapter M2.

Once the potential exposure pathways are identified and described, sampling and analytical data from various media are evaluated. The objectives for this evaluation include depicting the relative concentrations in the various riparian and nearshore media and to evaluate data quality. Media in the riparian and nearshore areas that have been sampled include groundwater, porewater, seeps/springs, surface water, sediments, biota, and soil. The results from this data evaluation are combined with the exposure pathway information (described previously) to determine if contaminant concentrations located at exposure points are potentially associated with Hanford Site activities. The data evaluation is described in Chapter M3.

An evaluation of potential ecological risks in riparian and nearshore zones was conducted as part of the RCBRA (RCBRA Report [DOE/RL-2007-21]). The results from this evaluation are summarized in Chapter M4. These results, which identified COECs, are compared with the results from the data evaluation in Chapter M3 to determine if those COECs might be associated with Hanford Site activities.

M2 Evaluation of Riparian and Nearshore Exposure Pathways

This chapter describes the sources, release and transport mechanisms, environmental media through which contaminant transport occurs and exposure points in the riparian and nearshore zones. This chapter provides the framework for the data evaluation that is presented in Chapter M3.

M2.1 Sources

In total, 554 waste sites are found in the 300, 400, and 600 Areas, located principally in the upland zone. As described in the RCBRA Literature Review (PNNL-SA-41467), the riparian environment is a strip along the Columbia River usually less than 40 m (130 ft) in width stretching north and south along the river. A limited number of the 300 and 600 Areas waste sites are of interest with regard to the riparian/nearshore CSM. In addition to these waste sites, groundwater in the 300-FF-5 OU is potentially a source for contaminant release to riparian and nearshore media.

M2.1.1 Waste Sites and Soils

The waste sites located close to the riparian zone in the 300 Area are presented in Figure M-3. Brief descriptions of these sites are presented in the following paragraphs. The nature and extent of contamination has been characterized, or is currently being characterized for these waste sites. While it is not known that there are potential releases or exposure pathways from these sites, their proximity to the riparian area makes them candidates for consideration as potential sources in this evaluation.

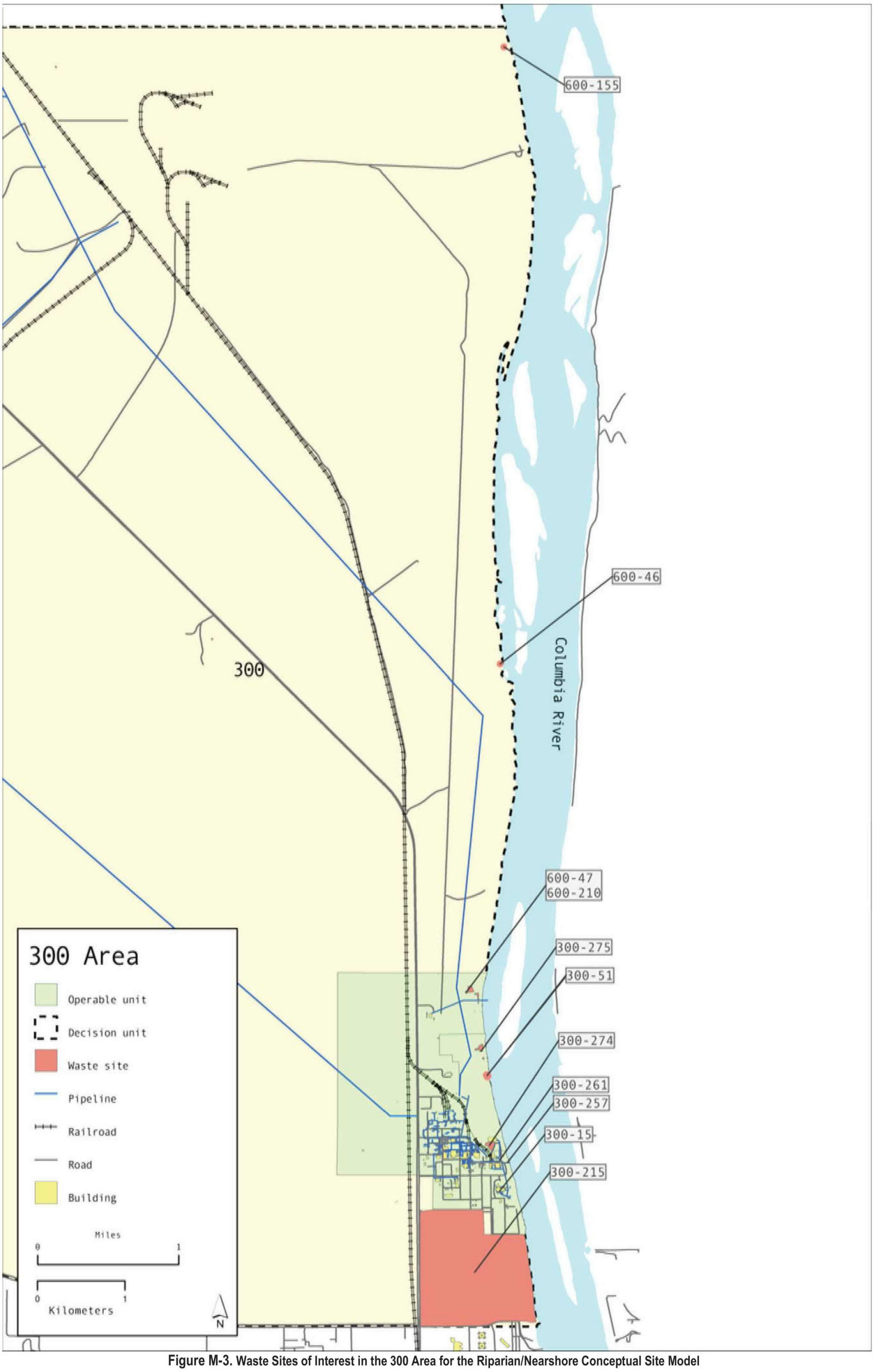

Figure M-3. Waste Sites of Interest in the 300 Area for the Riparian/Nearshore Conceptual Site Model

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300-15. The 300 Area process sewer system is an extensive system with an estimated 9.7 km (6 mi) of outside lines and an estimated 40 km (25 mi) of interior building waste pipe. The system was used for the disposal of potable water, cooling water, precipitation runoff, waste brine solution (sodium chloride with magnesium salts), chromium, copper, uranium nitrate, sulfate, and fluoride ions with the contaminants lead, silver, acetone, and cyanide. The original system was primarily 20 cm (8 in.) diameter vitrified clay pipes with acid proof joints running eastward to the North and South Process Ponds until 1975, then to the 300 Area Trenches from 1975 to 1994. Starting in 1994, the discharges were sent through a new pipeline to the 300 Area Treated Effluent Disposal Facility (TEDF) for treatment and release into the Columbia River. Initially, the system received low-level liquid wastes from the 313 and 314 Buildings and later from the 3706 and 321 Laboratories. The system was also connected to the 331 Life Science Building at the southern end of the 300 Area as well as the former discharge line to the river embankment near the 331 Building. As the system was updated and expanded, pipe materials included the original vitrified clay as well as cast iron, steel, concrete, polyvinyl chloride (PVC), and stainless steel. This site is classified as accepted with its status being inactive.

300-51. The 300-51 dumping area or landfill contained radiologically contaminated surface debris. The current site footprint is 70 m^2 (750 ft^2) located less than 7 m (23 ft) from the Columbia River. The site is classified as no action with its status being inactive.

300-215. The 300-215 dumping area is a very large area vegetated with cheatgrass and sagebrush. The site includes many different features and contains some construction debris. The current site footprint is 152 ha (375 ac) located south of the 300 Area. The site in its current configuration runs along the Columbia River shoreline for approximately 1,000 m (3,300 ft). This site is classified as rejected.

300-257. The 300-257 process sewer carried potentially radioactively contaminated water to the river. The site was originally connected to the 309 Building's Rupture Loop Holding Tank. The tank was removed in the late 1970s and line was isolated from the rest of the Radioactive Liquid Waste System. The pipeline is 0.91 m (36 in.) diameter corrugated steel pipe and runs 442 m (1,450 ft) from the site where the 309 holding tanks used to sit on the river. The site is also associated with the 3906 Vault. This site is classified as accepted with its status being inactive.

300-261. The 300-261 process sewer is constructed of vitrified clay pipe, which runs from the 315 Water Filter Plant to the riverbank. The process sewer pipeline received overflows and filter backwash from the 315 Filter Plant. Treatment chemicals included alum (aluminum sulfate), chlorine, and separan (a polyacrylamide flocculent). The site no longer receives material from the 315 Filter Plant; however, it can receive storm water. This site is classified as rejected with its status being active.

300-274. The 300-274 dumping area contains transite pipe, treated wood, insulation, and other various forms of transite were identified. The debris was determined to be potential asbestos containing material. This site consist of two separate locations, the area of interest for this evaluation is location just south of the 315 Filter Backwash Pond and is approximately 100 m (330 ft) from the river. This site is classified as accepted with its status being inactive.

300-275. The 300-275 Sanitary Landfill has been described as having areas of surface and subsurface debris. The surface areas contain sparsely scattered surface debris, including small fragments of potential asbestos containing shingles and concrete. The underground debris is of unknown type. The site in its entirety is approximately 4,000 m^2 (43,000 ft^2) and located less than 25 m (82 ft) from the river. This site is classified as interim closed out with its status being inactive.

300-292. The 300-292 waste site consists of ten abandoned nonhazardous waste pipeline segments associated with the process sewers from the 315 Water Filter Plant (filter backwash). The process waste

solutions for this site included nonhazardous solids suspended in water filter backwash waste solutions from the 315 Water Filter Plant that were routed north to the 315-C Sedimentation Pond (300 FBP:2) where the sediments settled. This site is classified as accepted with its status being inactive.

600-46. The 600-46 dumping area contained used diesel oil filters, an empty can of starting fluid, pieces of lumber, and an empty 208 L (55 gal) drum. It was the consensus of DOE, EPA, and the Washington State Department of Ecology (Ecology) that the only potential contaminants involved with past use of the site were TPH, polychlorinated biphenyls (PCBs) and, possibly, lead, cadmium, and chromium. The site is approximately 12 m^2 (130 ft^2) and located less than 28 m (92 ft) from the river. This site is classified as closed out with its status being inactive.

600-47. The 600-47 dumping area consisted of several areas of surface debris and contamination near the banks of the Columbia River. Debris found at the site includes concrete, brick, cinder block, glass, stainless steel, steel millings/filings, plastic, tar roofing paper, wire, pipe, bottles, sheet metal, screen, clay pipe, irrigation pipe, etc. Concreted soils were found during test diggings, burned wood was found on top of the rise. The site is approximately 6,400 m^2 (69,000 ft^2) in total and ranges from less than 30 m (100 ft) to approximately 150 m (490 ft) away from the river. This site is classified as interim closed out with a status being inactive.

600-155. The 600-155 dumping area consisted of an old rusty machine part. A field visit on July 19, 1999, verified that the large piece of equipment had been removed. A small piece of metal approximately 0.46 m [18 in.] long remained half buried in the soil. This site is classified as not accepted with its status of inactive.

600-210. This 600-210 is the pipeline and outfall for the 300 Area TEDF. The influent to the 300 TEDF is generated by facilities discharging to the 300 Area Process Sewer. The outfall line is a PVC pipeline that is routed to the shore of the Columbia River. The pipeline runs for 673 m (2,208 ft) from the 300 Area TEDF to the river. This site is classified as not accepted with its status of inactive.

M2.1.2 Groundwater

The geographic subregion of the 300-FF-5 OU with the most significant groundwater effect is the 300 Area, where nuclear fuels production and research activities were conducted during the Hanford Site operational period. Large volumes of liquid effluent were disposed to facilities for infiltration to underlying soil, resulting in contamination of the vadose zone and groundwater. The principal contaminant of concern in groundwater is uranium. Other contaminants of concern include tritium, nitrate, and some chlorinated volatile organic compounds (VOCs). Uranium is a contaminant in groundwater beneath the 300 Area and, to a much lesser degree, beneath the 618-10 Burial Ground/316-4 Cribs area (*Hanford Site Groundwater Monitoring and Performance Report for 2009: Volumes 1 & 2* [DOE/RL-2010-11]).

M2.2 Contaminant Release and Transport Mechanisms

Release and transport mechanisms potentially most likely associated with the occurrence of Hanford Site contaminants in riparian and nearshore zones are overland transport from waste sites, and contaminant leaching from the vadose zone to underlying groundwater, followed by lateral transport in groundwater.

M2.2.1 Overland Transport from Waste Sites

Hazardous and radioactive substances that are in surface materials can be transported away from facilities or known waste sites by surface runoff following precipitation events. Overland flow is water flow over the ground surface that occurs from precipitation (rainfall or snowmelt) that is greater than obstruction

demands (interception, evapotranspiration, or infiltration). In addition, overland flow can occur from the spillage of process effluent that had been historically discharged into liquid waste disposal units. Overland flow potentially results in the transport of contaminated sediments or water away from a waste site into other areas such as the riparian or nearshore locations. Factors that affect overland flow include ground surface slope, soil texture, vegetative cover, and precipitation frequency.

As discussed in Section M2.1.1, there are some examples of sites located near the riparian and nearshore area. However, as described previously, conditions at the Hanford Site are unlikely to support overland flow simply associated with precipitation. Contamination of riparian and nearshore media would likely be more associated with releases from process lines, process sewers, or pipelines that historically discharged to the river. Examples of historical process lines or sewers include the 300-15, 300-257, and 300-261 process sewers and 300-292 nonhazardous pipeline segments.

M2.2.2 Contaminant Leaching from Waste Site Soils to Groundwater

The mobility of uranium in soil in waste site soils, the underlying vadose zone, and the aquifer is highly variable. Influences on the mobility in soil include soil texture and mineralogy, chemical composition of the original waste effluent, and the subsurface geochemical environment, especially bicarbonate content, pH, and surface properties of minerals (*Hanford Site Groundwater Monitoring and Performance Report for 2009: Volumes 1 & 2* [DOE/RL-2010-11]). Uranium is considered to have moderate-to-high mobility in both the vadose zone and saturated zone, however it shows significant retardation in soil relative to Tc-99 (NOTE: Tc-99 travels at the same velocity as water through the vadose zone). Because of its low sorption to soil, uranium can represent a threat to groundwater quality when its sorbed concentration near the water table is two to three times background (10 to 12 mg/kg) (*A Site-Wide Perspective on Uranium Geochemistry at the Hanford Site* [PNNL-17031]).

M2.2.3 Transport in Groundwater

The groundwater system along the River Corridor generally is highly dynamic being influenced by regional groundwater conditions, the local site remediation efforts, and the daily and seasonal variations of river stage. The main features of the current conceptual model follow:

- Flow under the site and near the banks is generally assumed perpendicular to the river.
- Deeper geologic formations are assumed not to contribute to shallow groundwater or observed river exchanges along the riverbank.
- The daily variability of river stage creates a complex zone of mixing within the near-bank groundwater system.
- Springs observed on the riverbanks are attributed to bank storage of river water and site groundwater discharging to the river when river stage drops.
- Site groundwater generally discharges to the banks via springs and through the bottom of the Columbia River immediately adjacent to the site.

The site conceptual model clearly needs to include the transient nature of water exchange in this setting at multiple time scales (Figure M-4). For example, a daily 3 m (9.8 ft) change in river levels superimposed with seasonal changes or alterations of site groundwater flows by remediation efforts likely causes seasonal shifts in the regional groundwater flow system that will consequently impact groundwater-surface water exchange locations and rates. The complex geologic setting, aquifer heterogeneity, and transient nature of the surface water and groundwater results in a complex groundwater flow system. During major spring discharge events, river water may enter the banks and the

adjacent groundwater system upstream of the site and move laterally parallel to the river for some distance before discharging back into the river (*Technical Evaluation of the Interaction of Groundwater with the Columbia River at the U.S. Department of Energy Hanford Site, 100-D Area* [SGW-39305]).

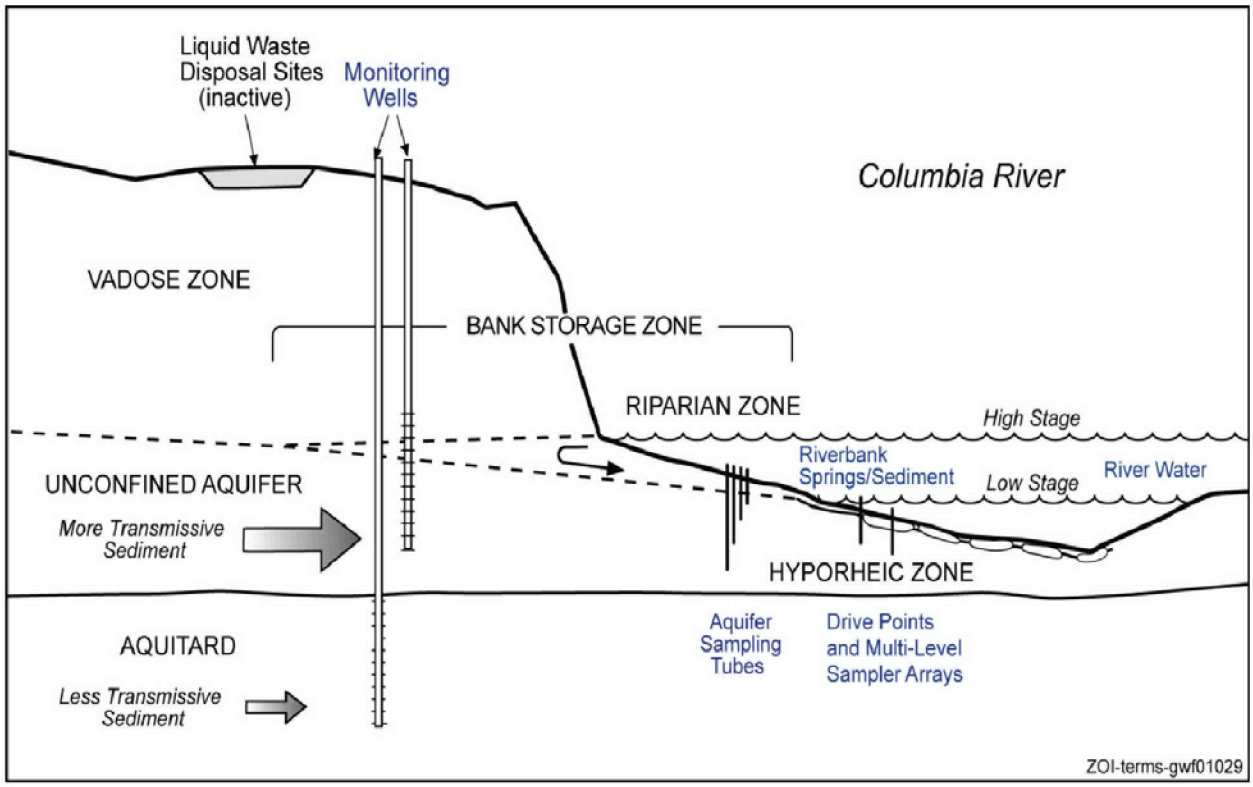


Figure M-4. Conceptual Model of Groundwater-Surface Water Interaction at the Hanford Site

Groundwater in the unconfined aquifer beneath the 300-FF-5 interest area flows generally to the east and southeast. Flow converges into the 300 Area from regions to the northwest, west, and southwest, and ultimately discharges to the Columbia River through the riverbed and to a lesser degree, along the shoreline as riverbank springs. In the northern and central portions of the 300 Area, flow direction is predominantly toward the southeast, while in the southern portion, flow is more toward the east, as inferred from water table elevations recorded during most of any particular year. This flow pattern reflects medium-to-low river stage conditions. As river discharge rises during late May or June, the direction of groundwater flow temporarily shifts to more southward in the northern portion of the 300 Area. The stage of the Columbia River has a profound effect on groundwater flow patterns and rates in the 300 Area. Seasonal changes in river stage are reflected in water levels measured at wells located as far as inland as 360 m (1,181 ft) from the Columbia River.

Because of highly transmissive aquifer materials, groundwater flow velocities can be quite high, with a recent tracer test revealing a rate of up to 15 m (49 ft)/day (*Treatability Test Plan for 300 Area Uranium Stabilization through Polyphosphate Injection* [PNNL-16571]). However, in spite of high flow velocities, the net rate of discharge to the Columbia River appears to be relatively low. This is a consequence of rapidly changing hydraulic gradients and their orientation, which results from the daily, weekly, and seasonal cycles in river stage. During the Columbia River's spring runoff period when high river stage conditions are present, river water infiltrates the banks and mixes with groundwater, thus diluting the concentrations of contaminants carried by groundwater. The rate at which groundwater discharges to the river is lowest during this period of high river stage because of bank storage effects (e.g., reduced

gradients and actual reversal of flow direction near the shoreline). Farther inland, higher water table elevations may result in groundwater encountering contaminants held in the lower vadose zone, thus remobilizing those contaminants. Consequently, higher concentrations may be observed during the early summer months, particularly in areas beneath former liquid waste disposal sites.

M2.3 Exposure Points in Seeps, Surface Water, Sediments, and Riparian Soils

The RCBRA (RCBRA Report [DOE/RL-2007-21]) showed a cross section of the river that defined the study zones to be the upland zone, the riparian zone, nearshore aquatic zone, and aquatic zone as a vertical panel that extends down from the surface into the subsurface to some undetermined depth when, in reality, they are three-dimensional zones that change size over time. In particular, it is the vertical distribution of the receptors beneath the river and in the deposits adjacent to the river that potentially (i.e., the depth to which they are found, or bottom of the system) have the greatest implications for remedial actions. This is because the mechanisms of dilution and mixing of groundwater may not be as effective at greater depths and so there is greater potential for exposure to contaminants from groundwater.

In the studies of the Columbia River at the Hanford Site, the term hyporheic zone has been used as a general term to describe the zone of all groundwater and surface water mixing. Receptors in the riverbed and benthic and hyporheic zones can be exposed to contaminated (1) groundwater, (2) groundwater surface-water mixtures, or (3) surface water. These distinctions become important when identifying from analytical results in groundwater and surface water COPECs that are related to Hanford Site operations.

Investigation of riparian area soils was conducted as part of the RCBRA. The riparian assessment evaluated ecological risks at 18 study sites potentially affected by contamination from Hanford Site sources. Eleven study sites were selected from locations that may be adjacent to or directly affected by known contaminated media (groundwater seeps and springs, soil, sediment). These sites were located along the Columbia River shoreline near the operating areas (100-BC, 100-K, 300 Area, etc.) and included six sites with relatively elevated contaminant concentrations and five sites with relatively low contaminant concentrations. Historic data and radiation surveys were used to determine the general contaminant levels at each site. Two of these riparian study sites were located near the 300 Area. These sites are described as follows:

- **Riparian 5c.** This site was located in a backwater region of the river, about 10 km (6 mi) upstream of the 300 Area. The site was located along a very steep embankment heavily covered with organic debris, such as decaying tumbleweed (*Salsola kali*) stems from prior year's growth. The width of the site was typically about 10 m (33 ft) and encompassed about 1,700 m^2 (18,298 ft^2) of shoreline habitat. Although medium-sized cobbles were common, the depositional characteristics at this site had resulted in heavy embedding. River currents may lightly scour this site when flows exceed 5,663 m^3/s (200,000 ft^3/s)

- **Riparian 6.** This site was located near the lower end of the Hanford Reach (nearly 48 km [30 mi]) downstream of the other riparian study sites), near the 300 Area, and influenced by McNary pool water elevation changes as well as the highly attenuated discharge fluctuations originating from Priest Rapids dam. Although this site is in more of a depositional zone within the Columbia River system in general, it had a mixture of slow-water shorelines and fast-water shorelines with substrate mixtures of sand/silt to gravel, to cobble, and boulders. The site is one of the more tree-covered riparian sites. The site had a small ravine running near the southern portion of the site. The ravine was supposedly associated with a liquid waste spill that took place there decades ago. The river's configuration near this site tends to deposit large amounts of organic debris (and litter) when high spring flood-type levels (200+ kcfs) persist. This site's dimensions were approximately 6 m × 200 m (20 ft × 656 ft),

with some variations in the widths such that it encompassed a total around 1,000 m^2 (10,764 ft^2) of riparian habitat.

Soil samples were collected from study sites and from reference sites using MULTI INCREMENT® sampling (MIS) methodology. This method was designed to obtain representative estimates of the average contaminant concentrations in the study site and control the sampling fundamental error and the grouping and segregation errors associated with measuring soil concentrations. Soil MIS represents surface soils of the 0 to 15 cm (0 to 6 in.) depth interval using a systematic random design across a 200 m (656 ft) long investigation area. The contaminants detected in these soil samples include inorganics (metals), organic compounds including PCB Aroclors, polycyclic aromatic hydrocarbons, phthalates and chlorinated pesticides, and radionuclides. Biota sampling conducted in these sites is described in detail in the RCBRA (RCBRA Report [DOE/RL-2007-21]). Assessment of ecological risks based on the soil and biota sampling is described further in Chapter M4 of this appendix.

Nearshore study sites sampled as part of the RCBRA in 2005 were located within three key contaminant plumes originating from Hanford Site operations (Cr(VI) at 100-K and 100-D, Sr-90 at 100-N, and uranium at the 300 Area) (RCBRA SAP [DOE/RL 2005-42]). Ten additional study sites sampled in 2006 were located in selected regions where the Hanford Site's legacy materials were known or suspected to have been deposited. Study sites located near 300 Area are summarized below:

- **Nearshore Sites U1 and U2.** The uranium nearshore sites 1 and 2 were located near the upriver boundary of the 300 Area. The riverine conditions nearby consisted of an asymmetric thalweg and an adjacent island. These two sites were located in backwater areas where the substrate was predominantly sediment with some highly embedded gravels and cobbles. The sites were immediately proximal to large macrophyte populations. The impounded waters from McNary Dam slightly influenced the river nearby. Groundwater upwellings were common throughout this area. Steelhead spawning habitat was not present at either of these sites.

- **Nearshore Sites U3 and U4.** The uranium nearshore sites 3 and 4 were located about 500 m (1,640 ft) and 400 m (1,312 ft), respectively, upstream of the 300 Area water intake structure. The river's thalweg crosses from Franklin County shoreline to the Benton County shoreline, causing extensive hydrological scouring of the riverbeds near this region. All three sites were located in relatively fast flowing region of the river containing a mixture of gravels and cobbles with low embedding. Groundwater upwellings were common throughout this area. Sites were found to contain suitable steelhead spawning habitat.

- **Nearshore Sites U5 through U10.** The uranium nearshore sites 5, 6, 8, 9, and 10 were located along a 1 km (0.6 mi) stretch of shoreline beginning at the 300 Area water intake structure. All sites were located in slack and depositional waters. Substrate size ranged from predominantly slightly embedded cobbles at sites U5 through U8, and progressed down to heavily embedded gravels within sites U9 and U10. The region represented a major interface between the impounded waters of McNary Dam and the free flowing waters of the Hanford Reach. Groundwater upwellings were common throughout this area. The sites did not contain any suitable steelhead spawning habitat.

Sediment, porewater, and surface water samples were collected from these sites. Further discussion of these data is incorporated into the data evaluation presented below in Chapter M3 of this appendix. Biota sampling performed at these sites is described in the RCBRA (RCBRA Report [DOE/RL-2007-21]). Assessment of ecological risks based on the biota sampling results is described in Chapter M4 of this appendix. Contaminants detected principally in the sediment, porewater, and surface water samples were inorganics and radionuclides.

M2.4 Routes of Potential Exposure and Receptors

A range of terrestrial and aquatic plant, invertebrate, and wildlife species were considered in the ecological risk assessment conducted as part of the RCBRA (DOE/RL-2007-21), and are discussed in detail in that ecological risk assessment. A conceptual model depicting the exposure pathways is provided in Figure M-5 followed by a depiction in FigureM-6 of the measurement endpoints used to evaluate those pathways to the receptors identified. These measures are discussed in Section M.3 and M.4. The measures of abiotic environmental media (e.g., groundwater or soil) are compared to effects levels presented in Section M.3.2. Biotic measures and a weight of evidence are discussed in Section M.4.

M2.4.1 Riparian Zone Exposure Pathways

The boundaries of the riparian zone are defined as extending from the water line of the Columbia River to the upper edge of the riverbank where upland vegetation becomes dominant. The riparian zone along the shoreline of the Columbia River is typically narrow because of the steep riverbank. Potential sources of contamination include seep water (upwelling of groundwater in the riparian zone) and associated sediment. Additionally, contaminants originating from past releases in operational areas could have been transported through several release mechanisms affecting the soil surface within the riparian zone.

Contaminants could have been transported to the riparian zone through surface drainage from the following:

- Precipitation contacting surface soil or waste and running off of the associated waste site
- Landslides or slumping of contaminated soil from upland operational areas into the riparian zone
- Fugitive dust transported through wind or work activities on the waste sites

The primary exposure pathways and release mechanisms in the riparian zone transporting the contaminants from the source, via environmental media, to potential receptors include the following:

- External radiation from contaminated surface soil or sediment
- Generation of dust emanating from surface soil to ambient air from wind
- Volatilization of chemicals emanating from surface soil or sediment to ambient air at the site
- Transport of contaminants in groundwater to release locations in the riparian area (i.e., seeps)
- Shoreline seeps/springs containing contaminants

Sampling locations were selected near historical operating areas and in areas likely to have been affected by contaminated source media such as surface soil, shoreline seeps, or groundwater plumes. The sampling locations were generally selected to optimize the potential for detecting contaminants and effects.

Through transport pathways (e.g., upwelling of groundwater in a riverbank seep), secondary media (such as plants) may become contaminated through root uptake from soil or groundwater/seeps. These secondary contaminated media, in turn, may be consumed by receptor species contributing to exposure.

The following ecological exposure routes were identified for the riparian zone:

- Incidental or intentional ingestion of contaminated soil, sediment, water, or biota
- Dermal contact with contaminated soil, sediment, water, or biota

- Exposure of terrestrial and aquatic vertebrates, invertebrates, and plants to external radiation emitted by contaminated soil or foodstuffs
- Uptake or absorption of soil-, sediment-, or water-bound contaminants
- Inhalation of contaminated dust or volatilized contaminants

The riparian ecological exposure routes that were evaluated in the ecological risk assessment include ingestion of contaminated soil, seep water, and biota. Exposure from external radiation was considered by comparing soil radioactivity to radionuclide-specific biota concentration guidelines. While there is a potentially complete exposure pathway via inhalation of fugitive dust and dermal contact with chemicals, these are generally considered minor exposure routes for ecological receptors (OSWER 9285.7-55).

M2.4.2 Near-Shore Aquatic Zone Exposure Pathway

The near-shore aquatic zone is defined as the area that is permanently inundated by river water, extending from the seasonal low-water mark (i.e., a "green line" where the periphyton [sessile algae] remains green year round) into the river to a water depth of about 2 m (6 ft). A near-shore study boundary depth of 2 m (6 ft) was selected to optimize the ability to measure potential influence of emergent groundwater and other potential Hanford Site contaminant sources within the Columbia River. Potential sources of contamination within the near-shore aquatic zone include contamination along the Columbia River shoreline at riverbank seeps/springs and other submerged locations where upwelling groundwater mixes with the river water.

The primary release mechanisms transporting the contaminants from the source, via environmental media, to potential receptors include the following:

- Transport of contaminants in groundwater to mixing areas in the near-shore area
- Seeps containing contaminants that flow into the river
- External irradiation from surface sediment containing contaminants (receptor irradiation from sediment replaces release and transport)

Sampling locations were selected near historical operating areas and in areas likely to have been affected by contaminated source media such as surface soil, shoreline seeps, or groundwater plumes. The sampling locations were generally selected to optimize the potential for detecting contaminants and effects.

Secondary media such as surface or pore water, sediment, or biota may become contaminated through transport pathways such as biotic uptake or upwelling of groundwater. These secondary contaminated media, in turn, may be contacted or consumed by receptor species, contributing to exposure.

The following ecological exposure routes were identified for the near-shore zone:

- Incidental or intentional ingestion of contaminated sediment, pore water, surface water, or biota
- Dermal contact with contaminated sediment, biota, pore water, or surface water
- Exposure of aquatic vertebrates, invertebrates, and plants to external radiation emitted by contaminated sediment or biota
- Uptake or absorption of sediment- or water-bound contaminants

The near-shore ecological exposure routes that were quantified in the ecological risk assessment include ingestion of contaminated sediment, surface water, and biota. Exposure from external radiation was considered by comparing contaminated sediment and water to radionuclide-specific biota concentration guidelines. While there is a potentially complete exposure pathway via dermal contact with chemicals, this is generally considered a minor exposure route for ecological receptors (OSWER 9285.7-55).

Figure M-5. Ecological Conceptual Exposure Model for the Aquatic Environment (Combined Riparian and Aquatic Near-Shore Zones)

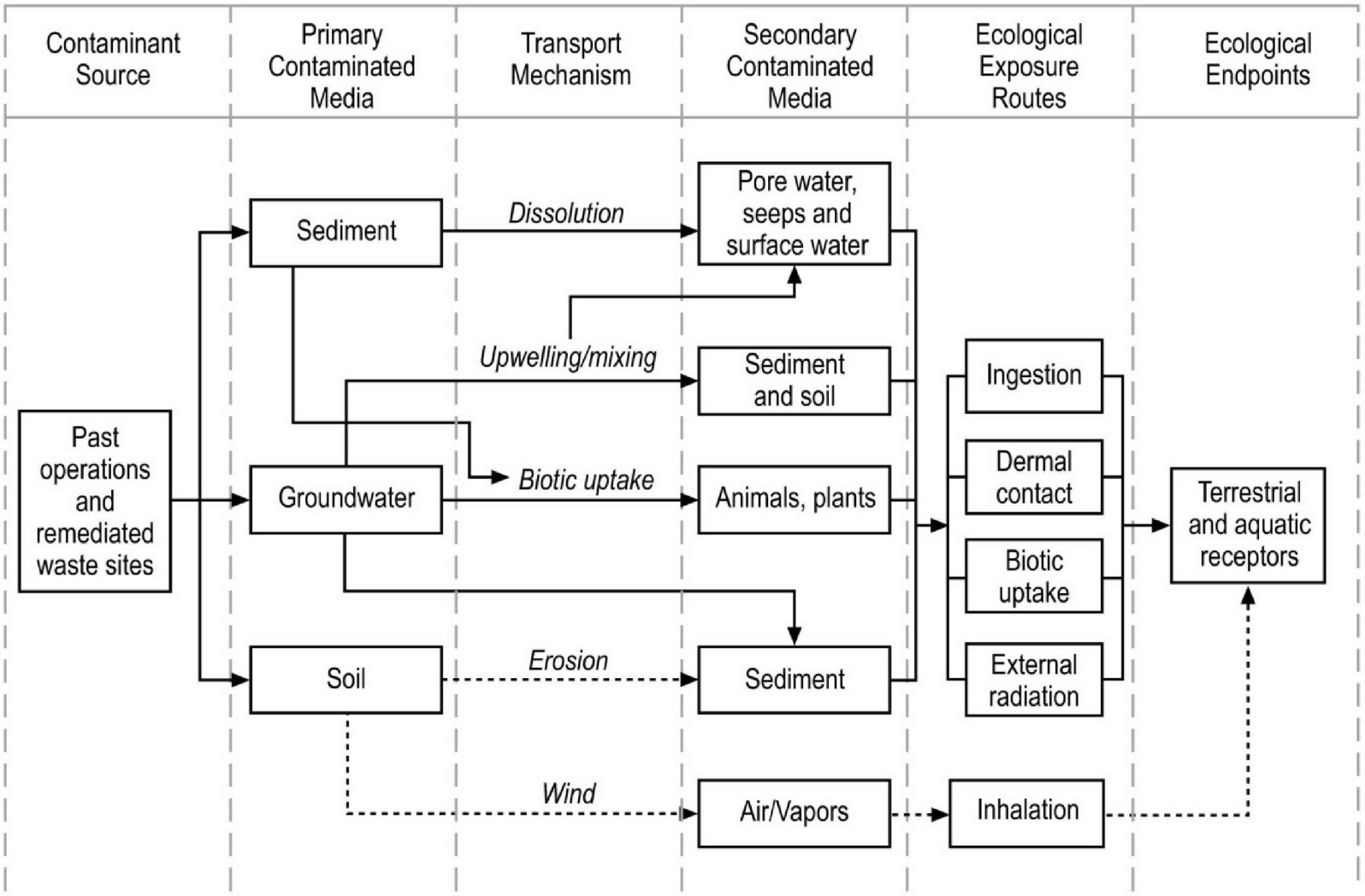
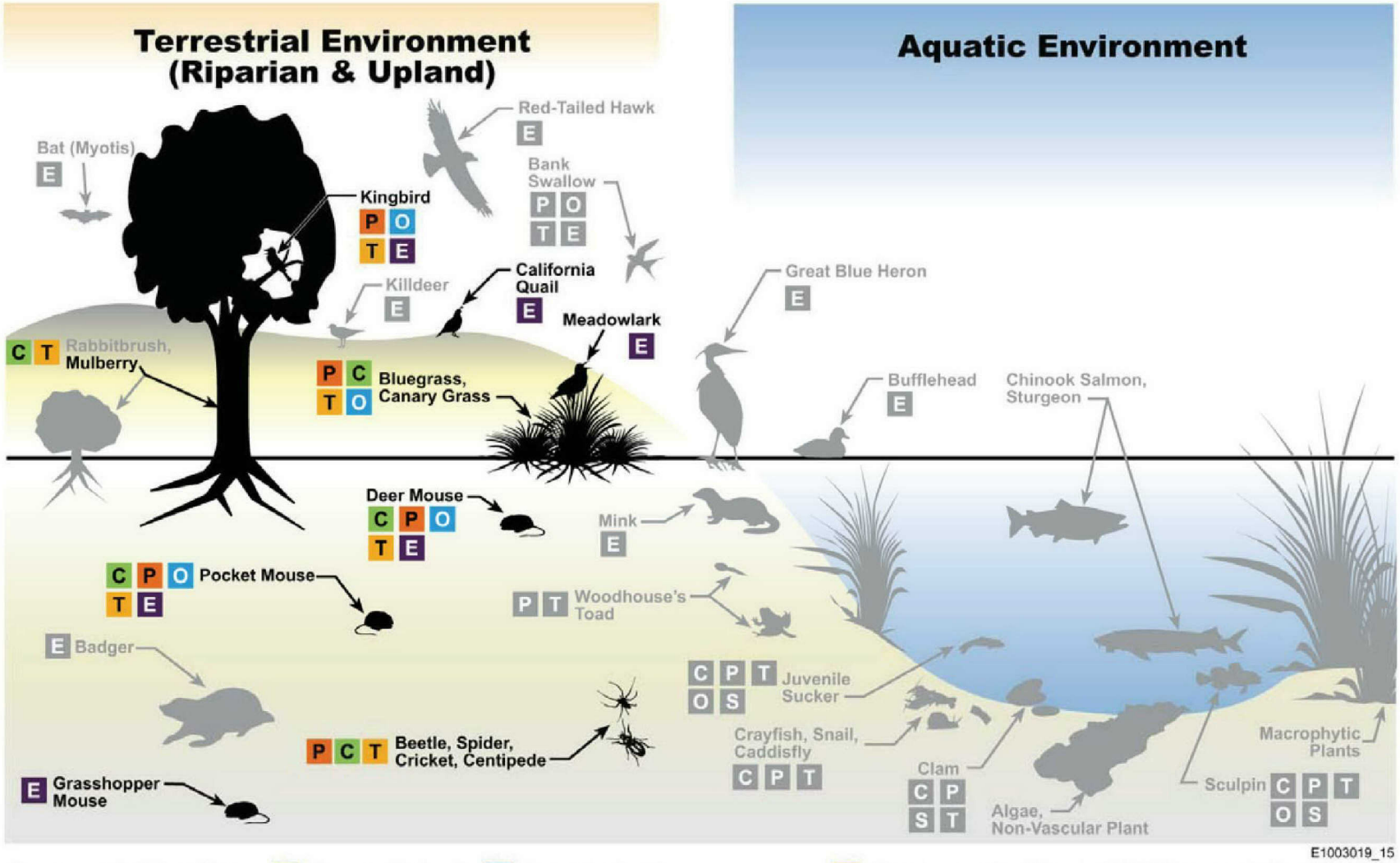


Figure M-6. Summary of Endpoints and Measures Evaluated in the Riparian Environment



M3 Data Evaluation

Analytical data collected from the riparian and nearshore zones were evaluated to focus on the COPECs that could be related to Hanford Site operations. This data evaluation encompassed groundwater (characterized by near river wells and aquifer tubes), seeps/springs, surface water, sediments, and riparian soil data, obtained from a range of Hanford Site sources. These sources included groundwater-monitoring activities documented in the annual groundwater monitoring reports, sampling of sediments, seeps and surface water conducted as part of the SESP, and sampling of sediments, porewater, surface water and riparian soils conducted as part of the RCBRA.

These analytical results were compared with ecological benchmarks and criteria to confirm if these should be identified as COPECs. Analytical data quality, in particular filtered versus unfiltered analyses of water samples, was taken into consideration in making the comparisons with benchmarks and criteria. The spatial relationships of contaminants concentrations in surface water, porewater, and groundwater were evaluated to address considerations of whether or not detected contaminants were related to Hanford Site operations (i.e., originated from upland groundwater sources) or reflected ambient background conditions.

M3.1 Data Sources and Data Processing

The data set used in this evaluation consisted of sampling and analysis data collected from 19 nearshore monitoring wells, 57 aquifer tubes, 61 seep/spring locations, 14 porewater locations, and 42 surface water locations within the boundaries of the 300-FF-5 Groundwater OU. A list of the nearshore wells and aquifer tubes used in this evaluation are provided in Table M-1 (tables are located at the end of this appendix). Seep/spring, porewater, and surface water sampling locations are based on sampling locations identified in the RCBRA. Figures M-7, M-8, and M-9 show the sampling locations for each type of water media, riparian soil, and sediment.

The data set used in this evaluation was obtained from the Hanford Environmental Information System (HEIS). The data included the following types of information:

- Analytical results from both unfiltered and filtered samples
- Data qualification and data validation flags, including rejected results
- Results for a given analyte reported by more than one analytical method
- Parent, field duplicate, and field split sample results

The analytical data were processed to eliminate unusable results and thus identify one set of results per sampling location and date of sample collection. The data processing steps are described in the following subsections.

M3.1.1 Laboratory and Data Validation Flags

Analytical data are received from the laboratory with data qualification flags. Validation qualifiers are assigned during the data validation process. The following rules determine how flagged and/or qualified sample results are used in identifying contaminants of interest (COIs).

- Sample results flagged with a “U” qualifier, or combinations of qualifiers that include a “U,” such as a “UJ,” are considered nondetected results.
- Sample results without a “U” qualifier are considered detected concentrations, including results with no qualifier or with a “J” qualifier.
- Sample results that are rejected and flagged with an “R” qualifier are not used in identifying COPCs.

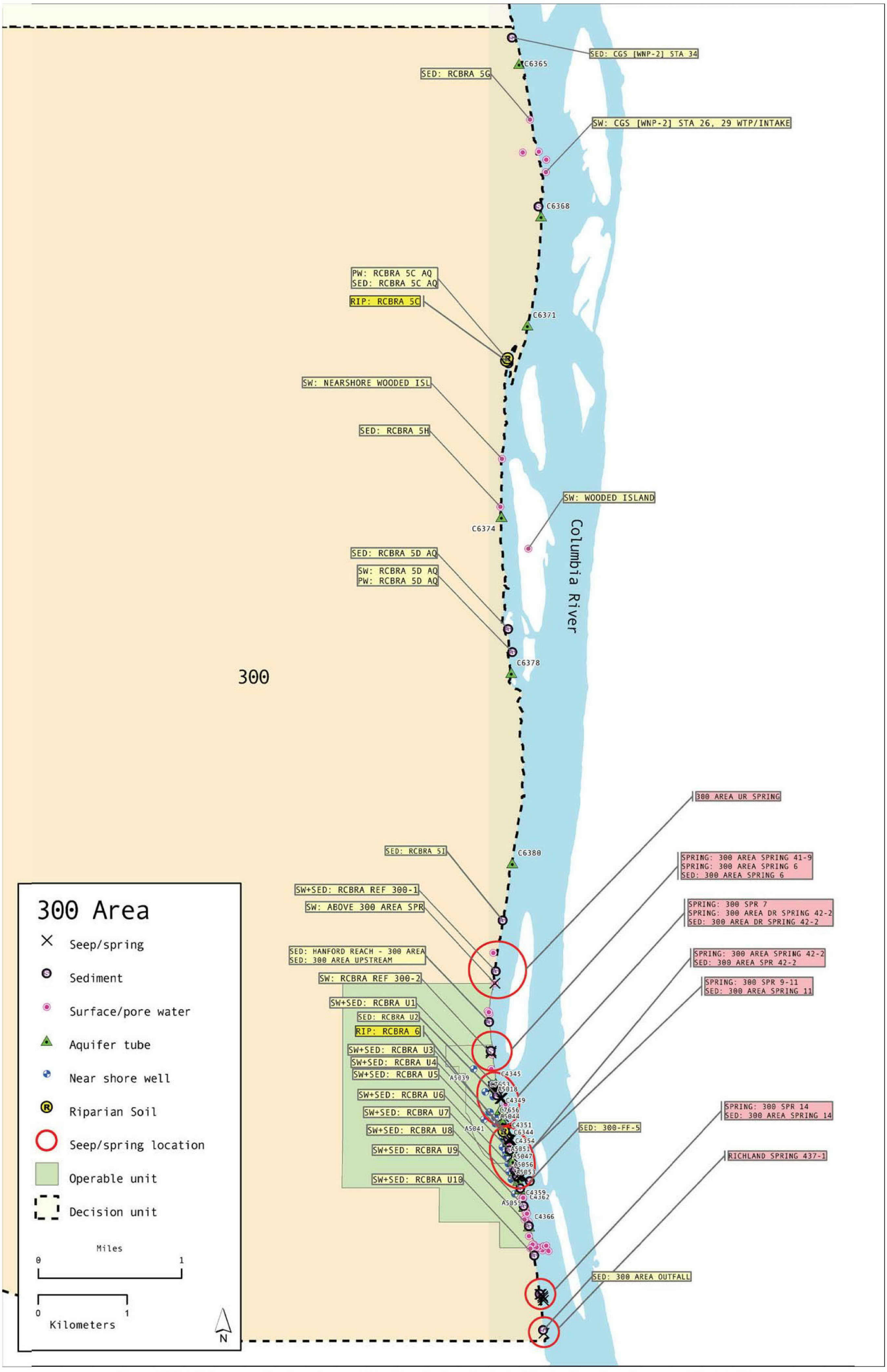


Figure M-7. 300 Area sampling Locations and Identifiers for Samples in the Riparian/Nearshore Conceptual Site Model

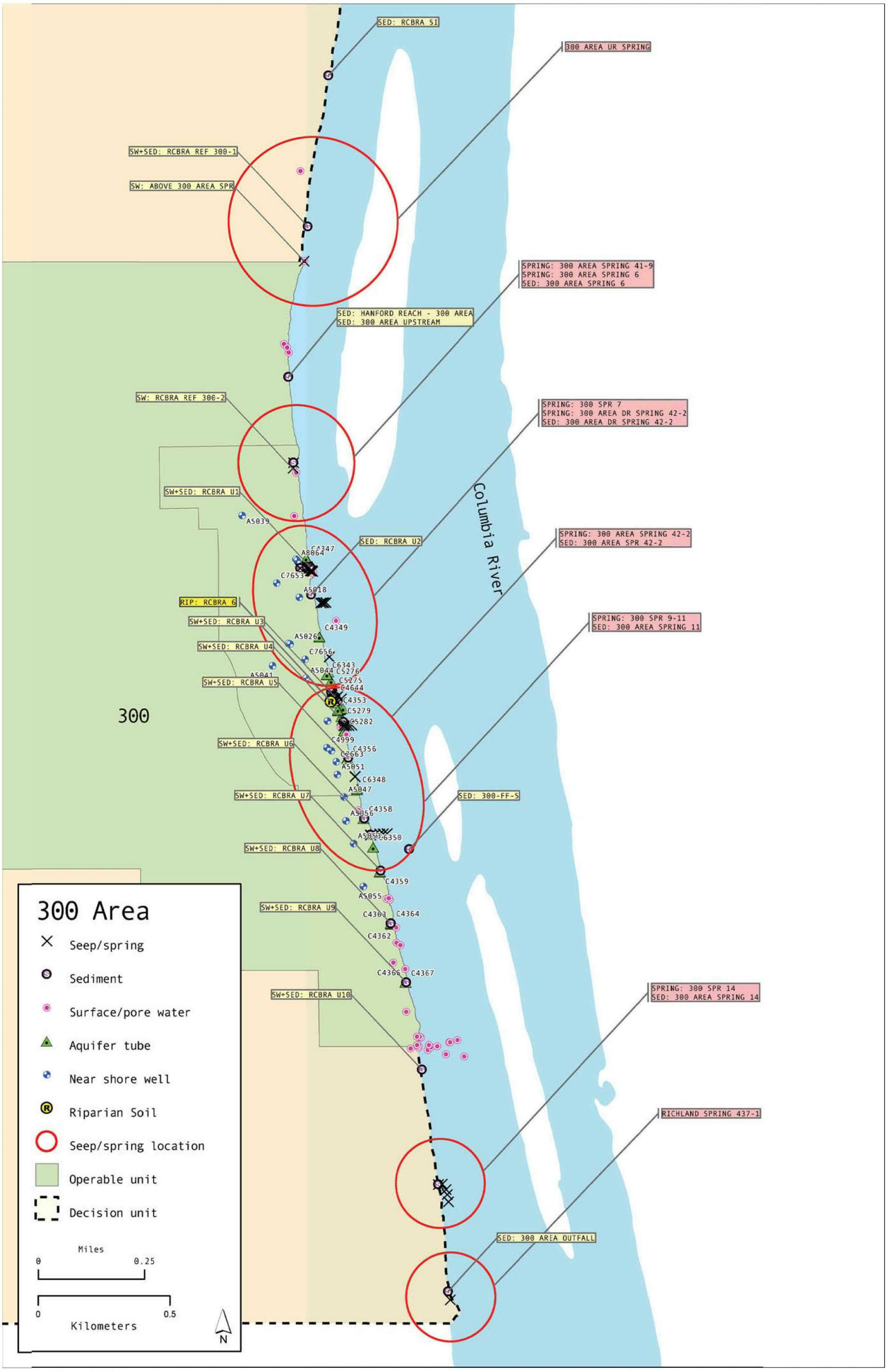


Figure M-8. 300 Area sampling Locations and Identifiers for Samples in the Riparian/Nearshore Conceptual Site Model (Inset—Southern Locations

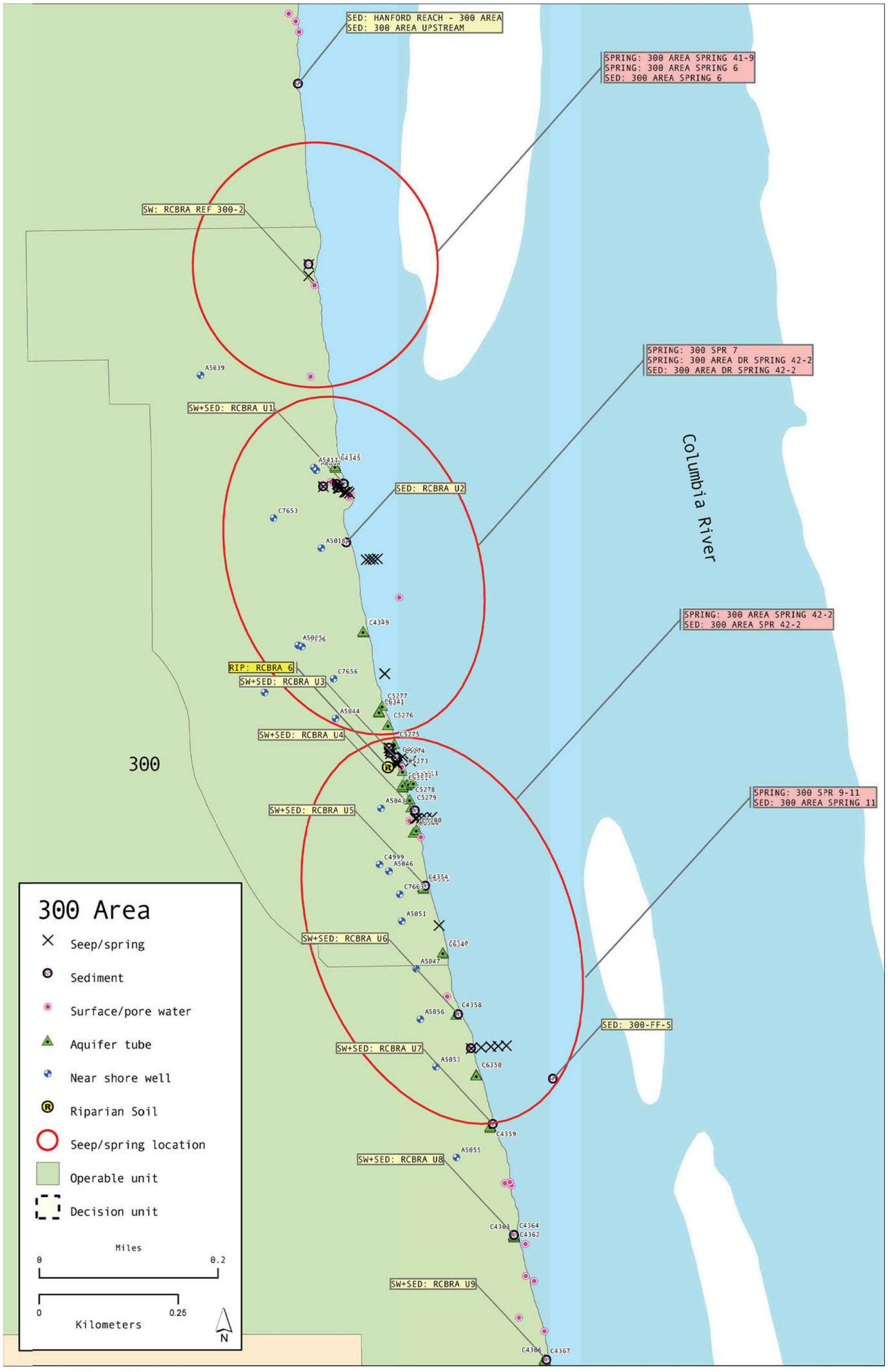


Figure M-9. 300 Area sampling Locations and Identifiers for Samples in the Riparian/Nearshore Conceptual Site Model (Additional Details)

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M3.1.2 Analytes Reported by Numerous Analytical Methods

Often analytes are reported by more than one analytical method, resulting in multiple results for the same analyte from the same location and sample date. When analytes are reported by more than one analytical method for a sample, the set of data that best represents the actual concentration is retained. For example, the gamma spectroscopy method provides concentration results for the uranium isotopes; however, uranium concentrations reported by a uranium-isotope-specific method are preferred.

M3.1.3 Field Duplicate and Field Split Results

Field quality control (QC) samples (field duplicates and field splits) are collected in the field and analyzed by the laboratory as unique samples. The parent sample and QC samples are collected from the same location (i.e., monitoring well) on the same date, resulting in more than one sample per location/date. The following criteria are used to reduce multiple sample results for an individual location/date to a single result:

- If two or more detections exist, the maximum concentration is used
- If at least one detection and one or more nondetected results exist, the detected concentration is used
- If only (two or more) nondetected results exist, the lowest detection limit is used

M3.2 Identification of Ecological Screening Levels

Ecological screening levels (ESLs) were used for comparison with analytical results in water, soil, and sediment to identify COPECs, and were derived from available sources of chemical-specific applicable or relevant and appropriate requirements(ARARs), readily available soil screening levels (SSLs), or site-specific preliminary remediation goals (PRGs) for plants and invertebrates or wildlife. A summary of ESLs for water are listed in Table M-2. A summary of the plant/invertebrate and wildlife ESLs are listed in Table M-3. A summary of the lower and upper threshold sediment ESLs is provided in Table M-4.

M3.2.1 Ecological Screening Levels for Water

The sources of water ESLs are as follows:

- "Phosphorous Toxicity in *Chara*" (Blindow, 1988)
- *Ambient Water Quality Criteria for Fluoride* (BCMOE, 1995)
- *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater* (CRWQCB, 2007)
- *RESRAD-BIOTA: A Tool for Implementing a Graded Approach to Biota Dose Evaluation, User's Guide, Version 1* (DOE/EH-0676)
- *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* (DOE-STD-1153-2002)
- *Ambient Aquatic Life Water Quality Criteria for Antimony (III)* (EPA 440/5-88-093)
- *National Recommended Water Quality Criteria* (EPA, 2009)
- *Toxicological Benchmarks for Screening Potential Contaminants of Concern for Effects on Aquatic Biota at Oak Ridge Reservation: 1996 Revision* (ES/ER/TM-96/R2)

- "Acute and Chronic Toxicity of Nitrate to Early Life Stages of Lake Trout (*Salvelinus Namaycush*) and Lake Whitefish (*Coregonus Clupeaformis*)" (McGurk et al., 2006)
- "Water Quality Values" (MDEQ, Rule 57)
- "Detrimental Effects of Nitrite on the Development of Benthic Chironomus Larvae, in Relation to Their Settlement in Muddy Sediments" (Neumann et al., 2001)
- "Derivation of Ecotoxicity Thresholds for Uranium" (Sheppard et al., 2005)
- "Water Quality Standards for Surface Waters of the State of Washington" (WAC 173-201A)
- *Vanadium Pentoxide and Other Inorganic Vanadium Compounds* (WHO, 2001)

The ESL was selected from lowest of the available values for protection of aquatic receptors, as listed above.

M3.2.2 Ecological Screening Levels for Soil

The sources of the plant/invertebrate ESLs wildlife ESLs are described below. In general, values for metals are preliminary remediation goals (PRGs), while for organics are soil screening levels (SSLs). The specific values and the sources and basis for each value are provided in Table M-3.

Plant/invertebrate ESLs. PRGs for plant and invertebrates are documented in *Tier 2 Terrestrial Plant and Invertebrate Preliminary Remediation Goals (PRGs) for Nonradionuclides for Use at the Hanford Site* (ECF-HANFORD-11-0158). When appropriate these represent thresholds of toxicity to plants and invertebrates at Hanford and are reflective of site-specific conditions. SSLs were employed when a PRG was not available as documented in *Tier 1 Risk-Based Soil Concentrations Protective of Ecological Receptors at the Hanford Site* [CHPRC-00784]). The most appropriate value for each COPEC was selected from:

- Site-specific NOECs from samples collected in 2011as documented in *Tier 2 Terrestrial Plant and Invertebrate Preliminary Remediation Goals (PRGs) for Nonradionuclides for Use at the Hanford Site* (ECF-HANFORD-11-0158).
- Site-specific NOECs from samples collected in 2006 and 2007 as documented in the RCBRA (RCBRA Report [DOE/RL-2007-21]).
- Site-specific PRGs for lead and arsenic presented in *Ecological Soil Screening Levels for Arsenic and Lead in the Tacoma Smelter Plume Footprint and Hanford Site Old Orchards* [Ecology Publication 11-03-006]).
- Hanford Site background:
  - *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes* (DOE/RL-92-24).
  - *Hanford Site Background: Part 2, Soil Background for Radionuclides* (DOE/RL-96-12).
  - *Hanford Site Background: Evaluation of Existing Soil Radionuclide Data* (DOE/RL-95-55).
  - *A Review of Metal Concentrations Measured in Surface Soil Samples Collected on and Around the Hanford Site* (PNNL-18577).
  - *Soil Background Data for Interim Use at the Hanford Site* (ECF-HANFORD-11-0038).

- EPA's ESLs (*Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)* [OSWER Directive 9285.7-55]).
- Ecology's Ecological Indicator Soil Concentrations for Protection of Terrestrial Plants and Animals ("Model Toxics Control Act—Cleanup," WAC 173-340, Table 749-3).
- Oak Ridge National Laboratory (ORNL) screening benchmarks:
  - *Toxicological Benchmarks for Screening Contaminants of Potential Concern for Effects on Terrestrial Plants: 1997 Revision* (ES/ER/TM-85/R3).
  - *Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes: 1997 Revision* (ES/ER/TM-126/R2).

Wildlife ESLs. PRGs for wildlife represent sets of site-specific values derived in order to be protective of wildlife that are found or that represent feeding guilds at the Hanford Site. PRGs rely on desktop food chain models that are effectively equivalent to those published by EPA (*Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)* [OSWER Directive 9285.7-55]) and Ecology ("Model Toxics Control Act—Cleanup," WAC 173-340, Table 749-3). PRGs typically use a combination of literature-based information for the species specifically found at the Hanford Site, while incorporating site-specific tissue data into the food chain models. Wildlife PRGS are documented in *Tier 2 Risk-Based Soil Concentrations Protective of Ecological Receptors at the Hanford Site* (CHPRC-01311), and SSLs are documented in *Tier 1 Risk-Based Soil Concentrations Protective of Ecological Receptors at the Hanford Site* (CHPRC-00784).

M3.2.3 Ecological Screening Levels for Sediment

ESLs for sediment are the same as those used in the RCBRA and in the *Columbia River Component Risk Assessment Volume 1: Screening Level Ecological Risk Assessment* (DOE/RL-2010-117), hereinafter called Columbia River Component (CRC), and come from a variety of published sources. When available, preference was given to values published in *Development of Benthic SQVs for Freshwater Sediments in Washington, Oregon, and Idaho* (Ecology Publication 11-09-054). Other sources were used when a value was not available in this report with preference toward specificity toward datasets from the Pacific Northwest.

M3.3 Identification of Contaminants of Interest - Water

After extracting and processing the 300-FF-5 OU groundwater analytical data set from HEIS, the following multi-step screening process was used to identify initial COIs:

- Apply exclusion criteria.
- Identify nondetected analytes.
- Identify analytes with maximum detected concentrations less than their respective ESLs.
- Identify analytes with maximum detected concentrations greater than their respective ESLs.

M3.3.1 Apply Exclusion Criteria

The first step in the COI identification process is to apply certain exclusion criteria. Analytes that meet the exclusion criteria were eliminated as COIs. The only exclusion criterion used was the absence of toxicity information for an analyte—if there were no ESLs available as described in Section M3.2.1, that analyte was not carried into the next step of the data evaluation process. Analytes that did not meet any of the exclusion criteria were carried forward into the next step.

The analytes in nearshore groundwater wells, aquifer tubes, porewater samples, and surface water samples that do not have ESLs are summarized in Tables M-5 through M-9. Sampling dates, minimum and maximum detected concentrations, and minimum and maximum method detection limits (MDLs), are also provided in Tables M-5 through M-9.

M3.3.2 Identify Nondetected Analytes

The next step in the groundwater COI identification process was to identify nondetected analytes. Chemicals and radionuclides that have been analyzed for, but not detected in any sample (collected from appropriate locations, with adequate detection limits), are eliminated as COIs. All analytes detected at least once were carried forward to the next step.

Analytes that were not detected in near-river groundwater wells, aquifer tubes, porewater, seep/spring, or surface water samples are summarized in Tables M-10 through M-14.

M3.3.3 Identify Analytes with Maximum Detected Concentrations Less Than ESLs

This step identifies analytes with maximum concentrations less than ESLs. In this screening step, the maximum concentration of each analyte detected in groundwater was compared to its ESL, to identify analytes not likely to contribute significantly to overall risk. If the maximum detected concentration of an analyte was less than its ESL, the analyte was eliminated as a COI.

A list of analytes with maximum concentrations less than their ESL is presented in Tables M-15 through M-19. With regard to groundwater, the focus of this analysis has been on analytes that are not identified as the contaminants that have already been identified for remedial alternatives evaluation in the feasibility study (FS), including uranium, nitrate, and several chlorinated VOCs. Further discussion of these contaminants is provided in Section 4.3.2 of the Remedial Investigation/FS Report.

M3.3.4 Identify Analytes with Maximum Detected Concentrations Greater than ESLs

This step identifies analytes with maximum concentrations greater than their respective ESLs. Such analytes are likely to contribute to overall risk. If the maximum detected concentration of an analyte is greater than its ESL, the analyte is identified as a COI. Analytes with maximum detected concentrations greater than their respective ESLs are described below. Tables M-20 through M-24 provides a summary of the analytes with maximum detected concentrations greater than their respective ESL for each water media. Table M-25 summarizes the results for all water media and all COIs described below.

Aluminum

Groundwater. Aluminum was detected in 5 of 30 unfiltered groundwater samples (17 percent frequency) with concentrations ranging from 27 to 65 µg/L. Aluminum concentrations in unfiltered samples are less than the ESL of 87 µg/L.

Aluminum was detected 2 of 19 filtered groundwater samples (11 percent frequency). Aluminum concentrations in filtered samples ranged from 14 to 122 µg/L. Of the two detected results, one sample was reported with a concentration greater than the ESL of 87 µg/L. Aluminum was detected at monitoring well 399-2-2 (122 µg/L), and flagged with a "Y" review qualifier, indicating the result is suspect.

All MDLs for filtered and unfiltered samples are less than the ESL.

Aquifer Tubes. Aluminum was detected in one filtered aquifer tube sample (100 percent frequency) at a concentration of 2.3 µg/L. Aluminum concentrations in filtered samples are less than the ESL of 87 µg/L.

Porewater. Aluminum was detected in 11 of 16 unfiltered porewater samples (69 percent frequency). Aluminum concentrations in unfiltered samples ranged from 30 to 161 µg/L. Of the 11 detected results,

four samples were reported with concentrations greater than the ESL of 87 µg/L. Aluminum was detected at locations RCBRA U4 (161 µg/L) and RCBRA REF 300-1 (130 µg/L). Aluminum was also detected at locations RCBRA U9 (125 µg/L) and RCBRA U8 (87 µg/L), these results were flagged with a "C" qualifier indicating that aluminum was reported in the sample and the QC blank. All MDLs are less than the ESL. No filtered samples were collected and analyzed for aluminum.

Seep/Spring. Aluminum was detected in all seven unfiltered seep/spring samples (100 percent frequency). Aluminum concentrations in unfiltered samples ranged from 31 to 3,100 µg/L. Of the seven detected results, five samples were reported with concentrations greater than the ESL of 87 µg/L. Aluminum was detected at location 300 Area Spring 42-2 (140, 960, and 3,100 µg/L), 300 Area DR Spring 42-2 (88 µg/L), and 300 Area Spring 11 (123 µg/L). No filtered samples were collected and analyzed for aluminum.

Surface Water. Aluminum was detected in 14 of 17 unfiltered surface water samples (82 percent frequency). Aluminum concentrations in unfiltered samples ranged from 20 to 310 µg/L. Of the 14 detected results, three samples were reported with concentrations greater than the ESL of 87 µg/L. Aluminum was detected at location 300 Area-1 HRM 43.1 (310 µg/L), RCBRA U10 (254 µg/L), and RCBRA U7 (106 µg/L). All MDLs are less than the ESL. No filtered samples were collected and analyzed for aluminum.

Antimony

Groundwater. Antimony was detected in 4 of 143 unfiltered groundwater samples (2.8 percent frequency). Antimony concentrations in unfiltered samples range from 33 to 55 µg/L. Of the four detected results, four samples were reported with concentrations greater than the ESL of 30 µg/L. Although the maximum detected concentrations are greater than the ESL, antimony concentrations are less than the Hanford Site background level of 55 µg/L.

Antimony was detected in 2 of 179 filtered groundwater samples (1.1 percent frequency). Antimony concentrations in filtered samples range from 45 to 52 µg/L. Of the two detected results, two samples were reported with concentrations greater than the ESL of 30 µg/L. Although the maximum detected concentrations are greater than the ESL, antimony concentrations are less than the Hanford Site background level of 55 µg/L.

Aquifer Tubes. Antimony was detected in 2 of 93 unfiltered aquifer tube samples (2.2 percent frequency). Antimony concentrations in unfiltered samples range from 34 to 36 µg/L. Of the two detected results, two samples were reported with concentrations greater than the ESL of 30 µg/L. Although the maximum detected concentrations are greater than the ESL, antimony concentrations are less than the Hanford Site background level of 55 µg/L.

Antimony was detected in 4 of 97 filtered aquifer tube samples (4.1 percent frequency). Antimony concentrations in filtered samples range from 0.31 to 51 µg/L. Of the four detected results, three samples were reported with concentrations greater than the ESL of 30 µg/L. Although the maximum detected concentrations are greater than the ESL, antimony concentrations are less than the Hanford Site background level of 55 µg/L.

Porewater. Antimony was not detected in unfiltered porewater samples (16 samples). All MDLs are less than the ESL of 30 µg/L.

Seep/Spring. Antimony was detected in 10 of 11 unfiltered seep/spring samples (91 percent frequency) with concentrations ranging from 0.19 to 0.39 µg/L. Antimony was detected in all three filtered seep/spring samples (100 percent frequency) with concentrations ranging from 0.22 to 0.26 µg/L.

Antimony concentrations in filtered and unfiltered samples are less than the ESL of 30 µg/L. MDLs in unfiltered samples are greater than the ESL.

Surface Water. Antimony was detected in 23 of 35 unfiltered surface water samples (66 percent frequency). Antimony concentrations in unfiltered samples range from 0.13 to 63 µg/L. Of the 23 detected results, one sample was reported with a concentration greater than the ESL of 30 µg/L. Antimony was reported at location 300 Area-2-HRM 43.1 (63 µg/L) with a concentration greater than the ESL and the Hanford Site background level. All MDLs are unfiltered samples are less than the ESL.

Antimony was detected in all 13 filtered surface water samples (100 percent frequency) with concentrations ranging from 0.16 to 0.31 µg/L. Antimony concentration in filtered samples are less than the ESL of 30 µg/L.

Barium

Groundwater. Barium was detected in all 143 unfiltered groundwater samples (100 percent frequency) with concentrations ranging from 15 to 83 µg/L. Barium was detected in all filtered groundwater samples (100 percent frequency) with concentrations ranging from 20 to 82 µg/L. Barium concentrations in filtered and unfiltered samples are less than the ESL of 364 µg/L.

Aquifer Tube. Barium was detected in all 86 unfiltered aquifer tube samples (100 percent frequency) with concentrations ranging from 27 to 238 µg/L. Barium concentrations in unfiltered samples are less than the ESL of 364 µg/L.

Barium was detected in all 91 filtered aquifer tube samples (100 percent frequency). Barium concentration in filtered samples range from 19 to 398 µg/L. Of the 91 detected results, one sample was reported with a concentration greater than the ESL of 364 µg/L. Barium was reported at location AT-3-1-D(1) (398 µg/L) with a concentration greater than the ESL.

Porewater. Barium was detected in all 16 unfiltered porewater samples (100 percent frequency) with concentrations ranging from 26 to 104 µg/L. Barium concentrations in unfiltered samples are less than the ESL of 364 µg/L.

Seep/Spring. Barium was detected in all nine unfiltered seep/spring samples (100 percent frequency) with concentrations ranging from 33 to 188 µg/L. Barium concentrations in unfiltered samples are less than the ESL of 364 µg/L.

Surface Water. Barium was detected in all 17 unfiltered surface water samples (100 percent frequency) with concentrations ranging from 28 to 40 µg/L. Barium concentrations in unfiltered samples are less than the ESL of 364 µg/L.

Cadmium

Groundwater. Cadmium was detected in 1 of 143 unfiltered groundwater samples (0.70 percent frequency), and was not detected in filtered groundwater samples (179 samples). The single cadmium sample was reported with a concentration greater than the ESL of 0.22 µg/L. Cadmium was detected at monitoring well 399-3-1 (4.2 µg/L). The single cadmium concentration was flagged with a “Y” review qualifier, indicating the result is suspect. Most MDLs are greater than the ESL of 0.22 µg/L.

Aquifer Tubes. Cadmium was detected in 3 of 93 unfiltered aquifer tube samples (3.2 percent frequency). Cadmium concentrations in unfiltered samples ranged from 4.6 to 6.4 µg/L. All three samples were reported with concentrations greater than the ESL of 0.22 µg/L. Cadmium was detected at locations AT-3-8-S (6.4 µg/L), C6344 (4.6 µg/L), and C6351 (4.6 µg/L). Cadmium concentrations were flagged

with "B" qualifiers, indicating the analyte was detected at a value less than the contract required detection limit (CRDL). Most MDLs are greater than the ESL of 0.22 µg/L.

Cadmium was detected in 2 of 98 filtered aquifer tube samples (2.0 percent frequency). Cadmium concentrations in filtered samples are 0.058 and 4.7 µg/L. Of the two detections, one sample was reported with a concentration greater than the ESL of 0.22 µg/L. Cadmium was detected at location AT-3-2-M (4.7 µg/L). The single cadmium concentration was flagged with a "B" qualifier, indicating the analyte was detected at a value less than the CRDL. Most MDLs are greater than the ESL of 0.22 µg/L.

Porewater. Cadmium was not detected in unfiltered porewater samples (16 samples). All MDLs are greater than the ESL of 0.22 µg/L.

Seep/Spring. Cadmium was detected in all 12 unfiltered seep/spring samples (100 percent frequency). Cadmium concentrations in unfiltered samples ranged from 0.025 to 0.57 µg/L. Of the 12 detected results, three samples were reported with concentrations greater than the ESL of 0.22 µg/L. Cadmium is reported at concentrations less than the Hanford Site background level of 0.92 µg/L.

Cadmium was detected in all three filtered seep/spring samples (100 percent frequency) with concentrations ranging from 0.016 to 0.028 µg/L. Cadmium concentrations in filtered samples are less than the ESL of 0.22 µg/L.

Surface Water. Cadmium was detected in 21 of 36 unfiltered surface water samples (58 percent frequency). Cadmium concentrations in unfiltered samples ranged from 0.013 to 2.1 µg/L. Of the 21 detected results, three samples were reported with concentrations greater than the ESL of 0.22 µg/L. Cadmium was detected at location 300 Area -2 HRM 43.1 (2.1 µg/L) with a concentration greater than the 90th percentile Hanford Site background value of 0.92 µg/L. Most MDLs for unfiltered samples are greater than the ESL.

Cadmium was detected in 8 of 13 filtered surface water samples (62 percent frequency) with concentrations ranging from 0.0086 to 0.016 µg/L. Cadmium concentrations in filtered samples are less than the ESL of 0.22 µg/L. All MDLs for filtered samples are less than the ESL.

Calculated Total Uranium

Porewater. Calculated total uranium was detected in all 16 unfiltered porewater samples (100 percent frequency). Calculated total uranium concentrations in unfiltered samples ranged from 0.52 to 141 µg/L. Of the 16 detected results, three samples were reported with concentrations greater than the ESL of 5.0 µg/L.

Seep/Spring. Calculated total uranium was detected in all 67 unfiltered seep/spring samples (100 percent frequency). Calculated total uranium concentrations in unfiltered samples ranged from 0.66 to 297 µg/L. Of the 67 detected results, 42 samples were reported with concentrations greater than the ESL of 5.0 µg/L.

Surface Water. Calculated total uranium was detected in all 81 unfiltered groundwater samples (100 percent frequency). Calculated total uranium concentrations in unfiltered samples ranged from 0.30 to 19 µg/L. Of the 81 detected results, five samples were reported with concentrations greater than the ESL of 5.0 µg/L.

Copper

Groundwater. Copper was detected in 16 of 143 unfiltered groundwater samples (11 percent frequency). Copper concentrations in unfiltered samples ranged from 0.22 to 229 µg/L. Of the 16 detected results, two

samples were reported with concentrations greater than the ESL of 10 µg/L. Copper was detected at monitoring well 399-3-18 (10 µg/L), and flagged with a "C" qualifier indicating the result was reported in the laboratory QC blank. Copper was detected at monitoring well 399-1-16A (229 µg/L), and flagged with a "Y" review qualifier indicating the result is suspect. All MDLs are less than the ESL.

Copper was detected in 9 of 179 filtered groundwater samples (5 percent frequency). Copper concentrations in filtered samples ranged from 0.24 to 12 µg/L. Of the nine detected results, one sample was reported with a concentration greater than the ESL of 10 µg/L. Copper was detected at monitoring well 399-3-18 (12 µg/L), and flagged with a "C" qualifier indicating the result was reported in the laboratory QC blank. Most MDLs are less than the ESL.

Aquifer tube. Copper was detected in 5 of 69 unfiltered aquifer tube samples (7.3 percent frequency). Copper concentrations in unfiltered samples ranged from 4.2 to 11 µg/L. Of the five detected results, one sample was reported with a concentration greater than the ESL of 10 µg/L. The single copper concentration was detected at location C6342 (11 µg/L).

Copper was detected in 4 of 78 filtered aquifer tube samples (5.1 percent frequency) with concentrations ranging from 4.0 to 6.0 µg/L. Copper concentrations in filtered samples are less than the ESL of 10 µg/L.

All MDLs for filtered and unfiltered samples are less than the ESL.

Porewater. Copper was detected in 8 of 16 unfiltered porewater samples (50 percent frequency) with concentrations ranging from 1.5 to 8.9 µg/L. Copper concentrations in unfiltered samples are less than the ESL of 10 µg/L. All MDLs are less than the ESL.

Seep/Spring. Copper was detected in all 12 unfiltered seep/spring samples (100 percent frequency). Copper concentrations in unfiltered samples ranged from 0.51 to 15 µg/L. Of the 12 detected results, two samples were reported with concentrations greater than the ESL of 10 µg/L. Copper was detected at locations 300 Area DR Spring 42-2 (15 µg/L) and 300 Area Spring 42-2 (14 µg/L).

Copper was detected in all three filtered seep/spring samples (100 percent frequency) with concentrations ranging from 0.34 to 0.45 µg/L. Copper concentrations in filtered samples are less than the ESL of 10 µg/L.

Surface Water. Copper was detected in 28 of 37 unfiltered surface water samples (76 percent frequency) with concentrations ranging from 0.53 to 3.5 µg/L. Copper was detected in all 13 filtered surface water samples (100 percent frequency) with concentrations ranging from 0.48 to 0.60 µg/L. All copper concentrations and MDLs are less than the ESL of 10 µg/L.

Dieldrin

Groundwater. Dieldrin was not detected in unfiltered groundwater samples (2 samples). All MDL are greater than the ESL of 0.0019 µg/L.

Aquifer tube. Dieldrin was detected in one of seven unfiltered aquifer tube samples (14 percent frequency). The single dieldrin sample was reported with a concentration greater than the ESL of 0.0019 µg/L. Dieldrin was detected at location C6371 (0.016 µg/L), and flagged with a "J" qualifier indicating the concentration is an estimated value. All MDLs are greater than the ESL.

Porewater. Dieldrin was not detected in unfiltered porewater samples (16 samples). All MDL are greater than the ESL of 0.0019 µg/L.

Surface Water. Dieldrin was not detected in unfiltered surface water samples (14 samples). All MDL are greater than the ESL of 0.0019 µg/L.

Fluoride

Groundwater. Fluoride was detected in all 276 unfiltered groundwater samples (100 percent frequency). Fluoride concentrations in unfiltered samples ranged from 52 to 1,630 µg/L. Of the 276 detected results, 127 samples were reported with concentrations greater than the ESL of 300 µg/L. Fluoride was detected at monitoring wells 399-1-10B (1,100 µg/L), 399-1-16B (1,100 and 1,100 µg/L), and 399-3-10 (1,630 µg/L) with concentrations greater than the Hanford Site background level of 1,047 µg/L.

Fluoride was detected in one filtered groundwater samples (100 percent frequency) at a concentration of 332 µg/L. The single fluoride sample was reported with a concentration greater than the ESL of 300 µg/L. Although fluoride was reported a concentration greater than the ESL, fluoride was reported a concentration less than the Hanford Site background level of 1,047 µg/L.

Aquifer Tubes. Fluoride was detected in 150 of 157 unfiltered aquifer tube samples (96 percent frequency). Fluoride concentrations in unfiltered samples ranged from 58 to 717 µg/L. Of the 150 detected results, 17 samples were reported with concentrations greater than the ESL of 1,000 µg/L. Although fluoride was reported a concentrations greater than the ESL, fluoride concentrations were reported less than the Hanford Site background level of 1,047 µg/L.

Porewater. Fluoride was not detected in unfiltered porewater samples (16 samples). All MDL are less than the ESL of 300 µg/L.

Seep/Spring. Fluoride was detected in all 12 unfiltered seep/spring samples (100 percent frequency). Fluoride concentrations in unfiltered samples ranged from 160 to 600 µg/L. Of the 12 detected results, three samples were reported with concentrations greater than the ESL of 1,000 µg/L. Although fluoride was reported a concentrations greater than the ESL, fluoride concentrations were reported less than the Hanford Site background level of 1,047 µg/L.

Surface Water. Fluoride was detected in 38 of 82 unfiltered surface water samples (73 percent frequency). Fluoride concentrations in unfiltered samples ranged from 40 to 400 µg/L. Of the 38 detected results, one sample was reported with a concentration greater than the ESL of 1,000 µg/L. Although fluoride was reported at a concentration greater than the ESL, fluoride was reported at a concentration less than the Hanford Site background level of 1,047 µg/L.

Iron

Groundwater. Iron was detected in 92 of 143 unfiltered groundwater samples (64 percent frequency). Iron concentrations in unfiltered samples ranged from 13 to 1,260 µg/L. Of the 92 detected results, three samples were reported with concentrations greater than the ESL of 1,000 µg/L. Iron was detected at monitoring well 399-1-10B (1,260, 1,170, and 1,060 µg/L).

Iron was detected in 76 of 179 filtered groundwater samples (42 percent frequency). Iron concentrations in filtered samples ranged from 13 to 1,190 µg/L. Of the 76 detected results, three samples were reported with concentration greater than the ESL of 1,000 µg/L. Iron was detected at monitoring well 399-1-10B (1,190, 1,160, and 1,100 µg/L).

All MDLs for filtered and unfiltered samples are less than the ESL.

Aquifer Tubes. Iron was detected in 63 of 86 unfiltered aquifer tube samples (73 percent frequency). Iron concentrations in unfiltered samples ranged from 21 to 8,970 µg/L. Of the 63 detected results, 11 samples were reported with concentrations greater than the ESL of 1,000 µg/L.

Iron was detected in 35 of 90 filtered aquifer tube samples (39 percent frequency). Iron concentrations in filtered samples ranged from 13 to 3,580 µg/L. Of the 13 detected results, one sample was reported with a concentration greater than the ESL of 1,000 µg/L. Iron was detected at location AT-3-2-M (3,580 µg/L).

All MDLs for filtered and unfiltered samples are less than the ESL.

Porewater. Iron was detected in 13 of 16 unfiltered porewater samples (81 percent frequency). Iron concentrations in unfiltered samples ranged from 26 to 8,270 µg/L. Of the 13 detected results, two samples were reported with concentrations greater than the ESL of 1,000 µg/L. Iron was detected at location RCBRA U1 (8,270 and 2,550 µg/L). All MDLs are less than the ESL.

Seep/Spring. Iron was detected in all three unfiltered seep/spring samples (100 percent frequency). Iron concentrations in unfiltered samples ranged from 190 to 4,700 µg/L. Of the three detected results, two samples were reported with concentrations greater than the ESL of 1,000 µg/L. Iron was detected at location 300 Area DR Spring 42-2 (4,700 and 1,200 µg/L).

Surface Water. Iron was detected in 15 of 17 unfiltered surface water samples (88 percent frequency) with concentrations ranging of 25 to 310 µg/L. Iron concentrations in unfiltered samples are less than the ESL of 1,000 µg/L. All MDLs are less than the ESL.

Lead

Groundwater. Lead was detected in 1 of 30 unfiltered groundwater samples (3.3 percent frequency), and was not detected in filtered groundwater samples (19 samples). The single lead concentration in unfiltered samples was detected at location 399-1-54 (0.22 µg/L), and flagged with a "BD" qualifier indicating the analyte was detected at a value less than the RDL but greater than the MDL. Lead concentrations in unfiltered samples are less than the ESL of 2.1 µg/L. Most MDLs for filtered and unfiltered samples are less than the ESL.

Aquifer Tubes. Lead was detected in one of eight filtered aquifer tube samples (13 percent frequency), and was not detected in unfiltered aquifer tube samples (7 samples). The single lead concentration in filtered samples was detected at location AT-3-3-D (0.013 µg/L). Lead concentrations in filtered samples are less than the ESL of 2.1 µg/L. Most MDLs for filtered and unfiltered samples are greater than the ESL.

Porewater. Lead was detected in 2 of 16 unfiltered porewater samples (13 percent frequency). Lead concentrations in unfiltered samples are 1.5 and 3.1 µg/L. Of the two detected results, one sample was reported with a concentration greater than the ESL of 2.1. Lead was detected at location RCBRA REF 300-1 (3.1 µg/L). All MDLs are less than the ESL.

Seep/Spring. Lead was detected in all 10 unfiltered seep/spring samples (100 percent frequency). Lead concentrations in unfiltered samples ranged from 0.062 to 16 µg/L. Of the 10 detected results, two samples were reported with concentrations greater than the ESL of 2.1 µg/L. Lead was detected at locations 300 Area DR Spring 42-2 (16 µg/L) and 300 Area Spring 42-2 (2.4 µg/L). All MDLs are less than the ESL.

Lead was detected in two of three filtered seep/spring samples (67 percent frequency) at concentrations 0.17 and 0.35 µg/L. Lead concentrations in filtered samples are less than the ESL of 2.1 µg/L.

Surface Water. Lead was detected in 22 of 35 unfiltered surface water samples (63 percent frequency). Lead concentration in unfiltered samples ranged from 0.0094 µg/L to 3.9 µg/L. Of the 22 detected results, one sample was reported with a concentration greater than the ESL of 2.1 µg/L. Lead was detected at location RCBRA U8 (3.9 µg/L). Most MDLs are greater than the ESL

Lead was detected in 12 of 14 filtered surface water samples (86 percent frequency) with concentrations ranging from 0.012 to 0.090 µg/L. Lead concentrations in filtered samples are less than the ESL of 2.1 µg/L. All MDLs are less than the ESL.

Manganese

Groundwater. Manganese was detected in 35 of 143 unfiltered groundwater samples (24 percent frequency). Manganese concentrations in unfiltered samples ranged from 1.7 to 319 µg/L. Of the 35 detected results, three samples were reported with concentrations greater than the ESL of 120 µg/L. Manganese was reported at monitoring wells 399-1-57 (142 and 319 µg/L) and 399-1-10B (133 µg/L) with concentrations greater than the ESL.

Manganese was detected in 58 of 179 filtered groundwater samples (32 percent frequency). Manganese concentrations in filtered samples ranged from 0.89 to 133 µg/L. Of the 58 detected results, one sample was reported with a concentration greater than the ESL of 120 µg/L. Manganese was reported at monitoring well 399-1-10B (133 µg/L) with a concentration greater than the ESL.

All MDLs in filtered and unfiltered samples are less than the ESL.

Aquifer Tubes. Manganese was detected in 48 of 93 unfiltered aquifer tube samples (52 percent frequency). Manganese concentrations in unfiltered samples ranged from 0.17 to 743 µg/L. Of the 48 detected results, nine samples were reported with concentrations greater than the ESL of 120 µg/L. Manganese was reported at seven locations with concentrations greater than the ESL.

Manganese was detected in 42 of 89 filtered aquifer tube samples (43 percent frequency). Manganese concentrations in filtered samples ranged from 0.12 to 723 µg/L. Of the 42 detected results, three samples were reported with concentrations greater than the ESL of 120 µg/L. Manganese was reported at locations C6380 (131 µg/L), C6368 (380 µg/L), C6378 (723 µg/L) with concentrations greater than the ESL.

All MDLs in filtered and unfiltered samples are less than the ESL.

Porewater. Manganese was detected in all 16 unfiltered porewater samples (100 percent frequency). Manganese concentrations in unfiltered samples are 0.69 and 1,640 µg/L. Of the 16 detected results, three samples were reported with concentrations greater than the ESL of 120. Manganese was detected at location RCBRA U1 (956 and 1,640 µg/L) and RCBRA 5D AQ (162 µg/L).

Seep/Spring. Manganese was detected in all seven unfiltered seep/spring samples (100 percent frequency). Manganese concentrations in unfiltered samples ranged from 4.6 to 220 µg/L. Of the seven detected results, one sample was reported with a concentration greater than the ESL of 120 µg/L. Manganese was reported at locations 300 Area DR Spring 42-2 (220 µg/L).

Surface Water. Manganese was detected in all 17 unfiltered surface water samples (100 percent frequency) with concentrations ranging 2.0 to 28 µg/L. Manganese concentrations in unfiltered samples are less than the ESL.

Nickel

Groundwater. Nickel was detected in 36 of 143 unfiltered groundwater samples (25 percent frequency). Nickel concentrations in unfiltered samples ranged from 0.72 to 56 µg/L. Of the 36 detected results, four samples were reported with concentrations greater than the ESL of 45 µg/L. Nickel was detected at monitoring well 399-1-16A with four samples greater than the ESL.

Nickel was detected in 32 of 179 filtered groundwater samples (18 percent frequency). Nickel concentrations in filtered samples ranged from 4.0 to 65 µg/L. Of the 32 detected results, six samples

were reported with concentrations greater than the ESL of 45 µg/L. Nickel was detected at monitoring wells 399-1-16A and 399-1-16B with six concentrations greater than the ESL.

All MDLs for filtered and unfiltered samples are less than the ESL.

Aquifer Tubes. Nickel was detected in 14 of 93 unfiltered aquifer tube samples (15 percent frequency) with concentrations ranging from 0.20 to 5.9 µg/L. Nickel was detected in seven of 98 filtered aquifer tube samples (7.1 percent frequency) with concentrations ranging from 0.27 to 4.5 µg/L. All nickel concentrations and MDLs are less than the ESL of 45 µg/L.

Porewater. Nickel was not detected in unfiltered porewater samples (16 samples). All MDLs are less than the ESL of 45 µg/L.

Seep/Spring. Nickel was detected in 12 of 13 unfiltered seep/spring samples (92 percent frequency) with concentrations ranging from 0.38 to 18 µg/L. Nickel was detected in all three filtered seep/spring samples (100 percent frequency) with concentrations ranging from 0.97 to 1.5 µg/L. All nickel concentrations and MDLs are less than the ESL of 45 µg/L.

Surface Water. Nickel was detected in 22 of 35 unfiltered surface water samples (63 percent frequency) with concentrations ranging from 0.20 to 22 µg/L. Nickel was detected in all 13 filtered surface water samples (100 percent frequency) with concentrations ranging from 0.65 to 1.4 µg/L. All nickel concentrations and MDLs are less than the ESL of 45 µg/L.

Nitrate

Groundwater. Nitrate was detected in 261 of 276 unfiltered groundwater samples (95 percent frequency). Nitrate concentrations in unfiltered samples ranged from 39 to 32,300 µg/L. Of the 261 detected results, 224 samples were reported with concentrations greater than the ESL of 7,100 µg/L. Twenty-six results were reported with concentrations greater than the Hanford Site background level of 26,871 µg/L. All MDLs are less than the ESL.

Nitrate was detected in one filtered groundwater samples (100 percent frequency) at a concentration 186 µg/L. The single nitrate concentration is less than the ESL of 26,871 µg/L.

Aquifer Tubes. Nitrate was detected in 154 of 156 unfiltered aquifer tube samples (99 percent frequency). Nitrate concentrations in unfiltered samples ranged from 460 to 974,000 µg/L. Of the 154 detected results, 126 samples were reported with concentrations greater than the ESL of 7,100 µg/L. Twenty-seven results were reported with concentrations greater than the Hanford Site background level of 26,871 µg/L. All MDLs are less than the ESL.

Nitrite

Groundwater. Nitrite was detected in 21 of 275 unfiltered groundwater samples (7.6 percent frequency). Nitrite was not detected in filtered groundwater samples (1 sample). Nitrite concentrations in unfiltered samples ranged from 43 to 985 µg/L. Of the 21 detected results, 14 samples were reported with concentrations greater than the ESL of 246 µg/L. Most MDLs are less than the ESL.

Aquifer Tubes. Nitrite was detected in 5 of 156 unfiltered aquifer tube samples (3.2 percent frequency) with concentration ranging from 65 to 161 µg/L. Nitrate concentration and most MDLs are less than the ESL of 246 µg/L.

Nitrogen in Nitrate

Aquifer Tubes. Nitrogen in nitrate was detected in one unfiltered aquifer tube samples (100 percent frequency). The single nitrogen in nitrate concentration in unfiltered samples was 2,439 µg/L. The single nitrogen in nitrate sample was reported with a concentration greater than the ESL of 1,600 µg/L.

Porewater. Nitrogen in nitrate was detected in 15 of 16 unfiltered porewater samples (94 percent frequency). Nitrogen in nitrate concentrations in unfiltered samples range from 95 to 4,448 µg/L. Of the 14 detected results, four samples were reported with concentrations greater than the ESL of 1,600 µg/L. Nitrogen in nitrate was reported at locations RCBRA U1, RCBRA U8 (2,098), RCBRA U10 (2,180 µg/L) (3,635 µg/L), and RCBRA U4 (4,448 µg/L)

Seep/Spring. Nitrogen in nitrate was detected in all 16 unfiltered seep/spring samples (100 percent frequency). Nitrogen in nitrate concentrations in unfiltered samples range from 1,490 to 25,000 µg/L. Of the 16 detected results, 15 samples were reported with concentrations greater than the ESL of 1,600 µg/L.

Surface Water. Nitrogen in nitrate was detected in all 52 unfiltered surface water samples (100 percent frequency). Nitrogen in nitrate concentrations in unfiltered samples range from 53 to 3,700 µg/L. Of the 52 detected results, four samples were reported with concentrations greater than the ESL of 1,600 µg/L. Nitrogen in nitrate was reported at two locations with concentrations greater than the ESL.

Phosphate

Groundwater. Phosphate was detected in 33 of 103 unfiltered groundwater samples (32 percent frequency). Phosphate was not detected in filtered groundwater samples (1 sample). Phosphate concentrations in unfiltered samples ranged from 534 to 1,400 µg/L. Of the 33 detected results, two samples were reported with concentrations greater than the ESL of 1,000 µg/L. Phosphate was reported at monitoring well 399-2-2 (1,170 and 1,400 µg/L). Most MDLs are less than the ESL.

Aquifer Tubes. Phosphate was detected in 8 of 42 unfiltered aquifer tube samples (19 percent frequency) with concentrations ranging from 50 to 940 µg/L. Phosphate concentrations and most MDLs are less than the ESL of 1,000 µg/L.

Porewater. Phosphate was not detected in porewater samples (16 samples). All MDLs are less than the ESL of 1,000 µg/L.

Seep/Spring. Phosphate was not detected in seep/spring samples (1 sample). All MDLs are less than the ESL of 1,000 µg/L.

Surface Water. Phosphate was not detected in porewater samples (16 samples). All MDLs are less than the ESL of 1,000 µg/L.

Silver

Groundwater. Silver was detected in 3 of 143 unfiltered groundwater samples (2.1 percent frequency). Silver concentrations in unfiltered samples ranged from 15 to 17 µg/L. All three silver samples were reported with concentrations greater than the ESL of 2.6 µg/L. Silver was detected at monitoring wells 399-4-10 (17 µg/L), 399-3-9 (16 µg/L), and 399-3-18 (15 µg/L), and all silver results were flagged with a "C" qualifier, indicating that silver was detected in the sample and the QC blank. MDLs for Method 6010 range from 1.4 to 7.0 µg/L. MDLs for Method 200.8 are 0.2 µg/L. Most MDLs are greater than the ESL.

Silver was detected in 4 of 179 filtered groundwater samples (2.2 percent frequency). Silver concentrations in filtered samples ranged from 5.5 to 15 µg/L. All four silver samples were reported with concentrations greater than the ESL of 2.6 µg/L. Silver was detected at monitoring wells 399-3-18

(15 µg/L), 399-3-9 (6.3 µg/L), 399-4-7 (6.2 µg/L), and 399-1-6 (5.5 µg/L). Silver results were flagged with a "C," "B," and "BC" qualifier, indicate the analyte was detected in the sample and the QC blank, the analyte was detected at a value less than the CRDL, or both; respectively. MDLs for Method 6010 range from 1.7 to 10 µg/L. MDLs for Method 200.8 are 0.2 µg/L. Most MDLs are greater than the ESL.

Aquifer Tubes. Silver was detected in 2 of 86 unfiltered aquifer tube samples (2.3 percent frequency). Silver concentrations in unfiltered samples are 5.5 and 6.6 µg/L. Both silver samples were reported with concentrations greater than the ESL of 2.6 µg/L. Silver was detected at location AT-3-8-S (6.6 and 5.5 µg/L), and flagged with a "B" qualifier indicating the analytes was detected at a value less than the CRDL. MDLs for Method 6010 range from 5.0 to 7.0 µg/L. MDLs for Method 200.8 are 0.1 µg/L. Most MDLs are greater than the ESL.

Silver was detected in 4 of 90 filtered aquifer tube samples (4.4 percent frequency). Silver concentrations in filtered samples range from 5.3 to 8.1 µg/L. All four silver samples were reported with concentrations greater than the ESL of 2.6 µg/L. Silver was detected at location AT-3-4-S (8.1 µg/L), C6342 (7.0 µg/L), AT-3-2-M (6.0 µg/L), and C6351 (5.3 µg/L). All silver results were flagged with a "B" qualifier. MDLs for method 6010 range from 5.0 to 7.0 µg/L. MDLs for Method 200.8 are 0.1 µg/L. Most MDLs are greater than the ESL.

Porewater. Silver was not detected in unfiltered porewater samples (16 samples). All MDLs are less than the ESL of 2.6 µg/L.

Seep/Spring. Silver was detected in 5 of 11 unfiltered seep/spring samples (45 percent frequency) and was not detected in filtered samples (3 samples). Silver concentration in unfiltered samples ranged from 0.0013 to 0.064 µg/L. Silver concentrations in unfiltered samples are less than the ESL of 2.6 µg/L. Most MDLs are less than the ESL.

Surface Water. Silver was detected in 12 of 35 unfiltered surface water samples (34 percent frequency). Silver concentrations in unfiltered samples ranged from 0.0028 to 6.4 µg/L. Of the 12 detected results, one sample reported a concentration greater than the ESL of 2.6 µg/L. The single silver concentration was reported at location 300 Area -6 HRM 43.1 (6.4 µg/L).

Silver was detected in 1 of 13 filtered surface water samples (7.7 percent frequency) at a concentration of 0.0029 µg/L. Silver concentrations in filtered samples are less than the ESL of 2.6 µg/L.

All MDLs for filtered and unfiltered samples are less than the ESL.

Trichloroethene

Groundwater. Trichloroethene was detected in 89 of 323 unfiltered groundwater samples (28 percent frequency). Trichloroethene was not detected in filtered groundwater samples (1 sample). Trichloroethene concentrations in unfiltered samples ranged from 0.23 to 63 µg/L. Of the 89 detected results, three samples were reported with concentrations greater than the ESL of 47 µg/L. Trichloroethene was reported at monitoring well 399-3-18 (51 and 63 µg/L), and flagged with "D" qualifier indicating the analytes was reported by a secondary dilution factor; and monitoring well 399-1-57 (60 µg/L). All MDLs for filtered and unfiltered samples are less than the ESL.

Aquifer Tubes. Trichloroethene was detected in 57 of 149 unfiltered aquifer tube samples (38 percent frequency). Trichloroethene concentrations in unfiltered samples ranged from 0.25 to 830 µg/L. Of the 57 detected results, 12 samples were reported with concentrations greater than the ESL of 47 µg/L. Trichloroethene was reported at two locations with concentrations greater than the ESL.

Trichloroethene was detected in the one of two filtered aquifer tube samples (50 percent frequency) at a concentration of 28 µg/L. Trichloroethene concentration in filtered samples are less than the ESL of 47 µg/L.

All MDLs for filtered and unfiltered samples are less than the ESL.

Seep/Spring. Trichloroethene was detected in five of seven unfiltered seep/spring samples (71 percent frequency) with concentrations ranging from 0.72 to 2.3 µg/L. Trichloroethene concentrations and MDLs are less than the ESL of 47 µg/L.

Surface Water. Trichloroethene was detected in two unfiltered surface water samples (100 percent frequency) at concentrations 0.71 and 0.80 µg/L. Trichloroethene concentrations in unfiltered samples are less than the ESL of 47 µg/L.

Uranium

Groundwater. Uranium was detected in 337 of 379 unfiltered groundwater samples (89 percent frequency). Uranium was not detected in filtered groundwater samples (1 samples). Uranium concentrations in unfiltered samples ranged from 0.076 to 218 µg/L. Of the 337 detected results, 324 samples were reported with concentrations greater than the ESL of 5.0 µg/L. 301 samples were reported with concentrations greater than the Hanford Site background level of 9.9 µg/L. All MDLs are less than the ESL.

Aquifer Tube. Uranium was detected in 250 of 251 unfiltered groundwater samples (100 percent frequency). Uranium concentrations in unfiltered samples range from 0.13 to 394 µg/L. Of the 250 detected results, 225 samples were reported with concentrations greater than the ESL of 5.0 µg/L. 207 samples were reported with concentrations greater than the Hanford Site background level of 9.9 µg/L. All MDLs are less than the ESL.

Uranium was detected in all 21 filtered groundwater samples (100 percent frequency). Uranium concentrations in filtered samples range from 0.55 to 167 µg/L. Of the 21 detected results, 14 samples were reported with concentrations greater than the ESL of 5.0 µg/L and the Hanford Site background level of 9.9 µg/L.

Porewater. Uranium was detected in 3 of 16 unfiltered porewater samples (19 percent frequency). Uranium concentration in unfiltered samples range from 23 to 137 µg/L. Of the three detected results, three samples were reported with concentrations greater than the ESL of 5.0 µg/L and the Hanford Site background level of 9.9 µg/L. Uranium was reported at location RCBRA U5 (23 µg/L), RCBRA U1 (26 µg/L), and RCBRA U4 (137 µg/L).

Seep/Spring. Uranium was detected in two unfiltered seep/spring samples (100 percent frequency). Uranium concentrations in unfiltered samples are 120 and 175 µg/L. Two samples were reported with concentrations greater than the ESL of 5.0 µg/L and the Hanford Site background level of 9.9 µg/L. Uranium was reported at location 300 SPR 7-1 (229 µg/L)and 300 SPR 9-1 120 (µg/L).

Surface Water. Uranium was not detected in unfiltered surface water samples (14 samples). All MDLs are greater than the ESL of 5.0 µg/L.

Zinc

Groundwater. Zinc was detected in 34 of 143 unfiltered groundwater samples (24 percent frequency) with concentrations ranging from 2.7 to 30 µg/L. Zinc concentrations in unfiltered samples are less than the ESL of 90 µg/L.

Zinc was detected in 38 of 179 filtered groundwater samples (21 percent frequency). Zinc concentrations in filtered samples ranged from 4.0 to 104 µg/L. Of the 38 detected results, one sample was reported with a concentration greater than the ESL of 90 µg/L. Zinc was detected at location 399-2-1 (104 µg/L).

All MDLs for filtered and unfiltered samples are less than the ESL.

Aquifer Tubes. Zinc was detected in 24 of 93 unfiltered aquifer tube samples (26 percent frequency). Zinc concentrations in unfiltered samples ranged from 1.1 to 490 µg/L. Of the 24 detected results, seven samples were reported with concentrations greater than the ESL of 90 µg/L. Six of the seven unfiltered samples were flagged with a "C" or "CN" qualifier indicating the analyte was reported in the laboratory QC blank.

Zinc was detected in 19 of 98 filtered aquifer tube samples (19 percent frequency). Zinc concentrations in filtered samples ranged from 1.0 to 594 µg/L. Of the 19 detected results, 8 samples were reported with concentrations greater than the ESL of 90 µg/L. Six of the eight samples were flagged with either a "C" or "CN" qualifier.

All MDLs for filtered and unfiltered samples are less than the ESL.

Porewater. Zinc was detected in 15 of 16 unfiltered porewater samples (94 percent frequency) with concentrations ranging from 1.2 to 13 µg/L. Zinc concentrations in unfiltered sample are less than the ESL of 90 µg/L.

Seep/Spring. Zinc was detected in all 13 unfiltered seep/spring samples (100 percent frequency). Zinc concentrations in unfiltered samples ranged from 1.4 to 106 µg/L. Of the 13 detected results, two samples were reported with concentrations greater than the ESL of 90 µg/L. Zinc was detected at locations 300 Area DR Spring 42-2 (106 µg/L) and 300 Area Spring 42-2 (100 µg/L).

Zinc was detected in all three filtered seep/spring samples (100 percent frequency) with concentrations ranging from 1.1 to 1.9 µg/L. Zinc concentrations in filtered samples are less than the ESL of 90 µg/L.

Surface Water. Zinc was detected in 36 of 37 unfiltered surface water samples (97 percent frequency) with concentrations ranging from 0.56 to 57 µg/L. Zinc was detected in all 13 filtered surface water samples (100 percent frequency) with concentrations ranging from 0.69 to 2.0 µg/L. All zinc concentrations and MDLs are less than the ESL of 90 µg/L.

M3.4 Identification of Contaminants of Interest—Riparian Soil

Contaminants of interest were identified using the same process that was used for water.

M3.4.1 Apply Exclusion Criteria

The analytes in riparian soil that do not have plant/invert screening level are summarized in Table M-26 and analytes that do not have a wildlife screening level are summarized in Table M-27. Sampling dates, minimum and maximum detected concentrations, and minimum and maximum MDLs are also provided in Tables M-26 and M-27.

M3.4.2 Identify Nondetected Analytes

Analytes that were not detected in riparian soil samples and have a plant/invertebrate SSL are summarized in Table M-28. Analytes that were not detected in riparian soil samples but have a wildlife SSL are summarized in Table M-29. Sampling dates, minimum and maximum detected concentrations, and minimum and maximum MDLs are also provided in Tables M-28 and M-29.

M3.4.3 Identify Analytes with Maximum Detected Concentrations Less Than ESLs

A summary of the riparian soil analytes that do not exceed the lowest Plant/Invertebrate ESLs is provided in Table M-30. A summary of the riparian soil analytes that do not exceed the lowest wildlife ESLs is provided in Table M-31. Sampling dates, minimum and maximum detected concentrations, and minimum and maximum MDLs are also provided in Tables M-30 and M-31.

M3.4.4 Identify Analytes with Maximum Detected Concentrations Greater Than ESLs

This step identifies analytes with maximum concentrations greater than their plant/invertebrate or wildlife ESLs. No analytes were reported with concentrations exceeding the lowest plant/invertebrate ESL.

A summary of the riparian soil analytes that exceed the lowest wildlife ESLs is provided in Table M-32. As shown in Table M-32, aluminum and vanadium are greater than the wildlife ESLs.

Aluminum was measured in 11 riparian soil samples (2 MIS locations) with concentrations raging between 670 and 1,150 mg/kg. Aluminum concentrations measured in riparian soil are less than the Hanford Site 90th percentile background value of 11,800 mg/kg. In addition, aluminum is generally more bioavailable and toxic at low pHs (*Guidance for Developing Ecological Soil Screening Levels (Eco-SSLs)* [OSWER Directive 9285.7-55]). The Eco-SSLs for aluminum (*Ecological Soil Screening Level for Aluminum: Interim Final* [OSWER Directive 9285.7-60]), identified potential toxicity in soils when the pH is 5.5 or less. All measurements of soil pH in the River Corridor are greater than the 5.5 threshold. Therefore, concentrations of aluminum are not likely bioavailable for uptake.

Vanadium was measured in 11 riparian soil samples (2 MIS locations) with concentrations ranging between 49 and 73 mg/kg. Vanadium concentrations measured in riparian soil are less than the Hanford Site 90th percentile background value of 85 mg/kg. A discussion of the ecological risk considerations associated with this result is presented in Chapter M4.

M3.5 Identification of Contaminants of Interest—Nearshore Sediment

Contaminants of interest were identified using the same process that was used for water.

M3.5.1 Apply Exclusion Criteria

The analytes in sediment that do not have ESLs are summarized in Table M-33. Sampling dates, minimum and maximum detected concentrations, and minimum and maximum MDLs are also provided in Table M-33.

M3.5.2 Identify Nondetected Analytes

Analytes that were not detected in sediment samples are summarized in Table M-34. Sampling dates and minimum and maximum MDLs are also provided in Table M-34.

M3.5.3 Identify Analytes with Maximum Detected Concentrations Less Than ESLs

A summary of the sediment analytes that do not exceed the sediment screening levels is provided in Table M-35. Sampling dates, minimum and maximum detected concentrations, and minimum and maximum MDLs, are also provided in Table M-35.

M3.5.4 Identify Analytes with Maximum Detected Concentrations Greater Than ESLs

This step identifies analytes with maximum concentrations greater than sediment screening levels. A summary of the sediment analytes that exceed the sediment screening levels is provided in Table M-36. Table M-36 shows that concentrations of the following nine analytes are greater than their lower

threshold sediment screening level: antimony, aroclor-1260, arsenic, beta- (BHC), cadmium, iron, manganese, phosphorus, and TPH.

In at least one sediment sample, there were concentrations of one chlorinated pesticide (beta-BHC), TPH, and metals (antimony, cadmium, iron, manganese, and phosphorus) detected at concentrations higher than a lower threshold ecological screening level. The presence of beta-BHC are not a contaminant associated with Hanford Site operations, and is not likely to be associated with overland flow from upland waste site areas; in addition, chlorinated pesticides generally are not mobile in soil.

The analytes listed above that exceed the lower threshold sediment screening value are subsequently compared to the upper threshold sediment screening values; the results of this comparison are shown in Table M-37. Table M-37 shows that antimony and TPH exceed the upper threshold sediment screening values.

Antimony was detected in 2 of 17 samples with concentrations of 2.2 and 10 mg/kg. Both detections were reported with antimony concentrations greater than the upper threshold sediment screening level of 0.6 mg/kg. Antimony was reported at location 300 Area Spring 42-2.

TPH was detected in 1 of 15 samples at a concentration of 287 mg/kg. TPH was reported with a concentration greater than the upper threshold sediment screening level of 30 mg/kg at location RCBRA 5DAQ.

A discussion of the ecological risk considerations associated with this result is presented in Chapter M4.

M3.6 Data Evaluation Summary

A range of inorganic contaminants and one pesticide were detected in near-river groundwater samples collected from the 300-FF-5 OU. In many cases, these contaminants also could be detected in aquifer tube, porewater, spring/seep, and surface water samples. In most cases, the analytical results that were most relevant to assessing aquatic water quality (i.e., from filtered analyses) were at concentrations below aquatic criteria. In other cases where concentrations higher than aquatic criteria were observed, these results were associated with analytical data quality issues such as presence of contamination in blank samples, or elevated detection limits relative to the criteria.

The analytical results addressed in this evaluation did not provide evidence that contaminants from Hanford Site soils or groundwater or associated with Hanford Site operations evaluated in this appendix have potentially been discharged to riparian or nearshore media, or to the Columbia River. A more detailed discussion of potential ecological risks in the context of abiotic and biotic media evaluations and potential contributions to these risks from the Hanford Site is presented in Chapter M4.

M4 Summary of Ecological Risks

Ecological risks in riparian and nearshore areas were assessed as part of the RCBRA (RCBRA Report [DOE/RL-2007-21]). Survey of Contaminants in the 300 Area Near-Shore (PNNL-13692) also presented the results and evaluation of radiological and chemical concentrations measured in the nearshore environment adjacent to the 300 Area. This risk evaluation in this appendix incorporates the results from the assessment of ecological risks in the riparian and nearshore areas based on the data evaluation and calculations performed in the RCBRA. The risk evaluation discusses Survey of Contaminants in the 300 Area Near-Shore (PNNL-13692), as appropriate.

The RCBRA evaluated risks to an array of assessment endpoints using multiple measures of exposure, effect, and ecosystem/receptor characteristics at representative nearshore study sites. The study sites were

selected to represent locations that may be adjacent to or directly affected by known contaminated media (groundwater seeps and springs, soil, sediment).

M4.1 Risks to Terrestrial Plants

As shown in Table 5-61 of the RCBRA Report (DOE/RL-2007-21), Central Tendency Estimates (CTEs), some COPECs in riparian soil collected across the Hanford Reach (i.e., estimate of central tendency across both the 100 and 300 Areas) exceed literature-based plant soil screening level (SSL) concentrations developed for the RCBRA (RCBRA Report [DOE/RL-2007-21]), indicating that potential for effects in plants warranted further evaluation. CTEs for arsenic, chromium, lead, vanadium, and zinc were greater than SSLs, across the Hanford Site; in the 300 Area riparian study areas (5c and Rip 6), concentrations of arsenic, vanadium, and zinc were higher than the benchmark value for protection of terrestrial plants (RCBRA [DOE/RL-2007-21], Tables 5-61). SSLs are literature-based values compiled from state and federal criteria and were initially presented in both the RCBRA Report (DOE/RL-2007-21) and *Tier 1 Risk-Based Soil Concentrations Protective of Ecological Receptors at the Hanford Site* (CHPRC-00784). For risk driving inorganics, bioassays were collected using a representative native plant species (Sandberg's bluegrass [*poa secunda*]) to develop site-specific toxicity thresholds. These refined values were presented in the RCBRA Report (DOE/RL-2007-21) and used to establish plant PRGs. Additional bioassays, conducted in 2011, on the same species with a broader concentration gradient of inorganic constituents to further refine toxicity thresholds and establish PRGs as described in *Tier 2 Terrestrial Plant and Invertebrate Preliminary Remediation Goals (PRGs) for Nonradionuclides for Use at the Hanford Site* (ECF-HANFORD-11-0158). The organic SSLs and inorganic PRGs were identified as the ecological screening levels (ESLs) presented in this RI/FS as summarized in Table M-3.

Measurements of all chemicals within the riparian soils of the 300 Area riparian study sites were below plant ESLs (Table M-30). Also, other lines of evidence obtained through seven different measures in bioassay testing indicate that COPECs may not adversely affect riparian plants, including those at the rare plant sites that performed better than bioassays from reference soils. Bioassays showed no significant differences in plant seed germination, root length, stem height, root biomass, or shoot biomass between riparian study sites and reference sites. Some COPECs were detected in plant tissues, but the concentrations of the COPECs were statistically different between riparian study area site concentrations and reference site concentrations for only four COPECs: barium, copper, thallium, and zinc (Table 5-32, RCBRA Report [DOE/RL-2007-21]). Similar to the upland plant data, COPEC concentrations found in riparian plant tissues did not correlate to those in riparian soil. Therefore, although soil concentrations are greater than plant SSLs for some COPECs, the weight attributed to this line of evidence is low and SSL comparisons to ESLs do not overwhelm the conclusions of the other lines of evidence, which do not indicate risks to plants in riparian soils. While several analytes were detected in RCBRA plant tissue, and statistical differences between riparian study area sites and reference site concentrations were noted, there were no statistically significant relationships of COPEC concentrations in plant tissue and soil. Therefore, no COPECs in 300 Area riparian soils warrant further evaluation in the FS, based on risks to terrestrial plants.

M4.2 Risks to Aquatic Plants

Potential effects on aquatic plants were evaluated through comparison of sediment and porewater concentrations to SSLs (RCBRA Report [DOE/RL-2007-21], Tables 6-88 through 6-91) and CRC ecological risk assessment (DOE/RL-2010-117) and results of a bioassay in sediment (RCBRA Report [DOE/RL-2007-21]). The combined porewater and sediment RCBRA COECs were identified as cadmium, total chromium, Cr(VI), manganese, and uranium warranting further evaluation for potential effects on aquatic plants, as noted in Section 8.5.1.1 (RCBRA Report [DOE/RL-2007-21]). The final

COECs for porewater and sediment in CRC (DOE/RL-2010-117) within the 300 Area were identified as aluminum, Cr(VI), lead, nitrate, selenium, and uranium, as noted in the executive summary of the CRC (DOE/RL-2010-117).

Laboratory bioassays (i.e., toxicity tests) were conducted with field-collected sediments. Some significant relationships were determined with observed response within aquatic plant toxicity tests in association with confounding factors and some COPECs. Additionally, there were clear measures of exposure (i.e., accumulation into plants), primarily for inorganic COPECs that were detected in porewater and sediment. However, of the significant relationships determined, none was with COPECs for which porewater concentrations were greater than aquatic plant benchmarks. Further, no risks to aquatic plants were noted based on toxicity testing. Though the analysis represents only one season of sampling and analysis, the weight of the available data does not suggest risk to aquatic plants.

For the 300 Area nearshore sampling sites, two COPECs were detected in nearshore sediment at concentrations greater than the upper threshold sediment biota ESL: antimony and TPH – diesel range (Table M-37). Since the RCBRA Report (DOE/RL-2007-21) did not identify these analytes as COECs for aquatic plants, additional evaluation for risks to aquatic plants is not warranted for these COPECs within the 300 Area.

From the 300 Area nearshore sampling sites, the porewater concentrations of aluminum, calculated total uranium, uranium, iron, lead, manganese, and nitrate were greater than the chronic ambient water quality criteria (Table M-22). No other chemicals in porewater samples from the 300 Area groundwater OU exceeded water ESLs. Moreover, only aluminum and Cr(VI) porewater concentrations exceeded the screening level values presented in the RCBRA Report (DOE/RL-2007-21, Table 6-92) specifically for plants and only Cr(VI) was retained as a COEC (RCBRA Report [DOE/RL-2007-21], Section 8.5.1.1). The 300 Area nearshore water data are discussed further in Section 3.3.4 of this Appendix. The RCBRA (DOE/RL-2007-21) and CRC (DOE/RL-2010-117) porewater COECs, as well as 300 Area nearshore porewater COPECs are discussed in more detail, below, with respect to potential contributions from the 100-K riparian area to risks to aquatic plants in the Columbia River.

Aluminum—Concentrations of aluminum were elevated in porewater samples presented in the CRC (DOE/RL-2010-117), for the 300-FF-5 OU and upstream at 100-HR-3 and 100-BC-5. Concentrations within the 300 Area exceeded the ESL in unfiltered porewater (4 of 16 samples), seeps (5 of 7 samples), surface water (3 of 17 samples), and filtered groundwater samples (1 of 19 samples) (Table M-25). The single filtered aquifer tube sample did not exceed the ESL. Filtered porewater was not analyzed for aluminum. Thus, evidence is not sufficient to suggest aluminum within the 300 groundwater OU wells within the vicinity of 300 Area are contributing to concentrations of aluminum observed in porewater at locations within the reach of the Columbia River adjacent to the 300 nearshore area.

Cadmium—Cadmium was elevated in porewater samples presented in the RCBRA (DOE/RL-2007-21). However, concentrations within all the 300 riparian and nearshore aqueous media (porewater, seep, surface water, and near-river well samples) were below the ESL. Only one of 98 filtered aquifer tube samples exceeded the ESL, which does not indicate a source. Thus, cadmium within the 300 Area is not contributing to concentrations of cadmium observed in porewater at locations within the reach of the Columbia River adjacent to the 300 nearshore area.

Total Chromium—Porewater and surface water were not filtered in the RCBRA samples but were below the ESL (DOE/RL-2007-21). Total chromium was not detected above the ESL in porewater, seep, aquifer tube, and near-river groundwater samples (Tables M-15 through M-19). Thus, total chromium within the 300 Area is not contributing to concentrations of total chromium observed in porewater at locations within the reach of the Columbia River.

Cr(VI)—Concentrations of Cr(VI) were elevated in porewater samples presented in the RCBRA (DOE/RL-2007-21). Within the 300 Area, nearshore samples were less than the ESL in all aquatic media (porewater, groundwater, seeps, aquifer tubes and surface water). Thus, the 300 Area is not contributing to concentrations of Cr(VI) within the reach of the Columbia River.

Iron—Concentrations of iron were elevated in porewater samples presented in the RCBRA Report (DOE/RL-2007-21). Manganese was detected above the ESL in just 3 of 143 unfiltered and 3 of 179 filtered groundwater samples in the 300 Area nearshore environment. Likewise, iron was detected above the ESL infrequently in aquifer tube samples (11 of 86 unfiltered and 1 of 90 filtered). Thus, there does not appear to be a consistent source of iron to the Columbia River porewater and it was not carried forward to the FS.

Lead—Concentrations of lead were elevated in porewater samples presented in the CRC (DOE/RL-2010-117), for the 300-FF-5 and upstream (100-HR-3, 100-BC-5, and 200-PO-1) OUs. All filtered concentrations within the 300 Area groundwater, aquifer tube, seep, and surface water samples were below the ESL. One unfiltered porewater sample was greater than the ESL in 16 samples, which does not suggest 300 Area to be the source. Thus, the 300 Area is not contributing to concentrations of lead observed in porewater at locations within the reach of the Columbia River adjacent to the 300 Area.

Manganese—Concentrations of manganese were elevated in porewater samples presented in the RCBRA Report (DOE/RL-2007-21). Manganese was detected above the ESL in just 3 of 143 unfiltered and 1 of 179 filtered groundwater samples in the 300 Area nearshore environment. Likewise, manganese was detected above the ESL infrequently in aquifer tube samples 9 of 93 unfiltered and 3 of 98 filtered). Thus, there does not appear to be a consistent source of manganese to the Columbia River porewater and it was not carried forward to the FS.

Nitrate—Concentrations of nitrate were elevated in porewater samples presented in the CRC (DOE/RL-2010-117), for the 300-FF-5. Within the 300 Area, 224 of 276 samples exceeded the NOEC of 7.1 mg/L but none of the samples exceeded the LOEC of 37.4 mg/L presented in the CRC (DOE/RL-2010-17). For aquifer tube samples, 124 of 154 samples exceed the NOEC and 13 samples exceed the LOEC. Exceedances of the LOEC were all from just 4 of the 36 aquifer tubes locations sampled between 2006 and 2011; C4349 (1 time); C4363 (6 times); C4366 (1 times), and C4367 (5 times). Though concentrations at C4349 have decreased since 2006, this is not the case at C4363 and C4367. Thus, there is a potential source of nitrate from the 300 area to the Columbia River that warrants further evaluation in the FS.

Selenium—While concentrations of selenium were elevated in porewater samples presented in the CRC (DOE/RL-2010-117) for the 300-FF-5 OU, concentrations within all the 300 Area riparian and nearshore aqueous media were below the ESL. Thus, selenium within the 300 Area is not contributing to concentrations of selenium observed in porewater at locations within the reach of the Columbia River adjacent to the 300-FF-5 OU.

Uranium—Concentrations of calculated total uranium and inorganic uranium exceeded the ESL at study site U4 for the 300-FF-5 OU in the CRC (DOE/RL-2010-117). Concentrations within the 300 Area exceeded the ESL in unfiltered porewater (3 of 16 samples), seeps (2 of 2 samples), and filtered aquifer tube samples (14 of 21 samples) (Table M-25). The single filtered groundwater sample did not exceed the ESL, but 324 of 379 unfiltered groundwater samples exceeded the ESL. As shown in Table 6-43 of the RCBRA Report (DOE/RL-2007-21), statistical tests showed that the concentrations of uranium are not greater than reference porewater concentrations. However, as discussed previously, uranium concentrations in groundwater, seeps, aquifer tubes, and porewater exceed background. Likewise, Survey of Contaminants in the 300 Area Near-Shore (PNNL-13692) noted uranium in groundwater, springs, and

river water as the only contaminant with concentrations of interest. Other constituents in the PNNL study (arsenic, barium, Cs-137, chromium, I-129, selenium, Tc-99, thallium, tritium, and zinc) had concentrations above background samples from the Vernita Bridge) but were below ambient water quality criteria or BCGs. Total uranium and inorganic uranium in groundwater in the 300 Area, which represents a potential source for porewater concentrations that exceed water quality criteria, warrant further evaluation in the FS.

M4.3 Risks to Terrestrial Invertebrates

No COPECs showed exceedances of Hanford Site-specific terrestrial invertebrate ESLs (Table M-30); thus, the 300 Area is not a source contributing to risks to terrestrial invertebrates.

Concentrations of chromium, mercury, and zinc in riparian soil exceeded benchmarks developed for the RCBRA (RCBRA Report [DOE/RL-2007-21]) that are protective of terrestrial invertebrates; in the 300 Area riparian study area (Rip 6), concentrations of mercury and zinc were higher than the benchmark value for protection of terrestrial invertebrates (RCBRA Report [DOE/RL-2007-21], Tables 5-69 and 5-70). However, none of the concentrations exceeded Hanford Site-specific PRGs (Table M-30).

Terrestrial invertebrate tissue concentrations, which provide an indication of contaminant uptake and bioavailability, were measured at River Corridor study sites and reference locations and some, but not all, COPECs were detected in terrestrial invertebrates. Statistical differences were found between RCBRA (RCBRA Report [DOE/RL-2007-21]) terrestrial invertebrate tissue concentrations for some COPECs between study site and reference site soils. However, this line of evidence was ranked low in the RCBRA (RCBRA Report [DOE/RL-2007-21]) because of detection of COPECs in terrestrial invertebrates did not always correlate with concentrations in soil. Statistical differences in tissue concentrations of mercury and zinc in terrestrial invertebrates were noted between River Corridor and reference study sites; this relationship is based on data across the entire River Corridor, and should not be inferred as a relationship that is specific for the 300 Area. However, there is insufficient evidence for COPECs in general of a correlation between tissue concentrations in terrestrial invertebrates and concentrations in soil (RCBRA Report [DOE/RL-2007-21]). Based on this analysis, no COPECs in riparian soil warrant further evaluation in the FS based on risks to terrestrial invertebrates.

M4.4 Risks to Aquatic Invertebrates

The primary lines of evidence used to evaluate risks to aquatic invertebrates are field surveys, the results of bioassays, and comparison of sediment and water concentrations to benchmarks, such as ESLs.

M4.4.1 Abiotic Media Concentrations Compared to Literature Values

The final COECs for porewater within the 300 Area were identified as aluminum, lead, nitrate, selenium, and uranium, as noted in the executive summary of the CRC (DOE/RL-2010-117). Porewater concentrations at study sites were greater than chronic water standards or criteria for three COECs (Cr(VI), manganese and uranium) in the RCBRA (DOE/RL-2007-21, Table 6-90). However, there are significant uncertainties relative to any of the conclusions based on porewater sampling because abiotic measurements represent a single point measurement within a dynamic river system with daily and seasonal fluctuations and flow volumes that can shift the composition of the substrates that were sampled. Thus, exceedances should not be ignored as they can be indicative of exposure an levels presenting a risk. But because of the uncertainty in the representativeness of the measurements due to the dynamic environment, the exceedances should be considered along with other data that identifies whether there is in fact an ongoing source of the measurements. The interpretation of porewater results as an indication of adverse effects to aquatic invertebrates is the same as that for aquatic plants, given that ESLs are

protective of both plants and aquatic invertebrates. For the 300 Area nearshore sampling sites (U1 through U10), the porewater concentration of calculated total uranium and inorganic uranium exceeded the aquatic invertebrate-based water benchmark at study site U4 (RCBRA Report [DOE/RL-2007-21], Table 6-91). Uranium in aquifer tube samples (14 of 21) and unfiltered groundwater (301 of 379) exceeded background and ESLs (Tables M-20 and M-21). Total uranium and inorganic uranium in groundwater in the 300 Area, which represents a potential source for porewater concentrations that exceed water quality criteria, warrants further evaluation in the FS.

The RCBRA identified three COECs (Cr(VI), manganese, and uranium) in sediment for the River Corridor as a whole (RCBRA [DOE/RL-2007-21], Section 8.5.1.2). Cr(VI) in sediment was also identified as a COEC in the 300 area in the CRC (DOE/RL-2010-117). For the 300 Area nearshore sediment sampling sites, concentrations were greater than the lower threshold ESLs for 9 COECs (antimony, Aroclor-1260. arsenic, beta-BHC, cadmium, iron, manganese, phosphorous, and TPH). Survey of Contaminants in the 300 Area Near-Shore (PNNL-13692) noted Sr-90, Cs-137, and uranium above background but, as shown in Table M-31, concentrations from the RCBRA data set were below SSLs. Metals concentrations in Survey of Contaminants in the 300 Area Near-Shore (PNNL-13692) were reported as similar to or lower than sediment from the Vernita Bridge. Given the uncertainty with representativeness already mentioned, a more detailed discussion of each of these 12 COECs/COPECs from the RCBRA (DOE/RL-2007-21), CRC (DOE/RL-2010-117), and 300 Area nearshore sediment (Appendix M) is presented below.

Antimony—Antimony was detected in 2 of 17 samples within the 300 Area nearshore sediments. Both detected concentrations exceed the upper threshold ESL. The two detected concentrations of antimony were reported at the 300 Area DR Springs 42-2 sample site, and the RCBRA reports that there were no detections of antimony in the RCBRA nearshore study sites in the 300 Area. None of the detected concentrations of antimony in filtered samples from the 300 Area seeps/porewater analysis was above background concentrations for groundwater at the Hanford Site. Table 5-29 of the RCBRA Report (DOE/RL-2007-21) indicates that antimony concentrations across the Hanford Site riparian soils were not statistically different from riparian reference soil concentrations. Therefore, the 300 Area is not the source of antimony because no environmentally relevant concentrations of antimony are in RCBRA nearshore sediments, no detections of antimony are in 300 Area riparian soils, and riparian study site concentrations are not greater than reference sediment concentrations for antimony. There is no complete or significant pathway for observed antimony concentrations in sediment from the 300 Area riparian study area.

Aroclor-1260—Aroclor-1260 was detected in 1 of 15 samples within the 300 Area nearshore sediments. The detected concentration exceeded the lower threshold ESL but was below the upper threshold. Tables 5-29 and 6-40 of the RCBRA Report (DOE/RL-2007-21) indicate that Aroclor-1260 concentrations across the Hanford Site riparian soils and near-shore sediment are not greater than reference concentrations. Aroclor-1260 was not identified as a COEC in the RCBRA Report (DOE/RL-2007-21) or CRC (DOE/RL-2010-117). Because no environmentally relevant concentrations of Aroclor-1260 are in RCBRA nearshore sediments, no detections of Aroclor-1260 are in 300 Area riparian soils, and riparian study site concentrations are not greater than reference sediment concentrations for Aroclor-1260. There is no complete or significant pathway for observed Aroclor-1260 concentrations in sediment from the 300 Area riparian study area.

Arsenic—Arsenic was detected in 15 of 15 samples within the 300 Area nearshore sediments. One detected concentration exceeded the lower threshold ESL but was below the upper threshold. Table 5-29 of the RCBRA Report (DOE/RL-2007-21) indicates that arsenic concentrations across the Hanford Site riparian soils are greater than riparian reference soil concentrations in one of three tests and greater than background, based primarily on concentrations measured at riparian site 1. Arsenic was detected less than

the ESLs for all aquatic media (groundwater, seeps, porewater, and surface water) at 300 Area study site locations. Table 6-40 of the RCBRA Report (DOE/RL-2007-21) indicates sediment concentrations across the Hanford site are less than reference site concentrations.

Beta-BHC—Beta-BHC was detected in 2 of 15 samples within the 300 Area nearshore sediments. One of the detected concentrations exceeded the lower threshold ESL, but it was below the upper threshold. Table 5-29 of the RCBRA Report (DOE/RL-2007-21) indicates that beta-BHC concentrations across the Hanford Site riparian soils are not greater than riparian reference soil concentrations. The only detected concentration of beta-BHC in riparian soils in the 300 Area was a detection of 1 µg/kg at study site Rip 5c. This concentration was lower than the beta-BHC concentration detected at the adjacent nearshore sediment site (5c Aq) of 2 µg/kg and the other detected concentration of beta-BHC in the 300 Area nearshore study sites (5g Aq) of 8 µg/kg. Beta-BHC was not detected in any groundwater, seep/porewater, or surface water samples at 300 Area study site locations. Table 6-40 of the RCBRA (DOE/RL-2007-21) indicates that detected nearshore sediment study site concentrations are not greater than reference sediment concentrations. Therefore, the 300 Area is not the source of beta-BHC because riparian soil concentrations are less than nearshore sediment concentrations and concentrations for both riparian soils and nearshore sediments are not greater than site reference sediment concentrations. There is no complete or significant pathway for observed beta-BHC concentrations in sediment from the 300 Area riparian area.

Cadmium—Cadmium was detected in 17 of 18 samples within the 300 Area nearshore sediments. Five of these detected concentrations exceeded the lower threshold ESL, but none exceeded the upper threshold. Table 5-29 of the RCBRA Report (DOE/RL-2007-21) indicates that cadmium concentrations across the Hanford Site riparian soils are greater than riparian reference soil concentrations. For the 300 Area riparian soil samples collected at riparian study sites Rip 6 and 5c, detected concentrations of cadmium (0.78 to 1.3 mg/kg) were lower than the maximum sediment reference concentration (2.2 mg/kg) presented in Table 6-40 of the RCBRA Report (DOE/RL-2007-21). These concentrations were also lower than the maximum detected concentration at the 300 Area study sites (2.4 mg/kg at 300 Area nearshore study site U10). As previously described in Chapter M3, exceedances of ambient water quality criteria in groundwater and aquifer tubes were anomalous (1 of 143 unfiltered groundwater samples and 1 of 98 filtered aquifer tube samples) and cadmium was not detected in porewater samples. These media do not represent a significant contribution to observed sediment concentrations in the Columbia River. Table 6-40 of the RCBRA Report (DOE/RL-2007-21) indicates that detected nearshore sediment study site concentrations are not greater than reference sediment concentrations. Therefore, the 300 Area is not the source of cadmium as riparian soil concentrations are not greater than 300 Area nearshore sediment concentrations and site reference sediment concentrations and there is no clear link to riparian area soils or groundwater. There is no complete or significant pathway for observed cadmium concentrations in sediment from the 300 Area riparian area.

Total chromium—Total chromium was identified as a COEC in the RCBRA (DOE/RL-2007-21). Chromium was detected in all 20 sediment samples in the 300 Area nearshore environment, with all detections below the lower threshold ESL of 72 mg/kg. Chromium was detected in all 11 100-BC riparian soil samples. The maximum detect from the 300 Area was 22.6 mg/kg. As presented above in the detailed analysis of porewater, total chromium in groundwater is detected below the ESL and background suggesting no potential source partitioning to sediments. There is no complete or significant pathway for observed total chromium concentrations in sediment from the 300 riparian area.

Cr(VI)—Cr(VI) was detected in 31 of 117 sediment samples in the 100 Areas reach of the Columbia River as part of the CRC ecological risk assessment (DOE/RL-2010-117) with a maximum of 7.38 mg/kg. It was also detected in nearshore sediment samples collected for the RCBRA at 0.92 mg/kg

at 100-D (1 of 10 detects). With no substantial toxicological data available with which to evaluate the bulk sediment measurements, this contaminant was identified as a COPEC in both reports. However, Cr(VI) was not detected in 300 Area sediments (Table M-34), nor was Cr(VI) detected above ESLs in any of the aqueous media measurements (Tables M-10 through M-19). Therefore, there is no complete or significant pathway for observed Cr(VI) concentrations in sediment from the 300 riparian area and it does not warrant further discussion in the FS.

Iron—Iron was detected in 18 of 18 samples within the 300 Area nearshore sediments. Five of these detected concentrations exceeded the lower threshold ESL, but no upper threshold was available. Table 5-29 of the RCBRA Report (DOE/RL-2007-21) indicates that iron concentrations across the Hanford Site riparian soils are not greater than riparian reference soil concentrations. For the 300 Area riparian soil samples collected at riparian study sites Rip 6 and 5c, detected concentrations of iron (22,400 to 26,600 mg/kg) were lower than the maximum detected concentration at the 300 Area nearshore study sites (29,400 mg/kg at 300 Area nearshore study site U2). Table 6-40 of the RCBRA Report (DOE/RL-2007-21) indicates that the detected nearshore sediment study site concentrations are not greater than reference sediment concentrations. Iron was detected in eight of eight porewater samples and three of three seep samples collected from the 300 Area nearshore study sites, as well as groundwater and aquifer tube samples (Tables M-20 through M-24). Two of the detected concentrations of iron in the porewater samples and seep samples exceeded surface water criteria and groundwater background levels. However, all the iron analyses were conducted on unfiltered samples. Filtered groundwater and aquifer tube samples showed only anomalous exceedances of the final surface water cleanup numbers for iron (3 of 179 samples for groundwater and 1 of 90 aquifer tube samples). The 300 Area is not the source of iron because riparian soil concentrations are not greater than 300 Area nearshore sediment concentrations and site reference sediment concentrations and there is no clear link to riparian area soils or groundwater. There is no complete or significant pathway for observed iron concentrations in sediment from the 300 Area riparian area.

Manganese—Manganese was detected in 18 of 18 samples within the 300 Area nearshore sediments. Four of these detected concentrations exceeded the lower threshold ESL, but were below the upper threshold. Table 5-29 of the RCBRA Report (DOE/RL-2007-21) indicates that manganese concentrations across the Hanford Site riparian soils are not greater than riparian reference soil concentrations. For the 300 Area riparian soil samples collected at riparian study sites Rip 6 and 5c, detected concentrations of manganese (207 to 418 mg/kg) were lower than the maximum sediment reference concentration (577 mg/kg) presented in Table 6-40 of the RCBRA Report (DOE/RL-2007-21). These concentrations were also lower than the maximum detected concentration at the 300 Area study sites (746 mg/kg at 300 Area nearshore study site U2), suggesting the riparian soils are less likely to be the source. Table 6-40 of the RCBRA Report (DOE/RL-2007-21) indicates that the detected study site concentrations are not greater than reference sediment concentrations. Manganese was detected in 9 of 9 porewater samples, 7 of 7 seep samples, 58 of 179 groundwater samples, and in 42 of 98 aquifer tube samples collected from the 300 Area nearshore study sites. Many of these samples were greater than the groundwater background concentrations of manganese. However, as shown in the RCBRA Report (DOE/RL-2007-21), Table 6-43, manganese concentrations in porewater were not determined to be greater than reference. The seep maximum detect in the 300 Area riparian/nearshore environment was 220 µg/L compared to the maximum porewater reference of 1,210 µg/L. The maximum porewater concentration of 1,640 µg/L in the 300 Area did exceed the maximum reference concentration, however all samples were unfiltered and the results of this analysis may be biased high by the presence of suspended solids in these samples. Since riparian soil concentrations are not greater than 300 Area nearshore sediment concentrations and site reference sediment concentrations for manganese, and the seeps and porewater samples were not different

from reference, there is no complete or significant pathway for observed manganese concentrations in sediment from the 300 Area riparian soils or groundwater.

Phosphorus—Phosphorus was detected in all 15 samples within the 300 Area nearshore sediments. Twelve detected concentrations exceeded the Lower Threshold ESL, but none exceeded the upper threshold ESL. Table 6-40 in the RCBRA Report (DOE/RL-2007-21) reports that phosphorus sediment concentrations do not differ from reference sediments. Table 5-29 of the RCBRA Report (DOE/RL-2007-21) indicates that phosphorus concentrations across the Hanford Site riparian soils were not statistically different from riparian reference. No background is available. For the 300 Areas where the sediment sample exceeded the lower threshold ESL, phosphorus was below the chronic aquatic life criteria for porewater and groundwater samples. Aquifer tube and seep samples were not analyzed for phosphorus. Phosphorus is not considered a COPC for the nearshore environment because there are no environmentally relevant concentrations of phosphorus in RCBRA nearshore sediment, riparian soils do not differ from reference concentrations, and RCBRA riparian study site soil concentrations are not greater than reference sediment concentrations for phosphorus.

TPH—TPH was detected in 14 of 15 samples within the 300 Area nearshore sediments. The one detection exceeded both the lower and upper threshold ESLs. TPH was not analyzed in riparian soil samples. However, TPH motor oil was detected at upland sites. While no SSL or PRG was identified for the Hanford Site, concentrations detected are in the range that could result in adverse effects to terrestrial invertebrates. TPH-diesel was only detected in 2 of the 12 porewater samples collected from the 300 Area nearshore study sites with a maximum detect of 120 µg/L, while TPH and TPH gasoline were not detected in 16 porewater samples analyzed. Though there is no a state or federal surface water criterion or background groundwater concentration to put these data in context, the state of Massachusetts has published groundwater protection standards ("MCP Method 1 Groundwater Standards" [310 CMR 40.0000]) for the protection of discharges to surface water for TPH. Massachusetts standards ("MCP Method 1 Groundwater Standards" [310 CMR 40.0000]) for petroleum hydrocarbons are broken out by aliphatic and aromatic compounds and by ranges based on the number of carbon atoms in the basic molecule chain ("MCP Method 1 Groundwater Standards" [310 CMR 40.0000]). At 2,000 µg/L, the lowest of these thresholds is an order of magnitude greater than the maximum detect in the 300 Area of 120 µg/L. The California water control board also provides a value for TPH of 500 µg/L (Table M-2), and all concentrations were below this as well, Table 6-40 of the RCBRA Report (DOE/RL-2007-21) indicates that the detected study site nearshore sediment sample concentrations are not greater than reference sediment concentrations for TPH. There is no complete or significant pathway for observed TPH concentrations in sediment from the 300 Area riparian area.

Uranium—Uranium was identified as a COEC for sediment along the River Corridor (RCBRA Report [DOE/RL-2007-21]; CRC [DOE/RL-2010-117]). The maximum sediment concentration (15 mg/kg) was less than the sediment benchmark (100 mg/kg) (Figure 8-38) in the River Corridor as a whole and was not detected above the lower threshold ESL in nearshore sediment in the 300 Area; thus, adverse effects on invertebrates are unlikely for this pathway. The groundwater/seep/porewater analysis showed concentrations of uranium related to the 300 Area. As discussed previously, uranium concentrations in groundwater, seeps, aquifer tubes, and porewater exceed background. Likewise, Survey of Contaminants in the 300 Area Near-Shore (PNNL-13692) noted uranium in groundwater, springs, and river water as the only contaminant with concentrations of interest. Uranium was not detected in 20 soil samples collected. Table 5-29 of the RCBRA Report (DOE/RL-2007-21) indicates that uranium concentrations across the Hanford Site riparian soils were not statistically different from riparian reference soil concentrations or background. While there is no evidence of a terrestrial pathway to the Columbia River (e.g., soil runoff or

nearshore sediments migrating downstream), as indicated earlier under the discussion of porewater effects on aquatic plants, uranium in groundwater is a potential source that warrants further evaluation in the FS.

M4.4.2 Direct Toxicity Measures

Risks to aquatic macroinvertebrates based on toxicity testing showed some relationships with confounding factors and some COPECs. Histopathology measures differed in study sites compared to reference sites; these measures also showed some negative relationships with COPECs. Sediment bioassays for the 300 Area study sites showed no difference in growth or higher growth in amphipod (*Hyalella azteca*) relative to reference sites, and the survival at 300 Area study sites was higher than that for the 300 Area reference sites with the exception of study site U10. Likewise, survival and reproduction tests on water fleas in porewater showed no difference at four 300 Area sites (5c Aq, 5d Aq, U1, and U4) relative to reference sites. Correlation between abiotic media chemistry and any observed differences in measured effects from both bioassays was conducted across the whole Hanford Reach. Mercury was the only COPEC with a significant correlation that showed a potential negative effect with a significant regression; however, mercury was below sediment ESLs at the 300 Area study sites. Clams were also monitored for survival. There was a statistical decrease in survival at study sites compared to reference sites, but there was no correlation of clam survival with COPECs. Together these measures do not indicate substrate concentrations were toxic. However, they do represent only a snapshot in time and do not represent all seasonal conditions and river stage fluctuations.

M4.4.3 Community Structure Measures

Key community metrics do not suggest that contaminant-related impacts to benthic macroinvertebrates are evident in aquatic study sites as a group, as evident by the comparison of Ephemeroptera, Plecoptera, and Trichopera (EPT) data from study sites relative to reference sites. Most of the aquatic community measures did not differ between the study sites and reference sites. There were exceptions among the large number of aquatic community measures evaluated, but the agreement among measures was weak and the biological significance to populations is not evident.

M4.4.4 Measures of Exposure

Within the RCBRA (DOE/RL-2007-21), clear measures of exposure (accumulation), primarily for inorganic COPECs were detected in water, sediment, and tissues. Survey of Contaminants in the 300 Area Near-Shore (PNNL-13692) also noted elevated levels of uranium, selenium, and chromium in clam tissues adjacent to the 300 Area relative to the Vernita Bridge background. However, as shown in the RCBRA Report (DOE/RL-2007-21), there were no statistically significant correlations between COPEC concentrations in porewater or sediment with tissues of aquatic organisms, indicating a lack of significant COPEC bioaccumulation. Further, no tissue effect levels for COPECs in invertebrate tissue were exceeded.

Most histopathology measures of clams and mussels showed no significant differences between study sites and reference. While, there were some exceptions, COPEC concentrations generally did not correlate with differences in histopathology measures. Histopathology results in Survey of Contaminants in the 300 Area Near-Shore (PNNL-13692) support these findings because there were no abnormal frequency of lesions in target tissues in crayfish and sculpin.

In Survey of Contaminants in the 300 Area Near-Shore (PNNL-13692), radiation dose estimates were conducted for aquatic and terrestrial organisms exposed to sediment and surface water with all sum of fractions being below 1 indicating no adverse effects are likely.

M4.4.5 Weight of Evidence

As stated previously, both the abiotic and biotic measures collected for the RCBRA (RCBRA Report [DOE/RL-2007-21]) represent only a snapshot in time and do not represent all seasonal conditions and river stage fluctuations. Abiotic measurements do exceed literature based screening values for some COPECs, and this line of evidence is generally given the lowest weight given the lack of site-specificity in the literature-based values. Although biological measures give a different perspective than the chemistry, given the limited data set and the uncertainty with full representation of seasonal measurements, the results of the chemistry cannot be ignored.

Of the key plume contaminants investigated, only uranium had concentrations of ecological relevance in the nearshore environment for the 300 Area. As porewater concentrations of uranium were higher than chronic water quality standards or criteria, this COPEC in groundwater in the 300 Area warrants further evaluation in the FS. This conclusion is applicable to both aquatic invertebrates and amphibians.

M4.5 Risk to Riparian Wildlife

For riparian soils, field ecological measures of the small mammal community were developed as qualitative information on the status of these populations. Estimated dietary contaminant exposures and biological concentrations in bird or small mammal tissues are compared to ecological effects levels established for dietary ingestion or related to tissue residues. For selected COPECs (cadmium, chromium, lead, selenium, and polychlorinated biphenyl), measured tissue concentrations in small mammals trapped in River Corridor study sites were not greater than reference areas (RCBRA Report [DOE/RL-2007-21], Table 5-48), and were less than available tissue effect levels (RCBRA Report [DOE/RL-2007-21], page 5-91). Dietary exposure to terrestrial birds and mammals estimated using wildlife exposure models, estimated for riparian concentrations across the River Corridor indicated potential exposure higher than lowest observed adverse effect level (LOAEL)-based SSL values for copper, selenium, vanadium, and zinc. Only zinc was identified as a final COEC for riparian soil exposure to birds and mammals. However, concentrations of zinc, in 300 Area, although greater than Hanford Site-wide background (67.8 mg/kg), falls below the ESL (Table M-31) and within the reference study sites (336 mg/kg); and therefore do not warrant further evaluation in the FS (RCBRA Report [DOE/RL-2007-21], Table 2-9).

Most concentrations detected in riparian soils within the 100-K fell below ESLs (in this case, specifically SSLs and PRGs described earlier) and do not warrant further evaluation in the FS. Two chemicals within riparian soils had concentrations above ESLs: aluminum and vanadium (Table M-32).

Aluminum—Aluminum concentrations were below background and within the reference study (RCBRA Table 5-29). While all samples were above the ESL for mammals and 7 of 11 samples were above the ESL for birds, *Ecological Soil Screening Level for Aluminum: Interim Final* (OSWER Directive 9285.7-60) presents a clear discussion that toxicity is only identified in soils when the pH is 5.5 or less. Measures of pH for soils in the 300 Area are above 5.5, thus aluminum toxicity to wildlife is not a concern.

Vanadium—The maximum detected concentration of 73 mg/kg was less than the site background of 85 mg/kg. While the PRG was developed with a model using site-specific tissue data, it still included uncertainties. However, with concentrations being below background, potential toxic effects to wildlife are unlikely.

Within the RCBRA, information on dietary contaminant exposures were also compared to ecological effects levels for diet to assess risks to birds or mammals potentially exposed to contaminants in

nearshore sediments, biota, and water. Only chromium was considered a final COEC. However, the single study site with which this risk was associated is not within the 300 Area nearshore environment.

M4.6 Risk to Fish

No COECs in the RCBRA Report (DOE/RL-2007-21) or in the CRC (DOE/RL-2010-117) were identified for surface water exposures to fish.

The RCBRA Report (DOE/RL-2007-21) identified Cr(VI) pore water concentrations indicative of risk to fish and warranting additional consideration. The CRC (DOE/RL-2010-117) also indicated exceedances of water quality standards or criteria for aluminum, lead, nitrate, selenium, and uranium in pore water. However, most other lines of evidence suggest that there is no unacceptable risk to fish in the Columbia River. In general across the River Corridor, fish were smaller (in length and mass) at study sites relative to reference sites. However, there are many factors that either confound or contribute to the size of fish captured such as fishing pressure or ease of capture of the target size range. Correlation with capture size and chemical concentration or any other factor (e.g., habitat, nutrient availability) was not possible since it was not considered as part of the original study design. There were no strong trends in fish histopathological observations between those collected at study sites and those from reference site locations. No tissue COPECs were correlated with histopathological endpoints associated with adverse effects at study sites. No exceedances of tissue effects levels for nearshore aquatic COPECs were measured in fish tissue. In addition, evidence of greater contaminant uptake in fish from study sites was not apparent for most COPECs and tissues. There are significant uncertainties relative to any of the conclusions based on porewater sampling. Further, all of these abiotic measurements represent a single point measurement within a dynamic river system with daily and seasonal fluctuations and flow volumes that can shift the composition of the substrates that were sampled. Thus, exceedances should not be ignored as they can be indicative of exposure an levels presenting a risk. But because of the uncertainty in the representativeness of the measurements due to the dynamic environment, the exceedances should be considered along with other data that identifies whether there is in fact an ongoing source of the measurements. The interpretation of porewater results as an indication of potential adverse effects to fish is the same as that for aquatic plants, given that ESLs are protective of both plants and fish.

For the 300 Area, uranium in groundwater, which represents a potential source for porewater concentrations that exceed background, warrants further evaluation in the FS. Uranium concentrations in multiple nearshore wells and aquifer tubes exceed background suggesting an ongoing source. Other COPECs detected in porewater above ambient water criteria do not appear to be issues in groundwater or aquifer tubes suggesting that 300 Area is not the source of observed elevated concentrations.

M5 Conclusions

The purpose for preparing this CSM was to address, on a reactor decision area basis, the potential for Hanford Site contaminants in soil or groundwater to migrate to riparian or nearshore areas at concentrations that could be of concern for ecological receptors. This CSM supplements the analysis of River Corridor-wide ecological risks presented in the ecological risk assessment of the RCBRA Report (DOE/RL-2007-21). The RCBRA Report (DOE/RL-2007-21) identified on a site-wide basis some COECs that warranted further evaluation. Based on the results of the further evaluation contained in this CSM, with the exception of uranium, detected concentrations of contaminants in riparian or nearshore groundwater, seeps, aquifer tubes, and porewater are not reliably detectable at levels of ecological concern, or are not associated with contaminated groundwater resulting from Hanford Site operations. For purposes of alternatives evaluation in the 300 Area FS, uranium in groundwater should be considered the only COEC.

There are uncertainties in this evaluation related to analytical data quality. With the exception of most recently collected analytical data in groundwater, analytical methods had MDLs that approached or were higher than aquatic criteria; when methods with adequate detection limits are used, the results show that contaminant concentrations are less than aquatic criteria. In many cases where analytical results were higher than aquatic criteria, it was determined that the results were based on unfiltered samples. Unfiltered analytical results are inappropriate for comparison with aquatic criteria; in general, filtered analytical results were less than aquatic criteria. In some cases where concentrations were reported higher than aquatic criteria, further evaluation of the data revealed it was qualified because of the presence of blank contamination. The analytical detection limit considerations and data quality issues further support the conclusion that contaminants concentrations in water were not reliably detected above levels of ecological significance.

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Table M-1. Summary of Near Shore Wells and Aquifer Tubes for the 300-FF-5 Groundwater Operable Unit

Near Shore Wells			
399-1-1	399-1-54	399-2-2	399-3-9
399-1-10A	399-1-57	399-3-1	399-4-10
399-1-10B	399-1-6	399-3-10	399-4-7
399-1-16A	399-1-8	399-3-18	399-4-9
399-1-16B	399-2-1	399-3-33	
Aquifer Tubes			
103mArray-AT3A	300SPR9A-19cm	AT-3-6-D	C6350
103mArray-DS25	300SPR9A-86cm	AT-3-6-M	C6351
103mArray-DS50	AT-3-1-D(1)	AT-3-6-S	C6362
103mArray-DS75	AT-3-1-M	AT-3-7-D	C6365
103mArray-US100	AT-3-1-S	AT-3-7-M	C6368
103mArray-US125	AT-3-2-M	AT-3-7-S	C6371
103mArray-US25	AT-3-2-S	AT-3-8-M	C6374
103mArray-US50	AT-3-3-D	AT-3-8-S	C6375
103mArray-US75	AT-3-3-M	C6341	C6378
300-3-3A-124cm	AT-3-3-S	C6342	C6380
300-3-3A-579cm	AT-3-4-D	C6343	C6383
300-3-3B-376cm	AT-3-4-M	C6344	C6384
300-3-3B-518cm	AT-3-4-S	C6347	DS75-100cm
300-3-3C-409cm	AT-3-5-S	C6348	DS75-319cm
300SPR9A-142cm			

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Table M-2. Surface Water NOECs for Aquatic Biota and Amphibians

Analyte Name	CAS#	Units	Surface Water ESL	Surface Water ESL Basis	Surface Water ESL Source	Notes
4,4'-DDT (Dichlorodiphenyltrichloroethane)	50-29-3	ug/L	1.00E-03	WQC CCC	EPA, 2009	--
Acetone	67-64-1	ug/L	1.50E+03	Tier II SCV	ES/ER/TM-96/R2	--
Aldrin	309-00-2	ug/L	1.90E+03	WQS	WAC 173-201A	Water Quality Standards for Surface Waters of WA
Alpha-Chlordane	5103-71-9	ug/L	4.30E-03	WQC CCC	EPA, 2009	--
Aluminum	7429-90-5	ug/L	8.70E+01	WQC CCC	EPA, 2009	--
Antimony	7440-36-0	ug/L	3.00E+01	WQC CCC	EPA, 1988	Proposed continuous chronic criterion
Aroclor-1016	12674-11-2	ug/L	1.40E-02	WQC CCC	EPA 2009	--
Aroclor-1221	11104-28-2	ug/L	1.40E-02	WQC CCC	EPA, 2009	--
Aroclor-1232	11141-16-5	ug/L	1.40E-02	WQC CCC	EPA, 2009	--
Aroclor-1242	53469-21-9	ug/L	1.40E-02	WQC CCC	EPA, 2009	--
Aroclor-1248	12672-29-6	ug/L	1.40E-02	WQC CCC	EPA, 2009	--
Aroclor-1254	11097-69-1	ug/L	1.40E-02	WQC CCC	EPA, 2009	--
Aroclor-1260	11096-82-5	ug/L	1.40E-02	WQC CCC	EPA, 2009	--
Arsenic	7440-38-2	ug/L	1.50E+02	WQC CCC	EPA, 2009	--
Barium	7440-39-3	ug/L	3.64E+02	Tier II SCV	MDEQ, 2008	Based on a 2005 hardness equation developed by the Michigan DEQ (MDEQ) and used by the Province of Quebec. An earlier (1996) version of the MDEQ equation was previously used by Quebec and cited by MacDonald 1999, and used by RCBRA to calculate a screening value. The proposed NOEC value of 0.364 mg/L reflects the use of the updated MDEQ equation, which is now also used by Quebec. Value calculated at a hardness of 84 mg/L.
Cadmium	7440-43-9	ug/L	2.20E-01	WQC CCC	EPA, 2009	Hardness adjusted to 84 mg/L, average for Columbia River.
Calculated total uranium	calc_tot_U	ug/L	5.00E+00	PNEC	Sheppard et al., 2005	Sheppard aggregate value for invertebrates and plants. RCBRA receptor-specific value.
Chlordane	57-74-9	ug/L	4.30E-03	WQC CCC	EPA, 2009	--
Chloride	16887-00-6	ug/L	2.30E+05	WQC CCC	WAC 173-201A	--
Chloroform	67-66-3	ug/L	2.80E+01	Tier II SCV	ES/ER/TM-96/R2	--
Chromium	7440-47-3	ug/L	6.40E+01	WQC CCC	EPA, 2009	Hardness adjusted to 84 mg/L, average for Columbia River.
Cobalt	7440-48-4	ug/L	2.30E+01	Tier II SCV	ES/ER/TM-96/R2	--
Copper	7440-50-8	ug/L	1.00E+01	WQC CCC	WAC 173-201A	Hardness adjusted to 84 mg/L, average for Columbia River.
Cyanide	57-12-5	ug/L	5.20E+00	WQC CCC	EPA, 2009	--
Dieldrin	60-57-1	ug/L	1.90E-03	--	--	40 CFR 131 Water Quality Standards-Freshwater CCC (Chronic)
Endosulfan I	959-98-8	ug/L	5.60E-02	WQC CCC	EPA, 2009	--
Endosulfan II	33213-65-9	ug/L	5.60E-02	WQC CCC	EPA, 2009	--
Endrin	72-20-8	ug/L	2.30E-03	--	--	40 CFR 131 Water Quality Standards-Freshwater CCC (Chronic)
Fluoride	16984-48-8	ug/L	3.00E+02	AWQC	BCMOE, 1995	Tentative criterion; maximum where water hardness >/= 50 mg/L, – British Columbia
Gamma-BHC (Lindane)	58-89-9	ug/L	8.00E-02	--	--	40 CFR 131 Water Quality Standards-Freshwater CCC (Chronic)
Heptachlor	76-44-8	ug/L	3.80E-03	WQC CCC	EPA, 2009	--
Heptachlor epoxide	1024-57-3	ug/L	3.80E-03	WQC CCC	EPA, 2009	--
Hexavalent chromium	18540-29-9	ug/L	1.00E+01	WQC CCC	WAC 173-201A	Washington State Water Quality Standards for Surface Waters, Table 240(3) Toxic Substances Criteria
iron	7439-89-6	ug/L	1.00E+03	WQC CCC	EPA, 2009	--
Lead	7439-92-1	ug/L	2.10E+00	WQC CCC	EPA, 2009	Hardness adjusted to 84 mg/L, average for Columbia River.
Manganese	7439-96-5	ug/L	1.20E+02	Tier II SCV	ES/ER/TM-96/R2	--
Mercury	7439-97-6	ug/L	1.20E-02	WQC CCC	WAC 173-201A	Washington State Water Quality Standards for SW, Table 240(3) Toxic Substances Criteria. Note based on HH consumption of fish, not designed to be protective of aquatic life which yields a different value.
Methoxychlor	72-43-5	ug/L	3.00E-02	WQC CCC	EPA, 2009	--
Nickel	7440-02-0	ug/L	4.50E+01	WQC CCC	EPA, 2009	Hardness adjusted to 84 mg/L, average for Columbia River.
Nitrate	14797-55-8	ug/L	7.10E+03	Fish NOEC	McGurk et al., 2006	Chronic NOEC for fish. In comparison, Camargo et al., 2005 suggest that 2,000 µg/L is protective of the most sensitive freshwater species
Nitrogen in Nitrate	NO3-N	ug/L	1.60E+03	Fish NOEC	McGurk et al., 2006	Chronic NOEC for fish. In comparison, Camargo et al., 2005 suggest that 2,000 µg/L is protective of the most sensitive freshwater species
Nitrite	14797-65-0	ug/L	2.46E+02	--	Neuman et al., 2001	UF of 2 applied to study LOEC of 0.49 mg/L (0.15 mg/L NO2-N) for sigificant reduction in development.

Table M-2. Surface Water NOECs for Aquatic Biota and Amphibians

Analyte Name	CAS#	Units	Surface Water ESL	Surface Water ESL Basis	Surface Water ESL Source	Notes
Pentachlorophenol	87-86-5	ug/L	1.30E+01	WQS	WAC 173-201A	Water Quality Standards for Surface Waters of WA
Phosphate	14265-44-2	ug/L	1.00E+03	Plant NOEC	Blindow, 1988	Plant value; no effect on growth. Phosphorpous used as surrogate.
Phosphorus	7723-14-0	ug/L	1.00E+03	Plant NOEC	Blindow, 1988	Plant value; no effect on growth.
Selenium	7782-49-2	ug/L	5.00E+00	WQC CCC	WAC 173-201A	--
Silver	7440-22-4	ug/L	2.61E+00	WQS	WAC 173-201A	Water Quality Standards for Surface Waters of WA
Total PCBs	TOTALPCB	ug/L	1.40E-01	Tier II SCV	ES/ER/TM-96/R2	--
Total Petroleum Hydrocarbons - diesel range	TPHDIESEL	ug/L	5.00E+02	--	CRWQCB, 2003	TPH value
Toxaphene	8001-35-2	ug/L	2.00E-04	WQS	WAC 173-201A	Water Quality Standards for Surface Waters of WA
Trichloroethene	79-01-6	ug/L	4.70E+01	Tier II SVC	ES/ER/TM-96/R2	--
Uranium	7440-61-1	ug/L	5.00E+00	PNEC	Sheppard et al., 2005	Sheppard aggregate value for invertebrates and plants. RCBRA receptor-specific value.
Vanadium	7440-62-2	ug/L	1.00E+02	NOEC	WHO, 2001	World Health Organization gives range of LC_{50} values for freshwater fish, from 400 µg/L (144-h exposure) to 118,000 µg/L (96-h exposure). Given the uncertainty in such a broad concentration range for the same endpoint, a NOEC was considered based on using the lowest LC_{50} (400 ug/L; Knudston 1979). This study apparently lacked controls, had nominal concentrations and measured non-native species (guppy). It is recommended that Stendahl and Sprague (1982) be used because of good study design (measured values, representative species and hardness [103 mg/L $CaCO_3$], flow-through test) based on 11-d LC50 of 2,000 ug/L. UF of 20 applied.
Zinc	7440-66-6	ug/L	9.00E+01	Washington chronic WQS	WAC 173-201A	Hardness adjusted to 84 mg/L, average for Columbia River.
Sulfate	14808-79-8	ug/L	NA	--	--	No value available
Total Petroleum Hydrocarbons - motor oil (high boiling)	TPH/OILH	ug/L	NA	--	--	No value available
Antimony-125	14234-35-6	pCi/L	3.67E+05	BCG	DOE-STD-1153-2002	Aquatic animal
Barium-140	14798-08-4	pCi/L	9.46E+01	BCG	RESRAD BIOTA v1.5 (DOE/EH-0676)	Riparian animal value
Carbon-14	14762-75-5	pCi/L	6.09E+02	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Riparian animal value
Cerium/Praseodymium-144	CE/PR-144	pCi/L	1.60E+03	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Aquatic animal
Cerium-141	13967-74-3	pCi/L	8.83E+03	BCG	RESRAD BIOTA v1.5 (DOE/EH-0676)	Aquatic animal
Cerium-144	14762-78-8	pCi/L	1.60E+03	BCG	DOE-STD-1153-2002	Aquatic animal
Cesium-134	13967-70-9	pCi/L	2.11E+01	BCG	RESRAD BIOTA v1.5 (DOE/EH-0676)	Riparian animal value
Cesium-137	10045-97-3	pCi/L	4.26E+01	BCG	DOE-STD-1153-2002	Riparian animal value
Chromium-51	14392-02-0	pCi/L	2.68E+05	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Aquatic animal
Cobalt-58	13981-38-9	pCi/L	9.68E+03	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Aquatic animal
Cobalt-60	10198-40-0	pCi/L	3.76E+03	BCG	DOE-STD-1153-2002	Aquatic animal
Europium-152	14683-23-9	pCi/L	2.55E+04	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Aquatic animal
Europium-154	15585-10-1	pCi/L	2.16E+04	BCG	DOE-STD-1153-2002	Aquatic animal
Europium-155	14391-16-3	pCi/L	2.64E+04	BCG	DOE-STD-1153-2002	Aquatic animal
Iodine-129	15046-84-1	pCi/L	3.84E+04	BCG	DOE-STD-1153-2002	Riparian animal value
Iodine-131	10043-66-0	pCi/L	1.37E+04	BCG	DOE-STD-1153-2002	Riparian animal value
Neptunium-237	13994-20-2	pCi/L	6.85E+01	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Aquatic animal
Plutonium-238	13981-16-3	pCi/L	1.76E+02	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Aquatic animal
Plutonium-239	15117-48-3	pCi/L	1.87E+02	BCG	DOE-STD-1153-2002	Aquatic animal
Plutonium-239/240	PU-239/240	pCi/L	1.87E+02	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Aquatic animal. Value for Pu-239
Potassium-40	13966-00-2	pCi/L	2.50E+02	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Riparian animal value
Radium-226	13982-63-3	pCi/L	4.08E+00	BCG	DOE-STD-1153-2002	Riparian animal value
Radium-228	15262-20-1	pCi/L	3.40E+00	BCG	DOE-STD-1153-2002	Riparian animal value
Selenium-75	SE-75	pCi/L	4.78E+04	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Aquatic animal
Strontium-90	10098-97-2	pCi/L	2.78E+02	BCG	DOE-STD-1153-2002	Riparian animal value
Technetium-99	14133-76-7	pCi/L	6.67E+05	BCG	DOE-STD-1153-2002	Riparian animal value

Table M-2. Surface Water NOECs for Aquatic Biota and Amphibians

Analyte Name	CAS#	Units	Surface Water ESL	Surface Water ESL Basis	Surface Water ESL Source	Notes
Thorium		pCi/L	3.04E+02	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Aquatic animal
Thorium-230	14269-63-7	pCi/L	2.57E+03	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Aquatic animal
Thorium-232	TH-232	pCi/L	3.04E+02	BCG	DOE-STD-1153-2002	Aquatic animal
Thorium-234	15065-10-8	pCi/L	2.67E+05	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Aquatic animal
Tritium	10028-17-8	pCi/L	2.65E+08	BCG	RESRAD-BIOTA v1.5 (DOE/EH-0676)	Riparian animal value
Uranium-233/234	U-233/234	pCi/L	2.02E+02	BCG	DOE-STD-1153-2002	Value for U-234; same CAS no. Aquatic animal value.
Uranium-234	13966-29-5	pCi/L	2.02E+02	BCG	DOE-STD-1153-2002	Aquatic animal value
Uranium-235	15117-96-1	pCi/L	2.17E+02	BCG	DOE-STD-1153-2002	Aquatic animal
Uranium-238	U-238	pCi/L	2.23E+02	BCG	DOE-STD-1153-2002	Aquatic animal value
Zinc-65	13982-39-3	pCi/L	1.32E+01	BCG	DOE-STD-1153-2002	Riparian animal value
Zirconium/Niobium-95	ZR/NB-95	pCi/L	7.33E+03	BCG	DOE-STD-1153-2002	Aquatic animal value
Zirconium-95	13967-71-0	pCi/L	7.33E+03	BCG	DOE-STD-1153-2002	Aquatic animal value

Acronyms:

AWQC = ambient water quality criteria

BCG = biota concentration guide

Tier II SCV = Tier 2 secondary chronic value

WQC = water quality criteria

WQS = water quality standard

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Table M-3. Summary of Ecological Soil Preliminary Remediation Goals

Analyte Name	CAS No	Analyte Group	Units	Plant ESL	Plant ESL Basis	Plant ESL Source	Invertebrate ESL	Invertebrate ESL Basis	Invertebrate ESL Source	Avian ESL	Avian ESL Basis	Avian ESL Source	Mammal ESL	Mammal ESL Basis	Mammal ESL Source
1,1,1-Trichloroethane	71-55-6	Non-Rad	ug/kg	--	--	--	--	--	--	165,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	1.00E+07	SSL (NOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
1,1,2,2-Tetrachloroethane	79-34-5	Non-Rad	ug/kg	--	--	--	--	--	--	165,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	894,000	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
1,1,2-Trichloroethane	79-00-5	Non-Rad	ug/kg	--	--	--	--	--	--	165,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	1.00E+07	SSL (NOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
1,1-Dichloroethane	75-34-3	Non-Rad	ug/kg	--	--	--	--	--	--	165,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	502,000	SSL (NOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
1,1-Dichloroethene	75-35-4	Non-Rad	ug/kg	--	--	--	--	--	--	165,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	301,000	SSL (NOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
1,2,4-Trichlorobenzene	120-82-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichlorobenzene	95-50-1	Non-Rad	ug/kg	--	--	--	--	--	--	164,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	282,000	SSL (NOAEL) - great basin pocket mouse	CHPRC-00784, Table 6-13
1,2-Dichloroethane	107-06-2	Non-Rad	ug/kg	--	--	--	--	--	--	169,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	513,000	SSL (NOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
1,2-Dichloroethene (Total)	540-59-0	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
1,2-Dichloropropane	78-87-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
1,3-Dichlorobenzene	541-73-1	Non-Rad	ug/kg	--	--	--	--	--	--	164,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	310,000	SSL (NOAEL) - great basin pocket mouse	CHPRC-00784, Table 6-13
1,4-Dichlorobenzene	106-46-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
1-Butanol	71-36-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
1-Propanol	71-23-8	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2,4-D(2,4-Dichlorophenoxyacetic acid)	94-75-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-T(2,4,5-Trichlorophenoxyacetic acid)	93-76-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-TP(2-(2,4,5-Trichlorophenoxy)propionic acid)Silvex	93-72-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2,4,5-Trichlorophenol	95-95-4	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2,4,6-Trichlorophenol	88-06-2	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2,4-DB(4-(2,4-Dichlorophenoxy)butanoic acid)	94-82-6	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dichlorophenol	120-83-2	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dimethylphenol	105-67-9	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrophenol	51-28-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2,4-Dinitrotoluene	121-14-2	Non-Rad	ug/kg	--	--	--	--	--	--	26,400	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	28,100	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
2,6-Dinitrotoluene	606-20-2	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2-Butanone	78-93-3	Non-Rad	ug/kg	--	--	--	--	--	--	3.12E+06	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	4.12E+08	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
2-Butoxyethanol	111-76-2	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2-Chloronaphthalene	91-58-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2-Chlorophenol	95-57-8	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2-Hexanone	591-78-6	Non-Rad	ug/kg	--	--	--	--	--	--	1.86E+06	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	1.71E+06	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
2-Methylnaphthalene	91-57-6	Non-Rad	ug/kg	--	--	--	29,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	8,370	SSL (LOAEL) - California quail	CHPRC-00784, Table 6-13	6,010	SSL (LOAEL) - great basin pocket mouse	CHPRC-00784, Table 6-13
2-Methylphenol (cresol, o-)	95-48-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	9.29E+06	SSL (NOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
2-Nitroaniline	88-74-4	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
2-Nitrophenol	88-75-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
3,3'-Dichlorobenzidine	91-94-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
3+4 Methylphenol (cresol, m+p)	65794-96-9	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
3-Nitroaniline	99-09-2	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
4,4'-DDD (Dichlorodiphenyldichloroethane)	72-54-8	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
4,4'-DDE (Dichlorodiphenyldichloroethylene)	72-55-9	Non-Rad	ug/kg	--	--	--	--	--	--	800	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	400	SSL (LOAEL) - badger	CHPRC-00784, Table 6-13
4,4'-DDT (Dichlorodiphenyltrichloroethane)	50-29-3	Non-Rad	ug/kg	--	--	--	--	--	--	1,190	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	882	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
4,6-Dinitro-2-methylphenol	534-52-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
4-Amino-3,5,6-trichloropicolinic acid	1918-02-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
4-Bromophenylphenyl ether	101-55-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloro-3-methylphenol	59-50-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
4-Chloroaniline	106-47-8	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
4-Chlorophenylphenyl ether	7005-72-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
4-Methyl-2-Pentanone	108-10-1	Non-Rad	ug/kg	--	--	--	--	--	--	1.93E+06	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	2.27E+08	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
4-Methylphenol (cresol, p-)	106-44-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	9.36E+06	SSL (NOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
4-Nitroaniline	100-01-6	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
4-Nitrophenol	100-02-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Acenaphthene	83-32-9	Non-Rad	ug/kg	20,000	SSL - ORNL	ES/ER/TM-85/R3	29,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	1.10E+06	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	2.42E+06	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Acenaphthylene	208-96-8	Non-Rad	ug/kg	--	--	--	29,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	73,600	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	156,000	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Acetone	67-64-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Aldrin	309-00-2	Non-Rad	ug/kg	--	--	--	--	--	--	164	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	9,820	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Alpha-BHC	319-84-6	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
alpha-Chlordane	5103-71-9	Non-Rad	ug/kg	--	--	--	1,000	SSL - MTCA	WAC 173-340, Table 749-3	50,400	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	205,000	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Aluminum	7429-90-5	Non-Rad	ug/kg	--	--	--	--	--	--	7.21E+06	PRG (mod) - killdeer	CHPRC-01311, Table 3-1	3.99E+06	PRG (mod) - deer mouse	CHPRC-01311, Table 3-1
Aniline	62-53-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--		
Anthracene	120-12-7	Non-Rad	ug/kg	--	--	--	29,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	678,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	4.21E+06	SSL (NOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Antimony	7440-36-0	Non-Rad	ug/kg	842,000	PRG - Site specific study	ECF-HANFORD-11-0158	842,000	PRG - Site specific study	ECF-HANFORD-11-0158	--	--	--	92,000	PRG (mod-high) - deer mouse	CHPRC-01311, Table 3-1
Aroclor-1016	12674-11-2	Non-Rad	ug/kg	40,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	1,820	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	4,850	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Aroclor-1221	11104-28-2	Non-Rad	ug/kg	40,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	1,820	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	1,470	SSL (LOAEL) - deer mouse, grasshopper mouse	CHPRC-00784, Table 6-13
Aroclor-1232	11141-16-5	Non-Rad	ug/kg	40,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	1,820	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	1,440	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Aroclor-1242	53469-21-9	Non-Rad	ug/kg	40,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	1,820	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	1,490	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Aroclor-1248	12672-29-6	Non-Rad	ug/kg	40,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	1,820	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	325	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Aroclor-1254	11097-69-1	Non-Rad	ug/kg	40,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	1,820	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	1,470	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Aroclor-1260	11096-82-5	Non-Rad	ug/kg	40,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	1,820	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	1,470	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Arsenic	7440-38-2	Non-Rad	ug/kg	128,000	PRG - Site specific study	Ecology Publication 11-03-006	128,000	PRG - Site specific study	Ecology Publication 11-03-006	2.28E+06	PRG (high) - killdeer	CHPRC-01311, Table 3-1	127,000	PRG (mod-high) - deer mouse	CHPRC-01311, Table 3-1
Barium	7440-39-3	Non-Rad	ug/kg	500,000	PRG - ORNL	ES/ER/TM-85/R3	358,000	PRG - site-specific NOEC	RCBRA - DOE/RL-2007-21	1.69E+06	PRG (mod) - killdeer	CHPRC-01311, Table 3-1	2.27E+06	PRG (mod) - great basin pocket mouse	CHPRC-01311, Table 3-1
Benzene	71-43-2	Non-Rad	ug/kg	--	--	--	--	--	--	195,000	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	70,000	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Benzo(a)anthracene	56-55-3	Non-Rad	ug/kg	--	--	--	18,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	2,030	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	64,000	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Benzo(a)pyrene	50-32-8	Non-Rad	ug/kg	--	--	--	18,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	2,410	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	76,400	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Benzo(b)fluoranthene	205-99-2	Non-Rad	ug/kg	--	--	--	18,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	1,270	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	39,200	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Benzo(ghi)perylene	191-24-2	Non-Rad	ug/kg	--	--	--	18,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	1,120	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	32,400	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Benzo(k)fluoranthene	207-08-9	Non-Rad	ug/kg	--	--	--	18,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	1,270	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	39,200	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Benzoic acid	65-85-0	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Benzyl alcohol	100-51-6	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Beryllium	7440-41-7	Non-Rad	ug/kg	10,000	PRG - ORNL	ES/ER/TM-85/R3	40,000	PRG - EcoSSL	OSWER Directive 9285.7-64	--	--	--	14,000	PRG (mod) - great basin pocket mouse	CHPRC-01311, Table 3-1
beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	319-85-7	Non-Rad	ug/kg	--	--	--	--	--	--	4,080	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	8,670	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Bis(2-chloro-1-methylethyl)ether	108-60-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-Chloroethoxy)methane	111-91-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-chloroethyl) ether	111-44-4	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Bis(2-ethylhexyl) phthalate	117-81-7	Non-Rad	ug/kg	100,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	140	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	45,400	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Bismuth	7440-69-9	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Boron	7440-42-8	Non-Rad	ug/kg	29,600	PRG - site-specific NOEC	RCBRA - DOE/RL-2007-21	28,600	PRG - site-specific NOEC	RCBRA - DOE/RL-2007-21	54,000	PRG (mod) – California quail	CHPRC-01311, Table 3-1	32,000	PRG (mod-high) - great basin pocket mouse	CHPRC-01311, Table 3-1
Bromide	24959-67-9	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Bromodichloromethane	75-27-4	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Bromoform	75-25-2	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--

Table M-3. Summary of Ecological Soil Preliminary Remediation Goals

Analyte Name	CAS No	Analyte Group	Units	Plant ESL	Plant ESL Basis	Plant ESL Source	Invertebrate ESL	Invertebrate ESL Basis	Invertebrate ESL Source	Avian ESL	Avian ESL Basis	Avian ESL Source	Mammal ESL	Mammal ESL Basis	Mammal ESL Source
Bromomethane	74-83-9	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Butylbenzylphthalate	85-68-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Cadmium	7440-43-9	Non-Rad	ug/kg	9,840	PRG - Site specific study	ECF-HANFORD-11-0158	20,000	PRG - ORNL	ES/ER/TM-126/R2	29,000	PRG (mod) - killdeer	CHPRC-01311, Table 3-1	624,000	PRG (high) - deer mouse	CHPRC-01311, Table 3-1
Calcium	7440-70-2	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Carbazole	86-74-8	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Carbon disulfide	75-15-0	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Carbon tetrachloride	56-23-5	Non-Rad	ug/kg	--	--	#VALUE!	--	--	--	165,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	160,000	SSL (NOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Chlordane	57-74-9	Non-Rad	ug/kg	--	--	--	1,000	SSL - MTCA	WAC 173-340, Table 749-3	50,200	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	204,000	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Chloride	16887-00-6	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Chlorobenzene	108-90-7	Non-Rad	ug/kg	--	--	--	40,000	SSL - ORNL	ES/ER/TM-126/R2	165,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	387,000	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Chloroethane	75-00-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Chloroform	67-66-3	Non-Rad	ug/kg	--	--	--	--	--	--	165,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	412,000	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Chloromethane	74-87-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Chromium	7440-47-3	Non-Rad	ug/kg	259,000	PRG - Site specific study	ECF-HANFORD-11-0158	149,000	PRG - site-specific NOEC	RCBRA - DOE/RL-2007-21	109,000	PRG (mod) - killdeer	CHPRC-01311, Table 3-1	517,000	PRG (mod) - deer mouse	CHPRC-01311, Table 3-1
Chrysene	218-01-9	Non-Rad	ug/kg	--	--	--	18,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	1,430	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	44,500	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
cis-1,2-Dichloroethylene	156-59-2	Non-Rad	ug/kg	--	--	--	--	--	--	165,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	453,000	SSL (NOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
cis-1,3-Dichloropropene	10061-01-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Cobalt	7440-48-4	Non-Rad	ug/kg	15,700	PRG - Background	DOE/RL-92-24	15,700	PRG - Background	DOE/RL-92-24	484,000	PRG (high) - killdeer	CHPRC-01311, Table 3-1	2.14E+06	PRG (mod) - deer mouse	CHPRC-01311, Table 3-1
Co-elution of Aroclor-1242 and Aroclor-1016		Non-Rad	ug/kg	40,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	--	--	--	--	--	--
Copper	7440-50-8	Non-Rad	ug/kg	70,000	PRG - EcoSSL	OSWER Directive 9285.7-68	58,000	PRG - Site specific study	Ecology Publication 11-03-006	213,000	PRG (high) - killdeer	CHPRC-01311, Table 3-1	193,000	PRG (high) - deer mouse	CHPRC-01311, Table 3-1
Cyanide	57-12-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	2.07E+07	SSL (NOAEL) - deer mouse	CHPRC-00784, Table 6-13
Cyclohexane	110-82-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Dalapon	75-99-0	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Decane	124-18-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Delta-BHC	319-86-8	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Dibenz[a,h]anthracene	53-70-3	Non-Rad	ug/kg	--	--	--	18,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	1,420	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	44,100	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Dibenzofuran	132-64-9	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Dibromochloromethane	124-48-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Dicamba	1918-00-9	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Dichloroprop	120-36-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Dieldrin	60-57-1	Non-Rad	ug/kg	--	--	--	--	--	--	79	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	21	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Diethyl ether	60-29-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Diethylphthalate	84-66-2	Non-Rad	ug/kg	100,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	--	--	--	--	--	--
Dimethyl phthalate	131-11-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-butylphthalate	84-74-2	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Di-n-octylphthalate	117-84-0	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Dinoseb(2-secButyl-4,6-dinitrophenol)	88-85-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Endosulfan I	959-98-8	Non-Rad	ug/kg	--	--	--	--	--	--	41,400	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	710	SSL (NOAEL) - great basin pocket mouse	CHPRC-00784, Table 6-13
Endosulfan II	33213-65-9	Non-Rad	ug/kg	--	--	--	--	--	--	41,400	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	710	SSL (NOAEL) - great basin pocket mouse	CHPRC-00784, Table 6-13
Endosulfan sulfate	1031-07-8	Non-Rad	ug/kg	--	--	--	--	--	--	41,400	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	560	SSL (NOAEL) - great basin pocket mouse	CHPRC-00784, Table 6-13
Endrin	72-20-8	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Endrin aldehyde	7421-93-4	Non-Rad	ug/kg	--	--	--	--	--	--	231	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	1,360	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Endrin ketone	53494-70-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Ethanol	64-17-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Ethelyne glycol	107-21-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Ethylbenzene	100-41-4	Non-Rad	ug/kg	--	--	--	--	--	--	159,000	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	1.03E+06	SSL (LOAEL) - great basin pocket mouse	CHPRC-00784, Table 6-13
Fluoranthene	206-44-0	Non-Rad	ug/kg	--	--	--	18,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	1,090	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	839,000	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Fluorene	86-73-7	Non-Rad	ug/kg	--	--	--	29,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	175,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	267,000	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Fluoride	16984-48-8	Non-Rad	ug/kg	--	--	--	--	--	--	2.28E+06	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	1.38E+07	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Gamma-BHC (Lindane)	58-89-9	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
gamma-Chlordane	5566-34-7	Non-Rad	ug/kg	--	--	--	1,000	SSL - MTCA	WAC 173-340, Table 749-3	50,200	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	204,000	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Heptachlor	76-44-8	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Heptachlor epoxide	1024-57-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobenzene	118-74-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorobutadiene	87-68-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Hexachlorocyclopentadiene	77-47-4	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Hexachloroethane	67-72-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Hexane	110-54-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Hexavalent Chromium	18540-29-9	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	1.25E+06	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Indeno(1,2,3-cd)pyrene	193-39-5	Non-Rad	ug/kg	--	--	--	18,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	1,150	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	35,700	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Iron	7439-89-6	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Isophorone	78-59-1	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Lead	7439-92-1	Non-Rad	ug/kg	9.09E+06	PRG - Site specific study	ECF-HANFORD-11-0158	1.70E+06	PRG - EcoSSL	OSWER Directive 9285.7-70	156,000	PRG (high) - killdeer	CHPRC-01311, Table 3-1	1.58E+06	PRG (high) - deer mouse	CHPRC-01311, Table 3-1
Lithium	7439-93-2	Non-Rad	ug/kg	35,000	PRG - MTCA	WAC 173-340, Table 749-3	--	--	--	--	--	--	1.66E+06	PRG (mod) - great basin pocket mouse	CHPRC-01311, Table 3-1
Magnesium	7439-95-4	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Manganese	7439-96-5	Non-Rad	ug/kg	1.26E+06	PRG - Site specific study	ECF-HANFORD-11-0158	1.26E+06	PRG - Site specific study	ECF-HANFORD-11-0158	1.44E+07	PRG (mod) - killdeer	CHPRC-01311, Table 3-1	3.32E+06	PRG (mod) - great basin pocket mouse	CHPRC-01311, Table 3-1
Mercury	7439-97-6	Non-Rad	ug/kg	300	PRG - ORNL	ES/ER/TM-85/R3	12,500	PRG - Site specific study	ECF-HANFORD-11-0158	2,000	PRG (mod) - killdeer	CHPRC-01311, Table 3-1	1,600	PRG (mod-high) - deer mouse	CHPRC-01311, Table 3-1
Methoxychlor	72-43-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	21,800	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Methylene chloride	75-09-2	Non-Rad	ug/kg	--	--	--	--	--	--	166,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	504,000	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Molybdenum	7439-98-7	Non-Rad	ug/kg	2,000	PRG - ORNL	ES/ER/TM-85/R3	28,000	PRG - Site specific study	ECF-HANFORD-11-0158	95,000	PRG (mod) - killdeer	CHPRC-01311, Table 3-1	5,700	PRG (mod) - deer mouse	CHPRC-01311, Table 3-1
m-Xylene	108-38-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Naphthalene	91-20-3	Non-Rad	ug/kg	--	--	--	29,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	340,000	SSL (LOAEL) - California quail	CHPRC-00784, Table 6-13	100,000	SSL (LOAEL) - great basin pocket mouse	CHPRC-00784, Table 6-13
n-Butylbenzene	104-51-8	Non-Rad	ug/kg	--	--	--	--	--	--	193,000	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	1.45E+06	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Nickel	7440-02-0	Non-Rad	ug/kg	38,000	PRG - EcoSSL	OSWER Directive 9285.7-76	280,000	PRG - EcoSSL	OSWER Directive 9285.7-76	361,000	PRG (mod) - killdeer	CHPRC-01311, Table 3-1	247,000	PRG (mod-high) - deer mouse	CHPRC-01311, Table 3-1
Nitrate	14797-55-8	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	3.40E+08	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Nitrite	14797-65-0	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	3.40E+08	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Nitrobenzene	98-95-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen in Nitrate	NO3-N	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen in Nitrite	NO2-N	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Nitrogen in Nitrite and Nitrate	NO2+NO3-N	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
n-Nitrosodi-n-dipropylamine	621-64-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
N-Nitrosodiphenylamine	86-30-6	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
o-Xylene	95-47-6	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
PCB		Non-Rad	ug/kg	40,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	1,820	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	1,470	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Pentachlorophenol	87-86-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Phenanthrene	85-01-8	Non-Rad	ug/kg	--	--	--	29,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	943,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	5.92E+06	SSL (NOAEL) - grasshopper mouse	DOE/EH-0676 and CHPRC-00784, Table 6-13

Table M-3. Summary of Ecological Soil Preliminary Remediation Goals

Analyte Name	CAS No	Analyte Group	Units	Plant ESL	Plant ESL Basis	Plant ESL Source	Invertebrate ESL	Invertebrate ESL Basis	Invertebrate ESL Source	Avian ESL	Avian ESL Basis	Avian ESL Source	Mammal ESL	Mammal ESL Basis	Mammal ESL Source
Phenol	108-95-2	Non-Rad	ug/kg	70,000	SSL - ORNL	ES/ER/TM-85/R3	30,000	SSL - ORNL	ES/ER/TM-126/R2	--	--	--	1.51E+06	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Phosphate	14265-44-2	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Phosphorus	7723-14-0	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Potassium	7440-09-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Pyrene	129-00-0	Non-Rad	ug/kg	--	--	--	18,000	SSL - EcoSSL	OSWER Dir. 9285.7-75	1,860	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	600,000	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Selenium	7782-49-2	Non-Rad	ug/kg	2,020	PRG - Site specific study	ECF-HANFORD-11-0158	4,100	PRG - EcoSSL	OSWER Directive 9285.7-72	2,400	PRG (mod) - killdeer	CHPRC-01311, Table 3-1	1,400	PRG (mod-high) - deer mouse	CHPRC-01311, Table 3-1
Silicon	7440-21-3	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Silver	7440-22-4	Non-Rad	ug/kg	560,000	PRG - EcoSSL	OSWER Directive 9285.7-77	2,990	PRG - Site specific study	ECF-HANFORD-11-0158	983,000	PRG (mod) - killdeer	CHPRC-01311, Table 3-1	9.81E+06	PRG (mod-high) - deer mouse	CHPRC-01311, Table 3-1
Sodium	7440-23-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Strontium	7440-24-6	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	1.21E+06	PRG (mod) - great basin pocket mouse	CHPRC-01311, Table 3-1
Styrene	100-42-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Sulfate	14808-79-8	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Sulfide	12597-04-5	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Tetrachloroethene	127-18-4	Non-Rad	ug/kg	--	--	--	--	--	--	164,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	69,800	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Thallium	7440-28-0	Non-Rad	ug/kg	1,000	PRG - ORNL	ES/ER/TM-85/R3	459	PRG - Site specific study	ECF-HANFORD-11-0158	--	--	--	6,200	PRG (mod) - deer mouse	CHPRC-01311, Table 3-1
Tin	7440-31-5	Non-Rad	ug/kg	838,000	PRG - Site specific study	ECF-HANFORD-11-0158	838,000	PRG - Site specific study	ECF-HANFORD-11-0158	84,000	PRG (LOAEL) - killdeer-Calculated	CHPRC-01311, Table 3-1	130,000	PRG (LOAEL) - great basin pocket mouse	CHPRC-01311, Table 3-1
Titanium	7440-32-6	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Toluene	108-88-3	Non-Rad	ug/kg	200,000	SSL - ORNL	ES/ER/TM-85/R3	--	--	--	195,000	SSL (NOAEL) - killdeer	CHPRC-00784, Table 6-13	5.20E+06	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Total petroleum hydrocarbons	TPH	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Total petroleum hydrocarbons - diesel range	TPHDIESEL	Non-Rad	ug/kg	--	--	--	200,000	SSL - MTCA	WAC 173-340, Table 749-3	3.56E+08	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	4.52E+08	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Total petroleum hydrocarbons - kerosene range	TPHKEROSENE	Non-Rad	ug/kg	--	--	--	--	--	--	3.56E+08	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	4.52E+08	SSL (LOAEL) - deer mouse	CHPRC-00784, Table 6-13
Total petroleum hydrocarbons - motor oil (high boiling)	TPH/OILH	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Toxaphene	8001-35-2	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
trans-1,2-Dichloroethylene	156-60-5	Non-Rad	ug/kg	--	--	--	--	--	--	165,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	453,000	SSL (NOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
trans-1,3-Dichloropropene	10061-02-6	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Trichloroethene	79-01-6	Non-Rad	ug/kg	--	--	--	--	--	--	165,000	SSL (LOAEL) - killdeer	CHPRC-00784, Table 6-13	70,000	SSL (LOAEL) - grasshopper mouse	CHPRC-00784, Table 6-13
Trichloromonofluoromethane	75-69-4	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Uranium	7440-61-1	Non-Rad	ug/kg	250,000	PRG - PNEC	Sheppard et al., 2005	100,000	PRG - PNEC	Sheppard et al., 2005	82,000	PRG (mod) - red-tailed hawk	CHPRC-01311, Table 3-1	40,000	PRG (high) - badger	CHPRC-01311, Table 3-1
Vanadium	7440-62-2	Non-Rad	ug/kg	89,400	PRG - Site specific study	ECF-HANFORD-11-0158	116,000	PRG - Site specific study	ECF-HANFORD-11-0158	43,000	PRG (mod) - killdeer	CHPRC-01311, Table 3-1	260,000	PRG (high) - great basin pocket mouse	CHPRC-01311, Table 3-1
Vinyl acetate	108-05-4	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Vinyl chloride	75-01-4	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Xylenes (total)	1330-20-7	Non-Rad	ug/kg	--	--	--	--	--	--	149,000	SSL (NOAEL) - California quail	CHPRC-00784, Table 6-13	826,000	SSL (LOAEL) - great basin pocket mouse	CHPRC-00784, Table 6-13
Zinc	7440-66-6	Non-Rad	ug/kg	621,000	PRG - site-specific NOEC	RCBRA - DOE/RL-2007-21	8.98E+06	PRG - Site specific study	ECF-HANFORD-11-0158	856,000	PRG (high) - killdeer	CHPRC-01311, Table 3-1	1.04E+06	PRG (mod) - badger	CHPRC-01311, Table 3-1
Zirconium	7440-67-7	Non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--
Americium-241	14596-10-2	Rad	pCi/g	21,500	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	11,900	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	4,840	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Carbon-14	14762-75-5	Rad	pCi/g	60,700	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	50	PRG (LOAEL) - red-tailed hawk - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	32	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Cesium-137	10045-97-3	Rad	pCi/g	2,210	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	1,430	PRG (LOAEL) - red-tailed hawk - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	924	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Cobalt-60	10198-40-0	Rad	pCi/g	6,130	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	805	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	805	PRG (LOAEL) - mice - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Curium-243	15757-87-6	Rad	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--
Curium-244	13981-15-2	Rad	pCi/g	153,000	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	1.05E+06	PRG (LOAEL) - red-tailed hawk - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	50,800	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Curium-245	15621-76-8	Rad	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--
Europium-152	14683-23-9	Rad	pCi/g	14,700	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	1,740	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	1,740	PRG (LOAEL) - mice - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Europium-154	15585-10-1	Rad	pCi/g	12,500	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	1,610	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	1,610	PRG (LOAEL) - mice - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Europium-155	14391-16-3	Rad	pCi/g	153,000	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	33,400	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	33,400	PRG (LOAEL) - mice - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Nickel-63	13981-37-8	Rad	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--
Plutonium-238	13981-16-3	Rad	pCi/g	17,500	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	20,900	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	5,980	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Plutonium-239/240	PU-239/240	Rad	pCi/g	12,700	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	22,300	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	6,270	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Plutonium-241	14119-32-5	Rad	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--
Potassium-40	13966-00-2	Rad	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--
Radium-226	13982-63-3	Rad	pCi/g	288	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	58	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	165	PRG (LOAEL) - deer mouse - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Radium-226 measured via daughter isotope		Rad	pCi/g	288	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	58	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	165	PRG (LOAEL) - deer mouse - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Radium-228	15262-20-1	Rad	pCi/g	245	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	55	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	165	PRG (LOAEL) - deer mouse - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Technetium-99	14133-76-7	Rad	pCi/g	21,900	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	5,360	PRG (LOAEL) - California quail - Calculated	CHPRC-00784, Table 6-13	8,670	PRG (LOAEL) - great basin pocket mouse-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Thorium-228	14274-82-9	Rad	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--
Thorium-230	14269-63-7	Rad	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--
Thorium-232	TH-232	Rad	pCi/g	23,500	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	5,070	PRG (LOAEL) - California quail - Calculated	CHPRC-00784, Table 6-13	4,560	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Thorium-232 measured via daughter isotope		Rad	pCi/g	23,500	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	5,070	PRG (LOAEL) - California quail - Calculated	CHPRC-00784, Table 6-13	4,560	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Total beta radiostrontium	SR-RAD	Rad	pCi/g	3,580	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	112	PRG (LOAEL) - red-tailed hawk - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	91	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Strontium-90	10098-97-2	Rad	pCi/g	3,580	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	112	PRG (LOAEL) - red-tailed hawk - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	91	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Tritium (hydrogen 3)	10028-17-8	Rad	pCi/g	1.68E+06	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	936	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	420	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Uranium-233/234	U-233/234	Rad	pCi/g	51,600	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	6,370	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	14,200	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Uranium-235	15117-96-1	Rad	pCi/g	27,400	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	4,360	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	8,060	PRG (LOAEL) - badger - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Uranium-238	U-238	Rad	pCi/g	15,700	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	5,150	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	11,000	PRG (LOAEL) - deer mouse - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13

Table M-3. Summary of Ecological Soil Preliminary Remediation Goals

Analyte Name	CAS No	Analyte Group	Units	Plant ESL	Plant ESL Basis	Plant ESL Source	Invertebrate ESL	Invertebrate ESL Basis	Invertebrate ESL Source	Avian ESL	Avian ESL Basis	Avian ESL Source	Mammal ESL	Mammal ESL Basis	Mammal ESL Source
Uranium-238 measured via daughter isotope		Rad	pCi/g	15,700	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	5,150	PRG (LOAEL) - killdeer-Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13	11,000	PRG (LOAEL) - deer mouse - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-13
Iodine-129	15046-84-1	Rad	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--
Neptunium-237	13994-20-2	Rad	pCi/g	8,150	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	--	--	--	--	--	--
Nickel-59	14336-70-0	Rad	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--
Niobium-94	14681-63-1	Rad	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--
Curium-243/244	CM-243/244	Rad	pCi/g	153,000	SSL - BCG - Calculated	DOE/EH-0676 and CHPRC-00784, Table 6-1	--	--	--	--	--	--	--	--	--
Silver-108	14391-65-2	Rad	pCi/g	--	--	--	--	--	--	--	--	--	--	--	--
Total petroleum hydrocarbons - diesel range extended to C36	TPHDIESELEXT	non-Rad	ug/kg	--	--	--	--	--	--	--	--	--	--	--	--

BCG = biota concentration guide
DOE = department of energy
EcoSSL = Ecological soil screening level
EPA = United States Environmental Protection Agency
High = estimate of analyte in receptor diet based upon regression model with r2 >0.1 at p=0.05 with greater than 100 data points
mg/kg = Milligram per kilogram
mod = estimate of analyte in receptor diet based upon median BAF from between 10 and 100 data points
mod-high = estimate of analyte in receptor diet based upon regression model with r2 >0.1 at p=0.05 with greater than 100 data points for one dietary item and estimated using a median BAF from between 10 and 100 data points forthe other dietary item
MTCA = Model Toxic Control Act
Non-Rad = non radiological chemical
ORNL = Oakridge National Laboratory
pCi/g = Pico Curie per gram
pCi/g = pico curies per gram
PNEC = probable no effect concentration
PRG = preliminary rmediation goal
Rad = radiation wave emitting chemical
SSL = soil screening level
TPH = Total petroleum hydrocarbons
ug/kg = micrograms per kilogram

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Table M-4. Summary of Sediment Ecological Screening Levels

Analyte Name	CAS#	Units	Lower Threshold ESL	Lower Threshold Sediment ESL Basis	Lower Threshold ESL Source	Upper Threshold Sediment ESL	Upper Threshold ESLBasis	Upper Threshold ESL Source
1,1*-Biphenyl,2,3*,4,4*,5-pentachloro-	31508-00-6	ug/kg	--	--	--	--	--	--
1,2,4-Trichlorobenzene	120-82-1	ug/kg	9,600	EqP at 1% TOC using SCV	ES/ER/TM-95/R4	--	--	--
1,2-Dichlorobenzene	95-50-1	ug/kg	--	--	--	--	--	--
1,3-Dichlorobenzene	541-73-1	ug/kg	--	--	--	--	--	--
1,4-Dichlorobenzene	106-46-7	ug/kg	--	--	--	--	--	--
2,2*,3,3*,4,4*,5,5*,6,6*-Decachlorobiphenyl	2051-24-3	ug/kg	--	--	--	--	--	--
2,2*,3,3*,4,4*,5,5*,6-Nonachlorobiphenyl	40186-72-9	ug/kg	--	--	--	--	--	--
2,2*,3,3*,4,4*,5,6-Octachlorobiphenyl	52663-78-2	ug/kg	--	--	--	--	--	--
2,2*,3,3*,4,4*,5-Heptachlorobiphenyl	35065-30-6	ug/kg	--	--	--	--	--	--
2,2*,3,3*,4,4*-Hexachlorobiphenyl	38380-07-3	ug/kg	--	--	--	--	--	--
2,2*,3,3*,4,5,6,6*-Octachlorobiphenyl	52663-73-7	ug/kg	--	--	--	--	--	--
2,2*,3,4*,5,5*,6-Heptachlorobiphenyl	52663-68-0	ug/kg	--	--	--	--	--	--
2,2*,3,4,4*,5*-Hexachlorobiphenyl	35065-28-2	ug/kg	--	--	--	--	--	--
2,2*,3,4,4*,5,5*-Heptachlorobiphenyl	35065-29-3	ug/kg	--	--	--	--	--	--
2,2*,3,5*-Tetrachloro-1-1*-biphenyl	41464-39-5	ug/kg	--	--	--	--	--	--
2,2*,4,4*,5,5*,-Hexachloro-Biphenyl	35065-27-1	ug/kg	--	--	--	--	--	--
2,2*,4,5,5*-Pentachlorobiphenyl	37680-73-2	ug/kg	--	--	--	--	--	--
2,2*,5,5*-Tetrachlorobiphenyl	35693-99-3	ug/kg	--	--	--	--	--	--
2,2*,5-Trichlorobiphenyl	37680-65-2	ug/kg	--	--	--	--	--	--
2,3*,4,4*-Tetrachlorobiphenyl	32598-10-0	ug/kg	--	--	--	--	--	--
2,3,3*,4,4*-Pentachlorobiphenyl	32598-14-4	ug/kg	--	--	--	--	--	--
2,4*-Dichlorobiphenyl	34883-43-7	ug/kg	--	--	--	--	--	--
2,4,4*-Trichlorobiphenyl	7012-37-5	ug/kg	--	--	--	--	--	--
2,4,5-Trichlorophenol	95-95-4	ug/kg	10	Dutch -target	MHSPE, 2001	22,000	dutch intervention	MHSPE, 2001
2,4,6-Trichlorophenol	88-06-2	ug/kg	10	Dutch -target	MHSPE, 2001	110,000	dutch intervention	MHSPE, 2001
2,4-Dichlorophenol	120-83-2	ug/kg	--	--	--	--	--	--
2,4-Dimethylphenol	105-67-9	ug/kg	--	--	--	--	--	--
2,4-Dinitrophenol	51-28-5	ug/kg	--	--	--	--	--	--
2,4-Dinitrotoluene	121-14-2	ug/kg	--	--	--	--	--	--
2,6-Dinitrotoluene	606-20-2	ug/kg	--	--	--	--	--	--
2-Chloronaphthalene	91-58-7	ug/kg	--	--	--	--	--	--
2-Chlorophenol	95-57-8	ug/kg	55	Dutch -target	MHSPE, 2001	7,800	MHSPE, 2001	MHSPE, 2001
2-Methylnaphthalene	91-57-6	ug/kg	470	SQS	Ecology Publication 03-09-088	560	CSL	Ecology Publication 03-09-088
2-Methylphenol [cresol, o-]	95-48-7	ug/kg	12	EqP at 1% TOC using SCV	ES/ER/TM-95/R4	50,000	dutch intervention	MHSPE, 2001
2-Nitroaniline	88-74-4	ug/kg	--	--	--	--	--	--
2-Nitrophenol	88-75-5	ug/kg	--	--	--	--	--	--
3,3*,4,4*,5-Pentachlorobiphenyl	57465-28-8	ug/kg	--	--	--	--	--	--
3,3*,4,4*-Tetrachlorobiphenyl	32598-13-3	ug/kg	--	--	--	--	--	--
3,3*-Dichlorobenzidine	91-94-1	ug/kg	--	--	--	--	--	--
3+4 Methylphenol [cresol, m+p]	65794-96-9	ug/kg	260	SQS	Ecology Publication 11-09-054	2,000	CSL	Ecology Publication 03-09-088
3-Nitroaniline	99-09-2	ug/kg	--	--	--	--	--	--
4,6-Dinitro-2-methylphenol	534-52-1	ug/kg	--	--	--	--	--	--
4-Bromophenylphenyl ether	101-55-3	ug/kg	--	--	--	--	--	--
4-Chloro-3-methylphenol	59-50-7	ug/kg	--	--	--	--	--	--
4-Chloroaniline	106-47-8	ug/kg	--	--	--	--	--	--
4-Chlorophenylphenyl ether	7005-72-3	ug/kg	--	--	--	--	--	--
4-Nitroaniline	100-01-6	ug/kg	--	--	--	--	--	--
4-Nitrophenol	100-02-7	ug/kg	--	--	--	--	--	--
Acenaphthene	83-32-9	ug/kg	1,060	SQS	Ecology Publication 03-09-088	1,320	CSL	Ecology Publication 03-09-088
Acenaphthylene	208-96-8	ug/kg	470	SQS	Ecology Publication 03-09-088	640	CSL	Ecology Publication 03-09-088
acetone	67-64-1	ug/kg	8.7	EqP at 1% TOC using SCV	ES/ER/TM-95/R4	--	--	--

Table M-4. Summary of Sediment Ecological Screening Levels

Analyte Name	CAS#	Units	Lower Threshold ESL	Lower Threshold Sediment ESL Basis	Lower Threshold ESL Source	Upper Threshold Sediment ESL	Upper Threshold ESLBasis	Upper Threshold ESL Source
Aldrin	309-00-2	ug/kg	2.0	LEL	Buchman, 2008	8.0	SEL - Concentration in ug/g organic carbon	Buchman, 2008
Alpha-BHC	319-84-6	ug/kg	6.0	LEL	Buchman, 2008	100	SEL - Concentration in ug/g organic carbon	Buchman, 2008
alpha-Chlordane	5103-71-9	ug/kg	0.030	Dutch -target	MHSPE, 2001	4,000	dutch intervention	MHSPE, 2001
Aluminum	7429-90-5	ug/kg	1.40E+07	ERL	Buchman, 2008	2.50E+07	ARCS	Buchman, 2008
Anthracene	120-12-7	ug/kg	1,200	SQS	Ecology Publication 03-09-088	1,580	CSL	Ecology Publication 03-09-088
Antimony	7440-36-0	ug/kg	400	SQS	Ecology Publication 03-09-088	600	CSL	Ecology Publication 03-09-088
Aroclor-1016	12674-11-2	ug/kg	7.0	LEL	Buchman, 2008	53,000	SEL - Concentration in ug/g organic carbon	Buchman, 2008
Aroclor-1221	11104-28-2	ug/kg	--	--	--	--	--	--
Aroclor-1232	11141-16-5	ug/kg	--	--	--	--	--	--
Aroclor-1242	53469-21-9	ug/kg	--	--	--	--	--	--
Aroclor-1248	12672-29-6	ug/kg	30	LEL	Buchman, 2008	150,000	SEL - Concentration in ug/g organic carbon	Buchman, 2008
Aroclor-1254	11097-69-1	ug/kg	60	LEL	Buchman, 2008	340,000	SEL - Concentration in ug/g organic carbon	Buchman, 2008
Aroclor-1260	11096-82-5	ug/kg	5.0	LEL	Buchman, 2008	240,000	SEL - Concentration in ug/g organic carbon	Buchman, 2008
Arsenic	7440-38-2	ug/kg	14,000	SQS	Ecology Publication 11-09-054	120,000	CSL	Ecology Publication 03-09-088
Barium	7440-39-3	ug/kg	300,000		Crommentuijn, 2000	--	--	--
Benzo[a]anthracene	56-55-3	ug/kg	4,260	SQS	Ecology Publication 03-09-088	5,800	CSL	Ecology Publication 03-09-088
Benzo[a]pyrene	50-32-8	ug/kg	3,300	SQS	Ecology Publication 03-09-088	4,810	CSL	Ecology Publication 03-09-088
Benzo[b]fluoranthene	205-99-2	ug/kg	11,000	SQS	Ecology Publication 03-09-088	14,000	CSL	Ecology Publication 03-09-088
Benzo[ghi]perylene	191-24-2	ug/kg	4,020	SQS	Ecology Publication 03-09-088	5,200	CSL	Ecology Publication 03-09-088
Benzo[k]fluoranthene	207-08-9	ug/kg	11,000	SQS	Ecology Publication 03-09-088	14,000	CSL	Ecology Publication 03-09-088
Beryllium	7440-41-7	ug/kg	--	--	--	--	--	--
beta-1,2,3,4,5,6-Hexachlorocyclohexane	319-85-7	ug/kg	7.2	SQS	Ecology Publication 11-09-054	11	CSL	Ecology Publication 03-09-088
Bis[2-chloro-1-methylethyl]ether	108-60-1	ug/kg	--	--	--	--	--	--
Bis[2-Chloroethoxy]methane	111-91-1	ug/kg	--	--	--	--	--	--
Bis[2-chloroethyl] ether	111-44-4	ug/kg	--	--	--	--	--	--
Bis[2-ethylhexyl] phthalate	117-81-7	ug/kg	500	SQS	Ecology Publication 11-09-054	22,000	CSL	Ecology Publication 03-09-088
Bismuth	7440-69-9	ug/kg	--	--	--	--	--	--
Boron	7440-42-8	ug/kg	--	--	--	--	--	--
Butylbenzylphthalate	85-68-7	ug/kg	260	SQS	Ecology Publication 03-09-088	370	CSL	Ecology Publication 03-09-088
Cadmium	7440-43-9	ug/kg	2,100	SQS	Ecology Publication 11-09-054	5,400	CSL	Ecology Publication 11-09-054
Calcium	7440-70-2	ug/kg	--	--	--	--	--	--
Calculated Total Uranium	calc_tot_U	ug/kg	100,000	PNEC	Sheppard et al. 2005	--	--	--
Carbazole	86-74-8	ug/kg	900	SQS	Ecology Publication 11-09-054	1,100	CSL	Ecology Publication 11-09-054
Chloride	16887-00-6	ug/kg	--	--	--	--	--	--
Chromium	7440-47-3	ug/kg	72,000	SQS	Ecology Publication 11-09-054	88,000	CSL	Ecology Publication 11-09-054
Chrysene	218-01-9	ug/kg	5,940	SQS	Ecology Publication 03-09-088	6,400	CSL	Ecology Publication 03-09-088
Cobalt	7440-48-4	ug/kg	50,000	LEL	Buchman, 2008	--	--	--
Copper	7440-50-8	ug/kg	400,000	SQS	Ecology Publication 11-09-054	1.20E+06	CSL	Ecology Publication 11-09-054
Delta-BHC	319-86-8	ug/kg	12	EqP at 1% TOC using SCV	ES/ER/TM-95/R4	2,000	dutch intervention	MHSPE, 2001
Dibenz[a,h]anthracene	53-70-3	ug/kg	800	SQS	Ecology Publication 03-09-088	840	CSL	Ecology Publication 03-09-088
Dibenzofuran	132-64-9	ug/kg	200	SQS	Ecology Publication 11-09-054	680	CSL	Ecology Publication 11-09-054
Dichlorodiphenyldichloroethane	72-54-8	ug/kg	310	SQS	Ecology Publication 11-09-054	860	CSL	Ecology Publication 11-09-054
Dichlorodiphenyldichloroethylene	72-55-9	ug/kg	21	SQS	Ecology Publication 11-09-054	33	CSL	Ecology Publication 11-09-054
Dichlorodiphenyltrichloroethane	50-29-3	ug/kg	100	SQS	Ecology Publication 11-09-054	8,100	CSL	Ecology Publication 11-09-054
Dieldrin	60-57-1	ug/kg	4.9	SQS	Ecology Publication 11-09-054	9.3	CSL	Ecology Publication 11-09-054

Table M-4. Summary of Sediment Ecological Screening Levels

Analyte Name	CAS#	Units	Lower Threshold ESL	Lower Threshold Sediment ESL Basis	Lower Threshold ESL Source	Upper Threshold Sediment ESL	Upper Threshold ESLBasis	Upper Threshold ESL Source
Diethylphthalate	84-66-2	ug/kg	530	Dutch -target	MHSPE, 2001	53,000	dutch intervention	MHSPE, 2001
Dimethyl phthalate	131-11-3	ug/kg	46	SQS	Ecology Publication 03-09-088	440	CSL	Ecology Publication 03-09-088
Di-n-butylphthalate	84-74-2	ug/kg	380	SQS	Ecology Publication 11-09-054	1,000	CSL	Ecology Publication 11-09-054
Di-n-octylphthalate	117-84-0	ug/kg	39	SQS	Ecology Publication 11-09-054	1,100	CSL	Ecology Publication 11-09-054
Endosulfan I	959-98-8	ug/kg	5.0	EqP at 1% TOC using SCV	ES/ER/TM-95/R4	4,000	dutch intervention	MHSPE, 2001
Endosulfan II	33213-65-9	ug/kg	5.0	EqP at 1% TOC using SCV	ES/ER/TM-95/R4	--	--	--
Endosulfan sulfate	1031-07-8	ug/kg	5.0	EqP at 1% TOC using SCV	ES/ER/TM-95/R4	--	--	--
Endrin	72-20-8	ug/kg	2.2	TEC	MacDonald, 2000	207	PEC	MacDonald, 2000
Endrin aldehyde	7421-93-4	ug/kg	2.2	TEC	MacDonald, 2000	207	PEC	MacDonald, 2000
Endrin ketone	53494-70-5	ug/kg	8,500	SQS	Ecology Publication 11-09-054	--	--	--
Fluoranthene	206-44-0	ug/kg	11,000	SQS	Ecology Publication 03-09-088	15,000	CSL	Ecology Publication 03-09-088
Fluorene	86-73-7	ug/kg	1,000	SQS	Ecology Publication 03-09-088	3,000	CSL	Ecology Publication 03-09-088
Fluoride	16984-48-8	ug/kg	--	--	--	--	--	--
Gamma-BHC [Lindane]	58-89-9	ug/kg	2.4	TEC	MacDonald, 2000	5.0	PEC	MacDonald, 2000
gamma-Chlordane	5566-34-7	ug/kg	0.030	Dutch -target		4,000	dutch intervention	MHSPE, 2001
Heptachlor	76-44-8	ug/kg	68	EqP at 1% TOC using SCV	ES/ER/TM-95/R4	4,000	dutch intervention	MHSPE, 2001
Heptachlor epoxide	1024-57-3	ug/kg	2.5	TEC	MacDonald, 2000	16	PEC	MacDonald, 2000
Hexachlorobenzene	118-74-1	ug/kg	20	LEL	Buchman, 2008	240	SEL - Concentration in ug/g organic carbon	Buchman, 2008
Hexachlorobutadiene	87-68-3	ug/kg	--	--	--	--	--	--
Hexachlorocyclopentadiene	77-47-4	ug/kg	--	--	--	--	--	--
Hexachloroethane	67-72-1	ug/kg	1,000	EqP at 1% TOC using SCV	ES/ER/TM-95/R4	--	--	--
Hexavalent Chromium	18540-29-9	ug/kg	--	--	--	--	--	--
Indeno[1,2,3-cd]pyrene	193-39-5	ug/kg	4,120	SQS	Ecology Publication 03-09-088	5,300	CSL	Ecology Publication 03-09-088
Iron	7439-89-6	ug/kg	2.00E+07	LEL	Buchman, 2008	--	--	--
Isophorone	78-59-1	ug/kg	--	--	--	--	--	--
Lead	7439-92-1	ug/kg	360,000	SQS	Ecology Publication 11-09-054	1.30E+06	CSL	Ecology Publication 11-09-054
Lithium	7439-93-2	ug/kg	--	--	--	--	--	--
Magnesium	7439-95-4	ug/kg	--	--	--	--	--	--
Manganese	7439-96-5	ug/kg	460,000	LEL	Buchman, 2008	1.10E+06	SEL	Buchman, 2008
Mercury	7439-97-6	ug/kg	660	SQS	Ecology Publication 11-09-054	800	CSL	Ecology Publication 11-09-054
Methoxychlor	72-43-5	ug/kg	19	EqP at 1% TOC using SCV	ES/ER/TM-95/R4	--	--	--
Molybdenum	7439-98-7	ug/kg	250,000	MPC	Crommentuijn, 2000	--	--	--
Naphthalene	91-20-3	ug/kg	500	SQS	Ecology Publication 03-09-088	1,310	CSL	Ecology Publication 03-09-088
Nickel	7440-02-0	ug/kg	26,000	SQS	Ecology Publication 11-09-054	110,000	CSL	Ecology Publication 11-09-054
Nitrobenzene	98-95-3	ug/kg	--	--	--	--	--	--
Nitrogen in ammonia	NH3-N	ug/kg	--	--	--	--	--	--
Nitrogen in Nitrate	NO3-N	ug/kg	--	--	--	--	--	--
Nitrogen in Nitrite	NO2-N	ug/kg	--	--	--	--	--	--
Nitrogen, Kjeldahl total	N-KJELDAHL	ug/kg	--	--	--	--	--	--
N-Nitroso-di-n-dipropylamine	621-64-7	ug/kg	--	--	--	--	--	--
N-Nitrosodiphenylamine	86-30-6	ug/kg	--	--	--	--	--	--
PCB 126 Calculated TEQ Bird	BIRD_TEQ_PCB_126	ug/kg	--	--	--	--	--	--
PCB 126 Calculated TEQ Fish	FISH_TEQ_PCB_126	ug/kg	--	--	--	--	--	--
PCB 126 Calculated TEQ Mammal	MAMMAL_TEQ_PCB_126	ug/kg	--	--	--	--	--	--
PCB 77 Calculated TEQ Mammal	MAMMAL_TEQ_PCB_077	ug/kg	--	--	--	--	--	--
PCB 77 Calculated TEQ Bird	BIRD_TEQ_PCB_77	ug/kg	--	--	--	--	--	--
PCB 77 Calculated TEQ Fish	FISH_TEQ_PCB_77	ug/kg	--	--	--	--	--	--
Pentachlorophenol	87-86-5	ug/kg	1,200	SQS	Ecology Publication 11-09-054	1,200	CSL	Ecology Publication 11-09-054
Phenanthrene	85-01-8	ug/kg	6,100	SQS	Ecology Publication 03-09-088	7,600	CSL	Ecology Publication 03-09-088
Phenol	108-95-2	ug/kg	120	SQS	Ecology Publication 11-09-054	210	CSL	Ecology Publication 11-09-054

Table M-4. Summary of Sediment Ecological Screening Levels

Analyte Name	CAS#	Units	Lower Threshold ESL	Lower Threshold Sediment ESL Basis	Lower Threshold ESL Source	Upper Threshold Sediment ESL	Upper Threshold ESLBasis	Upper Threshold ESL Source
Phosphorus	7723-14-0	ug/kg	600,000	LEL	Buchman, 2008	2.00E+06	SEL	Buchman, 2008
Potassium	7440-09-7	ug/kg	--	--	--	--	--	--
Pyrene	129-00-0	ug/kg	8,800	SQS	Ecology Publication 03-09-088	16,000	CSL	Ecology Publication 03-09-088
Selenium	7782-49-2	ug/kg	11,000	SQS	Ecology Publication 11-09-054	20,000	CSL	Ecology Publication 11-09-054
Silicon	7440-21-3	ug/kg	--	--	--	--	--	--
Silver	7440-22-4	ug/kg	570	SQS	Ecology Publication 11-09-054	1,700	CSL	Ecology Publication 11-09-054
Sodium	7440-23-5	ug/kg	--	--	--	--	--	--
Strontium [elemental]	7440-24-6	ug/kg	--	--	--	--	--	--
Sulfate	14808-79-8	ug/kg	--	--	--	--	--	--
TEC Bird	TEC_BIRD	ug/kg	--	--	--	--	--	--
TEC Fish	TEC_FISH	ug/kg	--	--	--	--	--	--
TEC Mammal	TEC_MAMMAL	ug/kg	--	--	--	--	--	--
Thallium	7440-28-0	ug/kg	2,600		Crommentuijn, 2000	--	--	--
Tin	7440-31-5	ug/kg	239,000		Crommentuijn, 2000	2.20E+07	--	Crommentuijn, 2000
Titanium	7440-32-6	ug/kg	--	--	--	--	--	--
Toluene		ug/kg	50	EqP at 1% TOC using SCV	ES/ER/TM-95/R4	--	--	--
Total PCB	TOTALPCB	ug/kg	110	SQS	Ecology Publication 11-09-054	2,500	CSL	Ecology Publication 11-09-054
Total petroleum hydrocarbons	TPH	ug/kg	17,000	SQS	Ecology Publication 11-09-054	30,000	CSL	Ecology Publication 11-09-054
Total petroleum hydrocarbons - diesel range	TPHDIESEL	ug/kg	340,000	SQS	Ecology Publication 11-09-054	510,000	CSL	Ecology Publication 11-09-054
Total petroleum hydrocarbons - gasoline range	TPHGASOLINE	ug/kg	--	--	--	--	--	--
Total petroleum hydrocarbons - motor oil [high boiling]	TPH/OILH	ug/kg	--	--	--	--	--	--
Toxaphene	8001-35-2	ug/kg	0.10	TEL	MacDonald, 2000	--	--	--
Uranium [inorganic]	7440-61-1	ug/kg	100,000	PNEC	Sheppard et al., 2005	--	--	--
Vanadium	7440-62-2	ug/kg	90,000	PNEC	Environment Canada, 2010	--	--	--
Zinc	7440-66-6	ug/kg	3.20E+06	SQS	Ecology Publication 11-09-054	4.20E+06	CSL	Ecology Publication 11-09-054
Zirconium	7440-67-7	ug/kg	--	--	--	--	--	--
Americium-241	14596-10-2	pCi/g	5,150	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Antimony-124	14683-10-4	pCi/g	7,030	No BCG available; value for Sb-125 used. Riparian animal sediment	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Antimony-125	14234-35-6	pCi/g	7,030	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Barium-133	13981-41-4	pCi/g	230	No BCG available; value for Ba140 used. Riparian animal sediment	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Barium-140	14798-08-4	pCi/g	230	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Carbon-14	14762-75-5	pCi/g	59,000	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Cerium/Praseodymium-144	CE/PR-144	pCi/g	2,900	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Cerium-139	CE-139	pCi/g	2,900	No BCG available; value for Ce-144 used. Riparian animal sediment	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Cerium-141	13967-74-3	pCi/g	15,900	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Cerium-144	14762-78-8	pCi/g	2,900	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Cesium-134	13967-70-9	pCi/g	1,480	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Cesium-136	CS-136	pCi/g	1,480	No BCG available; value for Cs-134 used. Riparian animal sediment	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Cesium-137	10045-97-3	pCi/g	3,120	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Chromium-51	14392-02-0	pCi/g	106,000	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Cobalt-57	13981-50-5	pCi/g	1,460	No BCG available; value for Co-60 used. Riparian animal sediment	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Cobalt-58	13981-38-9	pCi/g	3,800	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--

Table M-4. Summary of Sediment Ecological Screening Levels

Analyte Name	CAS#	Units	Lower Threshold ESL	Lower Threshold Sediment ESL Basis	Lower Threshold ESL Source	Upper Threshold Sediment ESL	Upper Threshold ESLBasis	Upper Threshold ESL Source
Cobalt-60	10198-40-0	pCi/g	1,460	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Europium-152	14683-23-9	pCi/g	3,040	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Europium-154	15585-10-1	pCi/g	2,570	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Europium-155	14391-16-3	pCi/g	31,600	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Iodine-131	10043-66-0	pCi/g	5,490	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Neptunium-237	13994-20-2	pCi/g	7,630	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Plutonium-238	13981-16-3	pCi/g	5,730	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Plutonium-239	15117-48-3	pCi/g	5,860	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Plutonium-239/240	PU-239/240	pCi/g	5,860	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Potassium-40	13966-00-2	pCi/g	4,430	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Radium-223	15623-45-7	pCi/g	88	No BCG available; value for Ra-228 used. Riparian animal sediment	DOE-STD-1153-2002	--	--	--
Radium-226	13982-63-3	pCi/g	101	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Radium-228	15262-20-1	pCi/g	88	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Selenium-75	SE-75	pCi/g	9,570	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Strontium-85	13967-73-2	pCi/g	582	No BCG available; value for Sr-90 used. Riparian animal sediment	DOE-STD-1153-2002	--	--	--
Strontium-90	10098-97-2	pCi/g	582	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Technetium-99	14133-76-7	pCi/g	42,200	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Thorium-228	14274-82-9	pCi/g	805	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Thorium-230	14269-63-7	pCi/g	10,400	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Thorium-232	TH-232	pCi/g	1,300	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Thorium-234	15065-10-8	pCi/g	4,330	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Tritium	10028-17-8	pCi/g	374,000	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Uranium [radionuclide]	U_rad	pCi/g	2,490	No BCG available; value for Ur-238 used. Riparian animal sediment	DOE-STD-1153-2002	--	--	--
Uranium-233/234	U-233/234	pCi/g	5,270	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Uranium-235	15117-96-1	pCi/g	3,730	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Uranium-236	13982-70-2	pCi/g	2,490	No BCG available; value for Ur-238 used. Riparian animal sediment	DOE-STD-1153-2002	--	--	--
Uranium-238	U-238	pCi/g	2,490	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Zinc-65	13982-39-3	pCi/g	1,430	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Zirconium/Niobium-95	ZR/NB-95	pCi/g	2,330	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Zirconium-95	13967-71-0	pCi/g	2,330	BCG riparian animal	DOE-STD-1153-2002	--	--	--
Actinium-228	14331-83-0	pCi/g	--	--	--	--	--	--
Beryllium-7	13966-02-4	pCi/g	--	--	--	--	--	--
Gross alpha	12587-46-1	pCi/g	--	--	--	--	--	--
Gross beta	12587-47-2	pCi/g	--	--	--	--	--	--
Iron-59	14596-12-4	pCi/g	--	--	--	--	--	--
Lanthanum-140	13981-28-7	pCi/g	--	--	--	--	--	--
Manganese-54	13966-31-9	pCi/g	--	--	--	--	--	--
Molybdenum-99	14119-15-4	pCi/g	--	--	--	--	--	--
Niobium-94	14681-63-1	pCi/g	--	--	--	--	--	--
Niobium-95	13967-76-5	pCi/g	--	--	--	--	--	--
Ruthenium-103	13968-53-1	pCi/g	--	--	--	--	--	--
Ruthenium-106	13967-48-1	pCi/g	--	--	--	--	--	--
Silver-110 [metastable]	AG-110M	pCi/g	--	--	--	--	--	--
Tellurium-129M	TE-129M	pCi/g	--	--	--	--	--	--

Table M-4. Summary of Sediment Ecological Screening Levels

Analyte Name	CAS#	Units	Lower Threshold ESL	Lower Threshold Sediment ESL Basis	Lower Threshold ESL Source	Upper Threshold Sediment ESL	Upper Threshold ESLBasis	Upper Threshold ESL Source
Tin-113	13966-06-8	pCi/g	NA	BCG riparian animal	RESRAD-BIOTA v1.5 (DOE/EH-0676)	--	--	--
Yttrium-88	Y-88	pCi/g	--	--	--	--	--	--

Acronyms and Notes:

BCG = biota concentration guide
CSL = cleanup screening level
EqP = value based on the use of equilibrium partitioning principles to establish a value from a surface water criteria
ERL = effects range low
ESL = ecological screening level
LEL = lower effect level
Lower threshold ESL - More conservative value used for screening purposes and generally (but not alwys) based on effects to 20% or less of test organisms below which significant effects are unlikely.
MPC = maximum permissable concentration
PEC = probable effect concentration
PEL = probable effect level
PNEC = probable no effect concentration
SEL = severe effect level
SQS = sediment quality standard
TEC = threshold effect concentration
TEL = threshold effect level
TOC = total organic carbon
Upper threshold ESL - Value used for defining for decision making based on effects to a greater number of individuals and above which effects are probable

Citations:

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Table M-5. Summary of Groundwater Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 Area Near-Shore Wells	1,1,1,2-Tetrachloroethane	630-20-6	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.090	0.090	--	--	--	--	--	--
300 Area Near-Shore Wells	1,1,1-Trichloroethane	71-55-6	ug/L	N	1/4/2006	4/5/2011	323	0	0	0.035	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,1,1-Trichloroethane	71-55-6	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,1,2,2-Tetrachloroethane	79-34-5	ug/L	N	6/4/2010	12/6/2010	28	0	0	0.098	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,1,2,2-Tetrachloroethane	79-34-5	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,1,2-Trichloroethane	79-00-5	ug/L	N	1/4/2006	4/5/2011	323	0	0	0.092	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,1,2-Trichloroethane	79-00-5	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,1-Dichloroethane	75-34-3	ug/L	N	1/4/2006	4/5/2011	323	0	0	0.046	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,1-Dichloroethane	75-34-3	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,1-Dichloroethene	75-35-4	ug/L	N	1/4/2006	4/5/2011	323	0	0	0.045	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,1-Dichloroethene	75-35-4	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,2,3-Trichloropropane	96-18-4	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.15	0.15	--	--	--	--	--	--
300 Area Near-Shore Wells	1,2,4-Trichlorobenzene	120-82-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	1,2-Dibromo-3-chloropropane	96-12-8	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.41	0.41	--	--	--	--	--	--
300 Area Near-Shore Wells	1,2-Dibromoethane	106-93-4	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.13	0.13	--	--	--	--	--	--
300 Area Near-Shore Wells	1,2-Dichlorobenzene	95-50-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	1,2-Dichloroethane	107-06-2	ug/L	N	1/4/2006	4/5/2011	323	0	0	0.10	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,2-Dichloroethane	107-06-2	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,2-Dichloroethene (Total)	540-59-0	ug/L	N	6/4/2010	12/6/2010	28	9	32	0.15	1.0	0.19	270	--	--	--	--
300 Area Near-Shore Wells	1,2-Dichloroethene (Total)	540-59-0	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,2-Dichloropropane	78-87-5	ug/L	N	6/4/2010	12/6/2010	28	0	0	0.097	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,2-Dichloropropane	78-87-5	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	1,3-Dichlorobenzene	541-73-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	1,4-Dichlorobenzene	106-46-7	ug/L	N	1/4/2006	4/5/2011	313	2	0.64	0.047	1.0	0.43	0.57	--	--	--	--
300 Area Near-Shore Wells	1,4-Dioxane	123-91-1	ug/L	N	1/4/2006	11/11/2010	132	0	0	2.0	12	--	--	--	--	--	--
300 Area Near-Shore Wells	1-Butanol	71-36-3	ug/L	N	1/4/2006	4/5/2011	313	0	0	2.6	100	--	--	--	--	--	--
300 Area Near-Shore Wells	2,4,5-Trichlorophenol	95-95-4	ug/L	N	1/19/2006	1/19/2006	2	0	0	25	25	--	--	--	--	--	--
300 Area Near-Shore Wells	2,4,6-Trichlorophenol	88-06-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	2,4-Dichlorophenol	120-83-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	2,4-Dimethylphenol	105-67-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	2,4-Dinitrophenol	51-28-5	ug/L	N	1/19/2006	1/19/2006	2	0	0	25	25	--	--	--	--	--	--
300 Area Near-Shore Wells	2,4-Dinitrotoluene	121-14-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	2,6-Dinitrotoluene	606-20-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	2-Butanone	78-93-3	ug/L	N	1/4/2006	4/5/2011	323	1	0.31	0.52	1.8	1.8	1.8	--	--	--	--
300 Area Near-Shore Wells	2-Butanone	78-93-3	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	2-Chloronaphthalene	91-58-7	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	2-Chlorophenol	95-57-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	2-Hexanone	591-78-6	ug/L	N	6/4/2010	12/6/2010	28	0	0	0.22	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	2-Hexanone	591-78-6	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	2-Methylnaphthalene	91-57-6	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	2-Methylphenol (cresol, o-)	95-48-7	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	2-Nitroaniline	88-74-4	ug/L	N	1/19/2006	1/19/2006	2	0	0	25	25	--	--	--	--	--	--
300 Area Near-Shore Wells	2-Nitrophenol	88-75-5	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	3 Methylphenol (cresol, m)	65794-96-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	3,3'-Dichlorobenzidine	91-94-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	3-Nitroaniline	99-09-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	25	25	--	--	--	--	--	--
300 Area Near-Shore Wells	4,4'-DDD (Dichlorodiphenyldichloroethane)	72-54-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	--	--	--	--
300 Area Near-Shore Wells	4,4'-DDE (Dichlorodiphenyldichloroethylene)	72-55-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	--	--	--	--
300 Area Near-Shore Wells	4,6-Dinitro-2-methylphenol	534-52-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	25	25	--	--	--	--	--	--
300 Area Near-Shore Wells	4-Bromophenylphenyl ether	101-55-3	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	4-Chloro-3-methylphenol	59-50-7	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	4-Chloroaniline	106-47-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	4-Chlorophenylphenyl ether	7005-72-3	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	4-Methyl-2-pentanone	108-10-1	ug/L	N	1/4/2006	4/5/2011	323	0	0	0.12	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	4-Methyl-2-pentanone	108-10-1	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--

Table M-5. Summary of Groundwater Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 Area Near-Shore Wells	4-Nitroaniline	100-01-6	ug/L	N	1/19/2006	1/19/2006	2	0	0	25	25	--	--	--	--	--	--
300 Area Near-Shore Wells	4-Nitrophenol	100-02-7	ug/L	N	1/19/2006	1/19/2006	2	0	0	25	25	--	--	--	--	--	--
300 Area Near-Shore Wells	Acenaphthene	83-32-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Acenaphthylene	208-96-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Acetonitrile	75-05-8	ug/L	N	6/4/2010	11/11/2010	18	0	0	2.0	2.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Acrolein	107-02-8	ug/L	N	6/4/2010	11/11/2010	18	0	0	2.8	2.8	--	--	--	--	--	--
300 Area Near-Shore Wells	Alkalinity	ALKALINITY	ug/L	N	1/4/2006	4/5/2011	277	277	100	--	--	60,000	170,000	--	--	147,127	21
300 Area Near-Shore Wells	Alkalinity	ALKALINITY	ug/L	Y	12/6/2010	12/6/2010	1	1	100	--	--	110,000	110,000	--	--	147,127	--
300 Area Near-Shore Wells	Allyl chloride	107-05-1	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.11	0.11	--	--	--	--	--	--
300 Area Near-Shore Wells	Alpha-BHC	319-84-6	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	--	--	--	--
300 Area Near-Shore Wells	Americium-241	14596-10-2	pCi/L	N	1/19/2006	1/19/2006	2	0	0	57	200	--	--	--	--	7.70E-05	--
300 Area Near-Shore Wells	Anthracene	120-12-7	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Benzene	71-43-2	ug/L	N	1/4/2006	4/5/2011	323	4	1.2	0.064	1.0	2.5	2.8	--	--	--	--
300 Area Near-Shore Wells	Benzene	71-43-2	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Benzo(a)anthracene	56-55-3	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Benzo(a)pyrene	50-32-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Benzo(b)fluoranthene	205-99-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Benzo(ghi)perylene	191-24-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Benzo(k)fluoranthene	207-08-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Beryllium	7440-41-7	ug/L	N	1/19/2006	4/5/2011	143	0	0	0.050	4.0	--	--	--	--	2.3	--
300 Area Near-Shore Wells	Beryllium	7440-41-7	ug/L	Y	1/4/2006	4/5/2011	179	5	2.8	0.10	10	0.21	3.4	--	--	2.3	1
300 Area Near-Shore Wells	Beryllium-7	13966-02-4	pCi/L	N	1/19/2006	1/19/2006	2	0	0	120	260	--	--	--	--	8.6	--
300 Area Near-Shore Wells	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	319-85-7	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	--	--	--	--
300 Area Near-Shore Wells	Bis(2-chloro-1-methylethyl)ether	108-60-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Bis(2-Chloroethoxy)methane	111-91-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Bis(2-chloroethyl) ether	111-44-4	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Bis(2-ethylhexyl) phthalate	117-81-7	ug/L	N	1/19/2006	1/19/2006	2	2	100	--	--	3.0	4.0	--	--	--	--
300 Area Near-Shore Wells	Bismuth	7440-69-9	ug/L	N	1/19/2006	12/6/2010	30	4	13	6.1	37	26	47	--	--	--	--
300 Area Near-Shore Wells	Bismuth	7440-69-9	ug/L	Y	6/4/2010	12/6/2010	19	1	5.3	23	37	24	24	--	--	--	--
300 Area Near-Shore Wells	Boron	7440-42-8	ug/L	N	1/19/2006	12/6/2010	30	6	20	19	41	28	118	--	--	36	5
300 Area Near-Shore Wells	Boron	7440-42-8	ug/L	Y	6/4/2010	12/6/2010	19	6	32	19	41	19	86	--	--	36	2
300 Area Near-Shore Wells	Bromide	24959-67-9	ug/L	N	1/19/2006	4/5/2011	76	41	54	90	250	92	212	--	--	124	30
300 Area Near-Shore Wells	Bromide	24959-67-9	ug/L	Y	12/6/2010	12/6/2010	1	0	0	110	110	--	--	--	--	124	--
300 Area Near-Shore Wells	Bromodichloromethane	75-27-4	ug/L	N	6/4/2010	12/6/2010	28	0	0	0.088	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Bromodichloromethane	75-27-4	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Bromoform	75-25-2	ug/L	N	6/4/2010	12/6/2010	28	0	0	0.17	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Bromoform	75-25-2	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Bromomethane	74-83-9	ug/L	N	6/4/2010	12/6/2010	28	2	7.1	0.13	1.0	0.56	0.77	--	--	--	--
300 Area Near-Shore Wells	Bromomethane	74-83-9	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Butylbenzylphthalate	85-68-7	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Calcium	7440-70-2	ug/L	N	1/19/2006	4/5/2011	143	143	100	--	--	13,800	61,200	--	--	52,644	28
300 Area Near-Shore Wells	Calcium	7440-70-2	ug/L	Y	1/4/2006	4/5/2011	179	178	99	27	27	13,900	61,200	--	--	52,644	32
300 Area Near-Shore Wells	Carbazole	86-74-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Carbon disulfide	75-15-0	ug/L	N	1/4/2006	4/5/2011	323	6	1.9	0.031	1.0	0.056	0.66	--	--	--	--
300 Area Near-Shore Wells	Carbon disulfide	75-15-0	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Carbon tetrachloride	56-23-5	ug/L	N	1/4/2006	4/5/2011	323	7	2.2	0.039	1.0	0.11	4.0	--	--	--	--
300 Area Near-Shore Wells	Carbon tetrachloride	56-23-5	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Chlorobenzene	108-90-7	ug/L	N	9/6/2007	4/5/2011	218	0	0	0.15	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Chlorobenzene	108-90-7	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Chloroethane	75-00-3	ug/L	N	6/4/2010	12/6/2010	28	0	0	0.099	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Chloroethane	75-00-3	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Chloromethane	74-87-3	ug/L	N	6/4/2010	12/6/2010	28	1	3.6	0.077	1.0	0.14	0.14	--	--	--	--
300 Area Near-Shore Wells	Chloromethane	74-87-3	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Chloroprene	126-99-8	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.097	0.097	--	--	--	--	--	--

Table M-5. Summary of Groundwater Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 Area Near-Shore Wells	Chrysene	218-01-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	cis-1,2-Dichloroethylene	156-59-2	ug/L	N	1/4/2006	4/5/2011	323	75	23	0.048	1.0	0.10	400	--	--	--	--
300 Area Near-Shore Wells	cis-1,2-Dichloroethylene	156-59-2	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	cis-1,3-Dichloropropene	10061-01-5	ug/L	N	6/4/2010	12/6/2010	28	0	0	0.073	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	cis-1,3-Dichloropropene	10061-01-5	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Delta-BHC	319-86-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	--	--	--	--
300 Area Near-Shore Wells	Dibenz[a,h]anthracene	53-70-3	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Dibenzofuran	132-64-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Dibromochloromethane	124-48-1	ug/L	N	6/4/2010	12/6/2010	28	0	0	0.13	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Dibromochloromethane	124-48-1	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Dibromomethane	74-95-3	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.21	0.21	--	--	--	--	--	--
300 Area Near-Shore Wells	Dichlorodifluoromethane	75-71-8	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.084	0.084	--	--	--	--	--	--
300 Area Near-Shore Wells	Diethylphthalate	84-66-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Dimethyl phthalate	131-11-3	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Di-n-butylphthalate	84-74-2	ug/L	N	1/19/2006	1/19/2006	2	2	100	--	--	1.0	3.0	--	--	--	--
300 Area Near-Shore Wells	Di-n-octylphthalate	117-84-0	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Dissolved oxygen	DO	ug/L	N	1/4/2006	4/5/2011	259	257	99	--	--	6.0	10,810	--	--	--	--
300 Area Near-Shore Wells	Dissolved oxygen	DO	ug/L	Y	1/28/2011	1/28/2011	1	1	100	--	--	10,540	10,540	--	--	--	--
300 Area Near-Shore Wells	Endosulfan sulfate	1031-07-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	--	--	--	--
300 Area Near-Shore Wells	Endrin aldehyde	7421-93-4	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	--	--	--	--
300 Area Near-Shore Wells	Endrin ketone	53494-70-5	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	--	--	--	--
300 Area Near-Shore Wells	Ethyl cyanide	107-12-0	ug/L	N	1/4/2006	4/5/2011	313	0	0	1.4	2.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Ethyl methacrylate	97-63-2	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.11	0.11	--	--	--	--	--	--
300 Area Near-Shore Wells	Ethylbenzene	100-41-4	ug/L	N	1/4/2006	4/5/2011	323	0	0	0.064	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Ethylbenzene	100-41-4	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Fluoranthene	206-44-0	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Fluorene	86-73-7	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Gross alpha	12587-46-1	pCi/L	N	1/19/2006	4/5/2011	129	123	95	0.24	2.0	1.3	96	--	--	--	--
300 Area Near-Shore Wells	Gross beta	12587-47-2	pCi/L	N	1/19/2006	4/5/2011	129	129	100	--	--	3.4	63	--	--	3.1	129
300 Area Near-Shore Wells	Hexachlorobenzene	118-74-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Hexachlorobutadiene	87-68-3	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Hexachlorocyclopentadiene	77-47-4	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Hexachloroethane	67-72-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Indeno(1,2,3-cd)pyrene	193-39-5	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Iodomethane	74-88-4	ug/L	N	6/4/2010	11/11/2010	18	2	11	0.092	0.092	0.74	0.75	--	--	--	--
300 Area Near-Shore Wells	Isobutyl alcohol	78-83-1	ug/L	N	6/4/2010	11/11/2010	18	0	0	8.7	8.7	--	--	--	--	--	--
300 Area Near-Shore Wells	Isophorone	78-59-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Lithium	7439-93-2	ug/L	N	1/19/2006	12/6/2010	30	24	80	4.0	4.0	4.0	28	--	--	11,321	--
300 Area Near-Shore Wells	Lithium	7439-93-2	ug/L	Y	6/4/2010	12/6/2010	19	15	79	4.0	4.0	4.0	28	--	--	11,321	--
300 Area Near-Shore Wells	Magnesium	7439-95-4	ug/L	N	1/19/2006	4/5/2011	143	143	100	--	--	3,070	15,000	--	--	24,816	--
300 Area Near-Shore Wells	Magnesium	7439-95-4	ug/L	Y	1/4/2006	4/5/2011	179	178	99	14	14	3,440	15,400	--	--	24,816	--
300 Area Near-Shore Wells	Methacrylonitrile	126-98-7	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.50	0.50	--	--	--	--	--	--
300 Area Near-Shore Wells	Methyl methacrylate	80-62-6	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.26	0.26	--	--	--	--	--	--
300 Area Near-Shore Wells	Methylene chloride	75-09-2	ug/L	N	1/4/2006	4/5/2011	323	9	2.8	0.10	1.0	1.2	81	--	--	--	--
300 Area Near-Shore Wells	Methylene chloride	75-09-2	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Molybdenum	7439-98-7	ug/L	N	1/19/2006	12/6/2010	30	30	100	--	--	2.1	27	--	--	3.2	29
300 Area Near-Shore Wells	Molybdenum	7439-98-7	ug/L	Y	6/4/2010	12/6/2010	19	19	100	--	--	2.5	5.6	--	--	3.2	18
300 Area Near-Shore Wells	Naphthalene	91-20-3	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Nitrobenzene	98-95-3	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	n-Nitrosodi-n-dipropylamine	621-64-7	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	n-Nitrosodiphenylamine	86-30-6	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Oxidation Reduction Potential	EH	mV	N	1/4/2006	4/5/2011	259	259	100	--	--	-1.21E+02	482	--	--	--	--
300 Area Near-Shore Wells	Oxidation Reduction Potential	EH	mV	Y	1/28/2011	1/28/2011	1	1	100	--	--	465	465	--	--	--	--
300 Area Near-Shore Wells	pH Measurement	PH	unitless	N	1/4/2006	4/5/2011	367	367	100	--	--	6.9	8.7	--	--	8.2	1
300 Area Near-Shore Wells	pH Measurement	PH	unitless	Y	7/1/2008	1/28/2011	2	2	100	--	--	7.6	7.6	--	--	8.2	--

Table M-5. Summary of Groundwater Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 Area Near-Shore Wells	Phenanthrene	85-01-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Phenol	108-95-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Potassium	7440-09-7	ug/L	N	1/19/2006	4/5/2011	143	143	100	--	--	1,710	8,390	--	--	9,122	--
300 Area Near-Shore Wells	Potassium	7440-09-7	ug/L	Y	1/4/2006	4/5/2011	179	174	97	73	3,270	1,880	7,520	--	--	9,122	--
300 Area Near-Shore Wells	Pyrene	129-00-0	ug/L	N	1/19/2006	1/19/2006	2	0	0	10	10	--	--	--	--	--	--
300 Area Near-Shore Wells	Radium	7440-14-4	pCi/L	N	1/20/2006	1/20/2006	1	0	0	0.12	0.12	--	--	--	--	--	--
300 Area Near-Shore Wells	Ruthenium-106	13967-48-1	pCi/L	N	1/19/2006	1/19/2006	2	0	0	100	200	--	--	--	--	128	--
300 Area Near-Shore Wells	Silicon	7440-21-3	ug/L	N	1/19/2006	12/6/2010	30	30	100	--	--	7,450	22,900	--	--	33,949	--
300 Area Near-Shore Wells	Silicon	7440-21-3	ug/L	Y	6/4/2010	12/6/2010	19	18	95	25	25	7,570	21,400	--	--	33,949	--
300 Area Near-Shore Wells	Sodium	7440-23-5	ug/L	N	1/19/2006	4/5/2011	143	143	100	--	--	5,830	51,400	--	--	26,998	25
300 Area Near-Shore Wells	Sodium	7440-23-5	ug/L	Y	1/4/2006	4/5/2011	179	178	99	11	11	6,600	51,600	--	--	26,998	28
300 Area Near-Shore Wells	Specific Conductance	CONDUCT	uS/cm	N	1/4/2006	4/5/2011	367	367	100	--	--	145	500	--	--	541,000	--
300 Area Near-Shore Wells	Specific Conductance	CONDUCT	uS/cm	Y	7/1/2008	1/28/2011	2	2	100	--	--	173	262	--	--	541,000	--
300 Area Near-Shore Wells	Strontium	7440-24-6	ug/L	N	1/19/2006	4/5/2011	143	143	100	--	--	78	352	--	--	323	6
300 Area Near-Shore Wells	Strontium	7440-24-6	ug/L	Y	1/4/2006	4/5/2011	179	178	99	4.0	4.0	68	356	--	--	323	7
300 Area Near-Shore Wells	Styrene	100-42-5	ug/L	N	6/4/2010	12/6/2010	28	0	0	0.074	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Styrene	100-42-5	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Sulfate	14808-79-8	ug/L	N	1/4/2006	4/5/2011	276	266	96	41	260	74	68,100	--	--	47,014	135
300 Area Near-Shore Wells	Sulfate	14808-79-8	ug/L	Y	12/6/2010	12/6/2010	1	1	100	--	--	669	669	--	--	47,014	--
300 Area Near-Shore Wells	Temperature	EMPERATUF	Deg C	N	1/4/2006	4/5/2011	367	367	100	--	--	11	35	--	--	--	--
300 Area Near-Shore Wells	Temperature	EMPERATUF	Deg C	Y	7/1/2008	1/28/2011	2	2	100	--	--	15	17	--	--	--	--
300 Area Near-Shore Wells	Tetrachloroethene	127-18-4	ug/L	N	1/4/2006	4/5/2011	323	2	0.62	0.17	1.0	0.83	1.8	--	--	--	--
300 Area Near-Shore Wells	Tetrachloroethene	127-18-4	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Tetrahydrofuran	109-99-9	ug/L	N	1/4/2006	4/5/2011	313	0	0	1.1	2.9	--	--	--	--	--	--
300 Area Near-Shore Wells	Thallium	7440-28-0	ug/L	N	1/19/2006	12/6/2010	30	0	0	0.050	6.4	--	--	--	--	1.7	--
300 Area Near-Shore Wells	Thallium	7440-28-0	ug/L	Y	6/4/2010	12/6/2010	19	0	0	0.10	0.10	--	--	--	--	1.7	--
300 Area Near-Shore Wells	Thallium	7440-28-0	ug/L	N	1/19/2006	12/6/2010	30	0	0	0.050	6.4	--	--	--	--	1.7	--
300 Area Near-Shore Wells	Thallium	7440-28-0	ug/L	Y	6/4/2010	12/6/2010	19	0	0	0.10	0.10	--	--	--	--	1.7	--
300 Area Near-Shore Wells	Thorium-228	14274-82-9	pCi/L	N	1/19/2006	1/19/2006	2	0	0	0.021	0.039	--	--	--	--	--	--
300 Area Near-Shore Wells	Tin	7440-31-5	ug/L	N	1/19/2006	12/6/2010	30	2	6.7	0.050	5.2	0.10	0.10	--	--	22	--
300 Area Near-Shore Wells	Tin	7440-31-5	ug/L	Y	6/4/2010	12/6/2010	19	1	5.3	0.10	0.10	0.22	0.22	--	--	22	--
300 Area Near-Shore Wells	Toluene	108-88-3	ug/L	N	1/4/2006	4/5/2011	323	7	2.2	0.025	1.0	0.23	3.3	--	--	--	--
300 Area Near-Shore Wells	Toluene	108-88-3	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	trans-1,2-Dichloroethylene	156-60-5	ug/L	N	1/4/2006	4/5/2011	323	13	4.0	0.016	1.0	0.12	5.5	--	--	--	--
300 Area Near-Shore Wells	trans-1,2-Dichloroethylene	156-60-5	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	trans-1,3-Dichloropropene	10061-02-6	ug/L	N	6/4/2010	12/6/2010	28	0	0	0.083	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	trans-1,3-Dichloropropene	10061-02-6	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	trans-1,4-Dichloro-2-butene	110-57-6	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.29	0.29	--	--	--	--	--	--
300 Area Near-Shore Wells	trans-Chlordane	5103-74-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	--	--	--	--
300 Area Near-Shore Wells	Trichloromonofluoromethane	75-69-4	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.11	0.11	--	--	--	--	--	--
300 Area Near-Shore Wells	Turbidity	TURBIDITY	NTU	N	1/4/2006	4/5/2011	366	366	100	--	--	0.10	24	--	--	--	--
300 Area Near-Shore Wells	Turbidity	TURBIDITY	NTU	Y	7/1/2008	1/28/2011	2	2	100	--	--	0.25	1.9	--	--	--	--
300 Area Near-Shore Wells	Vinyl acetate	108-05-4	ug/L	N	6/4/2010	11/11/2010	18	0	0	0.18	0.18	--	--	--	--	--	--
300 Area Near-Shore Wells	Vinyl chloride	75-01-4	ug/L	N	1/4/2006	4/5/2011	323	0	0	0.044	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Vinyl chloride	75-01-4	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Xylenes (total)	1330-20-7	ug/L	N	1/4/2006	4/5/2011	323	0	0	0.13	1.0	--	--	--	--	--	--
300 Area Near-Shore Wells	Xylenes (total)	1330-20-7	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	--

Table M-6. Summary of Aquifer Tube Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 ATs	1,1,1-Trichloroethane	71-55-6	ug/L	N	1/24/2006	4/13/2011	135	0	0	0.067	1.0	--	--	--	--	--	--
300 ATs	1,1,1-Trichloroethane	71-55-6	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	1,1,2,2-Tetrachloroethane	79-34-5	ug/L	N	12/11/2006	10/28/2008	28	0	0	0.078	1.0	--	--	--	--	--	--
300 ATs	1,1,2,2-Tetrachloroethane	79-34-5	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	1,1,2-Trichloroethane	79-00-5	ug/L	N	1/24/2006	4/13/2011	135	0	0	0.063	1.0	--	--	--	--	--	--
300 ATs	1,1,2-Trichloroethane	79-00-5	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	1,1-Dichloroethane	75-34-3	ug/L	N	1/24/2006	4/13/2011	135	0	0	0.068	1.0	--	--	--	--	--	--
300 ATs	1,1-Dichloroethane	75-34-3	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	1,1-Dichloroethene	75-35-4	ug/L	N	1/24/2006	4/13/2011	149	0	0	0.051	1.0	--	--	--	--	--	--
300 ATs	1,1-Dichloroethene	75-35-4	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	1,2,4-Trimethylbenzene	95-63-6	ug/L	N	8/22/2007	8/22/2007	1	0	0	0.22	0.22	--	--	--	--	--	--
300 ATs	1,2-Dichloroethane	107-06-2	ug/L	N	1/24/2006	4/13/2011	147	0	0	0.066	1.0	--	--	--	--	--	--
300 ATs	1,2-Dichloroethane	107-06-2	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	1,2-Dichloroethene (Total)	540-59-0	ug/L	N	12/11/2006	8/30/2007	21	1	4.8	0.54	1.0	1.7	1.7	--	--	--	--
300 ATs	1,2-Dichloroethene (Total)	540-59-0	ug/L	Y	12/12/2006	12/12/2006	2	1	50	1.0	1.0	1.9	1.9	--	--	--	--
300 ATs	1,2-Dichloropropane	78-87-5	ug/L	N	12/11/2006	8/30/2007	21	0	0	0.37	1.0	--	--	--	--	--	--
300 ATs	1,2-Dichloropropane	78-87-5	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	1,4-Dichlorobenzene	106-46-7	ug/L	N	1/24/2006	4/13/2011	114	0	0	0.12	1.0	--	--	--	--	--	--
300 ATs	1,4-Dioxane	123-91-1	ug/L	N	1/24/2006	3/10/2010	27	1	3.7	5.0	12	1.0	1.0	--	--	--	--
300 ATs	1-Butanol	71-36-3	ug/L	N	1/24/2006	4/13/2011	114	0	0	2.6	100	--	--	--	--	--	--
300 ATs	2,4-Dinitrophenol	51-28-5	ug/L	N	9/23/2008	10/28/2008	7	0	0	2.0	25	--	--	--	--	--	--
300 ATs	2-Butanone	78-93-3	ug/L	N	1/24/2006	4/13/2011	135	0	0	0.52	1.0	--	--	--	--	--	--
300 ATs	2-Butanone	78-93-3	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	2-Hexanone	591-78-6	ug/L	N	12/11/2006	8/30/2007	21	0	0	0.28	1.0	--	--	--	--	--	--
300 ATs	2-Hexanone	591-78-6	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	4-Methyl-2-pentanone	108-10-1	ug/L	N	1/24/2006	4/13/2011	135	0	0	0.12	1.0	--	--	--	--	--	--
300 ATs	4-Methyl-2-pentanone	108-10-1	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Acetonitrile	75-05-8	ug/L	N	8/22/2007	8/22/2007	1	0	0	2.0	2.0	--	--	--	--	--	--
300 ATs	Alkalinity	ALKALINITY	ug/L	N	6/10/2004	3/29/2011	149	149	100	--	--	62,000	150,000	--	--	147,127	3
300 ATs	Benzene	71-43-2	ug/L	N	1/24/2006	4/13/2011	149	2	1.3	0.045	1.0	2.5	2.5	--	--	--	--
300 ATs	Benzene	71-43-2	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Beryllium	7440-41-7	ug/L	N	12/11/2006	3/29/2011	86	1	1.2	0.050	4.0	0.086	0.086	--	--	2.3	--
300 ATs	Beryllium	7440-41-7	ug/L	Y	1/24/2006	3/29/2011	90	0	0	0.050	4.0	--	--	--	--	2.3	--
300 ATs	Bis(2-ethylhexyl) phthalate	117-81-7	ug/L	N	9/23/2008	10/28/2008	7	5	71	1.0	10	0.70	10	--	--	--	--
300 ATs	Bromide	24959-67-9	ug/L	N	6/10/2004	3/11/2010	42	16	38	30	1,200	40	1,350	--	--	124	8
300 ATs	Bromodichloromethane	75-27-4	ug/L	N	12/11/2006	10/28/2008	28	0	0	0.21	1.0	--	--	--	--	--	--
300 ATs	Bromodichloromethane	75-27-4	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Bromoform	75-25-2	ug/L	N	12/11/2006	8/30/2007	21	0	0	0.24	1.0	--	--	--	--	--	--
300 ATs	Bromoform	75-25-2	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Bromomethane	74-83-9	ug/L	N	12/11/2006	8/30/2007	21	0	0	0.31	1.0	--	--	--	--	--	--
300 ATs	Bromomethane	74-83-9	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Calcium	7440-70-2	ug/L	N	5/5/2006	3/29/2011	107	107	100	--	--	19,298	83,300	--	--	52,644	18
300 ATs	Calcium	7440-70-2	ug/L	Y	6/10/2004	3/29/2011	91	91	100	--	--	21,500	85,000	--	--	52,644	20
300 ATs	Carbon disulfide	75-15-0	ug/L	N	1/24/2006	4/13/2011	135	0	0	0.050	1.0	--	--	--	--	--	--
300 ATs	Carbon disulfide	75-15-0	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Carbon tetrachloride	56-23-5	ug/L	N	1/24/2006	4/13/2011	142	6	4.2	0.063	1.0	0.19	720	--	--	--	--

Table M-6. Summary of Aquifer Tube Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 ATs	Carbon tetrachloride	56-23-5	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Carbonate ion	3812-32-6	ug/L	N	6/10/2004	5/5/2006	20	20	100	--	--	56,300	107,000	--	--	--	--
300 ATs	Chlorobenzene	108-90-7	ug/L	N	12/11/2006	4/13/2011	129	0	0	0.12	1.0	--	--	--	--	--	--
300 ATs	Chlorobenzene	108-90-7	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Chloroethane	75-00-3	ug/L	N	12/11/2006	8/30/2007	21	0	0	0.35	1.0	--	--	--	--	--	--
300 ATs	Chloroethane	75-00-3	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Chloromethane	74-87-3	ug/L	N	12/11/2006	8/30/2007	21	0	0	0.44	1.0	--	--	--	--	--	--
300 ATs	Chloromethane	74-87-3	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	cis-1,2-Dichloroethylene	156-59-2	ug/L	N	1/24/2006	4/13/2011	115	12	10	0.083	1.0	0.11	7.5	--	--	--	--
300 ATs	cis-1,2-Dichloroethylene	156-59-2	ug/L	Y	12/12/2006	12/12/2006	1	1	100	--	--	2.5	2.5	--	--	--	--
300 ATs	cis-1,3-Dichloropropene	10061-01-5	ug/L	N	12/11/2006	8/30/2007	21	0	0	0.73	1.0	--	--	--	--	--	--
300 ATs	cis-1,3-Dichloropropene	10061-01-5	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Cyclohexanone	108-94-1	ug/L	N	8/22/2007	8/22/2007	1	0	0	14	14	--	--	--	--	--	--
300 ATs	Dibromochloromethane	124-48-1	ug/L	N	12/11/2006	10/28/2008	28	0	0	0.12	1.0	--	--	--	--	--	--
300 ATs	Dibromochloromethane	124-48-1	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Dimethoate	60-51-5	ug/L	N	9/23/2008	10/28/2008	7	0	0	1.1	10	--	--	--	--	--	--
300 ATs	Dissolved oxygen	DO	ug/L	N	1/24/2006	4/7/2011	237	237	100	--	--	1,700	12,090	--	--	--	--
300 ATs	Dissolved oxygen	DO	ug/L	Y	12/11/2006	4/7/2008	3	3	100	--	--	6,500	8,180	--	--	--	--
300 ATs	Ethyl cyanide	107-12-0	ug/L	N	1/24/2006	4/13/2011	114	0	0	1.2	2.0	--	--	--	--	--	--
300 ATs	Ethylbenzene	100-41-4	ug/L	N	1/24/2006	4/13/2011	135	0	0	0.086	1.0	--	--	--	--	--	--
300 ATs	Ethylbenzene	100-41-4	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Gross alpha	12587-46-1	pCi/L	N	12/11/2006	3/29/2011	92	72	78	-1.20E+00	2.6	1.5	76	--	--	--	--
300 ATs	Gross alpha	12587-46-1	pCi/L	Y	12/12/2006	12/12/2006	2	2	100	--	--	29	31	--	--	--	--
300 ATs	Gross beta	12587-47-2	pCi/L	N	12/11/2006	3/29/2011	92	89	97	1.0	2.6	2.4	68	--	--	3.1	84
300 ATs	Gross beta	12587-47-2	pCi/L	Y	12/12/2006	12/12/2006	2	2	100	--	--	7.8	9.5	--	--	3.1	2
300 ATs	Hexane	110-54-3	ug/L	N	8/22/2007	10/28/2008	8	1	13	0.45	1.0	4.1	4.1	--	--	--	--
300 ATs	Lithium	7439-93-2	ug/L	N	4/3/2008	4/7/2008	7	2	29	4.0	4.0	5.5	5.7	--	--	11,321	--
300 ATs	Lithium	7439-93-2	ug/L	Y	4/3/2008	4/7/2008	4	1	25	4.0	4.0	4.1	4.1	--	--	11,321	--
300 ATs	Magnesium	7439-95-4	ug/L	N	12/11/2006	3/29/2011	86	86	100	--	--	4,920	15,800	--	--	24,816	--
300 ATs	Magnesium	7439-95-4	ug/L	Y	6/10/2004	3/29/2011	91	91	100	--	--	4,990	15,900	--	--	24,816	--
300 ATs	Methylene chloride	75-09-2	ug/L	N	1/24/2006	4/13/2011	142	1	0.70	0.10	1.0	1.1	1.1	--	--	--	--
300 ATs	Methylene chloride	75-09-2	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Nitrobenzene	98-95-3	ug/L	N	9/23/2008	10/28/2008	7	0	0	1.0	10	--	--	--	--	--	--
300 ATs	Oxidation Reduction Potential	EH	mV	N	6/10/2004	4/7/2011	271	271	100	--	--	-1.74E+02	530	--	--	--	--
300 ATs	Oxidation Reduction Potential	EH	mV	Y	6/10/2004	4/7/2008	4	4	100	--	--	79	230	--	--	--	--
300 ATs	pH Measurement	PH	unitless	N	6/10/2004	4/7/2011	274	274	100	--	--	5.8	8.8	--	--	8.2	5
300 ATs	pH Measurement	PH	unitless	Y	6/10/2004	4/7/2008	4	4	100	--	--	6.9	7.7	--	--	8.2	--
300 ATs	Potassium	7440-09-7	ug/L	N	12/11/2006	3/29/2011	86	86	100	--	--	1,350	7,040	--	--	9,122	--
300 ATs	Potassium	7440-09-7	ug/L	Y	6/10/2004	3/29/2011	91	91	100	--	--	1,330	6,970	--	--	9,122	--
300 ATs	Protactinium-231	14331-85-2	pCi/L	N	8/25/2008	10/28/2008	8	1	13	-4.50E-02	0.12	0.16	0.16	--	--	--	--
300 ATs	Selenium-79	15758-45-9	pCi/L	N	8/25/2008	10/28/2008	8	0	0	-3.76E+00	12	--	--	--	--	--	--
300 ATs	Sodium	7440-23-5	ug/L	N	12/11/2006	3/29/2011	86	86	100	--	--	6,320	25,300	--	--	26,998	--
300 ATs	Sodium	7440-23-5	ug/L	Y	6/10/2004	3/29/2011	91	91	100	--	--	6,140	25,500	--	--	26,998	--
300 ATs	Specific Conductance	CONDUCT	uS/cm	N	6/10/2004	4/7/2011	274	274	100	--	--	133	649	--	--	541,000	--
300 ATs	Specific Conductance	CONDUCT	uS/cm	Y	6/10/2004	4/7/2008	4	4	100	--	--	272	440	--	--	541,000	--
300 ATs	Strontium	7440-24-6	ug/L	N	12/11/2006	3/29/2011	86	86	100	--	--	94	386	--	--	323	4

Table M-6. Summary of Aquifer Tube Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 ATs	Strontium	7440-24-6	ug/L	Y	6/10/2004	3/29/2011	91	91	100	--	--	96	368	--	--	323	3
300 ATs	Styrene	100-42-5	ug/L	N	12/11/2006	8/30/2007	21	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Styrene	100-42-5	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Sulfate	14808-79-8	ug/L	N	6/10/2004	3/29/2011	150	150	100	--	--	9,490	56,400	--	--	47,014	32
300 ATs	Temperature	TEMPERATURE	Deg C	N	6/10/2004	4/7/2011	275	275	100	--	--	3.4	27	--	--	--	--
300 ATs	Temperature	TEMPERATURE	Deg C	Y	6/10/2004	4/7/2008	4	4	100	--	--	11	20	--	--	--	--
300 ATs	Tetrachloroethene	127-18-4	ug/L	N	1/24/2006	4/13/2011	149	21	14	0.087	1.0	0.14	4.7	--	--	--	--
300 ATs	Tetrachloroethene	127-18-4	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Tetrahydrofuran	109-99-9	ug/L	N	1/24/2006	4/13/2011	114	0	0	1.1	2.9	--	--	--	--	--	--
300 ATs	Thallium	7440-28-0	ug/L	N	9/25/2008	10/28/2008	7	1	14	36	36	1.3	1.3	--	--	1.7	--
300 ATs	Thallium	7440-28-0	ug/L	Y	9/25/2008	10/28/2008	7	1	14	36	36	1.5	1.5	--	--	1.7	--
300 ATs	Toluene	108-88-3	ug/L	N	1/24/2006	4/13/2011	149	5	3.4	0.062	1.0	0.19	2.0	--	--	--	--
300 ATs	Toluene	108-88-3	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Total dissolved solids	TDS	ug/L	N	5/5/2006	5/5/2006	3	3	100	--	--	103,000	144,000	--	--	258,189	--
300 ATs	trans-1,2-Dichloroethylene	156-60-5	ug/L	N	1/24/2006	4/13/2011	114	0	0	0.083	1.0	--	--	--	--	--	--
300 ATs	trans-1,3-Dichloropropene	10061-02-6	ug/L	N	12/11/2006	8/30/2007	21	0	0	0.20	1.0	--	--	--	--	--	--
300 ATs	trans-1,3-Dichloropropene	10061-02-6	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Turbidity	TURBIDITY	NTU	N	1/24/2006	4/7/2011	177	176	99	--	--	0.030	1,000	--	--	--	--
300 ATs	Turbidity	TURBIDITY	NTU	Y	4/7/2008	4/7/2008	1	1	100	--	--	301	301	--	--	--	--
300 ATs	Vinyl chloride	75-01-4	ug/L	N	1/24/2006	4/13/2011	149	0	0	0.032	1.0	--	--	--	--	--	--
300 ATs	Vinyl chloride	75-01-4	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--
300 ATs	Xylenes (total)	1330-20-7	ug/L	N	1/24/2006	4/13/2011	135	0	0	0.11	1.0	--	--	--	--	--	--
300 ATs	Xylenes (total)	1330-20-7	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	--	--	--	--

Table M-7. Summary of Pore Water Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 PORE-WATER	1,2,4-Trichlorobenzene	120-82-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	1,2-Dichlorobenzene	95-50-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	1,3-Dichlorobenzene	541-73-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	1,4-Dichlorobenzene	106-46-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	2,4,5-Trichlorophenol	95-95-4	ug/L	N	1/16/2006	1/3/2007	16	0	0	25	26	--	--	--	--	--	--
300 PORE-WATER	2,4,6-Trichlorophenol	88-06-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	2,4-Dichlorophenol	120-83-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	2,4-Dimethylphenol	105-67-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	2,4-Dinitrophenol	51-28-5	ug/L	N	1/16/2006	1/3/2007	16	0	0	25	26	--	--	--	--	--	--
300 PORE-WATER	2,4-Dinitrotoluene	121-14-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	2,6-Dinitrotoluene	606-20-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	2-Chloronaphthalene	91-58-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	2-Chlorophenol	95-57-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	2-Methylnaphthalene	91-57-6	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	2-Methylphenol (cresol, o-)	95-48-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	2-Nitroaniline	88-74-4	ug/L	N	1/16/2006	1/3/2007	16	0	0	25	26	--	--	--	--	--	--
300 PORE-WATER	2-Nitrophenol	88-75-5	ug/L	N	1/16/2006	1/3/2007	16	1	6.3	10	10	9.0	9.0	--	--	--	--
300 PORE-WATER	3 Methylphenol (cresol, m)	65794-96-9	ug/L	N	1/16/2006	1/3/2007	16	1	6.3	10	10	20	20	--	--	--	--
300 PORE-WATER	3,3'-Dichlorobenzidine	91-94-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	3-Nitroaniline	99-09-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	25	26	--	--	--	--	--	--
300 PORE-WATER	4,4'-DDD (Dichlorodiphenyldichloroethane)	72-54-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	--	--	--	--
300 PORE-WATER	4,4'-DDE (Dichlorodiphenyldichloroethylene)	72-55-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	--	--	--	--
300 PORE-WATER	4,6-Dinitro-2-methylphenol	534-52-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	25	26	--	--	--	--	--	--
300 PORE-WATER	4-Bromophenylphenyl ether	101-55-3	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	4-Chloro-3-methylphenol	59-50-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	4-Chloroaniline	106-47-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	4-Chlorophenylphenyl ether	7005-72-3	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	4-Nitroaniline	100-01-6	ug/L	N	1/16/2006	1/3/2007	16	0	0	25	26	--	--	--	--	--	--
300 PORE-WATER	4-Nitrophenol	100-02-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	25	26	--	--	--	--	--	--
300 PORE-WATER	Acenaphthene	83-32-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Acenaphthylene	208-96-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Alkalinity	ALKALINITY	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	64,000	108,000	--	--	147,127	--
300 PORE-WATER	Alpha-BHC	319-84-6	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	--	--	--	--
300 PORE-WATER	Americium-241	14596-10-2	pCi/L	N	1/16/2006	1/3/2007	16	0	0	32	230	--	--	--	--	7.70E-05	--
300 PORE-WATER	Anthracene	120-12-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Benzo(a)anthracene	56-55-3	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Benzo(a)pyrene	50-32-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Benzo(b)fluoranthene	205-99-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Benzo(ghi)perylene	191-24-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Benzo(k)fluoranthene	207-08-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Beryllium	7440-41-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.10	0.20	--	--	--	--	2.3	--
300 PORE-WATER	Beryllium-7	13966-02-4	pCi/L	N	1/16/2006	1/3/2007	16	0	0	0.31	320	--	--	--	--	8.6	--
300 PORE-WATER	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	319-85-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	--	--	--	--
300 PORE-WATER	Bis(2-chloro-1-methylethyl)ether	108-60-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Bis(2-Chloroethoxy)methane	111-91-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Bis(2-chloroethyl) ether	111-44-4	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Bis(2-ethylhexyl) phthalate	117-81-7	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	0.60	37	--	--	--	--
300 PORE-WATER	Bismuth	7440-69-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	4.0	6.1	--	--	--	--	--	--
300 PORE-WATER	Boron	7440-42-8	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	11	31	--	--	36	--
300 PORE-WATER	Bromide	24959-67-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	250	250	--	--	--	--	124	--
300 PORE-WATER	Butylbenzylphthalate	85-68-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Calcium	7440-70-2	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	18,900	45,300	--	--	52,644	--
300 PORE-WATER	Carbazole	86-74-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Ceriodaphnia Number Young per Female	CERIO_YOUNG_FEM	Avg # young	N	1/16/2006	1/3/2007	16	16	100	--	--	22	37	--	--	--	--
300 PORE-WATER	Ceriodaphnia Survival	CERIO_SURV	%	N	1/16/2006	1/3/2007	16	16	100	--	--	90	100	--	--	--	--
300 PORE-WATER	Chlorine	7782-50-5	ug/L	N	1/16/2006	1/3/2007	15	6	40	20	20	10	30	--	--	--	--
300 PORE-WATER	Chrysene	218-01-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Delta-BHC	319-86-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	--	--	--	--
300 PORE-WATER	Dibenz[a,h]anthracene	53-70-3	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--

Table M-7. Summary of Pore Water Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 PORE-WATER	Dibenzofuran	132-64-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Diethylphthalate	84-66-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Dimethyl phthalate	131-11-3	ug/L	N	1/16/2006	1/3/2007	16	1	6.3	10	10	0.77	0.77	--	--	--	--
300 PORE-WATER	Di-n-butylphthalate	84-74-2	ug/L	N	1/16/2006	1/3/2007	16	8	50	10	10	0.60	1.0	--	--	--	--
300 PORE-WATER	Di-n-octylphthalate	117-84-0	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Dissolved oxygen	DO	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	9,530	13,410	--	--	--	--
300 PORE-WATER	Endosulfan sulfate	1031-07-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	--	--	--	--
300 PORE-WATER	Endrin aldehyde	7421-93-4	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	--	--	--	--
300 PORE-WATER	Endrin ketone	53494-70-5	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	--	--	--	--
300 PORE-WATER	FETAX deformity	FETAX_DEFORM	%	N	1/16/2006	1/3/2007	16	16	100	--	--	0	8.5	--	--	--	--
300 PORE-WATER	FETAX growth [Percent of CTL]	FETAX_GROWTH	%	N	1/16/2006	1/3/2007	16	16	100	--	--	96	105	--	--	--	--
300 PORE-WATER	FETAX Survival	FETAX_SURV	%	N	1/16/2006	1/3/2007	16	16	100	--	--	94	100	--	--	--	--
300 PORE-WATER	Fluoranthene	206-44-0	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Fluorene	86-73-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	gamma-Chlordane	5566-34-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	--	--	--	--
300 PORE-WATER	Hardness	HARDNESS	ug/L	N	1/16/2006	1/3/2007	15	15	100	--	--	960	154,000	--	--	--	--
300 PORE-WATER	Hexachlorobenzene	118-74-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Hexachlorobutadiene	87-68-3	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Hexachlorocyclopentadiene	77-47-4	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Hexachloroethane	67-72-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Indeno(1,2,3-cd)pyrene	193-39-5	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Isophorone	78-59-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Lithium	7439-93-2	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	1.2	4.3	--	--	11,321	--
300 PORE-WATER	Magnesium	7439-95-4	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	4,530	9,470	--	--	24,816	--
300 PORE-WATER	Molybdenum	7439-98-7	ug/L	N	1/16/2006	1/3/2007	16	11	69	1.3	1.6	1.3	5.9	--	--	3.2	2
300 PORE-WATER	Naphthalene	91-20-3	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Nitrobenzene	98-95-3	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Nitrogen in ammonia	NH3-N	ug/L	N	1/16/2006	1/3/2007	16	14	88	100	100	10	1,100	--	--	--	--
300 PORE-WATER	Nitrogen in Nitrite	NO2-N	ug/L	N	1/16/2006	1/3/2007	16	0	0	76	76	--	--	--	--	--	--
300 PORE-WATER	Nitrogen in Nitrite and Nitrate	NO2+NO3-N	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	33	5,200	--	--	--	--
300 PORE-WATER	Nitrogen, Kjeldahl total	N-KJELDAHL	ug/L	N	1/16/2006	1/3/2007	16	7	44	100	100	100	1,400	--	--	--	--
300 PORE-WATER	n-Nitrosodi-n-dipropylamine	621-64-7	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	n-Nitrosodiphenylamine	86-30-6	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	pH Measurement	PH	unitless	N	1/16/2006	1/3/2007	16	16	100	--	--	7.5	9.0	--	--	8.2	4
300 PORE-WATER	Phenanthrene	85-01-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Phenol	108-95-2	ug/L	N	1/16/2006	1/3/2007	16	1	6.3	10	10	2.0	2.0	--	--	--	--
300 PORE-WATER	Potassium	7440-09-7	ug/L	N	1/16/2006	1/3/2007	16	15	94	540	540	717	3,000	--	--	9,122	--
300 PORE-WATER	Pyrene	129-00-0	ug/L	N	1/16/2006	1/3/2007	16	0	0	10	10	--	--	--	--	--	--
300 PORE-WATER	Ruthenium-106	13967-48-1	pCi/L	N	1/16/2006	1/3/2007	16	0	0	59	250	--	--	--	--	128	--
300 PORE-WATER	Silicon	7440-21-3	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	2,190	10,200	--	--	33,949	--
300 PORE-WATER	Sodium	7440-23-5	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	2,190	14,200	--	--	26,998	--
300 PORE-WATER	Specific Conductance	CONDUCT	uS/cm	N	1/16/2006	1/3/2007	16	16	100	--	--	135	347	--	--	541,000	--
300 PORE-WATER	Strontium	7440-24-6	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	90	202	--	--	323	--
300 PORE-WATER	Sulfate	14808-79-8	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	8,200	39,300	--	--	47,014	--
300 PORE-WATER	Temperature	TEMPERATURE	Deg C	N	1/16/2006	1/3/2007	16	16	100	--	--	4.8	20	--	--	--	--
300 PORE-WATER	Thallium	7440-28-0	ug/L	N	1/16/2006	1/3/2007	16	1	6.3	5.5	6.4	6.4	6.4	--	--	1.7	1
300 PORE-WATER	Thorium-228	14274-82-9	pCi/L	N	1/16/2006	1/3/2007	16	0	0	-1.69E-01	0.081	--	--	--	--	--	--
300 PORE-WATER	Tin	7440-31-5	ug/L	N	1/16/2006	1/3/2007	16	0	0	3.5	5.2	--	--	--	--	22	--
300 PORE-WATER	Total dissolved solids	TDS	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	48,000	288,000	--	--	258,189	1
300 PORE-WATER	Total organic carbon	TOC	ug/L	N	1/16/2006	1/3/2007	14	14	100	--	--	740	2,400	--	--	2,706	--
300 PORE-WATER	Total petroleum hydrocarbons	TPH	ug/L	N	1/16/2006	1/3/2007	16	0	0	1,000	2,000	--	--	--	--	--	--
300 PORE-WATER	Total petroleum hydrocarbons - gasoline range	TPHGASOLINE	ug/L	N	1/16/2006	1/3/2007	16	0	0	29	30	--	--	--	--	--	--
300 PORE-WATER	Total suspended solids	TSS	ug/L	N	1/16/2006	1/3/2007	16	6	38	5,000	5,000	5,200	18,200	--	--	--	--
300 PORE-WATER	Water depth 1996 to 2006	WATER_DEPTH	m	N	1/16/2006	1/3/2007	16	16	100	--	--	0.71	2.2	--	--	--	--
300 PORE-WATER	Water depth exceedance from 1996 to 2006	PCT_DEPTH_EXCEE	m	N	1/16/2006	1/3/2007	16	16	100	--	--	15	96	--	--	--	--

Table M-8. Summary of Seep/Spring Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SEEP	1,1,1-Trichloroethane	71-55-6	ug/L	N	11/1/1999	10/25/2004	7	0	0	0.070	0.31	--	--	--	--	--	--
300 SEEP	1,1,2-Trichloroethane	79-00-5	ug/L	N	11/1/1999	10/25/2004	7	1	14	0.050	0.31	0.69	0.69	--	--	--	--
300 SEEP	1,1-Dichloroethane	75-34-3	ug/L	N	11/1/1999	10/25/2004	7	0	0	0.12	0.25	--	--	--	--	--	--
300 SEEP	1,1-Dichloroethene	75-35-4	ug/L	N	9/27/2000	9/27/2000	1	0	0	0.23	0.23	--	--	--	--	--	--
300 SEEP	1,2-Dichloroethane	107-06-2	ug/L	N	11/1/1999	10/25/2004	7	2	29	0.080	0.27	0.84	0.87	--	--	--	--
300 SEEP	1,4-Dichlorobenzene	106-46-7	ug/L	N	11/1/1999	10/25/2004	7	2	29	0.11	0.25	0.19	0.25	--	--	--	--
300 SEEP	1-Butanol	71-36-3	ug/L	N	11/1/1999	10/25/2004	6	0	0	3.8	7.0	--	--	--	--	--	--
300 SEEP	2-Butanone	78-93-3	ug/L	N	11/1/1999	10/25/2004	7	0	0	0.10	0.89	--	--	--	--	--	--
300 SEEP	4-Methyl-2-pentanone	108-10-1	ug/L	N	11/1/1999	10/25/2004	7	0	0	0.15	1.3	--	--	--	--	--	--
300 SEEP	Benzene	71-43-2	ug/L	N	11/1/1999	10/25/2004	7	0	0	0.070	0.23	--	--	--	--	--	--
300 SEEP	Beryllium	7440-41-7	ug/L	N	11/21/1996	10/25/2004	11	5	45	0.0080	0.048	0.034	0.35	--	--	2.3	--
300 SEEP	Beryllium	7440-41-7	ug/L	Y	10/13/2003	10/25/2004	3	0	0	0.0098	0.011	--	--	--	--	2.3	--
300 SEEP	Beryllium-7	13966-02-4	pCi/L	N	12/31/1991	10/25/2004	57	0	0	-3.08E+01	28	--	--	--	--	8.6	--
300 SEEP	Bismuth	7440-69-9	ug/L	N	2/24/2003	2/24/2003	2	2	100	--	--	0.037	0.081	--	--	--	--
300 SEEP	Boron	7440-42-8	ug/L	N	2/24/2003	2/24/2003	2	2	100	--	--	11	137	--	--	36	1
300 SEEP	Bromide	24959-67-9	ug/L	N	9/5/1995	11/21/1996	2	2	100	--	--	99	100	--	--	124	--
300 SEEP	Calcium	7440-70-2	ug/L	N	8/29/1994	2/24/2003	5	5	100	--	--	28,700	58,600	--	--	52,644	1
300 SEEP	Carbon disulfide	75-15-0	ug/L	N	11/1/1999	10/25/2004	7	1	14	0.060	0.43	0.46	0.46	--	--	--	--
300 SEEP	Carbon tetrachloride	56-23-5	ug/L	N	11/1/1999	10/25/2004	7	0	0	0.10	0.33	--	--	--	--	--	--
300 SEEP	Chlorobenzene	108-90-7	ug/L	N	9/27/2000	9/27/2000	1	0	0	0.28	0.28	--	--	--	--	--	--
300 SEEP	cis-1,2-Dichloroethylene	156-59-2	ug/L	N	11/1/1999	10/13/2003	5	4	80	0.24	0.24	0.30	0.40	--	--	--	--
300 SEEP	Ethyl cyanide	107-12-0	ug/L	N	11/1/1999	10/25/2004	7	0	0	0.68	2.6	--	--	--	--	--	--
300 SEEP	Ethylbenzene	100-41-4	ug/L	N	10/7/2002	10/13/2003	2	0	0	0.14	0.24	--	--	--	--	--	--
300 SEEP	Gross alpha	12587-46-1	pCi/L	N	12/31/1991	10/25/2004	34	32	94	0.16	0.70	9.0	228	--	--	--	--
300 SEEP	Gross beta	12587-47-2	pCi/L	N	12/31/1991	10/25/2004	34	33	97	1.0	1.0	2.8	64	--	--	3.1	32
300 SEEP	Iodine	7553-56-2	ug/L	N	9/20/1993	10/13/2003	16	16	100	--	--	0.43	34	--	--	250	--
300 SEEP	Lithium	7439-93-2	ug/L	N	2/24/2003	2/24/2003	2	2	100	--	--	4.7	5.7	--	--	11,321	--
300 SEEP	Magnesium	7439-95-4	ug/L	N	8/29/1994	2/24/2003	5	5	100	--	--	7,010	14,500	--	--	24,816	--
300 SEEP	Methylene chloride	75-09-2	ug/L	N	11/1/1999	10/25/2004	7	2	29	0.17	0.41	0.47	0.66	--	--	--	--
300 SEEP	Nitrogen in Nitrite	NO2-N	ug/L	N	11/21/1996	10/25/2004	10	1	10	2.0	17	24	24	--	--	--	--
300 SEEP	Nitrogen in Nitrite and Nitrate	NO2+NO3-N	ug/L	N	5/3/2001	5/10/2001	2	2	100	--	--	27,000	5.20E+06	--	--	--	--
300 SEEP	Potassium	7440-09-7	ug/L	N	8/29/1994	11/21/1996	3	3	100	--	--	1,900	3,800	--	--	9,122	--
300 SEEP	Ruthenium-106	13967-48-1	pCi/L	N	12/31/1991	10/25/2004	56	1	1.8	-4.71E+01	15	13	13	--	--	128	--
300 SEEP	Sodium	7440-23-5	ug/L	N	8/29/1994	2/24/2003	5	5	100	--	--	8,100	27,900	--	--	26,998	1
300 SEEP	Strontium	7440-24-6	ug/L	N	9/5/1995	11/21/1996	2	2	100	--	--	140	220	--	--	323	--
300 SEEP	Sulfate	14808-79-8	ug/L	N	8/29/1994	10/25/2004	12	12	100	--	--	21,000	55,000	--	--	47,014	6
300 SEEP	Tetrachloroethene	127-18-4	ug/L	N	11/1/1999	10/25/2004	7	1	14	0.080	0.57	0.70	0.70	--	--	--	--
300 SEEP	Tetrahydrofuran	109-99-9	ug/L	N	11/1/1999	10/25/2004	7	0	0	1.2	2.3	--	--	--	--	--	--
300 SEEP	Thallium	7440-28-0	ug/L	N	9/27/2000	10/25/2004	10	10	100	--	--	0.011	0.26	--	--	1.7	--
300 SEEP	Thallium	7440-28-0	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	0.010	0.016	--	--	1.7	--
300 SEEP	Thorium-228	14274-82-9	pCi/L	N	8/27/2001	9/18/2001	11	6	55	0.0018	0.030	0.057	0.75	--	--	--	--
300 SEEP	Tin	7440-31-5	ug/L	N	11/21/1996	11/21/1996	1	0	0	17	17	--	--	--	--	22	--
300 SEEP	Toluene	108-88-3	ug/L	N	11/1/1999	10/25/2004	7	4	57	0.12	0.23	0.30	0.63	--	--	--	--
300 SEEP	trans-1,2-Dichloroethylene	156-60-5	ug/L	N	11/1/1999	10/25/2004	7	0	0	0.090	0.26	--	--	--	--	--	--
300 SEEP	Uranium [radionuclide]	U_rad	pCi/L	N	9/27/2000	10/25/2004	10	10	100	--	--	2.3	100	--	--	--	--
300 SEEP	Uranium-236	13982-70-2	pCi/L	N	5/3/2001	10/25/2004	8	8	100	--	--	0.29	1.0	--	--	--	--
300 SEEP	Vinyl chloride	75-01-4	ug/L	N	11/1/1999	10/25/2004	7	0	0	0.080	0.32	--	--	--	--	--	--
300 SEEP	Xylenes (total)	1330-20-7	ug/L	N	11/1/1999	10/25/2004	7	1	14	0.28	0.79	0.34	0.34	--	--	--	--

Table M-9. Summary of Surface Water Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SW	1,1,1-Trichloroethane	71-55-6	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.36	0.36	--	--	--	--	--	--
300 SW	1,1,2-Trichloroethane	79-00-5	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.53	0.53	--	--	--	--	--	--
300 SW	1,1-Dichloroethane	75-34-3	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.37	0.37	--	--	--	--	--	--
300 SW	1,2,4-Trichlorobenzene	120-82-1	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	1,2-Dichlorobenzene	95-50-1	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	1,2-Dichloroethane	107-06-2	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.43	0.43	--	--	--	--	--	--
300 SW	1,3-Dichlorobenzene	541-73-1	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	1,4-Dichlorobenzene	106-46-7	ug/L	N	9/20/1996	2/6/2007	15	0	0	0.50	11	--	--	--	--	--	--
300 SW	1-Butanol	71-36-3	ug/L	N	9/20/1996	9/20/1996	1	0	0	25	25	--	--	--	--	--	--
300 SW	2,4,5-Trichlorophenol	95-95-4	ug/L	N	1/16/2006	2/6/2007	14	0	0	25	27	--	--	--	--	--	--
300 SW	2,4,6-Trichlorophenol	88-06-2	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	2,4-Dichlorophenol	120-83-2	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	2,4-Dimethylphenol	105-67-9	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	2,4-Dinitrophenol	51-28-5	ug/L	N	1/16/2006	2/6/2007	14	0	0	25	27	--	--	--	--	--	--
300 SW	2,4-Dinitrotoluene	121-14-2	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	2,6-Dinitrotoluene	606-20-2	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	2-Butanone	78-93-3	ug/L	N	9/20/1996	9/20/1996	1	0	0	3.4	3.4	--	--	--	--	--	--
300 SW	2-Chloronaphthalene	91-58-7	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	2-Chlorophenol	95-57-8	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	2-Methylnaphthalene	91-57-6	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	2-Methylphenol (cresol, o-)	95-48-7	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	2-Nitroaniline	88-74-4	ug/L	N	1/16/2006	2/6/2007	14	0	0	25	27	--	--	--	--	--	--
300 SW	2-Nitrophenol	88-75-5	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	3 Methylphenol (cresol, m)	65794-96-9	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	3,3'-Dichlorobenzidine	91-94-1	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	3-Nitroaniline	99-09-2	ug/L	N	1/16/2006	2/6/2007	14	0	0	25	27	--	--	--	--	--	--
300 SW	4,4'-DDD (Dichlorodiphenyldichloroethane)	72-54-8	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	--	--	--	--
300 SW	4,4'-DDE (Dichlorodiphenyldichloroethylene)	72-55-9	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	--	--	--	--
300 SW	4,6-Dinitro-2-methylphenol	534-52-1	ug/L	N	1/16/2006	2/6/2007	14	0	0	25	27	--	--	--	--	--	--
300 SW	4-Bromophenylphenyl ether	101-55-3	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	4-Chloro-3-methylphenol	59-50-7	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	4-Chloroaniline	106-47-8	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	4-Chlorophenylphenyl ether	7005-72-3	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	4-Methyl-2-pentanone	108-10-1	ug/L	N	9/20/1996	9/20/1996	1	0	0	1.1	1.1	--	--	--	--	--	--
300 SW	4-Nitroaniline	100-01-6	ug/L	N	1/16/2006	2/6/2007	14	0	0	25	27	--	--	--	--	--	--
300 SW	4-Nitrophenol	100-02-7	ug/L	N	1/16/2006	2/6/2007	14	0	0	25	27	--	--	--	--	--	--
300 SW	Acenaphthene	83-32-9	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Acenaphthylene	208-96-8	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Actinium-228	14331-83-0	pCi/L	N	11/5/2002	12/1/2004	24	0	0	5.0	26	--	--	--	--	--	--
300 SW	Alpha-BHC	319-84-6	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	--	--	--	--
300 SW	Americium-241	14596-10-2	pCi/L	N	1/16/2006	1/10/2007	14	0	0	6.8	200	--	--	--	--	7.70E-05	--
300 SW	Anthracene	120-12-7	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Antimony-124	14683-10-4	pCi/L	N	11/5/2002	11/5/2002	1	0	0	6.1	6.1	--	--	--	--	--	--
300 SW	Barium-133	13981-41-4	pCi/L	N	11/5/2002	11/5/2002	1	0	0	7.0	7.0	--	--	--	--	--	--
300 SW	Benzene	71-43-2	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.38	0.38	--	--	--	--	--	--
300 SW	Benzo(a)anthracene	56-55-3	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Benzo(a)pyrene	50-32-8	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Benzo(b)fluoranthene	205-99-2	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Benzo(ghi)perylene	191-24-2	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--

Table M-9. Summary of Surface Water Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SW	Benzo(k)fluoranthene	207-08-9	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Beryllium	7440-41-7	ug/L	N	9/20/1996	1/10/2007	32	4	13	0.0080	0.20	0.013	0.33	--	--	2.3	--
300 SW	Beryllium	7440-41-7	ug/L	Y	9/10/2002	9/15/2004	14	0	0	0.011	0.066	--	--	--	--	2.3	--
300 SW	Beryllium-7	13966-02-4	pCi/L	N	6/7/2000	1/10/2007	62	0	0	-3.00E-01	270	--	--	--	--	8.6	--
300 SW	Beryllium-7	13966-02-4	pCi/L	Y	1/24/1990	1/5/1993	25	17	68	-8.80E-01	0.21	0.015	0.11	--	--	8.6	--
300 SW	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	319-85-7	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	--	--	--	--
300 SW	Bis(2-chloro-1-methylethyl)ether	108-60-1	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Bis(2-Chloroethoxy)methane	111-91-1	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Bis(2-chloroethyl) ether	111-44-4	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Bis(2-ethylhexyl) phthalate	117-81-7	ug/L	N	1/16/2006	2/6/2007	14	14	100	--	--	0.60	4.0	--	--	--	--
300 SW	Bismuth	7440-69-9	ug/L	N	1/16/2006	1/10/2007	14	0	0	4.0	6.1	--	--	--	--	--	--
300 SW	Boron	7440-42-8	ug/L	N	1/16/2006	1/10/2007	14	14	100	--	--	9.1	21	--	--	36	--
300 SW	Bromide	24959-67-9	ug/L	N	9/18/1995	1/10/2007	16	0	0	15	250	--	--	--	--	124	--
300 SW	Butylbenzylphthalate	85-68-7	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Calcium	7440-70-2	ug/L	N	8/26/1994	1/10/2007	17	17	100	--	--	19,000	32,000	--	--	52,644	--
300 SW	Carbazole	86-74-8	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Carbon disulfide	75-15-0	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.33	0.33	--	--	--	--	--	--
300 SW	Carbon tetrachloride	56-23-5	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.35	0.35	--	--	--	--	--	--
300 SW	Cerium-139	CE-139	pCi/L	N	11/5/2002	11/5/2002	1	0	0	4.6	4.6	--	--	--	--	--	--
300 SW	Cesium-136	CS-136	pCi/L	N	11/5/2002	11/5/2002	1	0	0	8.4	8.4	--	--	--	--	--	--
300 SW	Chrysene	218-01-9	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	cis-1,2-Dichloroethylene	156-59-2	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.47	0.47	--	--	--	--	--	--
300 SW	Cobalt-57	13981-50-5	pCi/L	N	9/6/2000	12/1/2004	36	0	0	0	4.5	--	--	--	--	--	--
300 SW	Delta-BHC	319-86-8	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	--	--	--	--
300 SW	Dibenz[a,h]anthracene	53-70-3	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Dibenzofuran	132-64-9	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Diethylphthalate	84-66-2	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Dimethyl phthalate	131-11-3	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Di-n-butylphthalate	84-74-2	ug/L	N	1/16/2006	2/6/2007	14	7	50	10	10	0.50	1.0	--	--	--	--
300 SW	Di-n-octylphthalate	117-84-0	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Dissolved oxygen	DO	ug/L	N	1/16/2006	2/6/2007	15	15	100	--	--	10,500	14,110	--	--	--	--
300 SW	Endosulfan sulfate	1031-07-8	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	--	--	--	--
300 SW	Endrin aldehyde	7421-93-4	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	--	--	--	--
300 SW	Endrin ketone	53494-70-5	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	--	--	--	--
300 SW	Ethyl cyanide	107-12-0	ug/L	N	9/20/1996	9/20/1996	1	0	0	2.1	2.1	--	--	--	--	--	--
300 SW	Fluoranthene	206-44-0	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Fluorene	86-73-7	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	gamma-Chlordane	5566-34-7	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	--	--	--	--
300 SW	Gross alpha	12587-46-1	pCi/L	N	2/4/2000	2/4/2000	2	1	50	0.30	0.30	1.0	1.0	--	--	--	--
300 SW	Gross beta	12587-47-2	pCi/L	N	1/5/1999	2/1/2005	130	75	58	--	4.0	0.40	9.9	--	--	3.1	2
300 SW	Hexachlorobenzene	118-74-1	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Hexachlorobutadiene	87-68-3	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Hexachlorocyclopentadiene	77-47-4	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Hexachloroethane	67-72-1	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Highest Specific Conductance [uS/cm]	_BASKET_CON	uS/cm	N	7/25/2006	7/25/2006	1	1	100	--	--	504	504	--	--	--	--
300 SW	Indeno(1,2,3-cd)pyrene	193-39-5	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Iodine	7553-56-2	ug/L	N	4/3/1990	1/5/1993	8	8	100	--	--	0.58	1.7	--	--	250	--
300 SW	Iron-59	14596-12-4	pCi/L	N	1/5/1999	2/1/2005	122	8	6.6	-2.00E+00	26	1.8	3.0	--	--	--	--
300 SW	Isophorone	78-59-1	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--

Table M-9. Summary of Surface Water Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SW	Lanthanum-140	13981-28-7	pCi/L	N	6/7/2000	12/1/2004	48	0	0	2.0	172	--	--	--	--	--	--
300 SW	Lead-212	15092-94-1	pCi/L	Y	1/24/1990	5/15/1990	6	6	100	--	--	0.0049	0.019	--	--	--	--
300 SW	Lead-214	15067-28-4	pCi/L	Y	1/10/1990	5/15/1990	7	7	100	--	--	0.0043	0.042	--	--	--	--
300 SW	Lithium	7439-93-2	ug/L	N	1/16/2006	1/10/2007	14	14	100	--	--	1.2	2.6	--	--	11,321	--
300 SW	Magnesium	7439-95-4	ug/L	N	8/26/1994	1/10/2007	17	17	100	--	--	4,770	6,880	--	--	24,816	--
300 SW	Manganese-54	13966-31-9	pCi/L	N	1/5/1999	2/1/2005	122	0	0	-8.00E-01	6.1	--	--	--	--	--	--
300 SW	Methylene chloride	75-09-2	ug/L	N	8/26/1994	9/20/1996	2	1	50	0.35	0.35	0.43	0.43	--	--	--	--
300 SW	Molybdenum	7439-98-7	ug/L	N	1/16/2006	1/10/2007	14	6	43	1.3	1.6	1.7	5.3	--	--	3.2	2
300 SW	Molybdenum-99	14119-15-4	pCi/L	N	11/5/2002	11/5/2002	1	0	0	300	300	--	--	--	--	--	--
300 SW	Naphthalene	91-20-3	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Niobium-94	14681-63-1	pCi/L	N	11/5/2002	11/5/2002	1	0	0	5.9	5.9	--	--	--	--	--	--
300 SW	Niobium-95	13967-76-5	pCi/L	N	6/7/2000	12/1/2004	48	0	0	0	10	--	--	--	--	--	--
300 SW	Nitrobenzene	98-95-3	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Nitrogen in Nitrite	NO2-N	ug/L	N	9/18/1995	1/10/2007	51	1	2.0	2.0	76	6.7	6.7	--	--	--	--
300 SW	Nitrogen in Nitrite and Nitrate	NO2+NO3-N	ug/L	N	1/16/2006	1/10/2007	14	14	100	--	--	120	3,400	--	--	--	--
300 SW	n-Nitrosodi-n-dipropylamine	621-64-7	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	n-Nitrosodiphenylamine	86-30-6	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	pH Measurement	PH	unitless	N	1/16/2006	2/6/2007	15	15	100	--	--	7.4	9.7	--	--	8.2	1
300 SW	Phenanthrene	85-01-8	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Phenol	108-95-2	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Potassium	7440-09-7	ug/L	N	8/26/1994	1/10/2007	17	17	100	--	--	716	2,400	--	--	9,122	--
300 SW	Pyrene	129-00-0	ug/L	N	1/16/2006	2/6/2007	14	0	0	10	11	--	--	--	--	--	--
300 SW	Ruthenium-103	13968-53-1	pCi/L	N	6/7/2000	12/1/2004	47	0	0	1.5	14	--	--	--	--	--	--
300 SW	Ruthenium-106	13967-48-1	pCi/L	N	6/7/2000	1/10/2007	61	0	0	10	220	--	--	--	--	128	--
300 SW	Ruthenium-106	13967-48-1	pCi/L	Y	1/10/1990	1/5/1993	28	5	18	-1.00E-01	0.041	0.0091	0.060	--	--	128	--
300 SW	Selenium-75	SE-75	pCi/L	N	11/5/2002	11/5/2002	1	0	0	6.5	6.5	--	--	--	--	--	--
300 SW	Silicon	7440-21-3	ug/L	N	1/16/2006	1/10/2007	14	14	100	--	--	2,260	4,650	--	--	33,949	--
300 SW	Silver-110 [metastable]	AG-110M	pCi/L	N	11/5/2002	11/5/2002	1	0	0	5.7	5.7	--	--	--	--	--	--
300 SW	Sodium	7440-23-5	ug/L	N	8/26/1994	1/10/2007	17	17	100	--	--	2,250	5,220	--	--	26,998	--
300 SW	Sodium-24	13982-04-2	pCi/L	N	11/5/2002	11/5/2002	1	0	0	26,600	26,600	--	--	--	--	--	--
300 SW	Specific Conductance	CONDUCT	uS/cm	N	1/16/2006	2/6/2007	15	15	100	--	--	134	267	--	--	541,000	--
300 SW	Strontium	7440-24-6	ug/L	N	9/18/1995	1/10/2007	16	16	100	--	--	91	145	--	--	323	--
300 SW	Strontium-85	13967-73-2	pCi/L	N	11/5/2002	11/5/2002	1	0	0	7.8	7.8	--	--	--	--	--	--
300 SW	Sulfate	14808-79-8	ug/L	N	8/26/1994	1/10/2007	52	52	100	--	--	1,100	24,000	--	--	47,014	--
300 SW	Tellurium-129M	TE-129M	pCi/L	N	11/5/2002	11/5/2002	1	0	0	68	68	--	--	--	--	--	--
300 SW	Temperature	TEMPERATURE	Deg C	N	1/16/2006	2/6/2007	15	15	100	--	--	4.6	6.9	--	--	--	--
300 SW	Tetrachloroethene	127-18-4	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.35	0.35	--	--	--	--	--	--
300 SW	Tetrahydrofuran	109-99-9	ug/L	N	9/20/1996	9/20/1996	1	0	0	2.5	2.5	--	--	--	--	--	--
300 SW	Thallium	7440-28-0	ug/L	N	9/20/1996	1/10/2007	32	18	56	3.7	6.4	0.0067	6.8	--	--	1.7	1
300 SW	Thallium	7440-28-0	ug/L	Y	9/10/2002	9/15/2004	14	10	71	0.0090	0.0090	0.0068	0.019	--	--	1.7	--
300 SW	Thorium-228	14274-82-9	pCi/L	N	6/7/2000	1/10/2007	62	0	0	-7.20E-02	500	--	--	--	--	--	--
300 SW	Tin	7440-31-5	ug/L	N	8/26/1994	1/10/2007	17	3	18	3.6	5.2	26	56	--	--	22	3
300 SW	Tin-113	13966-06-8	pCi/L	N	11/5/2002	11/5/2002	1	0	0	7.1	7.1	--	--	--	--	--	--
300 SW	Toluene	108-88-3	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.44	0.44	--	--	--	--	--	--
300 SW	Total organic carbon	TOC	ug/L	N	1/16/2006	1/24/2006	12	12	100	--	--	910	1,200	--	--	2,706	--
300 SW	Total petroleum hydrocarbons	TPH	ug/L	N	1/16/2006	1/10/2007	14	0	0	1,000	2,000	--	--	--	--	--	--
300 SW	Total petroleum hydrocarbons - gasoline range	TPHGASOLINE	ug/L	N	1/16/2006	1/10/2007	14	0	0	30	42	--	--	--	--	--	--
300 SW	trans-1,2-Dichloroethylene	156-60-5	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.48	0.48	--	--	--	--	--	--
300 SW	Uranium [radionuclide]	U_rad	pCi/L	N	9/19/2000	9/15/2004	17	17	100	--	--	0.25	12	--	--	--	--

Table M-9. Summary of Surface Water Analytes Without Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SW	Vinyl chloride	75-01-4	ug/L	N	9/20/1996	9/20/1996	1	0	0	1.3	1.3	--	--	--	--	--	--
300 SW	Xylenes (total)	1330-20-7	ug/L	N	9/20/1996	9/20/1996	1	0	0	1.3	1.3	--	--	--	--	--	--
300 SW	Yttrium-88	Y-88	pCi/L	N	11/5/2002	11/5/2002	1	0	0	6.7	6.7	--	--	--	--	--	--

Table M-10. Summary of Groundwater Analytes That Were Not Detected

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 Area Near-Shore Wells	4,4'-DDT (Dichlorodiphenyltrichloroethane)	50-29-3	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	0.0010	--	--	--
300 Area Near-Shore Wells	Acetone	67-64-1	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	1,500	--	--	--
300 Area Near-Shore Wells	Aldrin	309-00-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	1,900	--	--	--
300 Area Near-Shore Wells	Alpha-Chlordane	5103-71-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	0.0043	--	--	--
300 Area Near-Shore Wells	Antimony-125	14234-35-6	pCi/L	N	1/19/2006	1/19/2006	2	0	0	29	57	--	--	367,000	--	--	--
300 Area Near-Shore Wells	Aroclor-1016	12674-11-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.40	0.40	--	--	0.014	--	--	--
300 Area Near-Shore Wells	Aroclor-1221	11104-28-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.40	0.40	--	--	0.014	--	--	--
300 Area Near-Shore Wells	Aroclor-1232	11141-16-5	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.40	0.40	--	--	0.014	--	--	--
300 Area Near-Shore Wells	Aroclor-1242	53469-21-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.40	0.40	--	--	0.014	--	--	--
300 Area Near-Shore Wells	Aroclor-1248	12672-29-6	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.40	0.40	--	--	0.014	--	--	--
300 Area Near-Shore Wells	Aroclor-1254	11097-69-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.40	0.40	--	--	0.014	--	--	--
300 Area Near-Shore Wells	Aroclor-1260	11096-82-5	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.40	0.40	--	--	0.014	--	--	--
300 Area Near-Shore Wells	Cadmium	7440-43-9	ug/L	Y	1/4/2006	4/5/2011	179	0	0	0.20	30	--	--	0.22	--	0.92	--
300 Area Near-Shore Wells	Carbon-14	14762-75-5	pCi/L	N	1/19/2006	1/19/2006	2	0	0	-2.02E+01	-1.43E+01	--	--	609	--	--	--
300 Area Near-Shore Wells	Cesium-134	13967-70-9	pCi/L	N	1/19/2006	1/19/2006	2	0	0	15	26	--	--	21	--	1.1	--
300 Area Near-Shore Wells	Cesium-137	10045-97-3	pCi/L	N	1/19/2006	1/19/2006	2	0	0	11	24	--	--	43	--	8.6	--
300 Area Near-Shore Wells	Chloroform	67-66-3	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	28	--	--	--
300 Area Near-Shore Wells	Cobalt-60	10198-40-0	pCi/L	N	1/19/2006	1/19/2006	2	0	0	12	26	--	--	3,760	--	0.023	--
300 Area Near-Shore Wells	Cyanide	57-12-5	ug/L	N	6/4/2010	11/11/2010	18	0	0	4.0	4.0	--	--	5.2	--	8.4	--
300 Area Near-Shore Wells	Dieldrin	60-57-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	0.0019	--	--	--
300 Area Near-Shore Wells	Endosulfan I	959-98-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	0.056	--	--	--
300 Area Near-Shore Wells	Endosulfan II	33213-65-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	0.056	--	--	--
300 Area Near-Shore Wells	Endrin	72-20-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	0.0023	--	--	--
300 Area Near-Shore Wells	Europium-152	14683-23-9	pCi/L	N	1/19/2006	1/19/2006	2	0	0	34	59	--	--	25,500	--	222	--
300 Area Near-Shore Wells	Europium-154	15585-10-1	pCi/L	N	1/19/2006	1/19/2006	2	0	0	32	70	--	--	21,600	--	70	--
300 Area Near-Shore Wells	Europium-155	14391-16-3	pCi/L	N	1/19/2006	1/19/2006	2	0	0	38	81	--	--	26,400	--	5.9	--
300 Area Near-Shore Wells	Gamma-BHC (Lindane)	58-89-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	0.080	--	--	--
300 Area Near-Shore Wells	Heptachlor	76-44-8	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	0.0038	--	--	--
300 Area Near-Shore Wells	Heptachlor epoxide	1024-57-3	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	0.0038	--	--	--
300 Area Near-Shore Wells	Hexavalent Chromium	18540-29-9	ug/L	N	1/19/2006	1/19/2006	2	0	0	2.0	2.0	--	--	10	--	--	--
300 Area Near-Shore Wells	Lead	7439-92-1	ug/L	Y	6/4/2010	12/6/2010	19	0	0	0.20	0.20	--	--	2.1	--	0.92	--
300 Area Near-Shore Wells	Mercury	7439-97-6	ug/L	N	1/19/2006	12/6/2010	30	0	0	0.050	0.10	--	--	0.012	--	0.0030	--
300 Area Near-Shore Wells	Mercury	7439-97-6	ug/L	Y	6/4/2010	12/6/2010	19	0	0	0.10	0.10	--	--	0.012	--	0.0030	--
300 Area Near-Shore Wells	Methoxychlor	72-43-5	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	0.030	--	--	--
300 Area Near-Shore Wells	Nitrite	14797-65-0	ug/L	Y	12/6/2010	12/6/2010	1	0	0	118	118	--	--	246	--	94	--
300 Area Near-Shore Wells	Pentachlorophenol	87-86-5	ug/L	N	1/19/2006	1/19/2006	2	0	0	25	25	--	--	13	--	--	--
300 Area Near-Shore Wells	Phosphate	14265-44-2	ug/L	Y	12/6/2010	12/6/2010	1	0	0	429	429	--	--	1,000	--	162	--
300 Area Near-Shore Wells	Potassium-40	13966-00-2	pCi/L	N	1/19/2006	1/19/2006	2	0	0	120	730	--	--	250	--	203	--
300 Area Near-Shore Wells	Radium-226	13982-63-3	pCi/L	N	1/19/2006	1/19/2006	2	0	0	22	58	--	--	4.1	--	1.1	--
300 Area Near-Shore Wells	Radium-228	15262-20-1	pCi/L	N	1/19/2006	1/19/2006	2	0	0	-2.25E-01	0.035	--	--	3.4	--	--	--
300 Area Near-Shore Wells	Strontium-90	10098-97-2	pCi/L	N	1/19/2006	11/11/2010	20	0	0	-1.10E+01	0.043	--	--	278	--	0.0010	--
300 Area Near-Shore Wells	Thorium-230	14269-63-7	pCi/L	N	1/19/2006	1/19/2006	2	0	0	-7.80E-02	-6.30E-02	--	--	2,570	--	--	--
300 Area Near-Shore Wells	Thorium-232	TH-232	pCi/L	N	1/19/2006	1/19/2006	2	0	0	-2.10E-02	0	--	--	304	--	--	--
300 Area Near-Shore Wells	Toxaphene	8001-35-2	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.50	0.50	--	--	2.00E-04	--	--	--
300 Area Near-Shore Wells	Trichloroethene	79-01-6	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	47	--	--	--
300 Area Near-Shore Wells	Uranium	7440-61-1	ug/L	Y	12/6/2010	12/6/2010	1	0	0	0.10	0.10	--	--	5.0	--	9.9	--

Table M-11. Summary of Aquifer Tube Analytes That Were Not Detected

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 ATs	Acetone	67-64-1	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	1,500	--	--	--
300 ATs	Chloroform	67-66-3	ug/L	Y	12/12/2006	12/12/2006	2	0	0	1.0	1.0	--	--	28	--	--	--
300 ATs	Heptachlor	76-44-8	ug/L	N	9/23/2008	10/28/2008	7	0	0	0.0030	0.050	--	--	0.0038	--	--	--
300 ATs	Heptachlor epoxide	1024-57-3	ug/L	N	9/23/2008	10/28/2008	7	0	0	0.0030	0.050	--	--	0.0038	--	--	--
300 ATs	Lead	7439-92-1	ug/L	N	9/25/2008	10/28/2008	7	0	0	1.3	45	--	--	2.1	--	0.92	--
300 ATs	Neptunium-237	13994-20-2	pCi/L	N	9/25/2008	10/28/2008	7	0	0	-8.30E-02	0.068	--	--	69	--	--	--
300 ATs	Pentachlorophenol	87-86-5	ug/L	N	9/23/2008	10/28/2008	7	0	0	2.0	25	--	--	13	--	--	--

Table M-12. Summary of Pore Water Analytes That Were Not Detected

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 PORE-WATER	4,4'-DDT (Dichlorodiphenyltrichloroethane)	50-29-3	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	0.0010	--	--	--
300 PORE-WATER	Aldrin	309-00-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	1,900	--	--	--
300 PORE-WATER	Alpha-Chlordane	5103-71-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	0.0043	--	--	--
300 PORE-WATER	Antimony	7440-36-0	ug/L	N	1/16/2006	1/3/2007	16	0	0	2.5	4.0	--	--	30	--	55	--
300 PORE-WATER	Antimony-125	14234-35-6	pCi/L	N	1/16/2006	1/3/2007	16	0	0	17	69	--	--	367,000	--	--	--
300 PORE-WATER	Aroclor-1016	12674-11-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.40	0.41	--	--	0.014	--	--	--
300 PORE-WATER	Aroclor-1221	11104-28-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.40	0.41	--	--	0.014	--	--	--
300 PORE-WATER	Aroclor-1232	11141-16-5	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.40	0.41	--	--	0.014	--	--	--
300 PORE-WATER	Aroclor-1242	53469-21-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.40	0.41	--	--	0.014	--	--	--
300 PORE-WATER	Aroclor-1248	12672-29-6	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.40	0.41	--	--	0.014	--	--	--
300 PORE-WATER	Aroclor-1254	11097-69-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.40	0.41	--	--	0.014	--	--	--
300 PORE-WATER	Aroclor-1260	11096-82-5	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.40	0.41	--	--	0.014	--	--	--
300 PORE-WATER	Cadmium	7440-43-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.30	0.70	--	--	0.22	--	0.92	--
300 PORE-WATER	Cesium-134	13967-70-9	pCi/L	N	1/16/2006	1/3/2007	16	0	0	8.1	35	--	--	21	--	1.1	--
300 PORE-WATER	Cesium-137	10045-97-3	pCi/L	N	1/16/2006	1/3/2007	16	0	0	6.3	29	--	--	43	--	8.6	--
300 PORE-WATER	Cobalt-60	10198-40-0	pCi/L	N	1/16/2006	1/3/2007	16	0	0	7.0	32	--	--	3,760	--	0.023	--
300 PORE-WATER	Dieldrin	60-57-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	0.0019	--	--	--
300 PORE-WATER	Endosulfan I	959-98-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	0.056	--	--	--
300 PORE-WATER	Endosulfan II	33213-65-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	0.056	--	--	--
300 PORE-WATER	Endrin	72-20-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	0.0023	--	--	--
300 PORE-WATER	Europium-152	14683-23-9	pCi/L	N	1/16/2006	1/3/2007	16	0	0	20	76	--	--	25,500	--	222	--
300 PORE-WATER	Europium-154	15585-10-1	pCi/L	N	1/16/2006	1/3/2007	16	0	0	19	88	--	--	21,600	--	70	--
300 PORE-WATER	Europium-155	14391-16-3	pCi/L	N	1/16/2006	1/3/2007	16	0	0	23	96	--	--	26,400	--	5.9	--
300 PORE-WATER	Fluoride	16984-48-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	250	250	--	--	300	--	1,047	--
300 PORE-WATER	Gamma-BHC (Lindane)	58-89-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	0.080	--	--	--
300 PORE-WATER	Heptachlor	76-44-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	0.0038	--	--	--
300 PORE-WATER	Heptachlor epoxide	1024-57-3	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	0.0038	--	--	--
300 PORE-WATER	Mercury	7439-97-6	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.10	0.10	--	--	0.012	--	0.0030	--
300 PORE-WATER	Methoxychlor	72-43-5	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	0.030	--	--	--
300 PORE-WATER	Nickel	7440-02-0	ug/L	N	1/16/2006	1/3/2007	16	0	0	1.3	2.2	--	--	45	--	1.6	--
300 PORE-WATER	Pentachlorophenol	87-86-5	ug/L	N	1/16/2006	1/3/2007	16	0	0	25	26	--	--	13	--	--	--
300 PORE-WATER	Phosphate	14265-44-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	250	250	--	--	1,000	--	162	--
300 PORE-WATER	Potassium-40	13966-00-2	pCi/L	N	1/16/2006	1/3/2007	16	0	0	0	860	--	--	250	--	203	--
300 PORE-WATER	Radium-226	13982-63-3	pCi/L	N	1/16/2006	1/3/2007	16	0	0	-2.80E-02	0.53	--	--	4.1	--	1.1	--
300 PORE-WATER	Radium-228	15262-20-1	pCi/L	N	1/16/2006	1/3/2007	16	0	0	-4.83E-01	1.2	--	--	3.4	--	--	--
300 PORE-WATER	Silver	7440-22-4	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.50	1.4	--	--	2.6	--	5.3	--
300 PORE-WATER	Strontium-90	10098-97-2	pCi/L	N	1/16/2006	1/3/2007	16	0	0	-1.53E-01	0.22	--	--	278	--	0.0010	--
300 PORE-WATER	Thorium-230	14269-63-7	pCi/L	N	1/16/2006	1/3/2007	16	0	0	-9.50E-02	0.24	--	--	2,570	--	--	--
300 PORE-WATER	Toxaphene	8001-35-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.50	0.52	--	--	2.00E-04	--	--	--

Table M-13. Summary of Seep/Spring Analytes That Were Not Detected

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SEEP	Cerium/Praseodymium-144	CE/PR-144	pCi/L	N	12/31/1991	9/25/1994	7	0	0	-1.02E+01	13	--	--	1,600	--	--	--
300 SEEP	Cesium-134	13967-70-9	pCi/L	N	12/31/1991	10/25/2004	57	0	0	-2.13E+00	3.6	--	--	21	--	1.1	--
300 SEEP	Europium-152	14683-23-9	pCi/L	N	10/13/2003	10/25/2004	3	0	0	-2.82E+00	-1.24E+00	--	--	25,500	--	222	--
300 SEEP	Europium-155	14391-16-3	pCi/L	N	12/31/1991	10/25/2004	57	0	0	-7.11E+00	5.6	--	--	26,400	--	5.9	--
300 SEEP	Phosphate	14265-44-2	ug/L	N	11/21/1996	11/21/1996	1	0	0	83	83	--	--	1,000	--	162	--
300 SEEP	Silver	7440-22-4	ug/L	Y	10/13/2003	10/25/2004	3	0	0	0.0017	0.0085	--	--	2.6	--	5.3	--
300 SEEP	Zinc-65	13982-39-3	pCi/L	N	12/31/1991	9/25/1994	7	0	0	-3.94E+00	0.81	--	--	13	--	--	--
300 SEEP	Zirconium/Niobium-95	ZR/NB-95	pCi/L	N	12/31/1991	9/25/1994	7	0	0	-2.42E+00	2.0	--	--	7,330	--	--	--

Table M-14. Summary of Surface Water Analytes That Were Not Detected

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SW	4,4'-DDT (Dichlorodiphenyltrichloroethane)	50-29-3	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	0.0010	--	--	--
300 SW	Acetone	67-64-1	ug/L	N	9/20/1996	9/20/1996	1	0	0	1.4	1.4	--	--	1,500	--	--	--
300 SW	Aldrin	309-00-2	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	1,900	--	--	--
300 SW	Alpha-Chlordane	5103-71-9	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	0.0043	--	--	--
300 SW	Antimony-125	14234-35-6	pCi/L	N	11/5/2002	1/10/2007	15	0	0	12	58	--	--	367,000	--	--	--
300 SW	Aroclor-1016	12674-11-2	ug/L	N	1/16/2006	2/6/2007	15	0	0	0.40	0.41	--	--	0.014	--	--	--
300 SW	Aroclor-1221	11104-28-2	ug/L	N	1/16/2006	2/6/2007	15	0	0	0.40	0.41	--	--	0.014	--	--	--
300 SW	Aroclor-1232	11141-16-5	ug/L	N	1/16/2006	2/6/2007	15	0	0	0.40	0.41	--	--	0.014	--	--	--
300 SW	Aroclor-1242	53469-21-9	ug/L	N	1/16/2006	2/6/2007	15	0	0	0.40	0.41	--	--	0.014	--	--	--
300 SW	Aroclor-1248	12672-29-6	ug/L	N	1/16/2006	2/6/2007	15	0	0	0.40	0.41	--	--	0.014	--	--	--
300 SW	Aroclor-1254	11097-69-1	ug/L	N	1/16/2006	2/6/2007	15	0	0	0.40	0.41	--	--	0.014	--	--	--
300 SW	Aroclor-1260	11096-82-5	ug/L	N	1/16/2006	2/6/2007	15	0	0	0.40	0.41	--	--	0.014	--	--	--
300 SW	Cerium-141	13967-74-3	pCi/L	N	6/7/2000	12/1/2004	47	0	0	2.5	25	--	--	8,830	--	--	--
300 SW	Cerium-144	14762-78-8	pCi/L	N	6/7/2000	12/1/2004	47	0	0	8.9	39	--	--	1,600	--	--	--
300 SW	Cesium-134	13967-70-9	pCi/L	Y	1/10/1990	1/5/1993	28	0	0	-2.61E-02	6.78E-04	--	--	21	--	1.1	--
300 SW	Chloroform	67-66-3	ug/L	N	9/20/1996	9/20/1996	1	0	0	0.41	0.41	--	--	28	--	--	--
300 SW	Chromium-51	14392-02-0	pCi/L	N	11/5/2002	11/5/2002	1	0	0	52	52	--	--	268,000	--	--	--
300 SW	Cobalt	7440-48-4	ug/L	N	9/20/1996	1/10/2007	15	0	0	0.50	5.0	--	--	23	--	0.92	--
300 SW	Cobalt-58	13981-38-9	pCi/L	N	1/5/1999	2/1/2005	122	0	0	-2.00E+00	9.5	--	--	9,680	--	--	--
300 SW	Dieldrin	60-57-1	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	0.0019	--	--	--
300 SW	Endosulfan I	959-98-8	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	0.056	--	--	--
300 SW	Endosulfan II	33213-65-9	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	0.056	--	--	--
300 SW	Endrin	72-20-8	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	0.0023	--	--	--
300 SW	Europium-152	14683-23-9	pCi/L	N	6/7/2000	1/10/2007	61	0	0	3.3	64	--	--	25,500	--	222	--
300 SW	Europium-154	15585-10-1	pCi/L	N	11/5/2002	1/10/2007	15	0	0	9.0	71	--	--	21,600	--	70	--
300 SW	Europium-155	14391-16-3	pCi/L	N	1/16/2006	1/10/2007	14	0	0	11	87	--	--	26,400	--	5.9	--
300 SW	Gamma-BHC (Lindane)	58-89-9	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	0.080	--	--	--
300 SW	Heptachlor	76-44-8	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	0.0038	--	--	--
300 SW	Heptachlor epoxide	1024-57-3	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	0.0038	--	--	--
300 SW	Methoxychlor	72-43-5	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	0.030	--	--	--
300 SW	Pentachlorophenol	87-86-5	ug/L	N	1/16/2006	2/6/2007	14	0	0	25	27	--	--	13	--	--	--
300 SW	Phosphate	14265-44-2	ug/L	N	9/18/1995	1/10/2007	16	0	0	83	340	--	--	1,000	--	162	--
300 SW	Radium-228	15262-20-1	pCi/L	N	1/16/2006	1/10/2007	14	0	0	-3.28E-01	0.55	--	--	3.4	--	--	--
300 SW	Thorium-230	14269-63-7	pCi/L	N	1/16/2006	1/10/2007	14	0	0	-9.30E-02	0.094	--	--	2,570	--	--	--
300 SW	Thorium-232	TH-232	pCi/L	N	11/5/2002	1/10/2007	15	0	0	-6.40E-02	25	--	--	304	--	--	--
300 SW	Total petroleum hydrocarbons - diesel range	TPHDIESEL	ug/L	N	1/16/2006	1/10/2007	14	0	0	100	103	--	--	500	--	--	--
300 SW	Toxaphene	8001-35-2	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.50	0.52	--	--	2.00E-04	--	--	--
300 SW	Uranium	7440-61-1	ug/L	N	1/16/2006	1/10/2007	14	0	0	14	21	--	--	5.0	--	9.9	--
300 SW	Zinc-65	13982-39-3	pCi/L	N	1/5/1999	2/1/2005	122	0	0	-4.00E+00	15	--	--	13	--	--	--

Table M-15. Summary of Groundwater Analytes That Do Not Exceed an Ecological Screening Level

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 Area Near-Shore Wells	Acetone	67-64-1	ug/L	N	1/4/2006	4/5/2011	323	11	3.4	0.34	1.0	0.71	41	1,500	--	--	--
300 Area Near-Shore Wells	Aluminum	7429-90-5	ug/L	N	1/19/2006	12/6/2010	30	5	17	5.0	18	27	65	87	--	7.1	5
300 Area Near-Shore Wells	Arsenic	7440-38-2	ug/L	N	1/19/2006	12/6/2010	30	23	77	0.80	0.80	0.93	7.0	150	--	7.9	--
300 Area Near-Shore Wells	Arsenic	7440-38-2	ug/L	Y	6/4/2010	12/6/2010	19	16	84	0.80	0.80	1.0	6.1	150	--	7.9	--
300 Area Near-Shore Wells	Barium	7440-39-3	ug/L	N	1/19/2006	4/5/2011	143	143	100	--	--	15	83	364	--	105	--
300 Area Near-Shore Wells	Barium	7440-39-3	ug/L	Y	1/4/2006	4/5/2011	179	179	100	--	--	20	82	364	--	105	--
300 Area Near-Shore Wells	Chloride	16887-00-6	ug/L	N	1/4/2006	4/5/2011	276	276	100	--	--	1,260	28,900	230,000	--	15,630	148
300 Area Near-Shore Wells	Chloride	16887-00-6	ug/L	Y	12/6/2010	12/6/2010	1	1	100	--	--	3,430	3,430	230,000	--	15,630	--
300 Area Near-Shore Wells	Chloroform	67-66-3	ug/L	N	1/4/2006	4/5/2011	323	5	1.6	0.048	1.0	0.20	1.1	28	--	--	--
300 Area Near-Shore Wells	Chromium	7440-47-3	ug/L	N	1/19/2006	4/5/2011	143	29	20	1.0	14	1.4	16	64	--	2.4	25
300 Area Near-Shore Wells	Chromium	7440-47-3	ug/L	Y	1/4/2006	4/5/2011	174	35	20	1.0	14	1.4	30	64	--	2.4	30
300 Area Near-Shore Wells	Cobalt	7440-48-4	ug/L	N	1/19/2006	4/5/2011	143	8	5.6	0.050	5.0	0.15	1.7	23	--	0.92	3
300 Area Near-Shore Wells	Cobalt	7440-48-4	ug/L	Y	1/4/2006	4/5/2011	179	21	12	0.10	70	0.11	8.6	23	--	0.92	13
300 Area Near-Shore Wells	Lead	7439-92-1	ug/L	N	1/19/2006	12/6/2010	30	1	3.3	0.10	3.1	0.22	0.22	2.1	--	0.92	--
300 Area Near-Shore Wells	Nitrate	14797-55-8	ug/L	Y	12/6/2010	12/6/2010	1	1	100	--	--	186	186	7,100	--	26,871	--
300 Area Near-Shore Wells	Phosphorus	7723-14-0	ug/L	N	1/19/2006	12/6/2010	30	20	67	55	72	75	402	1,000	--	--	--
300 Area Near-Shore Wells	Phosphorus	7723-14-0	ug/L	Y	6/4/2010	12/6/2010	19	11	58	55	72	76	445	1,000	--	--	--
300 Area Near-Shore Wells	Selenium	7782-49-2	ug/L	N	1/19/2006	12/6/2010	30	23	77	0.60	3.6	0.48	4.2	5.0	--	11	--
300 Area Near-Shore Wells	Selenium	7782-49-2	ug/L	Y	6/4/2010	12/6/2010	19	18	95	0.60	0.60	0.72	4.1	5.0	--	11	--
300 Area Near-Shore Wells	Tritium	10028-17-8	pCi/L	N	1/19/2006	4/5/2011	45	44	98	98	98	820	8,000	2.65E+08	--	119	44
300 Area Near-Shore Wells	Uranium-233/234	U-233/234	pCi/L	N	1/19/2006	4/5/2011	25	25	100	--	--	2.5	72	202	--	--	--
300 Area Near-Shore Wells	Uranium-234	13966-29-5	pCi/L	N	1/19/2006	12/30/2009	20	20	100	--	--	11	66	202	--	0.85	20
300 Area Near-Shore Wells	Uranium-235	15117-96-1	pCi/L	N	1/19/2006	4/5/2011	43	43	100	--	--	0.17	5.5	217	--	--	--
300 Area Near-Shore Wells	Uranium-238	U-238	pCi/L	N	1/19/2006	4/5/2011	43	43	100	--	--	2.1	69	223	--	--	--
300 Area Near-Shore Wells	Vanadium	7440-62-2	ug/L	N	1/19/2006	4/5/2011	143	31	22	0.40	17	0.59	34	100	--	12	17
300 Area Near-Shore Wells	Vanadium	7440-62-2	ug/L	Y	1/4/2006	4/5/2011	179	39	22	4.1	140	0.69	28	100	--	12	24
300 Area Near-Shore Wells	Zinc	7440-66-6	ug/L	N	1/19/2006	4/5/2011	143	34	24	1.6	9.0	2.7	30	90	--	22	3

Table M-16. Summary of Aquifer Tube Analytes That Do Not Exceed an Ecological Screening Level

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 ATs	Acetone	67-64-1	ug/L	N	1/24/2006	4/13/2011	135	5	3.7	0.34	1.0	1.1	42	1,500	--	--	--
300 ATs	Aluminum	7429-90-5	ug/L	Y	6/10/2004	6/10/2004	1	1	100	--	--	2.3	2.3	87	--	7.1	--
300 ATs	Arsenic	7440-38-2	ug/L	N	12/11/2006	10/28/2008	28	15	54	2.0	78	0.73	35	150	--	7.9	1
300 ATs	Arsenic	7440-38-2	ug/L	Y	6/10/2004	10/28/2008	21	12	57	2.0	78	0.75	61	150	--	7.9	1
300 ATs	Barium	7440-39-3	ug/L	N	12/11/2006	3/29/2011	86	86	100	--	--	27	238	364	--	105	7
300 ATs	Chloride	16887-00-6	ug/L	N	6/10/2004	3/29/2011	150	150	100	--	--	1,040	49,900	230,000	--	15,630	53
300 ATs	Chloroform	67-66-3	ug/L	N	1/24/2006	4/13/2011	135	11	8.2	0.10	1.0	0.33	7.3	28	--	--	--
300 ATs	Chromium	7440-47-3	ug/L	N	12/11/2006	3/29/2011	93	21	23	3.1	14	1.1	19	64	--	2.4	15
300 ATs	Chromium	7440-47-3	ug/L	Y	6/10/2004	3/29/2011	98	25	26	3.1	14	0.89	19	64	--	2.4	19
300 ATs	Cobalt	7440-48-4	ug/L	N	12/11/2006	3/29/2011	86	12	14	0.050	4.0	0.060	7.2	23	--	0.92	7
300 ATs	Cobalt	7440-48-4	ug/L	Y	1/24/2006	3/29/2011	90	13	14	0.050	5.0	1.4	7.9	23	--	0.92	13
300 ATs	Copper	7440-50-8	ug/L	Y	1/24/2006	3/29/2011	78	4	5.1	2.8	6.0	4.0	6.0	10	--	0.81	4
300 ATs	Hexavalent Chromium	18540-29-9	ug/L	N	2/19/2009	1/29/2010	14	3	21	2.0	2.0	2.0	2.2	10	--	--	--
300 ATs	Hexavalent Chromium	18540-29-9	ug/L	Y	11/15/2009	1/29/2010	6	1	17	2.0	2.0	2.6	2.6	10	--	--	--
300 ATs	Iodine-129	15046-84-1	pCi/L	N	8/25/2008	1/29/2010	22	1	4.6	-2.27E+00	0.72	0.27	0.27	38,400	--	9.00E-07	1
300 ATs	Lead	7439-92-1	ug/L	Y	6/10/2004	10/28/2008	8	1	13	1.3	45	0.013	0.013	2.1	--	0.92	--
300 ATs	Nickel	7440-02-0	ug/L	N	12/11/2006	3/29/2011	93	14	15	0.20	6.0	0.20	5.9	45	--	1.6	5
300 ATs	Nickel	7440-02-0	ug/L	Y	6/10/2004	3/29/2011	98	7	7.1	0.20	7.5	0.27	4.5	45	--	1.6	2
300 ATs	Nitrite	14797-65-0	ug/L	N	1/24/2006	3/29/2011	156	5	3.2	13	723	65	161	246	--	94	3
300 ATs	Phosphate	14265-44-2	ug/L	N	6/10/2004	3/11/2010	42	8	19	86	4,600	50	940	1,000	--	162	6
300 ATs	Selenium	7782-49-2	ug/L	Y	6/10/2004	6/10/2004	1	1	100	--	--	0.43	0.43	5.0	--	11	--
300 ATs	Strontium-90	10098-97-2	pCi/L	N	9/25/2008	10/28/2008	7	1	14	-2.97E+00	0.25	1.9	1.9	278	--	0.0010	1
300 ATs	Technetium-99	14133-76-7	pCi/L	N	9/25/2008	1/29/2010	22	6	27	-1.30E+01	4.7	13	45	667,000	--	0.83	6
300 ATs	Thorium	7440-29-1	ug/L	Y	6/10/2004	6/10/2004	1	1	100	--	--	0.026	0.026	304	--	0.50	--
300 ATs	Trichloroethene	79-01-6	ug/L	Y	12/12/2006	12/12/2006	2	1	50	1.0	1.0	28	28	47	--	--	--
300 ATs	Tritium	10028-17-8	pCi/L	N	1/24/2006	3/29/2011	98	73	74	-5.60E+01	340	198	24,000	2.65E+08	--	119	73
300 ATs	Uranium-233/234	U-233/234	pCi/L	N	9/25/2008	9/29/2008	6	6	100	--	--	0.24	0.83	202	--	--	--
300 ATs	Uranium-234	13966-29-5	pCi/L	N	10/28/2008	10/28/2008	1	1	100	--	--	1.9	1.9	202	--	0.85	1
300 ATs	Uranium-235	15117-96-1	pCi/L	N	9/25/2008	10/28/2008	7	5	71	0.018	0.027	0.036	0.12	217	--	--	--
300 ATs	Uranium-238	U-238	pCi/L	N	9/25/2008	10/28/2008	7	7	100	--	--	0.22	1.7	223	--	--	--
300 ATs	Vanadium	7440-62-2	ug/L	N	12/11/2006	3/29/2011	93	25	27	4.1	17	0.73	23	100	--	12	10
300 ATs	Vanadium	7440-62-2	ug/L	Y	1/24/2006	3/29/2011	97	19	20	4.1	17	0.74	17	100	--	12	6

Table M-17. Summary of Pore Water Analytes That Do Not Exceed an Ecological Screening Level

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 PORE-WATER	Arsenic	7440-38-2	ug/L	N	1/16/2006	1/3/2007	16	6	38	3.1	3.7	3.6	12	150	--	7.9	2
300 PORE-WATER	Barium	7440-39-3	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	26	104	364	--	105	--
300 PORE-WATER	Chloride	16887-00-6	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	980	13,200	230,000	--	15,630	--
300 PORE-WATER	Chromium	7440-47-3	ug/L	N	1/16/2006	1/3/2007	16	1	6.3	0.70	1.6	2.8	2.8	64	--	2.4	1
300 PORE-WATER	Cobalt	7440-48-4	ug/L	N	1/16/2006	1/3/2007	16	1	6.3	0.50	1.2	1.9	1.9	23	--	0.92	1
300 PORE-WATER	Copper	7440-50-8	ug/L	N	1/16/2006	1/3/2007	16	8	50	0.70	1.2	1.5	8.9	10	--	0.81	8
300 PORE-WATER	Hexavalent Chromium	18540-29-9	ug/L	N	1/16/2006	1/3/2007	15	1	6.7	2.0	3.0	5.5	5.5	10	--	--	--
300 PORE-WATER	Phosphorus	7723-14-0	ug/L	N	1/16/2006	1/3/2007	16	7	44	8.3	13	11	143	1,000	--	--	--
300 PORE-WATER	Selenium	7782-49-2	ug/L	N	1/16/2006	1/3/2007	16	1	6.3	2.6	4.3	4.1	4.1	5.0	--	11	--
300 PORE-WATER	Thorium-232	TH-232	pCi/L	N	1/16/2006	1/3/2007	16	1	6.3	-2.00E-02	0.035	0.28	0.28	304	--	--	--
300 PORE-WATER	Total petroleum hydrocarbons - diesel range	TPHDIESEL	ug/L	N	1/16/2006	1/3/2007	16	2	13	100	102	99	120	500	--	--	--
300 PORE-WATER	Tritium	10028-17-8	pCi/L	N	1/16/2006	1/3/2007	16	3	19	-4.28E+01	115	1,970	6,260	2.65E+08	--	119	3
300 PORE-WATER	Uranium-234	13966-29-5	pCi/L	N	1/16/2006	1/3/2007	16	16	100	--	--	0.21	51	202	--	0.85	7
300 PORE-WATER	Uranium-235	15117-96-1	pCi/L	N	1/16/2006	1/3/2007	16	3	19	0	0.12	0.36	5.8	217	--	--	--
300 PORE-WATER	Uranium-238	U-238	pCi/L	N	1/16/2006	1/3/2007	16	14	88	0.20	0.20	0.18	46	223	--	--	--
300 PORE-WATER	Vanadium	7440-62-2	ug/L	N	1/16/2006	1/3/2007	16	8	50	0.50	0.90	0.65	3.3	100	--	12	--
300 PORE-WATER	Zinc	7440-66-6	ug/L	N	1/16/2006	1/3/2007	16	15	94	0.50	0.50	1.1	13	90	--	22	--

Table M-18. Summary of Seep/Spring Analytes That Do Not Exceed an Ecological Screening Level

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SEEP	Acetone	67-64-1	ug/L	N	9/5/1995	10/25/2004	8	4	50	0.30	4.0	1.6	5.9	1,500	--	--	--
300 SEEP	Antimony	7440-36-0	ug/L	N	11/21/1996	10/25/2004	11	10	91	43	43	0.19	0.39	30	--	55	--
300 SEEP	Antimony	7440-36-0	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	0.22	0.26	30	--	55	--
300 SEEP	Antimony-125	14234-35-6	pCi/L	N	12/31/1991	10/25/2004	56	1	1.8	-4.98E+00	7.5	3.2	3.2	367,000	--	--	--
300 SEEP	Arsenic	7440-38-2	ug/L	N	9/27/2000	10/25/2004	10	10	100	--	--	0.79	4.0	150	--	7.9	--
300 SEEP	Arsenic	7440-38-2	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	1.2	1.6	150	--	7.9	--
300 SEEP	Barium	7440-39-3	ug/L	N	8/29/1994	2/24/2003	9	9	100	--	--	33	188	364	--	105	2
300 SEEP	Cadmium	7440-43-9	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	0.016	0.028	0.22	--	0.92	--
300 SEEP	Cesium-137	10045-97-3	pCi/L	N	12/31/1991	10/25/2004	57	2	3.5	-2.89E+00	2.9	0.88	1.2	43	--	8.6	--
300 SEEP	Chloride	16887-00-6	ug/L	N	8/29/1994	10/25/2004	12	12	100	--	--	4,800	18,300	230,000	--	15,630	4
300 SEEP	Chloroform	67-66-3	ug/L	N	11/1/1999	10/25/2004	7	1	14	0.070	0.23	3.4	3.4	28	--	--	--
300 SEEP	Chromium	7440-47-3	ug/L	N	9/5/1995	10/25/2004	14	14	100	--	--	0.42	18	64	--	2.4	9
300 SEEP	Chromium	7440-47-3	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	1.5	5.0	64	--	2.4	1
300 SEEP	Cobalt	7440-48-4	ug/L	N	11/21/1996	11/21/1996	1	1	100	--	--	8.3	8.3	23	--	0.92	1
300 SEEP	Cobalt-60	10198-40-0	pCi/L	N	12/31/1991	10/25/2004	57	3	5.3	-2.56E+00	1.8	1.5	6.6	3,760	--	0.023	3
300 SEEP	Copper	7440-50-8	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	0.34	0.45	10	--	0.81	--
300 SEEP	Europium-154	15585-10-1	pCi/L	N	12/31/1991	10/25/2004	57	1	1.8	-9.51E+00	12	2.2	2.2	21,600	--	70	--
300 SEEP	Hexavalent Chromium	18540-29-9	ug/L	N	11/21/1996	11/21/1996	1	1	100	--	--	0.90	0.90	10	--	--	--
300 SEEP	Iodine-129	15046-84-1	pCi/L	N	9/20/1993	10/25/2004	19	18	95	-5.00E-01	-5.00E-01	0.0019	0.0068	38,400	--	9.00E-07	18
300 SEEP	Lead	7439-92-1	ug/L	Y	10/13/2003	10/25/2004	3	2	67	0.011	0.011	0.17	0.35	2.1	--	0.92	--
300 SEEP	Mercury	7439-97-6	ug/L	N	9/27/2000	10/25/2004	8	8	100	--	--	7.35E-04	0.0047	0.012	--	0.0030	1
300 SEEP	Nickel	7440-02-0	ug/L	N	11/21/1996	10/25/2004	13	12	92	7.4	7.4	0.38	18	45	--	1.6	5
300 SEEP	Nickel	7440-02-0	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	0.97	1.5	45	--	1.6	--
300 SEEP	Potassium-40	13966-00-2	pCi/L	N	12/31/1991	10/25/2004	60	13	22	-1.11E+02	48	4.7	183	250	--	203	--
300 SEEP	Selenium	7782-49-2	ug/L	N	9/27/2000	10/25/2004	12	12	100	--	--	0.37	4.3	5.0	--	11	--
300 SEEP	Selenium	7782-49-2	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	1.1	3.1	5.0	--	11	--
300 SEEP	Silver	7440-22-4	ug/L	N	11/21/1996	10/25/2004	11	5	45	0.0012	4.5	0.0013	0.064	2.6	--	5.3	--
300 SEEP	Strontium-90	10098-97-2	pCi/L	N	9/20/1993	10/25/2004	24	15	63	-3.00E-01	0.30	0.11	3.0	278	--	0.0010	15
300 SEEP	Technetium-99	14133-76-7	pCi/L	N	12/31/1991	10/25/2004	25	24	96	0.50	0.50	1.2	34	667,000	--	0.83	24
300 SEEP	Thorium	7440-29-1	ug/L	N	2/24/2003	2/24/2003	2	2	100	--	--	0.35	0.41	304	--	0.50	--
300 SEEP	Thorium-230	14269-63-7	pCi/L	N	8/27/2001	9/18/2001	11	6	55	-6.00E-03	0.012	0.043	1.1	2,570	--	--	--
300 SEEP	Thorium-232	TH-232	pCi/L	N	8/27/2001	9/18/2001	11	6	55	0	0.0055	0.030	0.50	304	--	--	--
300 SEEP	Trichloroethene	79-01-6	ug/L	N	11/1/1999	10/25/2004	7	5	71	0.090	0.29	0.72	2.3	47	--	--	--
300 SEEP	Tritium	10028-17-8	pCi/L	N	12/31/1991	10/25/2004	46	45	98	56	56	38	12,300	2.65E+08	--	119	43
300 SEEP	Uranium-234	13966-29-5	pCi/L	N	12/31/1991	10/25/2004	73	73	100	--	--	0.26	111	202	--	0.85	55
300 SEEP	Uranium-235	15117-96-1	pCi/L	N	12/31/1991	10/25/2004	72	65	90	0.0019	0.050	0.010	6.3	217	--	--	--
300 SEEP	Uranium-238	U-238	pCi/L	N	12/31/1991	10/25/2004	73	73	100	--	--	0.22	99	223	--	--	--
300 SEEP	Vanadium	7440-62-2	ug/L	N	9/5/1995	11/21/1996	2	2	100	--	--	4.0	7.3	100	--	12	--
300 SEEP	Zinc	7440-66-6	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	1.1	1.9	90	--	22	--

Table M-19. Summary of Surface Water Analytes That Do Not Exceed an Ecological Screening Level

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SW	Antimony	7440-36-0	ug/L	Y	9/9/2003	9/15/2004	13	13	100	--	--	0.16	0.31	30	--	55	--
300 SW	Antimony-125	14234-35-6	pCi/L	Y	1/10/1990	1/5/1993	28	3	11	-1.63E-02	0.0037	0.0064	0.024	367,000	--	--	--
300 SW	Arsenic	7440-38-2	ug/L	N	9/20/1996	1/10/2007	35	23	66	2.6	3.4	0.55	6.3	150	--	7.9	--
300 SW	Arsenic	7440-38-2	ug/L	Y	9/9/2003	9/15/2004	13	13	100	--	--	0.56	3.0	150	--	7.9	--
300 SW	Barium	7440-39-3	ug/L	N	8/26/1994	1/10/2007	17	17	100	--	--	28	40	364	--	105	--
300 SW	Barium-140	14798-08-4	pCi/L	N	1/5/1999	2/1/2005	122	2	1.6	-5.00E+00	506	4.0	4.5	95	--	--	--
300 SW	Cadmium	7440-43-9	ug/L	Y	9/9/2003	9/15/2004	13	8	62	0.023	0.023	0.0086	0.016	0.22	--	0.92	--
300 SW	Cerium/Praseodymium-144	CE/PR-144	pCi/L	Y	1/10/1990	1/5/1993	28	1	3.6	-1.35E-01	0.049	0.067	0.067	1,600	--	--	--
300 SW	Cesium-134	13967-70-9	pCi/L	N	1/5/1999	1/10/2007	136	1	0.74	-1.90E+00	28	1.0	1.0	21	--	1.1	--
300 SW	Cesium-137	10045-97-3	pCi/L	N	1/5/1999	1/10/2007	136	5	3.7	-1.00E+00	25	0.30	1.3	43	--	8.6	--
300 SW	Cesium-137	10045-97-3	pCi/L	Y	1/10/1990	1/5/1993	28	11	39	-8.29E-03	0.0025	0.0018	0.0068	43	--	8.6	--
300 SW	Chloride	16887-00-6	ug/L	N	8/26/1994	1/10/2007	52	52	100	--	--	690	11,700	230,000	--	15,630	--
300 SW	Chromium	7440-47-3	ug/L	N	9/20/1996	1/10/2007	35	20	57	0.042	1.6	0.021	4.8	64	--	2.4	1
300 SW	Chromium	7440-47-3	ug/L	Y	9/10/2002	9/15/2004	14	11	79	0.047	0.047	0.024	2.0	64	--	2.4	--
300 SW	Cobalt-60	10198-40-0	pCi/L	N	1/5/1999	1/10/2007	136	1	0.74	-1.40E+00	26	1.0	1.0	3,760	--	0.023	1
300 SW	Cobalt-60	10198-40-0	pCi/L	Y	1/10/1990	1/5/1993	28	10	36	-5.44E-03	0.0021	0.0013	0.0073	3,760	--	0.023	--
300 SW	Copper	7440-50-8	ug/L	N	8/26/1994	1/10/2007	37	28	76	0.70	8.7	0.53	3.5	10	--	0.81	14
300 SW	Copper	7440-50-8	ug/L	Y	9/9/2003	9/15/2004	13	13	100	--	--	0.48	0.60	10	--	0.81	--
300 SW	Europium-154	15585-10-1	pCi/L	Y	10/2/1990	1/5/1993	19	2	11	-2.88E-02	0.0064	0.0070	0.040	21,600	--	70	--
300 SW	Europium-155	14391-16-3	pCi/L	Y	10/2/1990	1/5/1993	19	1	5.3	-6.74E-03	0.0044	0.013	0.013	26,400	--	5.9	--
300 SW	Hexavalent Chromium	18540-29-9	ug/L	N	1/16/2006	1/10/2007	14	2	14	2.0	3.0	3.8	4.9	10	--	--	--
300 SW	Iodine-129	15046-84-1	pCi/L	Y	4/3/1990	1/5/1993	8	8	100	--	--	5.66E-05	2.69E-04	38,400	--	9.00E-07	8
300 SW	Iodine-131	10043-66-0	pCi/L	N	1/5/1999	2/1/2005	121	3	2.5	-1.50E+00	1,100	1.0	1.2	13,700	--	--	--
300 SW	Iodine-131	10043-66-0	pCi/L	Y	1/10/1990	5/15/1990	9	2	22	-9.94E-03	8.12E-04	0.0094	0.0097	13,700	--	--	--
300 SW	Iron	7439-89-6	ug/L	N	8/26/1994	1/10/2007	17	15	88	32	32	25	310	1,000	--	570	--
300 SW	Lead	7439-92-1	ug/L	Y	9/10/2002	9/15/2004	14	12	86	0.011	0.011	0.012	0.090	2.1	--	0.92	--
300 SW	Manganese	7439-96-5	ug/L	N	8/26/1994	1/10/2007	17	17	100	--	--	2.0	28	120	--	39	--
300 SW	Mercury	7439-97-6	ug/L	N	9/16/1999	1/10/2007	25	11	44	0.10	0.10	3.89E-04	0.0044	0.012	--	0.0030	1
300 SW	Nickel	7440-02-0	ug/L	N	9/20/1996	1/10/2007	35	22	63	1.3	2.2	0.20	22	45	--	1.6	3
300 SW	Nickel	7440-02-0	ug/L	Y	9/9/2003	9/15/2004	13	13	100	--	--	0.65	1.4	45	--	1.6	--
300 SW	Phosphorus	7723-14-0	ug/L	N	1/16/2006	1/10/2007	14	3	21	8.3	13	8.4	21	1,000	--	--	--
300 SW	Plutonium-238	13981-16-3	pCi/L	Y	4/3/1990	1/5/1993	12	2	17	-5.59E-06	5.67E-07	4.07E-05	1.98E-04	176	--	4.99E-04	--
300 SW	Plutonium-239/240	PU-239/240	pCi/L	Y	4/3/1990	1/5/1993	12	10	83	5.69E-06	5.89E-06	1.26E-05	5.77E-04	187	--	--	--
300 SW	Potassium-40	13966-00-2	pCi/L	N	10/5/1999	1/10/2007	74	8	11	-1.20E+01	730	30	90	250	--	203	--
300 SW	Potassium-40	13966-00-2	pCi/L	Y	10/2/1990	1/5/1993	19	18	95	8.46E-04	8.46E-04	0.33	0.84	250	--	203	--
300 SW	Radium-226	13982-63-3	pCi/L	N	6/7/2000	1/10/2007	62	1	1.6	-3.61E-01	192	3.6	3.6	4.1	--	1.1	1
300 SW	Selenium	7782-49-2	ug/L	N	9/20/1996	1/10/2007	35	12	34	0.39	4.3	0.14	4.0	5.0	--	11	--
300 SW	Selenium	7782-49-2	ug/L	Y	9/9/2003	9/15/2004	13	8	62	0.50	0.50	0.14	1.3	5.0	--	11	--
300 SW	Silver	7440-22-4	ug/L	Y	9/9/2003	9/15/2004	13	1	7.7	0.0017	0.0085	0.0029	0.0029	2.6	--	5.3	--
300 SW	Strontium-90	10098-97-2	pCi/L	N	9/17/1993	1/10/2007	84	44	52	-9.00E-01	0.60	0.042	0.30	278	--	0.0010	44
300 SW	Trichloroethene	79-01-6	ug/L	N	9/18/1995	9/20/1996	2	2	100	--	--	0.71	0.80	47	--	--	--
300 SW	Tritium	10028-17-8	pCi/L	N	9/17/1993	1/10/2007	223	107	48	-7.10E+01	203	29	2,660	2.65E+08	--	119	41
300 SW	Uranium-234	13966-29-5	pCi/L	N	9/17/1993	1/10/2007	84	81	96	0.11	0.19	0.17	6.7	202	--	0.85	6
300 SW	Uranium-235	15117-96-1	pCi/L	N	9/17/1993	1/10/2007	105	25	24	-1.54E-02	34	0.0088	0.17	217	--	--	--
300 SW	Uranium-238	U-238	pCi/L	N	9/17/1993	1/10/2007	85	76	89	0.11	679	0.10	6.2	223	--	--	--

Table M-19. Summary of Surface Water Analytes That Do Not Exceed an Ecological Screening Level

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SW	Vanadium	7440-62-2	ug/L	N	9/18/1995	1/10/2007	16	4	25	0.60	0.90	1.1	5.0	100	--	12	--
300 SW	Zinc	7440-66-6	ug/L	N	8/26/1994	1/10/2007	37	36	97	7.7	7.7	0.56	57	90	--	22	2
300 SW	Zinc	7440-66-6	ug/L	Y	9/9/2003	9/15/2004	13	13	100	--	--	0.69	2.0	90	--	22	--
300 SW	Zinc-65	13982-39-3	pCi/L	Y	1/10/1990	1/5/1993	28	2	7.1	-9.02E-02	0.014	0.014	0.026	13	--	--	--
300 SW	Zirconium/Niobium-95	ZR/NB-95	pCi/L	Y	1/10/1990	1/5/1993	26	5	19	-6.04E-01	0.0033	0.0029	0.025	7,330	--	--	--
300 SW	Zirconium-95	13967-71-0	pCi/L	N	1/5/1999	2/1/2005	104	5	4.8	-3.00E+00	16	0.90	1.5	7,330	--	--	--

Table M-20. Summary of Groundwater Analytes That Do Not Exceed an Ecological Screening Level

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 Area Near-Shore Wells	Aluminum	7429-90-5	ug/L	Y	6/4/2010	12/6/2010	19	2	11	10	10	14	122	87	1	7.1	2
300 Area Near-Shore Wells	Antimony	7440-36-0	ug/L	N	1/19/2006	4/5/2011	143	4	2.8	0.30	60	33	55	30	4	55	--
300 Area Near-Shore Wells	Antimony	7440-36-0	ug/L	Y	1/4/2006	4/5/2011	179	2	1.1	0.60	720	45	52	30	2	55	--
300 Area Near-Shore Wells	Cadmium	7440-43-9	ug/L	N	1/19/2006	4/5/2011	143	1	0.70	0.10	4.0	4.2	4.2	0.22	1	0.92	1
300 Area Near-Shore Wells	Copper	7440-50-8	ug/L	N	1/19/2006	4/5/2011	143	16	11	0.10	6.0	0.22	229	10	2	0.81	6
300 Area Near-Shore Wells	Copper	7440-50-8	ug/L	Y	1/4/2006	4/5/2011	179	9	5.0	0.20	70	0.24	12	10	1	0.81	2
300 Area Near-Shore Wells	Fluoride	16984-48-8	ug/L	N	1/4/2006	4/5/2011	276	276	100	--	--	52	1,630	300	127	1,047	4
300 Area Near-Shore Wells	Fluoride	16984-48-8	ug/L	Y	12/6/2010	12/6/2010	1	1	100	--	--	332	332	300	1	1,047	--
300 Area Near-Shore Wells	Iron	7439-89-6	ug/L	N	1/19/2006	4/5/2011	143	92	64	9.0	38	13	1,260	1,000	3	570	8
300 Area Near-Shore Wells	Iron	7439-89-6	ug/L	Y	1/4/2006	4/5/2011	179	76	42	9.0	330	13	1,190	1,000	3	570	10
300 Area Near-Shore Wells	Manganese	7439-96-5	ug/L	N	1/19/2006	4/5/2011	143	35	24	0.20	6.0	1.7	319	120	3	39	26
300 Area Near-Shore Wells	Manganese	7439-96-5	ug/L	Y	1/4/2006	4/5/2011	179	58	32	0.84	30	0.89	133	120	1	39	29
300 Area Near-Shore Wells	Nickel	7440-02-0	ug/L	N	1/19/2006	4/5/2011	143	36	25	0.40	13	0.72	56	45	4	1.6	32
300 Area Near-Shore Wells	Nickel	7440-02-0	ug/L	Y	1/4/2006	4/5/2011	179	32	18	0.40	50	4.0	65	45	6	1.6	32
300 Area Near-Shore Wells	Nitrate	14797-55-8	ug/L	N	1/4/2006	4/5/2011	276	261	95	18	319	39	32,300	7,100	224	26,871	26
300 Area Near-Shore Wells	Nitrite	14797-65-0	ug/L	N	1/4/2006	4/5/2011	275	21	7.6	9.9	591	43	985	246	14	94	14
300 Area Near-Shore Wells	Phosphate	14265-44-2	ug/L	N	1/19/2006	4/5/2011	103	33	32	250	2,150	534	1,400	1,000	2	162	33
300 Area Near-Shore Wells	Silver	7440-22-4	ug/L	N	1/19/2006	4/5/2011	143	3	2.1	0.10	7.0	15	17	2.6	3	5.3	3
300 Area Near-Shore Wells	Silver	7440-22-4	ug/L	Y	1/4/2006	4/5/2011	179	4	2.2	0.20	110	5.5	15	2.6	4	5.3	4
300 Area Near-Shore Wells	Trichloroethene	79-01-6	ug/L	N	1/4/2006	4/5/2011	323	89	28	0.037	1.0	0.23	63	47	3	--	--
300 Area Near-Shore Wells	Uranium	7440-61-1	ug/L	N	1/4/2006	4/5/2011	379	337	89	-6.74E-03	0.10	0.076	218	5.0	324	9.9	301
300 Area Near-Shore Wells	Zinc	7440-66-6	ug/L	Y	1/4/2006	4/5/2011	179	38	21	4.0	19	4.0	104	90	1	22	10

Table M-21. Summary of Aquifer Tube Analytes That Do Not Exceed an Ecological Screening Level

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 ATs	Antimony	7440-36-0	ug/L	N	12/11/2006	3/29/2011	93	2	2.2	0.30	56	34	36	30	2	55	--
300 ATs	Antimony	7440-36-0	ug/L	Y	1/24/2006	3/29/2011	97	4	4.1	0.30	56	0.31	51	30	3	55	--
300 ATs	Barium	7440-39-3	ug/L	Y	6/10/2004	3/29/2011	91	91	100	--	--	19	398	364	1	105	1
300 ATs	Cadmium	7440-43-9	ug/L	N	12/11/2006	3/29/2011	93	3	3.2	0.10	4.0	4.6	6.4	0.22	3	0.92	3
300 ATs	Cadmium	7440-43-9	ug/L	Y	6/10/2004	3/29/2011	98	2	2.0	0.10	4.0	0.058	4.7	0.22	1	0.92	1
300 ATs	Copper	7440-50-8	ug/L	N	8/22/2007	3/29/2011	69	5	7.3	3.9	6.0	4.2	11	10	1	0.81	5
300 ATs	Dieldrin	60-57-1	ug/L	N	9/23/2008	10/28/2008	7	1	14	0.0020	0.10	0.016	0.016	0.0019	1	--	--
300 ATs	Fluoride	16984-48-8	ug/L	N	6/10/2004	3/29/2011	157	150	96	46	290	58	717	300	17	1,047	--
300 ATs	Iron	7439-89-6	ug/L	N	12/11/2006	3/29/2011	86	63	73	9.0	45	21	8,970	1,000	11	570	17
300 ATs	Iron	7439-89-6	ug/L	Y	1/24/2006	3/29/2011	90	35	39	9.0	45	13	3,580	1,000	1	570	2
300 ATs	Manganese	7439-96-5	ug/L	N	12/11/2006	3/29/2011	93	48	52	4.0	6.0	0.17	743	120	9	39	19
300 ATs	Manganese	7439-96-5	ug/L	Y	6/10/2004	3/29/2011	98	42	43	0.10	6.0	0.12	723	120	3	39	10
300 ATs	Nitrate	14797-55-8	ug/L	N	1/24/2006	3/29/2011	156	154	99	22	54	460	974,000	7,100	124	26,871	27
300 ATs	Nitrogen in Nitrate	NO3-N	ug/L	N	6/10/2004	6/10/2004	1	1	100	--	--	2,439	2,439	1,600	1	--	--
300 ATs	Silver	7440-22-4	ug/L	N	12/11/2006	3/29/2011	86	2	2.3	0.10	7.0	5.5	6.6	2.6	2	5.3	2
300 ATs	Silver	7440-22-4	ug/L	Y	1/24/2006	3/29/2011	90	4	4.4	0.10	7.0	5.3	8.1	2.6	4	5.3	4
300 ATs	Trichloroethene	79-01-6	ug/L	N	1/24/2006	4/13/2011	149	57	38	0.10	1.0	0.25	530	47	12	--	--
300 ATs	Uranium	7440-61-1	ug/L	N	1/24/2006	4/13/2011	251	250	100	0.10	0.10	0.13	394	5.0	225	9.9	207
300 ATs	Uranium	7440-61-1	ug/L	Y	6/10/2004	10/28/2008	21	21	100	--	--	0.55	167	5.0	14	9.9	14
300 ATs	Zinc	7440-66-6	ug/L	N	12/11/2006	3/29/2011	93	24	26	0.80	9.0	1.1	490	90	7	22	7
300 ATs	Zinc	7440-66-6	ug/L	Y	6/10/2004	3/29/2011	98	19	19	0.80	9.6	1.0	594	90	8	22	10

Table M-22. Summary of Pore Water Analytes That Do Not Exceed an Ecological Screening Level

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 PORE-WATER	Aluminum	7429-90-5	ug/L	N	1/16/2006	1/3/2007	16	11	69	18	31	30	161	87	4	7.1	11
300 PORE-WATER	Calculated Total Uranium	calc_tot_U	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	0.52	141	5.0	3	9.9	3
300 PORE-WATER	Iron	7439-89-6	ug/L	N	1/16/2006	1/3/2007	16	13	81	32	32	26	8,270	1,000	2	570	2
300 PORE-WATER	Lead	7439-92-1	ug/L	N	1/16/2006	1/3/2007	16	2	13	1.2	3.1	1.5	3.1	2.1	1	0.92	2
300 PORE-WATER	Manganese	7439-96-5	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	0.69	1,640	120	3	39	3
300 PORE-WATER	Nitrogen in Nitrate	NO3-N	ug/L	N	1/16/2006	1/3/2007	16	15	94	56	56	95	4,448	1,600	4	--	--
300 PORE-WATER	Uranium	7440-61-1	ug/L	N	1/16/2006	1/3/2007	16	3	19	14	21	23	137	5.0	3	9.9	3

Table M-23. Summary of Seep/Spring Analytes That Do Not Exceed an Ecological Screening Level

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SEEP	Aluminum	7429-90-5	ug/L	N	8/29/1994	8/27/2001	7	7	100	--	--	31	3,100	87	5	7.1	7
300 SEEP	Cadmium	7440-43-9	ug/L	N	9/27/2000	10/25/2004	12	12	100	--	--	0.025	0.57	0.22	3	0.92	--
300 SEEP	Calculated Total Uranium	calc_tot_U	ug/L	N	12/31/1991	10/25/2004	67	67	100	--	--	0.66	297	5.0	43	9.9	40
300 SEEP	Copper	7440-50-8	ug/L	N	8/29/1994	10/25/2004	12	12	100	--	--	0.51	15	10	2	0.81	7
300 SEEP	Fluoride	16984-48-8	ug/L	N	8/29/1994	10/25/2004	12	12	100	--	--	160	600	300	3	1,047	--
300 SEEP	Iron	7439-89-6	ug/L	N	8/29/1994	11/21/1996	3	3	100	--	--	190	4,700	1,000	2	570	2
300 SEEP	Lead	7439-92-1	ug/L	N	9/27/2000	10/25/2004	10	10	100	--	--	0.062	16	2.1	2	0.92	3
300 SEEP	Manganese	7439-96-5	ug/L	N	8/29/1994	8/27/2001	7	7	100	--	--	4.6	220	120	1	39	1
300 SEEP	Nitrogen in Nitrate	NO3-N	ug/L	N	8/29/1994	10/25/2004	16	16	100	--	--	1,490	25,000	1,600	15	--	--
300 SEEP	Uranium	7440-61-1	ug/L	N	2/24/2003	2/24/2003	2	2	100	--	--	120	229	5.0	2	9.9	2
300 SEEP	Zinc	7440-66-6	ug/L	N	8/29/1994	10/25/2004	13	13	100	--	--	1.4	106	90	2	22	3

Table M-24. Summary of Surface Water Analytes That Do Not Exceed an Ecological Screening Level

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 SW	Aluminum	7429-90-5	ug/L	N	8/26/1994	1/10/2007	17	14	82	18	18	20	310	87	3	7.1	14
300 SW	Antimony	7440-36-0	ug/L	N	9/20/1996	1/10/2007	35	23	66	2.5	4.0	0.13	63	30	1	55	1
300 SW	Cadmium	7440-43-9	ug/L	N	9/18/1995	1/10/2007	36	21	58	0.010	0.70	0.013	2.1	0.22	3	0.92	1
300 SW	Calculated Total Uranium	calc_tot_U	ug/L	N	9/17/1993	1/10/2007	81	81	100	--	--	0.30	19	5.0	5	9.9	4
300 SW	Fluoride	16984-48-8	ug/L	N	8/26/1994	1/10/2007	52	38	73	250	250	40	400	300	1	1,047	--
300 SW	Lead	7439-92-1	ug/L	N	9/20/1996	1/10/2007	35	22	63	1.6	3.1	0.0094	3.9	2.1	1	0.92	3
300 SW	Nitrogen in Nitrate	NO3-N	ug/L	N	8/26/1994	1/10/2007	52	52	100	--	--	53	3,700	1,600	4	--	--
300 SW	Silver	7440-22-4	ug/L	N	9/20/1996	1/10/2007	35	12	34	0.0012	1.4	0.0028	6.4	2.6	1	5.3	1

Table M-25. Comparison of Contaminants of Interest to Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Mean Detect	Median Detect	Max Detect Sample #	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 Area Near-Shore Wells	Aluminum	7429-90-5	ug/L	N	1/19/2006	12/6/2010	30	5	17	5.0	18	27	65	44	38	B28362	87	--	7.1	5
300 Area Near-Shore Wells	Aluminum	7429-90-5	ug/L	Y	6/4/2010	12/6/2010	19	2	11	10	10	14	122	68	68	B286N1	87	1	7.1	2
300 ATs	Aluminum	7429-90-5	ug/L	Y	6/10/2004	6/10/2004	1	1	100	--	--	2.3	2.3	2.3	2.3	B19H93	87	--	7.1	--
300 PORE-WATER	Aluminum	7429-90-5	ug/L	N	1/16/2006	1/3/2007	16	11	69	18	31	30	161	72	48	J11199	87	4	7.1	11
300 SEEP	Aluminum	7429-90-5	ug/L	N	8/29/1994	8/27/2001	7	7	100	--	--	31	3,100	644	123	B0G1G0	87	5	7.1	7
300 SW	Aluminum	7429-90-5	ug/L	N	8/26/1994	1/10/2007	17	14	82	18	18	20	310	90	65	B09J98	87	3	7.1	14
300 Area Near-Shore Wells	Antimony	7440-36-0	ug/L	N	1/19/2006	4/5/2011	143	4	2.8	0.30	60	33	55	39	34	B1RDB7	30	4	55	--
300 Area Near-Shore Wells	Antimony	7440-36-0	ug/L	Y	1/4/2006	4/5/2011	179	2	1.1	0.60	720	45	52	48	48	B24MY6	30	2	55	--
300 ATs	Antimony	7440-36-0	ug/L	N	12/11/2006	3/29/2011	93	2	2.2	0.30	56	34	36	35	35	B1TPH2	30	2	55	--
300 ATs	Antimony	7440-36-0	ug/L	Y	1/24/2006	3/29/2011	97	4	4.1	0.30	56	0.31	51	32	38	B249L0	30	3	55	--
300 PORE-WATER	Antimony	7440-36-0	ug/L	N	1/16/2006	1/3/2007	16	0	0	2.5	4.0	--	--	--	--	--	30	--	55	--
300 SEEP	Antimony	7440-36-0	ug/L	N	11/21/1996	10/25/2004	11	10	91	43	43	0.19	0.39	0.25	0.23	B12RM8	30	--	55	--
300 SEEP	Antimony	7440-36-0	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	0.22	0.26	0.25	0.26	B1BFY3	30	--	55	--
300 SW	Antimony	7440-36-0	ug/L	N	9/20/1996	1/10/2007	35	23	66	2.5	4.0	0.13	63	3.3	0.21	B0G1F1	30	1	55	1
300 SW	Antimony	7440-36-0	ug/L	Y	9/9/2003	9/15/2004	13	13	100	--	--	0.16	0.31	0.22	0.23	B1B7C6	30	--	55	--
300 Area Near-Shore Wells	Barium	7440-39-3	ug/L	N	1/19/2006	4/5/2011	143	143	100	--	--	15	83	55	56	B286P8	364	--	105	--
300 Area Near-Shore Wells	Barium	7440-39-3	ug/L	Y	1/4/2006	4/5/2011	179	179	100	--	--	20	82	54	55	B1H1T9	364	--	105	--
300 ATs	Barium	7440-39-3	ug/L	N	12/11/2006	3/29/2011	86	86	100	--	--	27	238	69	63	B22BY6	364	--	105	7
300 ATs	Barium	7440-39-3	ug/L	Y	6/10/2004	3/29/2011	91	91	100	--	--	19	398	63	59	B1PNV5	364	1	105	1
300 PORE-WATER	Barium	7440-39-3	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	26	104	41	33	J135W9	364	--	105	--
300 SEEP	Barium	7440-39-3	ug/L	N	8/29/1994	2/24/2003	9	9	100	--	--	33	188	93	95	B16KV0	364	--	105	2
300 SW	Barium	7440-39-3	ug/L	N	8/26/1994	1/10/2007	17	17	100	--	--	28	40	32	32	J111N6	364	--	105	--
300 Area Near-Shore Wells	Cadmium	7440-43-9	ug/L	N	1/19/2006	4/5/2011	143	1	0.70	0.10	4.0	4.2	4.2	4.2	4.2	B1VM85	0.22	1	0.92	1
300 Area Near-Shore Wells	Cadmium	7440-43-9	ug/L	Y	1/4/2006	4/5/2011	179	0	0	0.20	30	--	--	--	--	--	0.22	--	0.92	--
300 ATs	Cadmium	7440-43-9	ug/L	N	12/11/2006	3/29/2011	93	3	3.2	0.10	4.0	4.6	6.4	5.2	4.6	B249M7	0.22	3	0.92	3
300 ATs	Cadmium	7440-43-9	ug/L	Y	6/10/2004	3/29/2011	98	2	2.0	0.10	4.0	0.058	4.7	2.4	2.4	B249J5	0.22	1	0.92	1
300 PORE-WATER	Cadmium	7440-43-9	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.30	0.70	--	--	--	--	--	0.22	--	0.92	--
300 SEEP	Cadmium	7440-43-9	ug/L	N	9/27/2000	10/25/2004	12	12	100	--	--	0.025	0.57	0.16	0.080	B10903	0.22	3	0.92	--
300 SEEP	Cadmium	7440-43-9	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	0.016	0.028	0.021	0.021	B17RL6	0.22	--	0.92	--
300 SW	Cadmium	7440-43-9	ug/L	N	9/18/1995	1/10/2007	36	21	58	0.010	0.70	0.013	2.1	0.15	0.021	B0G0W4	0.22	3	0.92	1
300 SW	Cadmium	7440-43-9	ug/L	Y	9/9/2003	9/15/2004	13	8	62	0.023	0.023	0.0086	0.016	0.011	0.010	B19JC6	0.22	--	0.92	--
300 PORE-WATER	Calculated Total Uranium	calc_tot_U	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	0.52	141	13	2.0	J135X0	5.0	3	9.9	3
300 SEEP	Calculated Total Uranium	calc_tot_U	ug/L	N	12/31/1991	10/25/2004	67	67	100	--	--	0.66	297	53	33	B0WP28	5.0	43	9.9	40
300 SW	Calculated Total Uranium	calc_tot_U	ug/L	N	9/17/1993	1/10/2007	81	81	100	--	--	0.30	19	1.6	0.63	B17CX3	5.0	5	9.9	4
300 Area Near-Shore Wells	Copper	7440-50-8	ug/L	N	1/19/2006	4/5/2011	143	16	11	0.10	6.0	0.22	229	16	0.51	B22LD6	10	2	0.81	6
300 Area Near-Shore Wells	Copper	7440-50-8	ug/L	Y	1/4/2006	4/5/2011	179	9	5.0	0.20	70	0.24	12	2.0	0.30	B1PFX7	10	1	0.81	2
300 ATs	Copper	7440-50-8	ug/L	N	8/22/2007	3/29/2011	69	5	7.3	3.9	6.0	4.2	11	6.6	5.5	B22BY6	10	1	0.81	5
300 ATs	Copper	7440-50-8	ug/L	Y	1/24/2006	3/29/2011	78	4	5.1	2.8	6.0	4.0	6.0	5.0	5.1	B27W84	10	--	0.81	4
300 PORE-WATER	Copper	7440-50-8	ug/L	N	1/16/2006	1/3/2007	16	8	50	0.70	1.2	1.5	8.9	3.5	2.1	J11110	10	--	0.81	8
300 SEEP	Copper	7440-50-8	ug/L	N	8/29/1994	10/25/2004	12	12	100	--	--	0.51	15	3.5	0.89	B10903	10	2	0.81	7
300 SEEP	Copper	7440-50-8	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	0.34	0.45	0.41	0.43	B1BFY5	10	--	0.81	--
300 SW	Copper	7440-50-8	ug/L	N	8/26/1994	1/10/2007	37	28	76	0.70	8.7	0.53	3.5	1.2	0.79	B0CSC4	10	--	0.81	14
300 SW	Copper	7440-50-8	ug/L	Y	9/9/2003	9/15/2004	13	13	100	--	--	0.48	0.60	0.55	0.57	B19JC6	10	--	0.81	--
300 Area Near-Shore Wells	Dieldrin	60-57-1	ug/L	N	1/19/2006	1/19/2006	2	0	0	0.050	0.050	--	--	--	--	--	0.0019	--	--	--
300 ATs	Dieldrin	60-57-1	ug/L	N	9/23/2008	10/28/2008	7	1	14	0.0020	0.10	0.016	0.016	0.016	0.016	B1TRH4	0.0019	1	--	--
300 PORE-WATER	Dieldrin	60-57-1	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.050	0.50	--	--	--	--	--	0.0019	--	--	--
300 SW	Dieldrin	60-57-1	ug/L	N	1/16/2006	1/10/2007	14	0	0	0.050	0.052	--	--	--	--	--	0.0019	--	--	--
300 Area Near-Shore Wells	Fluoride	16984-48-8	ug/L	N	1/4/2006	4/5/2011	276	276	100	--	--	52	1,630	349	297	B1VM88	300	127	1,047	4
300 Area Near-Shore Wells	Fluoride	16984-48-8	ug/L	Y	12/6/2010	12/6/2010	1	1	100	--	--	332	332	332	332	B28360	300	1	1,047	--
300 ATs	Fluoride	16984-48-8	ug/L	N	6/10/2004	3/29/2011	157	150	96	46	290	58	717	217	221	B1TPF4	300	17	1,047	--
300 PORE-WATER	Fluoride	16984-48-8	ug/L	N	1/16/2006	1/3/2007	16	0	0	250	250	--	--	--	--	--	300	--	1,047	--
300 SEEP	Fluoride	16984-48-8	ug/L	N	8/29/1994	10/25/2004	12	12	100	--	--	160	600	291	244	B0CSG3	300	3	1,047	--
300 SW	Fluoride	16984-48-8	ug/L	N	8/26/1994	1/10/2007	52	38	73	250	250	40	400	120	120	B0CSC8	300	1	1,047	--
300 ATs	Iodine-129	15046-84-1	pCi/L	N	8/25/2008	1/29/2010	22	1	4.6	-2.27E+00	0.72	0.27	0.27	0.27	0.27	B22PN5	38,400	--	9.00E-07	1
300 SEEP	Iodine-129	15046-84-1	pCi/L	N	9/20/1993	10/25/2004	19	18	95	-5.00E-01	-5.00E-01	0.0019	0.0068	0.0044	0.0043	B17RL7	38,400	--	9.00E-07	18
300 SW	Iodine-129	15046-84-1	pCi/L	Y	4/3/1990	1/5/1993	8	8	100	--	--	5.66E-05	2.69E-04	1.60E-04	1.72E-04	E121571	38,400	--	9.00E-07	8
300 Area Near-Shore Wells	Iron	7439-89-6	ug/L	N	1/19/2006	4/5/2011	143	92	64	9.0	38	13	1,260	175	71	B1VLW4	1,000	3	570	8
300 Area Near-Shore Wells	Iron	7439-89-6	ug/L	Y	1/4/2006	4/5/2011	179	76	42	9.0	330	13	1,190	174	44	B1VLW3	1,000	3	570	10
300 ATs	Iron	7439-89-6	ug/L	N	12/11/2006	3/29/2011	86	63	73	9.0	45	21	8,970	651	119	B1TPF6	1,000	11	570	17
300 ATs	Iron	7439-89-6	ug/L	Y	1/24/2006	3/29/2011	90	35	39	9.0	45	13	3,580	186	32	B1H358	1,000	1	570	2
300 PORE-WATER	Iron	7439-89-6	ug/L	N	1/16/2006	1/3/2007	16	13	81	32	32	26	8,270	912	61	J135W9	1,000	2	570	2
300 SEEP	Iron	7439-89-6	ug/L	N	8/29/1994	11/21/1996	3	3	100	--	--	190	4,700	2,030	1,200	B0G1G0	1,000	2	570	2
300 SW	Iron	7439-89-6	ug/L	N	8/26/1994	1/10/2007	17	15	88	32	32	25	310	100	61	B09J98	1,000	--	570	--

Table M-25. Comparison of Contaminants of Interest to Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Mean Detect	Median Detect	Max Detect Sample #	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 Area Near-Shore Wells	Lead	7439-92-1	ug/L	N	1/19/2006	12/6/2010	30	1	3.3	0.10	3.1	0.22	0.22	0.22	0.22	B28313	2.1	--	0.92	--
300 Area Near-Shore Wells	Lead	7439-92-1	ug/L	Y	6/4/2010	12/6/2010	19	0	0	0.20	0.20	--	--	--	--	--	2.1	--	0.92	--
300 ATs	Lead	7439-92-1	ug/L	N	9/25/2008	10/28/2008	7	0	0	1.3	45	--	--	--	--	--	2.1	--	0.92	--
300 ATs	Lead	7439-92-1	ug/L	Y	6/10/2004	10/28/2008	8	1	13	1.3	45	0.013	0.013	0.013	0.013	B19H93	2.1	--	0.92	--
300 PORE-WATER	Lead	7439-92-1	ug/L	N	1/16/2006	1/3/2007	16	2	13	1.2	3.1	1.5	3.1	2.3	2.3	J11110	2.1	1	0.92	2
300 SEEP	Lead	7439-92-1	ug/L	N	9/27/2000	10/25/2004	10	10	100	--	--	0.062	16	2.2	0.39	B10903	2.1	2	0.92	3
300 SEEP	Lead	7439-92-1	ug/L	Y	10/13/2003	10/25/2004	3	2	67	0.011	0.011	0.17	0.35	0.26	0.26	B1BFY5	2.1	--	0.92	--
300 SW	Lead	7439-92-1	ug/L	N	9/20/1996	1/10/2007	35	22	63	1.6	3.1	0.0094	3.9	0.47	0.12	J111N4	2.1	1	0.92	3
300 SW	Lead	7439-92-1	ug/L	Y	9/10/2002	9/15/2004	14	12	86	0.011	0.011	0.012	0.090	0.035	0.017	B17CW8	2.1	--	0.92	--
300 Area Near-Shore Wells	Manganese	7439-96-5	ug/L	N	1/19/2006	4/5/2011	143	35	24	0.20	6.0	1.7	319	62	55	B261F4	120	3	39	26
300 Area Near-Shore Wells	Manganese	7439-96-5	ug/L	Y	1/4/2006	4/5/2011	179	58	32	0.84	30	0.89	133	40	39	B1VLW3	120	1	39	29
300 ATs	Manganese	7439-96-5	ug/L	N	12/11/2006	3/29/2011	93	48	52	4.0	6.0	0.17	743	70	17	B1TRF2	120	9	39	19
300 ATs	Manganese	7439-96-5	ug/L	Y	6/10/2004	3/29/2011	98	42	43	0.10	6.0	0.12	723	49	5.9	B1TRK7	120	3	39	10
300 PORE-WATER	Manganese	7439-96-5	ug/L	N	1/16/2006	1/3/2007	16	16	100	--	--	0.69	1,640	175	2.8	J135W9	120	3	39	3
300 SEEP	Manganese	7439-96-5	ug/L	N	8/29/1994	8/27/2001	7	7	100	--	--	4.6	220	41	8.2	B0G1G0	120	1	39	1
300 SW	Manganese	7439-96-5	ug/L	N	8/26/1994	1/10/2007	17	17	100	--	--	2.0	28	5.7	3.2	B09J98	120	--	39	--
300 Area Near-Shore Wells	Nickel	7440-02-0	ug/L	N	1/19/2006	4/5/2011	143	36	25	0.40	13	0.72	56	19	11	B24F52	45	4	1.6	32
300 Area Near-Shore Wells	Nickel	7440-02-0	ug/L	Y	1/4/2006	4/5/2011	179	32	18	0.40	50	4.0	65	25	23	B1LCR3	45	6	1.6	32
300 ATs	Nickel	7440-02-0	ug/L	N	12/11/2006	3/29/2011	93	14	15	0.20	6.0	0.20	5.9	1.8	0.44	B22BY6	45	--	1.6	5
300 ATs	Nickel	7440-02-0	ug/L	Y	6/10/2004	3/29/2011	98	7	7.1	0.20	7.5	0.27	4.5	1.6	0.97	B1PP08	45	--	1.6	2
300 PORE-WATER	Nickel	7440-02-0	ug/L	N	1/16/2006	1/3/2007	16	0	0	1.3	2.2	--	--	--	--	--	45	--	1.6	--
300 SEEP	Nickel	7440-02-0	ug/L	N	11/21/1996	10/25/2004	13	12	92	7.4	7.4	0.38	18	3.3	1.2	B10903	45	--	1.6	5
300 SEEP	Nickel	7440-02-0	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	0.97	1.5	1.3	1.5	B1BFY3	45	--	1.6	--
300 SW	Nickel	7440-02-0	ug/L	N	9/20/1996	1/10/2007	35	22	63	1.3	2.2	0.20	22	1.7	0.69	B0G1F5	45	--	1.6	3
300 SW	Nickel	7440-02-0	ug/L	Y	9/9/2003	9/15/2004	13	13	100	--	--	0.65	1.4	0.80	0.73	B19JC6	45	--	1.6	--
300 Area Near-Shore Wells	Nitrate	14797-55-8	ug/L	N	1/4/2006	4/5/2011	276	261	95	18	319	39	32,300	19,233	22,600	B1NKV6	7,100	224	26,871	26
300 Area Near-Shore Wells	Nitrate	14797-55-8	ug/L	Y	12/6/2010	12/6/2010	1	1	100	--	--	186	186	186	186	B28361	7,100	--	26,871	--
300 ATs	Nitrate	14797-55-8	ug/L	N	1/24/2006	3/29/2011	156	154	99	22	54	460	974,000	25,679	17,650	B1LKF2	7,100	124	26,871	27
300 Area Near-Shore Wells	Nitrite	14797-65-0	ug/L	N	1/4/2006	4/5/2011	275	21	7.6	9.9	591	43	985	431	437	B1MFB1	246	14	94	14
300 Area Near-Shore Wells	Nitrite	14797-65-0	ug/L	Y	12/6/2010	12/6/2010	1	0	0	118	118	--	--	--	--	--	246	--	94	--
300 ATs	Nitrite	14797-65-0	ug/L	N	1/24/2006	3/29/2011	156	5	3.2	13	723	65	161	115	135	B1TPF4	246	--	94	3
300 ATs	Nitrogen in Nitrate	NO3-N	ug/L	N	6/10/2004	6/10/2004	1	1	100	--	--	2,439	2,439	2,439	2,439	B19H94	1,600	1	--	--
300 PORE-WATER	Nitrogen in Nitrate	NO3-N	ug/L	N	1/16/2006	1/3/2007	16	15	94	56	56	95	4,448	1,048	242	J135X0	1,600	4	--	--
300 SEEP	Nitrogen in Nitrate	NO3-N	ug/L	N	8/29/1994	10/25/2004	16	16	100	--	--	1,490	25,000	7,310	5,081	30,940	1,600	15	--	--
300 SW	Nitrogen in Nitrate	NO3-N	ug/L	N	8/26/1994	1/10/2007	52	52	100	--	--	53	3,700	440	151	B19HP8	1,600	4	--	--
300 Area Near-Shore Wells	Phosphate	14265-44-2	ug/L	N	1/19/2006	4/5/2011	103	33	32	250	2,150	534	1,400	741	705	B23159	1,000	2	162	33
300 Area Near-Shore Wells	Phosphate	14265-44-2	ug/L	Y	12/6/2010	12/6/2010	1	0	0	429	429	--	--	--	--	--	1,000	--	162	--
300 ATs	Phosphate	14265-44-2	ug/L	N	6/10/2004	3/11/2010	42	8	19	86	4,600	50	940	349	307	B1MRT1	1,000	--	162	6
300 PORE-WATER	Phosphate	14265-44-2	ug/L	N	1/16/2006	1/3/2007	16	0	0	250	250	--	--	--	--	--	1,000	--	162	--
300 SEEP	Phosphate	14265-44-2	ug/L	N	11/21/1996	11/21/1996	1	0	0	83	83	--	--	--	--	--	1,000	--	162	--
300 SW	Phosphate	14265-44-2	ug/L	N	9/18/1995	1/10/2007	16	0	0	83	340	--	--	--	--	--	1,000	--	162	--
300 Area Near-Shore Wells	Silver	7440-22-4	ug/L	N	1/19/2006	4/5/2011	143	3	2.1	0.10	7.0	15	17	16	16	B1VMD6	2.6	3	5.3	3
300 Area Near-Shore Wells	Silver	7440-22-4	ug/L	Y	1/4/2006	4/5/2011	179	4	2.2	0.20	110	5.5	15	8.2	6.3	B1PFX7	2.6	4	5.3	4
300 ATs	Silver	7440-22-4	ug/L	N	12/11/2006	3/29/2011	86	2	2.3	0.10	7.0	5.5	6.6	6.1	6.1	B249M7	2.6	2	5.3	2
300 ATs	Silver	7440-22-4	ug/L	Y	1/24/2006	3/29/2011	90	4	4.4	0.10	7.0	5.3	8.1	6.6	6.5	B1TK66	2.6	4	5.3	4
300 PORE-WATER	Silver	7440-22-4	ug/L	N	1/16/2006	1/3/2007	16	0	0	0.50	1.4	--	--	--	--	--	2.6	--	5.3	--
300 SEEP	Silver	7440-22-4	ug/L	N	11/21/1996	10/25/2004	11	5	45	0.0012	4.5	0.0013	0.064	0.019	0.0060	B10903	2.6	--	5.3	--
300 SEEP	Silver	7440-22-4	ug/L	Y	10/13/2003	10/25/2004	3	0	0	0.0017	0.0085	--	--	--	--	--	2.6	--	5.3	--
300 SW	Silver	7440-22-4	ug/L	N	9/20/1996	1/10/2007	35	12	34	0.0012	1.4	0.0028	6.4	0.72	0.010	B0G1F5	2.6	1	5.3	1
300 SW	Silver	7440-22-4	ug/L	Y	9/9/2003	9/15/2004	13	1	7.7	0.0017	0.0085	0.0029	0.0029	0.0029	0.0029	B1B7C6	2.6	--	5.3	--
300 Area Near-Shore Wells	Trichloroethene	79-01-6	ug/L	N	1/4/2006	4/5/2011	323	89	28	0.037	1.0	0.23	63	3.2	1.1	B1FR94	47	3	--	--
300 Area Near-Shore Wells	Trichloroethene	79-01-6	ug/L	Y	12/6/2010	12/6/2010	1	0	0	1.0	1.0	--	--	--	--	--	47	--	--	--
300 ATs	Trichloroethene	79-01-6	ug/L	N	1/24/2006	4/13/2011	149	57	38	0.10	1.0	0.25	530	60	5.1	B1TK56	47	12	--	--
300 ATs	Trichloroethene	79-01-6	ug/L	Y	12/12/2006	12/12/2006	2	1	50	1.0	1.0	28	28	28	28	B1LMC9	47	--	--	--
300 SEEP	Trichloroethene	79-01-6	ug/L	N	11/1/1999	10/25/2004	7	5	71	0.090	0.29	0.72	2.3	1.8	2.0	B108Y5	47	--	--	--
300 SW	Trichloroethene	79-01-6	ug/L	N	9/18/1995	9/20/1996	2	2	100	--	--	0.71	0.80	0.76	0.76	B0G0X2	47	--	--	--
300 Area Near-Shore Wells	Uranium	7440-61-1	ug/L	N	1/4/2006	4/5/2011	379	337	89	-6.74E-03	0.10	0.076	218	60	52	B1PFX4	5.0	324	9.9	301
300 Area Near-Shore Wells	Uranium	7440-61-1	ug/L	Y	12/6/2010	12/6/2010	1	0	0	0.10	0.10	--	--	--	--	--	5.0	--	9.9	--
300 ATs	Uranium	7440-61-1	ug/L	N	1/24/2006	4/13/2011	251	250	100	0.10	0.10	0.13	394	63	53	B1H378	5.0	225	9.9	207
300 ATs	Uranium	7440-61-1	ug/L	Y	6/10/2004	10/28/2008	21	21	100	0	0	0.55	167	55	55	B1V2K7	5.0	14	9.9	14
300 PORE-WATER	Uranium	7440-61-1	ug/L	N	1/16/2006	1/3/2007	16	3	19	14	21	23	137	62	26	J135X0	5.0	3	9.9	3
300 SEEP	Uranium	7440-61-1	ug/L	N	2/24/2003	2/24/2003	2	2	100	--	--	120	229	175	175	B16KT8	5.0	2	9.9	2
300 SW	Uranium	7440-61-1	ug/L	N	1/16/2006	1/10/2007	14	0	0	14	21	--	--	--	--	--	5.0	--	9.9	--

Table M-25. Comparison of Contaminants of Interest to Ecological Screening Levels

Site	Analyte	CAS#	Units	Filtered?	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Mean Detect	Median Detect	Max Detect Sample #	Surface Water Ecological Screening Value	No. of Detects > Surface Water Ecological Screening Value	Ground Water Background Level	No. of Detects > Ground Water Background Level
300 Area Near-Shore Wells	Zinc	7440-66-6	ug/L	N	1/19/2006	4/5/2011	143	34	24	1.6	9.0	2.7	30	9.6	8.1	B25NV9	90	--	22	3
300 Area Near-Shore Wells	Zinc	7440-66-6	ug/L	Y	1/4/2006	4/5/2011	179	38	21	4.0	19	4.0	104	22	9.0	B1LCJ7	90	1	22	10
300 ATs	Zinc	7440-66-6	ug/L	N	12/11/2006	3/29/2011	93	24	26	0.80	9.0	1.1	490	102	12	B27VB4	90	7	22	7
300 ATs	Zinc	7440-66-6	ug/L	Y	6/10/2004	3/29/2011	98	19	19	0.80	9.6	1.0	594	141	23	B2BN51	90	8	22	10
300 PORE-WATER	Zinc	7440-66-6	ug/L	N	1/16/2006	1/3/2007	16	15	94	0.50	0.50	1.1	13	4.9	3.4	J111L5	90	--	22	--
300 SEEP	Zinc	7440-66-6	ug/L	N	8/29/1994	10/25/2004	13	13	100	--	--	1.4	106	23	5.9	B10903	90	2	22	3
300 SEEP	Zinc	7440-66-6	ug/L	Y	10/13/2003	10/25/2004	3	3	100	--	--	1.1	1.9	1.5	1.6	B1BFY3	90	--	22	--
300 SW	Zinc	7440-66-6	ug/L	N	8/26/1994	1/10/2007	37	36	97	7.7	7.7	0.56	57	5.4	1.8	B12T53	90	--	22	2
300 SW	Zinc	7440-66-6	ug/L	Y	9/9/2003	9/15/2004	13	13	100	--	--	0.69	2.0	1.1	0.84	B17CX6	90	--	22	--

Table M-26. Summary of Riparian Soil Analytes Without a Plant/Invertebrate Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Plant ESL	No. of Detects > Plant ESL	Invertebrate ESL	No. of Detects > Invertebrate ESL
300 SOIL	1,2,4-Trichlorobenzene	120-82-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	1,2-Dichlorobenzene	95-50-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	1,3-Dichlorobenzene	541-73-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	1,4-Dichlorobenzene	106-46-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2,4,5-Trichlorophenol	95-95-4	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	2,4,6-Trichlorophenol	88-06-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2,4-Dichlorophenol	120-83-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2,4-Dimethylphenol	105-67-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2,4-Dinitrophenol	51-28-5	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	2,4-Dinitrotoluene	121-14-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2,6-Dinitrotoluene	606-20-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2-Chloronaphthalene	91-58-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2-Chlorophenol	95-57-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2-Methylphenol (cresol, o-)	95-48-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2-Nitroaniline	88-74-4	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	2-Nitrophenol	88-75-5	ug/kg	4/17/2006	7/23/2007	11	1	9.1	330	450	21	21	--	--	--	--
300 SOIL	3,3'-Dichlorobenzidine	91-94-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	3+4 Methylphenol (cresol, m+p)	65794-96-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	3-Nitroaniline	99-09-2	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	4,4'-DDD (Dichlorodiphenyldichloroethane)	72-54-8	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	4,4'-DDE (Dichlorodiphenyldichloroethylene)	72-55-9	ug/kg	4/17/2006	7/23/2007	11	7	64	1.3	1.3	1.4	4.2	--	--	--	--
300 SOIL	4,4'-DDT (Dichlorodiphenyltrichloroethane)	50-29-3	ug/kg	4/17/2006	7/23/2007	11	5	45	1.3	1.8	0.93	2.3	--	--	--	--
300 SOIL	4,6-Dinitro-2-methylphenol	534-52-1	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	4-Bromophenylphenyl ether	101-55-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	4-Chloro-3-methylphenol	59-50-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	4-Chloroaniline	106-47-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	4-Chlorophenylphenyl ether	7005-72-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	4-Nitroaniline	100-01-6	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	4-Nitrophenol	100-02-7	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	Aldrin	309-00-2	ug/kg	4/17/2006	7/23/2007	11	4	36	1.3	1.8	1.5	2.3	--	--	--	--
300 SOIL	Alpha-BHC	319-84-6	ug/kg	4/17/2006	7/23/2007	11	3	27	1.3	1.8	2.3	2.7	--	--	--	--
300 SOIL	Aluminum	7429-90-5	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	6.70E+06	1.15E+07	--	--	--	--
300 SOIL	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	319-85-7	ug/kg	4/17/2006	7/23/2007	11	1	9.1	1.3	1.8	1.1	1.1	--	--	--	--
300 SOIL	Bis(2-chloro-1-methylethyl)ether	108-60-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Bis(2-Chloroethoxy)methane	111-91-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Bis(2-chloroethyl) ether	111-44-4	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Bismuth	7440-69-9	ug/kg	4/17/2006	7/23/2007	11	0	0	590	1,600	--	--	--	--	--	--
300 SOIL	Bluegrass 14-day germination	BG_14D_GERM	%	1/16/2007	7/23/2007	2	2	100	--	--	64	72	--	--	--	--
300 SOIL	Bluegrass average root biomass [wet]	BG_AVG_ROOT_MAS	mg	1/16/2007	7/23/2007	2	2	100	--	--	0.90	2.4	--	--	--	--
300 SOIL	Bluegrass average root length	BG_AVG_ROOT_LEN	mm	1/16/2007	7/23/2007	2	2	100	--	--	27	29	--	--	--	--
300 SOIL	Bluegrass average shoot biomass [wet]	BG_AVG_SHOOT_MA	mg	1/16/2007	7/23/2007	2	2	100	--	--	2.5	6.4	--	--	--	--
300 SOIL	Bluegrass average stem height	BG_AVG_STEM_HT	mm	1/16/2007	7/23/2007	2	2	100	--	--	30	64	--	--	--	--
300 SOIL	Butylbenzylphthalate	85-68-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Calcium	7440-70-2	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	3.41E+06	4.85E+06	--	--	--	--
300 SOIL	Calculated Total Uranium	calc_tot_U	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	1,587	5,156	--	--	--	--
300 SOIL	Carbazole	86-74-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Cesium-134	13967-70-9	pCi/g	4/17/2006	7/23/2007	11	0	0	0.072	0.23	--	--	--	--	--	--

Table M-26. Summary of Riparian Soil Analytes Without a Plant/Invertebrate Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Plant ESL	No. of Detects > Plant ESL	Invertebrate ESL	No. of Detects > Invertebrate ESL
300 SOIL	Chloride	16887-00-6	ug/kg	4/17/2006	7/23/2007	3	3	100	--	--	2,700	4,940	--	--	--	--
300 SOIL	Cumulative % retained on No. 100 screen	RET#100	%	4/17/2006	7/23/2007	3	3	100	--	--	83	84	--	--	--	--
300 SOIL	Cumulative % retained on No. 16 screen	RET#16	%	4/17/2006	7/23/2007	3	3	100	--	--	7.5	36	--	--	--	--
300 SOIL	Cumulative % retained on No. 200 screen	RET#200	%	4/17/2006	7/23/2007	3	3	100	--	--	94	97	--	--	--	--
300 SOIL	Cumulative % retained on No. 30 screen	RET#30	%	4/17/2006	7/23/2007	3	3	100	--	--	31	56	--	--	--	--
300 SOIL	Cumulative % retained on No. 50 screen	RET#50	%	4/17/2006	7/23/2007	3	3	100	--	--	55	67	--	--	--	--
300 SOIL	Cumulative % retained on No. 8 screen	RET#8	%	4/17/2006	7/23/2007	3	3	100	--	--	0	0.16	--	--	--	--
300 SOIL	Delta-BHC	319-86-8	ug/kg	4/17/2006	7/23/2007	11	3	27	1.3	1.8	0.67	2.1	--	--	--	--
300 SOIL	Dibenzofuran	132-64-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Dieldrin	60-57-1	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	Dimethyl phthalate	131-11-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Di-n-butylphthalate	84-74-2	ug/kg	4/17/2006	7/23/2007	11	5	45	330	450	20	51	--	--	--	--
300 SOIL	Di-n-octylphthalate	117-84-0	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Endosulfan I	959-98-8	ug/kg	4/17/2006	7/23/2007	11	7	64	1.3	1.3	0.50	4.6	--	--	--	--
300 SOIL	Endosulfan II	33213-65-9	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	Endosulfan sulfate	1031-07-8	ug/kg	4/17/2006	7/23/2007	11	1	9.1	1.3	1.3	51	51	--	--	--	--
300 SOIL	Endrin	72-20-8	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	Endrin aldehyde	7421-93-4	ug/kg	4/17/2006	7/23/2007	11	1	9.1	1.3	1.3	45	45	--	--	--	--
300 SOIL	Endrin ketone	53494-70-5	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	Fluoride	16984-48-8	ug/kg	4/17/2006	7/23/2007	3	2	67	1,120	1,120	285	1,050	--	--	--	--
300 SOIL	Fraction Coarse Sand	COARSE_SAND	%	4/17/2006	7/23/2007	3	3	100	--	--	18	23	--	--	--	--
300 SOIL	Fraction Coarse Silt/Silt/Clay [less than 0.074 mm]	COARSE_SILT_CLA	%	4/17/2006	7/23/2007	3	3	100	--	--	3.2	6.5	--	--	--	--
300 SOIL	Fraction Fine Sand	FINE_SAND	%	4/17/2006	7/23/2007	3	3	100	--	--	17	29	--	--	--	--
300 SOIL	Fraction Granules [greater than 2.38 mm]	GRANULE	%	4/17/2006	7/23/2007	3	3	100	--	--	0	0.16	--	--	--	--
300 SOIL	Fraction Medium Sand	MEDIUM_SAND	%	4/17/2006	7/23/2007	3	3	100	--	--	12	29	--	--	--	--
300 SOIL	Fraction Total Sand	TOTAL_SAND	%	4/17/2006	7/23/2007	3	3	100	--	--	93	97	--	--	--	--
300 SOIL	Fraction Very Coarse Sand	VERY_COARSE_SAN	%	4/17/2006	7/23/2007	3	3	100	--	--	7.4	36	--	--	--	--
300 SOIL	Fraction Very Fine Sand	VERY_FINE_SAND	%	4/17/2006	7/23/2007	3	3	100	--	--	9.2	13	--	--	--	--
300 SOIL	Gamma-BHC (Lindane)	58-89-9	ug/kg	4/17/2006	7/23/2007	11	2	18	1.3	1.8	0.90	2.6	--	--	--	--
300 SOIL	Heptachlor	76-44-8	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	Heptachlor epoxide	1024-57-3	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	Hexachlorobenzene	118-74-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Hexachlorobutadiene	87-68-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Hexachlorocyclopentadiene	77-47-4	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Hexachloroethane	67-72-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Hexavalent Chromium	18540-29-9	ug/kg	4/17/2006	7/23/2007	11	1	9.1	200	270	300	300	--	--	--	--
300 SOIL	Iron	7439-89-6	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	2.24E+07	2.66E+07	--	--	--	--
300 SOIL	Isophorone	78-59-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Magnesium	7439-95-4	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	3.73E+06	5.08E+06	--	--	--	--
300 SOIL	Methoxychlor	72-43-5	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	Nematode lab CTL Survival	NEMA_CTL_SURV	%	4/17/2006	4/17/2006	1	1	100	--	--	97	97	--	--	--	--
300 SOIL	Nematode Survival	NEMA_SURV	%	4/17/2006	1/16/2007	2	2	100	--	--	90	97	--	--	--	--
300 SOIL	Nitrobenzene	98-95-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Nitrogen in ammonia	NH3-N	ug/kg	4/17/2006	7/23/2007	3	3	100	--	--	1,620	3,520	--	--	--	--
300 SOIL	Nitrogen in Nitrate	NO3-N	ug/kg	4/17/2006	7/23/2007	13	13	100	--	--	454	48,774	--	--	--	--
300 SOIL	Nitrogen in Nitrite	NO2-N	ug/kg	4/17/2006	7/23/2007	3	1	33	1,010	1,240	1,110	1,110	--	--	--	--
300 SOIL	Nitrogen in Nitrite and Nitrate	NO2+NO3-N	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	960	52,600	--	--	--	--

Table M-26. Summary of Riparian Soil Analytes Without a Plant/Invertebrate Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Plant ESL	No. of Detects > Plant ESL	Invertebrate ESL	No. of Detects > Invertebrate ESL
300 SOIL	Nitrogen, Kjeldahl total	N-KJELDAHL	ug/kg	4/17/2006	7/23/2007	3	3	100	--	--	631,000	858,000	--	--	--	--
300 SOIL	n-Nitrosodi-n-dipropylamine	621-64-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	n-Nitrosodiphenylamine	86-30-6	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Pentachlorophenol	87-86-5	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	Percent moisture (wet sample)	%MOISTURE	%	4/17/2006	7/23/2007	3	3	100	--	--	0.95	23	--	--	--	--
300 SOIL	pH Measurement	PH	unitless	4/17/2006	7/23/2007	3	3	100	--	--	7.0	7.4	--	--	--	--
300 SOIL	Phosphorus	7723-14-0	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	704,000	959,000	--	--	--	--
300 SOIL	Potassium	7440-09-7	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	620,000	1.56E+06	--	--	--	--
300 SOIL	Potassium-40	13966-00-2	pCi/g	4/17/2006	7/23/2007	11	11	100	--	--	10	13	--	--	--	--
300 SOIL	Silicon	7440-21-3	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	196,000	661,000	--	--	--	--
300 SOIL	Sodium	7440-23-5	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	118,000	174,000	--	--	--	--
300 SOIL	Strontium	7440-24-6	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	20,300	33,600	--	--	--	--
300 SOIL	Sulfate	14808-79-8	ug/kg	4/17/2006	7/23/2007	3	3	100	--	--	7,740	28,400	--	--	--	--
300 SOIL	Thorium-228	14274-82-9	pCi/g	4/17/2006	7/23/2007	11	10	91	0.47	0.47	0.48	1.2	--	--	--	--
300 SOIL	Thorium-230	14269-63-7	pCi/g	4/17/2006	7/23/2007	11	5	45	-6.00E-02	0.35	0.33	0.75	--	--	--	--
300 SOIL	Total average root shoot mass [wet]	TOT_AVE_ROOT_SH	mg	1/16/2007	7/23/2007	2	2	100	--	--	3.4	8.8	--	--	--	--
300 SOIL	Total organic carbon	TOC	ug/kg	4/17/2006	7/23/2007	3	3	100	--	--	6.56E+06	1.40E+07	--	--	--	--
300 SOIL	Toxaphene	8001-35-2	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	--	--	--	--
300 SOIL	Uranium-233/234	13966-29-5	pCi/g	4/17/2006	7/23/2007	11	11	100	--	--	0.67	1.7	--	--	--	--

Table M-27. Summary of Riparian Soil Analytes Without a Wildlife Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Avian ESL	No. of Detects > Avian ESL	Mammal ESL	No. of Detects > Mammal ESL
300 SOIL	1,2,4-Trichlorobenzene	120-82-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	1,4-Dichlorobenzene	106-46-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2,4,5-Trichlorophenol	95-95-4	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	2,4,6-Trichlorophenol	88-06-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2,4-Dichlorophenol	120-83-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2,4-Dimethylphenol	105-67-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2,4-Dinitrophenol	51-28-5	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	2,6-Dinitrotoluene	606-20-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2-Chloronaphthalene	91-58-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2-Chlorophenol	95-57-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	2-Nitroaniline	88-74-4	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	2-Nitrophenol	88-75-5	ug/kg	4/17/2006	7/23/2007	11	1	9.1	330	450	21	21	--	--	--	--
300 SOIL	3,3'-Dichlorobenzidine	91-94-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	3+4 Methylphenol (cresol, m+p)	65794-96-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	3-Nitroaniline	99-09-2	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	4,4'-DDD (Dichlorodiphenyldichloroethane)	72-54-8	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	4,6-Dinitro-2-methylphenol	534-52-1	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	4-Bromophenylphenyl ether	101-55-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	4-Chloro-3-methylphenol	59-50-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	4-Chloroaniline	106-47-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	4-Chlorophenylphenyl ether	7005-72-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	4-Nitroaniline	100-01-6	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	4-Nitrophenol	100-02-7	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	Alpha-BHC	319-84-6	ug/kg	4/17/2006	7/23/2007	11	3	27	1.3	1.8	2.3	2.7	--	--	--	--
300 SOIL	Bis(2-chloro-1-methylethyl)ether	108-60-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Bis(2-Chloroethoxy)methane	111-91-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Bis(2-chloroethyl) ether	111-44-4	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Bismuth	7440-69-9	ug/kg	4/17/2006	7/23/2007	11	0	0	590	1,600	--	--	--	--	--	--
300 SOIL	Bluegrass 14-day germination	BG_14D_GERM	%	1/16/2007	7/23/2007	2	2	100	--	--	64	72	--	--	--	--
300 SOIL	Bluegrass average root biomass [wet]	BG_AVG_ROOT_MAS	mg	1/16/2007	7/23/2007	2	2	100	--	--	0.90	2.4	--	--	--	--
300 SOIL	Bluegrass average root length	BG_AVG_ROOT_LEN	mm	1/16/2007	7/23/2007	2	2	100	--	--	27	29	--	--	--	--
300 SOIL	Bluegrass average shoot biomass [wet]	BG_AVG_SHOOT_MA	mg	1/16/2007	7/23/2007	2	2	100	--	--	2.5	6.4	--	--	--	--
300 SOIL	Bluegrass average stem height	BG_AVG_STEM_HT	mm	1/16/2007	7/23/2007	2	2	100	--	--	30	64	--	--	--	--
300 SOIL	Butylbenzylphthalate	85-68-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Calcium	7440-70-2	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	3.41E+06	4.85E+06	--	--	--	--
300 SOIL	Calculated Total Uranium	calc_tot_U	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	1,587	5,156	--	--	--	--
300 SOIL	Carbazole	86-74-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Cesium-134	13967-70-9	pCi/g	4/17/2006	7/23/2007	11	0	0	0.072	0.23	--	--	--	--	--	--
300 SOIL	Chloride	16887-00-6	ug/kg	4/17/2006	7/23/2007	3	3	100	--	--	2,700	4,940	--	--	--	--
300 SOIL	Cumulative % retained on No. 100 screen	RET#100	%	4/17/2006	7/23/2007	3	3	100	--	--	83	84	--	--	--	--
300 SOIL	Cumulative % retained on No. 16 screen	RET#16	%	4/17/2006	7/23/2007	3	3	100	--	--	7.5	36	--	--	--	--
300 SOIL	Cumulative % retained on No. 200 screen	RET#200	%	4/17/2006	7/23/2007	3	3	100	--	--	94	97	--	--	--	--
300 SOIL	Cumulative % retained on No. 30 screen	RET#30	%	4/17/2006	7/23/2007	3	3	100	--	--	31	56	--	--	--	--
300 SOIL	Cumulative % retained on No. 50 screen	RET#50	%	4/17/2006	7/23/2007	3	3	100	--	--	55	67	--	--	--	--
300 SOIL	Cumulative % retained on No. 8 screen	RET#8	%	4/17/2006	7/23/2007	3	3	100	--	--	0	0.16	--	--	--	--
300 SOIL	Delta-BHC	319-86-8	ug/kg	4/17/2006	7/23/2007	11	3	27	1.3	1.8	0.67	2.1	--	--	--	--
300 SOIL	Dibenzofuran	132-64-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Diethylphthalate	84-66-2	ug/kg	4/17/2006	7/23/2007	11	4	36	330	450	27	47	--	--	--	--
300 SOIL	Dimethyl phthalate	131-11-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Di-n-butylphthalate	84-74-2	ug/kg	4/17/2006	7/23/2007	11	5	45	330	450	20	51	--	--	--	--

Table M-27. Summary of Riparian Soil Analytes Without a Wildlife Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Avian ESL	No. of Detects > Avian ESL	Mammal ESL	No. of Detects > Mammal ESL
300 SOIL	Di-n-octylphthalate	117-84-0	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Endrin	72-20-8	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	Endrin ketone	53494-70-5	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	Fraction Coarse Sand	COARSE_SAND	%	4/17/2006	7/23/2007	3	3	100	--	--	18	23	--	--	--	--
300 SOIL	Fraction Coarse Silt/Silt/Clay [less than 0.074 mm]	COARSE_SILT_CLA	%	4/17/2006	7/23/2007	3	3	100	--	--	3.2	6.5	--	--	--	--
300 SOIL	Fraction Fine Sand	FINE_SAND	%	4/17/2006	7/23/2007	3	3	100	--	--	17	29	--	--	--	--
300 SOIL	Fraction Granules [greater than 2.38 mm]	GRANULE	%	4/17/2006	7/23/2007	3	3	100	--	--	0	0.16	--	--	--	--
300 SOIL	Fraction Medium Sand	MEDIUM_SAND	%	4/17/2006	7/23/2007	3	3	100	--	--	12	29	--	--	--	--
300 SOIL	Fraction Total Sand	TOTAL_SAND	%	4/17/2006	7/23/2007	3	3	100	--	--	93	97	--	--	--	--
300 SOIL	Fraction Very Coarse Sand	VERY_COARSE_SAN	%	4/17/2006	7/23/2007	3	3	100	--	--	7.4	36	--	--	--	--
300 SOIL	Fraction Very Fine Sand	VERY_FINE_SAND	%	4/17/2006	7/23/2007	3	3	100	--	--	9.2	13	--	--	--	--
300 SOIL	Gamma-BHC (Lindane)	58-89-9	ug/kg	4/17/2006	7/23/2007	11	2	18	1.3	1.8	0.90	2.6	--	--	--	--
300 SOIL	Heptachlor	76-44-8	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	Heptachlor epoxide	1024-57-3	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	--	--
300 SOIL	Hexachlorobenzene	118-74-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Hexachlorobutadiene	87-68-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Hexachlorocyclopentadiene	77-47-4	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Hexachloroethane	67-72-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Iron	7439-89-6	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	2.24E+07	2.66E+07	--	--	--	--
300 SOIL	Isophorone	78-59-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Magnesium	7439-95-4	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	3.73E+06	5.08E+06	--	--	--	--
300 SOIL	Nematode lab CTL Survival	NEMA_CTL_SURV	%	4/17/2006	4/17/2006	1	1	100	--	--	97	97	--	--	--	--
300 SOIL	Nematode Survival	NEMA_SURV	%	4/17/2006	1/16/2007	2	2	100	--	--	90	97	--	--	--	--
300 SOIL	Nitrobenzene	98-95-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Nitrogen in ammonia	NH3-N	ug/kg	4/17/2006	7/23/2007	3	3	100	--	--	1,620	3,520	--	--	--	--
300 SOIL	Nitrogen in Nitrate	NO3-N	ug/kg	4/17/2006	7/23/2007	13	13	100	--	--	454	48,774	--	--	--	--
300 SOIL	Nitrogen in Nitrite	NO2-N	ug/kg	4/17/2006	7/23/2007	3	1	33	1,010	1,240	1,110	1,110	--	--	--	--
300 SOIL	Nitrogen in Nitrite and Nitrate	NO2+NO3-N	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	960	52,600	--	--	--	--
300 SOIL	Nitrogen, Kjeldahl total	N-KJELDAHL	ug/kg	4/17/2006	7/23/2007	3	3	100	--	--	631,000	858,000	--	--	--	--
300 SOIL	n-Nitrosodi-n-dipropylamine	621-64-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	n-Nitrosodiphenylamine	86-30-6	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	--	--
300 SOIL	Pentachlorophenol	87-86-5	ug/kg	4/17/2006	7/23/2007	11	0	0	830	1,100	--	--	--	--	--	--
300 SOIL	Percent moisture (wet sample)	%MOISTURE	%	4/17/2006	7/23/2007	3	3	100	--	--	0.95	23	--	--	--	--
300 SOIL	pH Measurement	PH	unitless	4/17/2006	7/23/2007	3	3	100	--	--	7.0	7.4	--	--	--	--
300 SOIL	Phosphorus	7723-14-0	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	704,000	959,000	--	--	--	--
300 SOIL	Potassium	7440-09-7	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	620,000	1.56E+06	--	--	--	--
300 SOIL	Potassium-40	13966-00-2	pCi/g	4/17/2006	7/23/2007	11	11	100	--	--	10	13	--	--	--	--
300 SOIL	Silicon	7440-21-3	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	196,000	661,000	--	--	--	--
300 SOIL	Sodium	7440-23-5	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	118,000	174,000	--	--	--	--
300 SOIL	Sulfate	14808-79-8	ug/kg	4/17/2006	7/23/2007	3	3	100	--	--	7,740	28,400	--	--	--	--
300 SOIL	Thorium-228	14274-82-9	pCi/g	4/17/2006	7/23/2007	11	10	91	0.47	0.47	0.48	1.2	--	--	--	--
300 SOIL	Thorium-230	14269-63-7	pCi/g	4/17/2006	7/23/2007	11	5	45	-6.00E-02	0.35	0.33	0.75	--	--	--	--
300 SOIL	Total average root shoot mass [wet]	TOT_AVE_ROOT_SH	mg	1/16/2007	7/23/2007	2	2	100	--	--	3.4	8.8	--	--	--	--
300 SOIL	Total organic carbon	TOC	ug/kg	4/17/2006	7/23/2007	3	3	100	--	--	6.56E+06	1.40E+07	--	--	--	--
300 SOIL	Toxaphene	8001-35-2	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	--	--	--	--
300 SOIL	Uranium-233/234	13966-29-5	pCi/g	4/17/2006	7/23/2007	11	11	100	--	--	0.67	1.7	--	--	--	--

Table M-28. Summary of Riparian Soil Analytes With Plant/Invertebrate Ecological Screening Level That Were Not Detected

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Plant ESL	No. of Detects > Plant ESL	Invertebrate ESL	No. of Detects > Invertebrate ESL
300 SOIL	2-Methylnaphthalene	91-57-6	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	29,000	--
300 SOIL	Acenaphthene	83-32-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	20,000	--	29,000	--
300 SOIL	Acenaphthylene	208-96-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	29,000	--
300 SOIL	Americium-241	14596-10-2	pCi/g	4/17/2006	7/23/2007	11	0	0	0.056	0.38	--	--	21,500	--	--	--
300 SOIL	Anthracene	120-12-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	29,000	--
300 SOIL	Antimony	7440-36-0	ug/kg	4/17/2006	7/23/2007	11	0	0	370	880	--	--	842,000	--	842,000	--
300 SOIL	Aroclor-1016	12674-11-2	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	40,000	--	--	--
300 SOIL	Aroclor-1221	11104-28-2	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	40,000	--	--	--
300 SOIL	Aroclor-1232	11141-16-5	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	40,000	--	--	--
300 SOIL	Aroclor-1242	53469-21-9	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	40,000	--	--	--
300 SOIL	Aroclor-1248	12672-29-6	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	40,000	--	--	--
300 SOIL	Aroclor-1254	11097-69-1	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	40,000	--	--	--
300 SOIL	Benzo(a)anthracene	56-55-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	18,000	--
300 SOIL	Benzo(a)pyrene	50-32-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	18,000	--
300 SOIL	Benzo(b)fluoranthene	205-99-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	18,000	--
300 SOIL	Benzo(ghi)perylene	191-24-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	18,000	--
300 SOIL	Benzo(k)fluoranthene	207-08-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	18,000	--
300 SOIL	Chrysene	218-01-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	18,000	--
300 SOIL	Cobalt-60	10198-40-0	pCi/g	4/17/2006	7/23/2007	11	0	0	0.059	0.20	--	--	6,130	--	--	--
300 SOIL	Dibenz[a,h]anthracene	53-70-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	18,000	--
300 SOIL	Europium-154	15585-10-1	pCi/g	4/17/2006	7/23/2007	11	0	0	0.18	0.56	--	--	12,500	--	--	--
300 SOIL	Europium-155	14391-16-3	pCi/g	4/17/2006	7/23/2007	11	0	0	0.10	0.29	--	--	153,000	--	--	--
300 SOIL	Fluoranthene	206-44-0	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	18,000	--
300 SOIL	Fluorene	86-73-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	29,000	--
300 SOIL	Indeno(1,2,3-cd)pyrene	193-39-5	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	18,000	--
300 SOIL	Naphthalene	91-20-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	29,000	--
300 SOIL	Phenanthrene	85-01-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	29,000	--
300 SOIL	Pyrene	129-00-0	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	18,000	--
300 SOIL	Selenium	7782-49-2	ug/kg	4/17/2006	7/23/2007	11	0	0	640	1,700	--	--	2,020	--	4,100	--
300 SOIL	Strontium-90	10098-97-2	pCi/g	4/17/2006	7/23/2007	11	0	0	-1.14E-01	0.088	--	--	3,580	--	--	--
300 SOIL	Thallium	7440-28-0	ug/kg	4/17/2006	7/23/2007	11	0	0	830	3,200	--	--	1,000	--	459	--

Table M-29. Summary of Riparian Soil Analytes With Wildlife Ecological Screening Level That Were Not Detected

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Avian ESL	No. of Detects > Avian ESL	Mammal ESL	No. of Detects > Mammal ESL
300 SOIL	1,2-Dichlorobenzene	95-50-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	164,000	--	282,000	--
300 SOIL	1,3-Dichlorobenzene	541-73-1	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	164,000	--	310,000	--
300 SOIL	2,4-Dinitrotoluene	121-14-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	26,400	--	28,100	--
300 SOIL	2-Methylnaphthalene	91-57-6	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	8,370	--	6,010	--
300 SOIL	2-Methylphenol (cresol, o-)	95-48-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	--	--	9.29E+06	--
300 SOIL	Acenaphthene	83-32-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	1.10E+06	--	2.42E+06	--
300 SOIL	Acenaphthylene	208-96-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	73,600	--	156,000	--
300 SOIL	Americium-241	14596-10-2	pCi/g	4/17/2006	7/23/2007	11	0	0	0.056	0.38	--	--	11,900	--	4,840	--
300 SOIL	Anthracene	120-12-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	678,000	--	4.21E+06	--
300 SOIL	Antimony	7440-36-0	ug/kg	4/17/2006	7/23/2007	11	0	0	370	880	--	--	--	--	9.20E+04	--
300 SOIL	Aroclor-1016	12674-11-2	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	1,820	--	4,850	--
300 SOIL	Aroclor-1221	11104-28-2	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	1,820	--	1,470	--
300 SOIL	Aroclor-1232	11141-16-5	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	1,820	--	1,440	--
300 SOIL	Aroclor-1242	53469-21-9	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	1,820	--	1,490	--
300 SOIL	Aroclor-1248	12672-29-6	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	1,820	--	325	--
300 SOIL	Aroclor-1254	11097-69-1	ug/kg	4/17/2006	7/23/2007	11	0	0	13	18	--	--	1,820	--	1,470	--
300 SOIL	Benzo(a)anthracene	56-55-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	2,030	--	64,000	--
300 SOIL	Benzo(a)pyrene	50-32-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	2,410	--	76,400	--
300 SOIL	Benzo(b)fluoranthene	205-99-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	1,270	--	39,200	--
300 SOIL	Benzo(ghi)perylene	191-24-2	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	1,120	--	32,400	--
300 SOIL	Benzo(k)fluoranthene	207-08-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	1,270	--	39,200	--
300 SOIL	Chrysene	218-01-9	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	1,430	--	44,500	--
300 SOIL	Cobalt-60	10198-40-0	pCi/g	4/17/2006	7/23/2007	11	0	0	0.059	0.20	--	--	805	--	805	--
300 SOIL	Dibenz[a,h]anthracene	53-70-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	1,420	--	44,100	--
300 SOIL	Dieldrin	60-57-1	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	79	--	21	--
300 SOIL	Endosulfan II	33213-65-9	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	41,400	--	710	--
300 SOIL	Europium-154	15585-10-1	pCi/g	4/17/2006	7/23/2007	11	0	0	0.18	0.56	--	--	1,610	--	1,610	--
300 SOIL	Europium-155	14391-16-3	pCi/g	4/17/2006	7/23/2007	11	0	0	0.10	0.29	--	--	33,400	--	33,400	--
300 SOIL	Fluoranthene	206-44-0	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	1,090	--	839,000	--
300 SOIL	Fluorene	86-73-7	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	175,000	--	267,000	--
300 SOIL	Indeno(1,2,3-cd)pyrene	193-39-5	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	1,150	--	35,700	--
300 SOIL	Methoxychlor	72-43-5	ug/kg	4/17/2006	7/23/2007	11	0	0	1.3	1.8	--	--	--	--	21,800	--
300 SOIL	Naphthalene	91-20-3	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	340,000	--	100,000	--
300 SOIL	Phenanthrene	85-01-8	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	943,000	--	5.92E+06	--
300 SOIL	Pyrene	129-00-0	ug/kg	4/17/2006	7/23/2007	11	0	0	330	450	--	--	1,860	--	600,000	--
300 SOIL	Selenium	7782-49-2	ug/kg	4/17/2006	7/23/2007	11	0	0	640	1,700	--	--	2,400	--	1,400	--
300 SOIL	Strontium-90	10098-97-2	pCi/g	4/17/2006	7/23/2007	11	0	0	-1.14E-01	0.088	--	--	112	--	91	--
300 SOIL	Thallium	7440-28-0	ug/kg	4/17/2006	7/23/2007	11	0	0	830	3,200	--	--	--	--	6,200	--

Table M-30. Summary of Riparin Soil Analytes That Do Not Exceed the Lowest Generic Plant/Invertebrate Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Plant ESL	No. of Detects > Plant ESL	Invertebrate ESL	No. of Detects > Invertebrate ESL
300 SOIL	Alpha-Chlordane	5103-71-9	ug/kg	4/17/2006	7/23/2007	11	1	9.1	1.3	1.8	0.40	0.40	--	--	1,000	--
300 SOIL	Aroclor-1260	11096-82-5	ug/kg	4/17/2006	7/23/2007	11	3	27	13	18	4.4	9.5	40,000	--	--	--
300 SOIL	Arsenic	7440-38-2	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	3,600	10,000	128,000	--	128,000	--
300 SOIL	Barium	7440-39-3	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	68,200	160,000	500,000	--	358,000	--
300 SOIL	Beryllium	7440-41-7	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	10	400	10,000	--	40,000	--
300 SOIL	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	4/17/2006	7/23/2007	11	10	91	330	330	26	96	100,000	--	--	--
300 SOIL	Boron	7440-42-8	ug/kg	4/17/2006	7/23/2007	11	9	82	280	1,400	460	3,100	29,600	--	28,600	--
300 SOIL	Cadmium	7440-43-9	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	590	1,300	9,840	--	20,000	--
300 SOIL	Cesium-137	10045-97-3	pCi/g	4/17/2006	7/23/2007	11	5	45	0.14	0.28	0.30	0.45	2,210	--	--	--
300 SOIL	Chromium	7440-47-3	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	16,900	22,600	259,000	--	149,000	--
300 SOIL	Cobalt	7440-48-4	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	5,900	8,800	15,700	--	15,700	--
300 SOIL	Copper	7440-50-8	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	20,400	31,200	70,000	--	58,000	--
300 SOIL	Diethylphthalate	84-66-2	ug/kg	4/17/2006	7/23/2007	11	4	36	330	450	27	47	100,000	--	--	--
300 SOIL	Europium-152	14683-23-9	pCi/g	4/17/2006	7/23/2007	11	2	18	0.14	0.41	0.26	0.29	14,700	--	--	--
300 SOIL	gamma-Chlordane	5566-34-7	ug/kg	4/17/2006	7/23/2007	11	1	9.1	1.3	1.8	1.6	1.6	--	--	1,000	--
300 SOIL	Lead	7439-92-1	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	15,200	31,100	9.09E+06	--	1.70E+06	--
300 SOIL	Lithium	7439-93-2	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	7,400	14,100	35,000	--	--	--
300 SOIL	Manganese	7439-96-5	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	190,000	418,000	1.26E+06	--	1.26E+06	--
300 SOIL	Mercury	7439-97-6	ug/kg	4/17/2006	7/23/2007	11	10	91	25	25	26	133	300	--	12,500	--
300 SOIL	Molybdenum	7439-98-7	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	480	660	2,000	--	28,000	--
300 SOIL	Nickel	7440-02-0	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	13,100	20,500	38,000	--	280,000	--
300 SOIL	Phenol	108-95-2	ug/kg	4/17/2006	7/23/2007	11	5	45	330	450	40	160	70,000	--	30,000	--
300 SOIL	Radium-226	13982-63-3	pCi/g	4/17/2006	7/23/2007	11	11	100	--	--	0.64	1.0	288	--	--	--
300 SOIL	Radium-228	15262-20-1	pCi/g	4/17/2006	7/23/2007	11	10	91	0.97	0.97	0.51	1.8	245	--	--	--
300 SOIL	Silver	7440-22-4	ug/kg	4/17/2006	7/23/2007	11	1	9.1	70	360	160	160	560,000	--	2,990	--
300 SOIL	Thorium-232	TH-232	pCi/g	4/17/2006	7/23/2007	11	10	91	0.24	0.24	0.59	1.5	23,500	--	--	--
300 SOIL	Tin	7440-31-5	ug/kg	4/17/2006	7/23/2007	11	6	55	1,600	1,600	540	2,700	838,000	--	838,000	--
300 SOIL	Uranium	7440-61-1	ug/kg	4/17/2006	7/23/2007	11	10	91	5,800	5,800	2,700	7,200	250,000	--	100,000	--
300 SOIL	Uranium-235	15117-96-1	pCi/g	4/17/2006	7/23/2007	11	1	9.1	0	0.27	0.041	0.041	27,400	--	--	--
300 SOIL	Uranium-238	U-238	pCi/g	4/17/2006	7/23/2007	11	11	100	--	--	0.53	1.7	15,700	--	--	--
300 SOIL	Vanadium	7440-62-2	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	49,200	73,000	89,400	--	116,000	--
300 SOIL	Zinc	7440-66-6	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	106,000	207,000	621,000	--	8.98E+06	--

Table M-31. Summary of Riparin Soil Analytes That Do Not Exceed the Lowest Generic Wildlife Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Avian ESL	No. of Detects > Avian ESL	Mammal ESL	No. of Detects > Mammal ESL
300 SOIL	4,4'-DDE (Dichlorodiphenyldichloroethylene)	72-55-9	ug/kg	4/17/2006	7/23/2007	11	7	64	1.3	1.3	1.4	4.2	800	--	400	--
300 SOIL	4,4'-DDT (Dichlorodiphenyltrichloroethane)	50-29-3	ug/kg	4/17/2006	7/23/2007	11	5	45	1.3	1.8	0.93	2.3	1,190	--	882	--
300 SOIL	Aldrin	309-00-2	ug/kg	4/17/2006	7/23/2007	11	4	36	1.3	1.8	1.5	2.3	164	--	9,820	--
300 SOIL	Alpha-Chlordane	5103-71-9	ug/kg	4/17/2006	7/23/2007	11	1	9.1	1.3	1.8	0.40	0.40	50,400	--	205,000	--
300 SOIL	Aroclor-1260	11096-82-5	ug/kg	4/17/2006	7/23/2007	11	3	27	13	18	4.4	9.5	1,820	--	1,470	--
300 SOIL	Arsenic	7440-38-2	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	3,600	10,000	2.28E+06	--	127,000	--
300 SOIL	Barium	7440-39-3	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	68,200	160,000	1.69E+06	--	2.27E+06	--
300 SOIL	Beryllium	7440-41-7	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	0,010	0,400	--	--	14,000	--
300 SOIL	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	319-85-7	ug/kg	4/17/2006	7/23/2007	11	1	9.1	1.3	1.8	1.1	1.1	4,080	--	8,670	--
300 SOIL	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	4/17/2006	7/23/2007	11	10	91	330	330	26	96	140	--	45,400	--
300 SOIL	Boron	7440-42-8	ug/kg	4/17/2006	7/23/2007	11	9	82	280	1400	0,460	3,100	54,000	--	32,000	--
300 SOIL	Cadmium	7440-43-9	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	590	1,300	29,000	--	624,000	--
300 SOIL	Cesium-137	10045-97-3	pCi/g	4/17/2006	7/23/2007	11	5	45	0.14	0.28	0.30	0.45	1,430	--	924	--
300 SOIL	Chromium	7440-47-3	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	16,900	22,600	109,000	--	517,000	--
300 SOIL	Cobalt	7440-48-4	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	5,900	8,800	484,000	--	2.14E+06	--
300 SOIL	Copper	7440-50-8	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	20,400	31,200	213,000	--	193,000	--
300 SOIL	Endosulfan I	959-98-8	ug/kg	4/17/2006	7/23/2007	11	7	64	1.3	1.3	0.50	4.6	41,400	--	710	--
300 SOIL	Endosulfan sulfate	1031-07-8	ug/kg	4/17/2006	7/23/2007	11	1	9.1	1.3	1.3	51	51	41,400	--	560	--
300 SOIL	Endrin aldehyde	7421-93-4	ug/kg	4/17/2006	7/23/2007	11	1	9.1	1.3	1.3	45	45	231	--	1,360	--
300 SOIL	Europium-152	14683-23-9	pCi/g	4/17/2006	7/23/2007	11	2	18	0.14	0.41	0.26	0.29	1,740	--	1,740	--
300 SOIL	Fluoride	16984-48-8	ug/kg	4/17/2006	7/23/2007	3	2	67	1,120	1,120	285	1,050	2.28E+06	--	1.38E+07	--
300 SOIL	gamma-Chlordane	5566-34-7	ug/kg	4/17/2006	7/23/2007	11	1	9.1	1.3	1.8	1.6	1.6	50,200	--	204,000	--
300 SOIL	Hexavalent Chromium	18540-29-9	ug/kg	4/17/2006	7/23/2007	11	1	9.1	200	270	300	300	--	--	1.25E+06	--
300 SOIL	Lead	7439-92-1	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	15,200	31,100	156,000	--	1.58E+06	--
300 SOIL	Lithium	7439-93-2	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	7,400	14,100	--	--	1.66E+06	--
300 SOIL	Manganese	7439-96-5	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	190,000	418,000	1.44E+07	--	3.32E+06	--
300 SOIL	Mercury	7439-97-6	ug/kg	4/17/2006	7/23/2007	11	10	91	25	25	26	133	2,000	--	1,600	--
300 SOIL	Molybdenum	7439-98-7	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	480	660	95,000	--	5,700	--
300 SOIL	Nickel	7440-02-0	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	13,100	20,500	361,000	--	247,000	--
300 SOIL	Phenol	108-95-2	ug/kg	4/17/2006	7/23/2007	11	5	45	330	450	40	160	--	--	1.51E+06	--
300 SOIL	Radium-226	13982-63-3	pCi/g	4/17/2006	7/23/2007	11	11	100	--	--	0.64	1.0	58	--	165	--
300 SOIL	Radium-228	15262-20-1	pCi/g	4/17/2006	7/23/2007	11	10	91	0.97	0.97	0.51	1.8	55	--	165	--
300 SOIL	Silver	7440-22-4	ug/kg	4/17/2006	7/23/2007	11	1	9.1	70	360	160	160	983,000	--	9.81E+06	--
300 SOIL	Strontium	7440-24-6	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	20,300	33,600	--	--	1.21E+06	--
300 SOIL	Thorium-232	TH-232	pCi/g	4/17/2006	7/23/2007	11	10	91	0.24	0.24	0.59	1.5	5,070	--	4,560	--
300 SOIL	Tin	7440-31-5	ug/kg	4/17/2006	7/23/2007	11	6	55	1,600	1,600	540	2,700	204,000	--	279,000	--
300 SOIL	Uranium	7440-61-1	ug/kg	4/17/2006	7/23/2007	11	10	91	5,800	5,800	2,700	7,200	82,000	--	40,000	--
300 SOIL	Uranium-235	15117-96-1	pCi/g	4/17/2006	7/23/2007	11	1	9.1	0	0.27	0.041	0.041	4,360	--	8,060	--
300 SOIL	Uranium-238	U-238	pCi/g	4/17/2006	7/23/2007	11	11	100	--	--	0.53	1.7	5,150	--	11,000	--
300 SOIL	Zinc	7440-66-6	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	106,000	207,000	856,000	--	1.04E+06	--

Table M-32. Summary of Riparin Soil Analytes That Exceed the Lowest Generic Wildlife Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Avian ESL	No. of Detects > Avian ESL	Mammal ESL	No. of Detects > Mammal ESL
300 SOIL	Aluminum	7429-90-5	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	6.70E+06	1.15E+07	7.21E+06	7	3.99E+06	11
300 SOIL	Vanadium	7440-62-2	ug/kg	4/17/2006	7/23/2007	11	11	100	--	--	49,200	73,000	43,000	11	260,000	--

Table M-33. Summary of Sediment Analytes Without a Lower Threshold Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Lower Threshold Sediment ESL	No. of Detects > Sediment ESL
300 SEDIMENT	1,2-Dichlorobenzene	95-50-1	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	1,3-Dichlorobenzene	541-73-1	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	1,4-Dichlorobenzene	106-46-7	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	2,4-Dichlorophenol	120-83-2	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	2,4-Dimethylphenol	105-67-9	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	2,4-Dinitrophenol	51-28-5	ug/kg	2/8/2006	12/21/2006	15	0	0	970	2,600	--	--	--	--
300 SEDIMENT	2,4-Dinitrotoluene	121-14-2	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	2,6-Dinitrotoluene	606-20-2	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	2-Chloronaphthalene	91-58-7	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	2-Nitroaniline	88-74-4	ug/kg	2/8/2006	12/21/2006	15	0	0	970	2,600	--	--	--	--
300 SEDIMENT	2-Nitrophenol	88-75-5	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	3,3'-Dichlorobenzidine	91-94-1	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	3-Nitroaniline	99-09-2	ug/kg	2/8/2006	12/21/2006	15	0	0	970	2,600	--	--	--	--
300 SEDIMENT	4,6-Dinitro-2-methylphenol	534-52-1	ug/kg	2/8/2006	12/21/2006	15	0	0	970	2,600	--	--	--	--
300 SEDIMENT	4-Bromophenylphenyl ether	101-55-3	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	4-Chloro-3-methylphenol	59-50-7	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	4-Chloroaniline	106-47-8	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	4-Chlorophenylphenyl ether	7005-72-3	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	4-Nitroaniline	100-01-6	ug/kg	2/8/2006	12/21/2006	15	0	0	970	2,600	--	--	--	--
300 SEDIMENT	4-Nitrophenol	100-02-7	ug/kg	2/8/2006	12/21/2006	15	0	0	970	2,600	--	--	--	--
300 SEDIMENT	Actinium-228	14331-83-0	pCi/g	3/21/2001	12/7/2004	8	8	100	--	--	0.32	1.6	--	--
300 SEDIMENT	Aroclor-1221	11104-28-2	ug/kg	2/8/2006	12/21/2006	15	0	0	15	44	--	--	--	--
300 SEDIMENT	Aroclor-1232	11141-16-5	ug/kg	2/8/2006	12/21/2006	15	0	0	15	44	--	--	--	--
300 SEDIMENT	Aroclor-1242	53469-21-9	ug/kg	2/8/2006	12/21/2006	15	0	0	15	44	--	--	--	--
300 SEDIMENT	Beryllium	7440-41-7	ug/kg	8/29/1994	12/21/2006	20	20	100	--	--	130	900	--	--
300 SEDIMENT	Beryllium-7	13966-02-4	pCi/g	4/9/1992	12/21/2006	42	9	21	0.011	0.46	0.073	0.56	--	--
300 SEDIMENT	Bis(2-chloro-1-methylethyl)ether	108-60-1	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	Bis(2-Chloroethoxy)methane	111-91-1	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	Bis(2-chloroethyl) ether	111-44-4	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	Bismuth	7440-69-9	ug/kg	2/8/2006	12/21/2006	15	0	0	550	1,800	--	--	--	--
300 SEDIMENT	Boron	7440-42-8	ug/kg	2/8/2006	12/21/2006	15	12	80	530	830	390	2,500	--	--
300 SEDIMENT	Calcium	7440-70-2	ug/kg	8/29/1994	12/21/2006	18	18	100	--	--	1.60E+06	5.35E+06	--	--
300 SEDIMENT	Chloride	16887-00-6	ug/kg	2/8/2006	12/14/2006	12	12	100	--	--	161	3,370	--	--
300 SEDIMENT	Cumulative % retained on No. 100 screen	RET#100	%	2/8/2006	12/14/2006	12	12	100	--	--	59	100	--	--
300 SEDIMENT	Cumulative % retained on No. 16 screen	RET#16	%	2/8/2006	12/14/2006	12	12	100	--	--	0	79	--	--
300 SEDIMENT	Cumulative % retained on No. 200 screen	RET#200	%	2/8/2006	12/14/2006	12	12	100	--	--	87	100	--	--
300 SEDIMENT	Cumulative % retained on No. 30 screen	RET#30	%	2/8/2006	12/14/2006	12	12	100	--	--	0.28	86	--	--
300 SEDIMENT	Cumulative % retained on No. 50 screen	RET#50	%	2/8/2006	12/14/2006	12	12	100	--	--	4.0	91	--	--
300 SEDIMENT	Cumulative % retained on No. 8 screen	RET#8	%	2/8/2006	12/14/2006	12	12	100	--	--	0	71	--	--
300 SEDIMENT	Dominant Substrate Class [1-4]	AQ_BASKET_DOM_S	class	7/24/2006	7/24/2006	1	1	100	--	--	2.0	2.0	--	--
300 SEDIMENT	Fluoride	16984-48-8	ug/kg	2/8/2006	12/14/2006	12	4	33	499	623	179	603	--	--
300 SEDIMENT	Fraction Coarse Sand	COARSE_SAND	%	2/8/2006	12/14/2006	12	12	100	--	--	0.25	11	--	--

Table M-33. Summary of Sediment Analytes Without a Lower Threshold Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Lower Threshold Sediment ESL	No. of Detects > Sediment ESL
300 SEDIMENT	Fraction Coarse Silt/Silt/Clay [less than 0.074 mm]	COARSE_SILT_CLA	%	2/8/2006	12/14/2006	12	12	100	--	--	0	13	--	--
300 SEDIMENT	Fraction Fine Sand	FINE_SAND	%	2/8/2006	12/14/2006	12	12	100	--	--	5.5	79	--	--
300 SEDIMENT	Fraction Granules [greater than 2.38 mm]	GRANULE	%	2/8/2006	12/14/2006	12	12	100	--	--	0	71	--	--
300 SEDIMENT	Fraction Medium Sand	MEDIUM_SAND	%	2/8/2006	12/14/2006	12	12	100	--	--	3.5	73	--	--
300 SEDIMENT	Fraction Total Sand	TOTAL_SAND	%	2/8/2006	12/14/2006	12	12	100	--	--	28	100	--	--
300 SEDIMENT	Fraction Very Coarse Sand	VERY_COARSE_SAN	%	2/8/2006	12/14/2006	12	12	100	--	--	0	17	--	--
300 SEDIMENT	Fraction Very Fine Sand	VERY_FINE_SAND	%	2/8/2006	12/14/2006	12	12	100	--	--	0.17	28	--	--
300 SEDIMENT	Gross beta	12587-47-2	pCi/g	4/19/1990	8/27/2001	12	12	100	--	--	19	30	--	--
300 SEDIMENT	Hexachlorobutadiene	87-68-3	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	Hexachlorocyclopentadiene	77-47-4	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	Hexavalent Chromium	18540-29-9	ug/kg	2/8/2006	12/21/2006	15	0	0	50	500	--	--	--	--
300 SEDIMENT	Hyalella CTL Growth	HYAL_CTL_GROWTH	mg	2/8/2006	2/19/2006	10	10	100	--	--	0.16	0.18	--	--
300 SEDIMENT	Hyalella CTL Survival	HYAL_CTL_SURV	%	2/8/2006	2/19/2006	10	10	100	--	--	92	96	--	--
300 SEDIMENT	Hyalella Growth	HYAL_GROWTH	mg	2/8/2006	12/14/2006	12	12	100	--	--	0.14	0.27	--	--
300 SEDIMENT	Hyalella Survival	HYAL_SURV	%	2/8/2006	12/14/2006	12	12	100	--	--	2.0	96	--	--
300 SEDIMENT	Iron-59	14596-12-4	pCi/g	4/9/1992	12/7/2004	10	2	20	0.031	0.13	0	0.0059	--	--
300 SEDIMENT	Isophorone	78-59-1	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	Lanthanum-140	13981-28-7	pCi/g	4/9/1992	12/7/2004	10	2	20	0.026	0.16	-4.20E-02	0.0059	--	--
300 SEDIMENT	Lithium	7439-93-2	ug/kg	2/8/2006	12/21/2006	15	15	100	--	--	3,600	13,000	--	--
300 SEDIMENT	Macrophyte Abundance Class [1-4]	AQ_BASKET_MACRO	class	7/24/2006	7/24/2006	1	1	100	--	--	3.0	3.0	--	--
300 SEDIMENT	Magnesium	7439-95-4	ug/kg	8/29/1994	12/21/2006	18	18	100	--	--	1.95E+06	5.11E+06	--	--
300 SEDIMENT	Manganese-54	13966-31-9	pCi/g	4/19/1990	12/7/2004	11	3	27	0.012	0.049	0.0012	0.018	--	--
300 SEDIMENT	Molybdenum-99	14119-15-4	pCi/g	10/29/2002	10/29/2002	1	0	0	110	110	--	--	--	--
300 SEDIMENT	Niobium-94	14681-63-1	pCi/g	10/29/2002	10/29/2002	1	0	0	0.016	0.016	--	--	--	--
300 SEDIMENT	Niobium-95	13967-76-5	pCi/g	4/9/1992	12/7/2004	10	2	20	0.016	0.066	0.0053	0.027	--	--
300 SEDIMENT	Nitrobenzene	98-95-3	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	Nitrogen in ammonia	NH3-N	ug/kg	2/8/2006	12/14/2006	12	11	92	2,640	2,640	1,140	5,660	--	--
300 SEDIMENT	Nitrogen in Nitrate	NO3-N	ug/kg	2/8/2006	12/14/2006	12	12	100	--	--	186	12,600	--	--
300 SEDIMENT	Nitrogen in Nitrite	NO2-N	ug/kg	2/8/2006	12/14/2006	12	8	67	513	814	221	1,690	--	--
300 SEDIMENT	Nitrogen, Kjeldahl total	N-KJELDAHL	ug/kg	2/8/2006	12/14/2006	12	12	100	--	--	255,000	1.92E+06	--	--
300 SEDIMENT	n-Nitrosodi-n-dipropylamine	621-64-7	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	n-Nitrosodiphenylamine	86-30-6	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	--	--
300 SEDIMENT	Pakchoi CTL Shoot Wt. Dry	PAK_CTL_SHOOT_W	g	2/8/2006	2/13/2006	7	7	100	--	--	5.8	5.8	--	--
300 SEDIMENT	Pakchoi shoot weight, dry	PAK_SHOOT_WT_DR	g	2/8/2006	12/14/2006	9	9	100	--	--	0.19	0.41	--	--
300 SEDIMENT	Pakchoi shoot weight, wet	PAK_SHOOT_WT_WE	g	2/8/2006	12/14/2006	9	9	100	--	--	3.5	8.5	--	--
300 SEDIMENT	Percent moisture (wet sample)	%MOISTURE	%	2/8/2006	12/14/2006	12	12	100	--	--	11	30	--	--
300 SEDIMENT	pH Measurement	PH	unitless	2/8/2006	12/14/2006	12	12	100	--	--	6.7	7.8	--	--
300 SEDIMENT	Potassium	7440-09-7	ug/kg	8/29/1994	12/21/2006	18	18	100	--	--	307,000	1.28E+06	--	--
300 SEDIMENT	Ruthenium-103	13968-53-1	pCi/g	4/9/1992	12/7/2004	10	2	20	0.016	0.061	-1.60E-02	0.0021	--	--
300 SEDIMENT	Ruthenium-106	13967-48-1	pCi/g	4/9/1992	12/21/2006	38	2	5.3	-7.03E-01	0.42	-1.40E-02	0.060	--	--
300 SEDIMENT	Silicon	7440-21-3	ug/kg	2/8/2006	12/21/2006	15	15	100	--	--	368,000	787,000	--	--
300 SEDIMENT	Silver-110 [metastable]	AG-110M	pCi/g	10/29/2002	10/29/2002	1	0	0	0.016	0.016	--	--	--	--

Table M-33. Summary of Sediment Analytes Without a Lower Threshold Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Lower Threshold Sediment ESL	No. of Detects > Sediment ESL
300 SEDIMENT	Sodium	7440-23-5	ug/kg	8/29/1994	12/21/2006	18	18	100	--	--	48,200	260,000	--	--
300 SEDIMENT	Strontium	7440-24-6	ug/kg	11/21/1996	12/21/2006	16	16	100	--	--	9,800	33,700	--	--
300 SEDIMENT	Sub Dominant Substrate Class [1-4]	AQ_BASKET_SUB_D	class	7/24/2006	7/24/2006	1	1	100	--	--	3.0	3.0	--	--
300 SEDIMENT	Substrate Embeddedness Class [1-4]	AQ_BASKET_EMBED	class	7/24/2006	7/24/2006	1	1	100	--	--	4.0	4.0	--	--
300 SEDIMENT	Sulfate	14808-79-8	ug/kg	2/8/2006	12/14/2006	12	12	100	--	--	799	10,900	--	--
300 SEDIMENT	Tellurium-129M	TE-129M	pCi/g	10/29/2002	10/29/2002	1	0	0	0.29	0.29	--	--	--	--
300 SEDIMENT	Tin-113	13966-06-8	pCi/g	10/29/2002	10/29/2002	1	0	0	0.022	0.022	--	--	--	--
300 SEDIMENT	Titanium	7440-32-6	ug/kg	2/8/2006	2/19/2006	10	10	100	--	--	847,000	2.03E+06	--	--
300 SEDIMENT	Total organic carbon	TOC	ug/kg	2/8/2006	12/14/2006	12	12	100	--	--	799,000	1.17E+07	--	--
300 SEDIMENT	Total petroleum hydrocarbons - gasoline range	TPHGASOLINE	ug/kg	2/8/2006	12/21/2006	15	2	13	33	140	6.6	120	--	--
300 SEDIMENT	Yttrium-88	Y-88	pCi/g	10/29/2002	10/29/2002	1	0	0	0.013	0.013	--	--	--	--
300 SEDIMENT	Zirconium	7440-67-7	ug/kg	2/8/2006	2/19/2006	10	10	100	--	--	7,500	33,600	--	--

Table M-34. Summary of Sediment Analytes That Were Not Detected

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Lower Threshold Sediment ESL	No. of Detects > Sediment ESL
300 SEDIMENT	1,2,4-Trichlorobenzene	120-82-1	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	9,600	--
300 SEDIMENT	2,4,5-Trichlorophenol	95-95-4	ug/kg	2/8/2006	12/21/2006	15	0	0	970	2,600	--	--	10	--
300 SEDIMENT	2,4,6-Trichlorophenol	88-06-2	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	10	--
300 SEDIMENT	2-Chlorophenol	95-57-8	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	55	--
300 SEDIMENT	2-Methylnaphthalene	91-57-6	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	470	--
300 SEDIMENT	2-Methylphenol (cresol, o-)	95-48-7	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	12	--
300 SEDIMENT	3+4 Methylphenol (cresol, m+p)	65794-96-9	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	260	--
300 SEDIMENT	4,4'-DDD (Dichlorodiphenyldichloroethane)	72-54-8	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	310	--
300 SEDIMENT	Acenaphthene	83-32-9	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	1,060	--
300 SEDIMENT	Acenaphthylene	208-96-8	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	470	--
300 SEDIMENT	Aldrin	309-00-2	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	2.0	--
300 SEDIMENT	Alpha-Chlordane	5103-71-9	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	0.030	--
300 SEDIMENT	Americium-241	14596-10-2	pCi/g	2/8/2006	12/21/2006	15	0	0	0.025	0.36	--	--	5,150	--
300 SEDIMENT	Anthracene	120-12-7	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	1,200	--
300 SEDIMENT	Antimony-124	14683-10-4	pCi/g	10/29/2002	10/29/2002	1	0	0	0.020	0.020	--	--	7,030	--
300 SEDIMENT	Antimony-125	14234-35-6	pCi/g	9/20/1993	12/21/2006	29	0	0	-3.45E-02	0.086	--	--	7,030	--
300 SEDIMENT	Aroclor-1016	12674-11-2	ug/kg	2/8/2006	12/21/2006	15	0	0	15	44	--	--	7.0	--
300 SEDIMENT	Aroclor-1248	12672-29-6	ug/kg	2/8/2006	12/21/2006	15	0	0	15	44	--	--	30	--
300 SEDIMENT	Aroclor-1254	11097-69-1	ug/kg	2/8/2006	12/21/2006	15	0	0	15	44	--	--	60	--
300 SEDIMENT	Barium-133	13981-41-4	pCi/g	10/29/2002	10/29/2002	1	0	0	0.020	0.020	--	--	230	--
300 SEDIMENT	Benzo(a)anthracene	56-55-3	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	4,260	--
300 SEDIMENT	Benzo(a)pyrene	50-32-8	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	3,300	--
300 SEDIMENT	Benzo(b)fluoranthene	205-99-2	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	11,000	--
300 SEDIMENT	Benzo(ghi)perylene	191-24-2	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	4,020	--
300 SEDIMENT	Benzo(k)fluoranthene	207-08-9	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	11,000	--
300 SEDIMENT	Butylbenzylphthalate	85-68-7	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	260	--
300 SEDIMENT	Carbazole	86-74-8	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	900	--
300 SEDIMENT	Cerium/Praseodymium-144	CE/PR-144	pCi/g	9/20/1993	8/29/1994	2	0	0	-4.91E-01	0.0012	--	--	2,900	--
300 SEDIMENT	Cerium-139	CE-139	pCi/g	10/29/2002	10/29/2002	1	0	0	0.014	0.014	--	--	2,900	--
300 SEDIMENT	Cesium-136	CS-136	pCi/g	10/29/2002	10/29/2002	1	0	0	0.066	0.066	--	--	1,480	--
300 SEDIMENT	Chromium-51	14392-02-0	pCi/g	10/29/2002	10/29/2002	1	0	0	0.24	0.24	--	--	106,000	--
300 SEDIMENT	Chrysene	218-01-9	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	5,940	--
300 SEDIMENT	Dibenz[a,h]anthracene	53-70-3	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	800	--
300 SEDIMENT	Dibenzofuran	132-64-9	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	200	--
300 SEDIMENT	Dieldrin	60-57-1	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	4.9	--
300 SEDIMENT	Diethylphthalate	84-66-2	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	530	--
300 SEDIMENT	Dimethyl phthalate	131-11-3	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	46	--
300 SEDIMENT	Di-n-octylphthalate	117-84-0	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	39	--
300 SEDIMENT	Endosulfan II	33213-65-9	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	5.0	--
300 SEDIMENT	Endosulfan sulfate	1031-07-8	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	5.0	--
300 SEDIMENT	Endrin	72-20-8	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	2.2	--
300 SEDIMENT	Endrin aldehyde	7421-93-4	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	2.2	--

Table M-34. Summary of Sediment Analytes That Were Not Detected

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Lower Threshold Sediment ESL	No. of Detects > Sediment ESL
300 SEDIMENT	Endrin ketone	53494-70-5	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	8,500	--
300 SEDIMENT	Fluoranthene	206-44-0	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	11,000	--
300 SEDIMENT	Fluorene	86-73-7	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	1,000	--
300 SEDIMENT	Gamma-BHC (Lindane)	58-89-9	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	2.4	--
300 SEDIMENT	gamma-Chlordane	5566-34-7	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	0.030	--
300 SEDIMENT	Heptachlor	76-44-8	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	68	--
300 SEDIMENT	Heptachlor epoxide	1024-57-3	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	2.5	--
300 SEDIMENT	Hexachlorobenzene	118-74-1	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	20	--
300 SEDIMENT	Hexachloroethane	67-72-1	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	1,000	--
300 SEDIMENT	Indeno(1,2,3-cd)pyrene	193-39-5	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	4,120	--
300 SEDIMENT	Methoxychlor	72-43-5	ug/kg	2/8/2006	12/21/2006	15	0	0	1.3	2.1	--	--	19	--
300 SEDIMENT	Naphthalene	91-20-3	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	500	--
300 SEDIMENT	Pentachlorophenol	87-86-5	ug/kg	2/8/2006	12/21/2006	15	0	0	970	2,600	--	--	1,200	--
300 SEDIMENT	Phenanthrene	85-01-8	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	6,100	--
300 SEDIMENT	Phenol	108-95-2	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	120	--
300 SEDIMENT	Pyrene	129-00-0	ug/kg	2/8/2006	12/21/2006	15	0	0	390	1,100	--	--	8,800	--
300 SEDIMENT	Selenium-75	SE-75	pCi/g	10/29/2002	10/29/2002	1	0	0	0.022	0.022	--	--	9,570	--
300 SEDIMENT	Silver	7440-22-4	ug/kg	9/5/1995	12/21/2006	17	0	0	80	520	--	--	570	--
300 SEDIMENT	Strontium-85	13967-73-2	pCi/g	10/29/2002	10/29/2002	1	0	0	0.022	0.022	--	--	582	--
300 SEDIMENT	Thallium	7440-28-0	ug/kg	2/8/2006	12/21/2006	15	0	0	720	2,500	--	--	2,600	--
300 SEDIMENT	Toxaphene	8001-35-2	ug/kg	2/8/2006	12/21/2006	15	0	0	13	21	--	--	0.10	--
300 SEDIMENT	Zirconium/Niobium-95	ZR/NB-95	pCi/g	9/20/1993	8/29/1994	2	0	0	-4.11E-02	0.070	--	--	2,330	--

Table M-35. Summary of Sediment Analytes With Concentrations That Do Not Exceed a Lower Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Lower Threshold Sediment ESL	No. of Detects > Sediment ESL
300 SEDIMENT	4,4'-DDE (Dichlorodiphenyldichloroethylene)	72-55-9	ug/kg	2/8/2006	12/21/2006	15	2	13	1.3	2.1	1.5	2.6	21	--
300 SEDIMENT	4,4'-DDT (Dichlorodiphenyltrichloroethane)	50-29-3	ug/kg	2/8/2006	12/21/2006	15	1	6.7	1.3	2.1	2.3	2.3	100	--
300 SEDIMENT	Alpha-BHC	319-84-6	ug/kg	2/8/2006	12/21/2006	15	1	6.7	1.3	2.1	3.1	3.1	6.0	--
300 SEDIMENT	Aluminum	7429-90-5	ug/kg	8/29/1994	12/21/2006	18	18	100	--	--	2.91E+06	9.64E+06	1.40E+07	--
300 SEDIMENT	Barium	7440-39-3	ug/kg	8/29/1994	12/21/2006	18	18	100	--	--	25,600	209,000	300,000	--
300 SEDIMENT	Barium-140	14798-08-4	pCi/g	4/9/1992	12/7/2004	10	2	20	0.094	0.55	-4.20E-02	-1.90E-03	230	--
300 SEDIMENT	Bis(2-ethylhexyl) phthalate	117-81-7	ug/kg	2/8/2006	12/21/2006	15	14	93	1,100	1,100	26	350	500	--
300 SEDIMENT	Calculated Total Uranium	calc_tot_U	ug/kg	9/14/1992	12/21/2006	37	37	100	--	--	482	29,851	100,000	--
300 SEDIMENT	Cerium-141	13967-74-3	pCi/g	4/9/1992	12/7/2004	10	2	20	0.024	0.098	0.011	0.013	15,900	--
300 SEDIMENT	Cerium-144	14762-78-8	pCi/g	4/9/1992	12/7/2004	10	2	20	0.084	0.30	-1.11E-01	-5.80E-02	2,900	--
300 SEDIMENT	Cesium-134	13967-70-9	pCi/g	4/19/1990	12/21/2006	69	4	5.8	-8.70E-02	0.10	4.00E-04	0.023	1,480	--
300 SEDIMENT	Cesium-137	10045-97-3	pCi/g	4/19/1990	12/21/2006	72	69	96	0.056	0.22	0.031	0.78	3,120	--
300 SEDIMENT	Chromium	7440-47-3	ug/kg	8/29/1994	12/21/2006	20	20	100	--	--	6,000	35,700	72,000	--
300 SEDIMENT	Cobalt	7440-48-4	ug/kg	8/29/1994	12/21/2006	18	18	100	--	--	2,700	12,400	50,000	--
300 SEDIMENT	Cobalt-57	13981-50-5	pCi/g	4/19/1990	12/7/2004	25	3	12	-1.16E-02	0.045	0.015	0.020	1,460	--
300 SEDIMENT	Cobalt-58	13981-38-9	pCi/g	4/9/1992	12/7/2004	10	2	20	0.014	0.049	-1.10E-02	-4.90E-03	3,800	--
300 SEDIMENT	Cobalt-60	10198-40-0	pCi/g	4/19/1990	12/21/2006	70	23	33	-1.14E-02	0.052	0.0066	0.044	1,460	--
300 SEDIMENT	Copper	7440-50-8	ug/kg	8/29/1994	12/21/2006	20	20	100	--	--	4,200	29,700	400,000	--
300 SEDIMENT	Delta-BHC	319-86-8	ug/kg	2/8/2006	12/21/2006	15	1	6.7	1.3	2.1	1.5	1.5	12	--
300 SEDIMENT	Di-n-butylphthalate	84-74-2	ug/kg	2/8/2006	12/21/2006	15	1	6.7	400	1,100	33	33	380	--
300 SEDIMENT	Endosulfan I	959-98-8	ug/kg	2/8/2006	12/21/2006	15	3	20	1.3	2.1	0.39	3.8	5.0	--
300 SEDIMENT	Europium-152	14683-23-9	pCi/g	4/19/1990	12/21/2006	53	23	43	0.0056	0.28	0.030	0.54	3,040	--
300 SEDIMENT	Europium-154	15585-10-1	pCi/g	9/20/1993	12/21/2006	30	2	6.7	-3.86E-02	0.12	0.045	0.083	2,570	--
300 SEDIMENT	Europium-155	14391-16-3	pCi/g	9/20/1993	12/21/2006	29	2	6.9	0.029	0.13	0.045	0.064	31,600	--
300 SEDIMENT	Iodine-131	10043-66-0	pCi/g	4/9/1992	12/7/2004	10	2	20	0.036	0.36	-2.00E-02	-1.30E-02	5,490	--
300 SEDIMENT	Lead	7439-92-1	ug/kg	2/8/2006	12/21/2006	15	15	100	--	--	4,200	48,700	360,000	--
300 SEDIMENT	Mercury	7439-97-6	ug/kg	2/8/2006	12/21/2006	15	5	33	20	20	30	70	660	--
300 SEDIMENT	Molybdenum	7439-98-7	ug/kg	2/8/2006	12/21/2006	15	10	67	450	700	290	890	250,000	--
300 SEDIMENT	Nickel	7440-02-0	ug/kg	8/29/1994	12/21/2006	19	19	100	--	--	6,300	23,800	26,000	--
300 SEDIMENT	Plutonium-238	13981-16-3	pCi/g	9/5/1995	8/4/2004	3	1	33	--	--	0.039	0.039	5,730	--
300 SEDIMENT	Plutonium-239/240	PU-239/240	pCi/g	9/5/1995	8/4/2004	3	1	33	--	--	0.010	0.010	5,860	--
300 SEDIMENT	Potassium-40	13966-00-2	pCi/g	4/19/1990	12/21/2006	78	78	100	--	--	8.5	21	4,430	--
300 SEDIMENT	Radium-226	13982-63-3	pCi/g	4/19/1990	12/21/2006	41	41	100	--	--	0.36	2.3	101	--
300 SEDIMENT	Radium-228	15262-20-1	pCi/g	10/27/1997	12/21/2006	16	16	100	--	--	0.56	1.4	88	--
300 SEDIMENT	Selenium	7782-49-2	ug/kg	2/8/2006	12/21/2006	15	5	33	430	4,600	420	4,300	11,000	--
300 SEDIMENT	Strontium-90	10098-97-2	pCi/g	9/14/1992	12/21/2006	37	11	30	-7.60E-02	0.15	0.0040	0.056	582	--
300 SEDIMENT	Technetium-99	14133-76-7	pCi/g	8/27/2001	8/27/2001	1	1	100	--	--	0.30	0.30	42,200	--
300 SEDIMENT	Thorium-228	14274-82-9	pCi/g	4/19/1990	12/21/2006	44	43	98	1.2	1.2	0.43	3.6	805	--
300 SEDIMENT	Thorium-230	14269-63-7	pCi/g	8/27/2001	12/21/2006	20	17	85	0.12	0.30	0.27	5.6	10,400	--
300 SEDIMENT	Thorium-232	TH-232	pCi/g	8/27/2001	12/21/2006	20	18	90	0.50	0.51	0.27	1.5	1,300	--
300 SEDIMENT	Tin	7440-31-5	ug/kg	8/29/1994	12/21/2006	18	12	67	1,000	2,300	830	6,600	239,000	--
300 SEDIMENT	Total petroleum hydrocarbons - diesel range	TPHDIESEL	ug/kg	2/8/2006	12/21/2006	15	14	93	5,290	5,290	1,500	45,000	340,000	--

Table M-35. Summary of Sediment Analytes With Concentrations That Do Not Exceed a Lower Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Lower Threshold Sediment ESL	No. of Detects > Sediment ESL
300 SEDIMENT	Uranium	7440-61-1	ug/kg	2/8/2006	12/21/2006	15	6	40	950	5,000	1,800	6,800	100,000	--
300 SEDIMENT	Uranium [radionuclide]	U_rad	pCi/g	9/5/1995	10/25/2004	7	7	100	--	--	1.9	9.3	2,490	--
300 SEDIMENT	Uranium-234	13966-29-5	pCi/g	9/14/1992	12/21/2006	40	40	100	--	--	0.071	11	5,270	--
300 SEDIMENT	Uranium-235	15117-96-1	pCi/g	9/14/1992	12/21/2006	51	33	65	0	0.28	0.0029	0.41	3,730	--
300 SEDIMENT	Uranium-236	13982-70-2	pCi/g	8/27/2001	10/25/2004	6	6	100	--	--	3.11E-05	0.050	2,490	--
300 SEDIMENT	Uranium-238	U-238	pCi/g	9/14/1992	12/21/2006	41	39	95	0.16	2.0	0.051	10.0	2,490	--
300 SEDIMENT	Vanadium	7440-62-2	ug/kg	8/29/1994	12/21/2006	18	18	100	--	--	19,600	66,000	90,000	--
300 SEDIMENT	Zinc	7440-66-6	ug/kg	8/29/1994	12/21/2006	18	18	100	--	--	48,400	310,000	3.20E+06	--
300 SEDIMENT	Zinc-65	13982-39-3	pCi/g	4/9/1992	12/7/2004	12	2	17	-3.04E-01	0.11	0.020	0.040	1,430	--
300 SEDIMENT	Zirconium-95	13967-71-0	pCi/g	4/9/1992	12/7/2004	10	2	20	0.025	0.10	-4.60E-02	0.18	2,330	--

Table M-36. Summary of Sediment Analytes With Concentrations Greater than a Lower Threshold Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Lower Threshold Sediment ESL	No. of Detects > Sediment ESL
300 SEDIMENT	Antimony	7440-36-0	ug/kg	9/5/1995	12/21/2006	17	2	12	450	1,100	2,200	10,000	400	2
300 SEDIMENT	Aroclor-1260	11096-82-5	ug/kg	2/8/2006	12/21/2006	15	1	6.7	15	44	11	11	5.0	1
300 SEDIMENT	Arsenic	7440-38-2	ug/kg	2/8/2006	12/21/2006	15	15	100	--	--	1,400	18,000	14,000	1
300 SEDIMENT	beta-1,2,3,4,5,6-Hexachlorocyclohexane (beta-BHC)	319-85-7	ug/kg	2/8/2006	12/21/2006	15	2	13	1.5	2.1	2.0	8.0	7.2	1
300 SEDIMENT	Cadmium	7440-43-9	ug/kg	8/29/1994	12/21/2006	18	17	94	90	90	110	2,400	2,100	1
300 SEDIMENT	Iron	7439-89-6	ug/kg	8/29/1994	12/21/2006	18	18	100	--	--	8.68E+06	2.94E+07	2.00E+07	5
300 SEDIMENT	Manganese	7439-96-5	ug/kg	8/29/1994	12/21/2006	18	18	100	--	--	87,000	746,000	460,000	4
300 SEDIMENT	Phosphorus	7723-14-0	ug/kg	2/8/2006	12/21/2006	15	15	100	--	--	421,000	1.30E+06	600,000	12
300 SEDIMENT	Total petroleum hydrocarbons	TPH	ug/kg	2/8/2006	12/21/2006	15	1	6.7	154,000	210,000	287,000	287,000	17,000	1

Table M-37. Summary of Sediment Analytes With Concentrations Greater than an Upper Threshold Ecological Screening Level

Site	Analyte	CAS#	Units	First Sample Date	Last Sample Date	Number of Results	Number of Detects	Frequency of Detects (%)	Min Non-Detect	Max Non-Detect	Min Detect	Max Detect	Upper Threshold Sediment ESL	No. of Detects > Sediment ESL
300 SEDIMENT	Antimony	7440-36-0	ug/kg	9/5/1995	12/21/2006	17	2	12	450	1,100	2,200	10,000	600	2
300 SEDIMENT	Total petroleum hydrocarbons	TPH	ug/kg	2/8/2006	12/21/2006	15	1	6.7	154,000	210,000	287,000	287,000	30,000	1

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Appendix N

Previous Investigations

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N1 Introduction

This appendix provides a comprehensive summary of previous investigations in the 300 Area. Table N-1 presents a summary of previous 300 Area investigations and findings. Table N-2 presents a summary of previous 300 Area modeling efforts.

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Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Baseline Reports		
300-FF-1 Facility and Waste Characterization (1990)—Gathered additional information on facility and waste characteristics for the 300-FF-1 operable unit (OU) by collecting and reporting: (1) meetings and onsite visits with current and past personnel having knowledge of operations in the OU; (2) a more precise determination of the location of the process sewer lines and Retired Radioactive Liquid Waste Sewer; (3) a better understanding of the phosphoric acid spill at the 340 Complex; and (4) a search for engineering plans and environmental reports related to the OU.	Provided additional information on facility and waste characteristics for the 300-FF-1 OU. The gathered and reported information included meetings and onsite visits with current and past personnel having OU operations knowledge, a more precise determination for the Process Sewer lines and Retired Radioactive Liquid Waste Sewer location, a better understanding of the phosphoric acid spill at the 340 Complex, and a search for related OU engineering plans and environmental reports. This data-gathering effort resulted in recommendations for further investigation that included: (1) the 307 Trench characterization to determine the underlying groundwater uranium plume origin, (2) more extensive sampling of near-surface and dike sediments in the North and South Process Ponds to better define the horizontal contamination extent, and (3) possible leak detection in the abandoned Radioactive Waste Sewer by either electromagnetic induction or remote television camera inspection techniques.	*Data Compilation Task Report for the Source Investigation of the 300-FF-1 Operable Unit Phase I Remedial Investigation* (PNL-7241)
Additional Facility and Waste Characterization in 300-FF-1 (1991)—Gathered additional information beyond what was presented in the 300-FF-1 Work Plan (DOE/RL-88-13), including information on undesignated waste sites, process chemicals, and waste disposal practices. This involved conducting interviews with present and former personnel; inspecting old reports, drawings, and aerial photographs; and visiting sites.	The purpose of this document was to expand on facility information and waste characterization in the 300-FF-1 OU beyond what was presented in the 300-FF-1 Work Plan (DOE/RL-88-13). It was recommended that geophysical surveys that include ground-penetrating radar (GPR), magnetometry, and metal detection be conducted in undesignated burial grounds, suspect areas, and any area that may be excavated in the future to ascertain the nature and location of buried debris. In addition, further investigation of spills from tank storage facilities was advised.	*Addendum to Data Compilation Task Report for the Source Investigation of the 300-FF-1 Operable Unit Phase I Remedial Investigations* (EMO-1026)
300 Area Facilities and Activities Data Compilation (1992)—Gathered data and information from historical 300 Area reports regarding facilities and activities within the 300 Area.	This report was a compilation of historical information of the 300 Area activities and facilities since 1943.	*Compilation of Historical Information of 300 Area Facilities and Activities* (WHC-MR-0388)
Data Compilation 618-11 Burial Ground (1993)—Compiled records dating back to 1962 on site use and inventory.	This report was a collection of site inventory, initial contaminant levels, and site history dating back to 1962.	*Miscellaneous Information Regarding Operation and Inventory of 618-11 Burial Ground* (WHC-MR-0416)
Data Compilation 618-10 Burial Ground (1993)—Compiled records dating back to 1962 on site use and inventory.	This report was a collection of site inventory, initial contaminant levels, and site history.	*Miscellaneous Information Regarding Operation and Inventory of 618-10 Burial Ground* (WHC-MR-0415)
Technical Baseline and Characterization (1994)—Waste sites described in this document include structures, contaminated equipment and facilities, waste distribution systems, French drains, solid waste burial grounds, septic tanks, drainfields, unplanned releases, trenches, and other types of sites.	This report provided a technical baseline and characterization of waste sites located in the 300-FF-2 OU and results from an environmental investigation undertaken by the Bechtel Hanford, Inc. (BHI) History Office in support of the environmental restoration engineering function.	*300-FF-2 Operable Unit Technical Baseline Report* (BHI-00012)
Construction and Completion Summary (1994)—This report contained documentation of remediation and decommissioning activities for existing wells in the 300-FF-5 OU. It also included summaries of construction data for newly constructed wells drilled during the 300-FF-5 Phase I Remedial Investigation (RI).	This report was a compilation of "as-built" well documents as well as construction data tabulated from driller or geologist logs for wells in the 300 Area up to 1994.	*Summaries of Well Construction Data and Field Observations for Existing 300-FF-5 Operable Unit Resource Protection Wells* (WHC-SD-ER-TI-004)
TCLP Data (1995)—Toxicity Characteristic Leaching Procedure (TCLP) tests were performed on two samples (B01038 and B01044) collected from the 300 Area Process Trenches during the expedited response action conducted in 1991.	Splits were taken of samples B01038 and B01044 for TCLP analysis during the expedited response action taken at the 300 Area Process Trenches in 1991. Specific sample location information can be found in *Phase I Remedial Investigation Report for the 300-FF-1 Operable Unit* (DOE/RL-92-43). One sample was taken near the head end and the other near the tail end of the east process trench. TCLP tests were run for herbicides, metals, pesticides, semivolatiles, and volatiles. Matrix spike and duplicate analyses were performed on B01038. All sample results passed regulatory limits.	*300-FF-1 Phase I Remedial Investigation TCLP Data* (BHI-00452)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
100 and 300 Area Burial Ground Study (1996)—The purpose of this study was to evaluate alternatives for the removal of burial grounds in the 100 and 300 Areas. These alternatives consisted of in-place remediation options that include barriers, institutional controls, and combinations of the two. Factors that included exposure scenarios, relative risks, costs, characterization potential, timing, and actions at other sites were evaluated. The results of evaluating these factors were then used to formulate options that were assessed in further detail site-by-site, considering the specific characteristics of each site, such as location and content.	Factors influencing burial ground remedial decisions were future exposure risk, relative risks to workers, ability to characterize, and cost. The study recognized that each burial ground was unique when its size and content were considered in conjunction with its location. Even if in-place closure options are considered, they may not necessarily make sense for all burial grounds. For example, as the cost analysis indicated, it is more cost effective to remove small-sized burial grounds than to cap them. Evaluation of remedial alternatives for burial grounds should consider site-specific factors such as the site's location relative to sites that will be removed and the site's proximity to reactor buildings that are expected to remain under U.S. Department of Energy (DOE) control for many years. The results of this study showed that considerable cost savings can be realized if remedial options other than complete removal can be considered for 100 and 300 Area burial grounds. However, for in-place remedial options to be considered viable, some portions of the 100 and 300 Areas would not be available for unrestricted land use and DOE's continued presence (or deed restrictions) would be necessary to enforce access and/or activity restrictions. DOE's presence would need to continue until the reactors are dispositioned or until other future events occur that warrant a re-evaluation.	*100 and 300 Area Burial Ground Remediation Study* (BHI-00768)
Radiological Investigations		
Radiological Survey Along Columbia River Shoreline (1980)—A radiological survey was performed to evaluate the magnitude and distribution of radioactive contamination on the exposed shorelines of the Columbia River along and downstream of the Hanford Site.	Measurable radioactive contamination, resulting from past Hanford Site operations was found to be present on the shorelines of the Columbia River along the study area. The average exposure rate over the survey area measured 11 ± 3 microroentgens per hour (μR/hr) compared to a background exposure rate measured along the shoreline upstream of 7 ± 1 μR/hr. Exposure rate readings exceeded 25 μR/hr in 92 areas. Discrete particles of contamination containing cobalt-60 (Co-60) were found along the river, usually in flat, rocky areas with little or no vegetation.	*Radiological Survey of Exposed Shorelines and Islands of the Columbia River Between Vernita and the Snake River Confluence* (PNL-3127)
Aerial Radiological Surveys - 1988 (1990)—Aerial radiological surveys of the Hanford Site and surrounding area were performed.	An aerial radiological survey was conducted over the Hanford Site from July 5 to August 26, 1988. The survey was flown at an altitude of 61 m by a helicopter containing 17 L of sodium iodide detectors. The processed data indicated that detected radioisotopes and their associated gamma ray exposure rates were generally consistent with those expected from normal background emitters and manufactured fission/activation products resulting from activities at the site. External exposure rates were generally 10 μR/h with some operating areas over 1,000 μR/h. The radiation levels over more than 95 percent of the site are because of normal background exposure rates.	*An Aerial Radiological Survey of the Hanford Site and Surrounding Area, Richland, Washington* (EGG-10617-1062)
Surface Radiation Survey (1990)—Radiation surveys were completed and soil samples collected within the 300-FF-1 OU as part of OU characterization.	Radiation occurred above background levels at 42 locations. Chemical analysis of samples from selected locations showed that above-background radiation levels were due primarily to the presence of uranium. Several pieces of nonradioactive, brown, fibrous, tile were observed on the ground surface in the northeast portion of the OU. A sample of this tile was collected and analyzed; the results indicated that the sample contained 10 to 20 percent asbestos. The presence of asbestos in this tile scrap was not considered a health hazard for surface activities.	*Surface Radiation Survey of the 300-FF-1 Operable Unit: A Status Report* (WHC-MR-0147)
Surface Radiation Survey (1990)—This project included: (1) radiation level determination near the 300 Area, (2) surface radiation surveys outside of established radiation areas, (3) geodetic surveys of locations above background, and (4) soil sampling and analysis.	Because of radiation survey and sampling activities, radiation occurred above a statistically calculated background estimate in 77 locations. Contamination was primarily associated with soil; however, some contaminated metal and other materials were found. Chemical analysis of samples from selected locations showed that above-background radiation levels were caused primarily by the presence of uranium. Some of the soil samples also contained relatively high concentrations of copper, but there did not appear to be a linear relationship between the concentration of copper and uranium. Additional surface radiation survey work was recommended to be performed using ultrasonic ranging and data system (USRADS) equipment with the sodium iodide detector. This work is needed to more completely characterize selected sites and provide information that will aid picking borehole locations for soil sampling.	*Final Report: Surface Radiation Survey for the Phase 1 Remedial Investigation of the 300-FF-1 Operable Unit on the Hanford Site* (EMO-1008)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Oil Uranium Survey (1990)—Sampling sites were chosen randomly based on a grid system. Surface soil samples were collected at each site by compositing four 1 in. deep × 4 in. diameter cores taken from within a radius of 5 m or less of the site identification stake. The objective of the study was to determine the spatial distribution of uranium in the study area and to ascertain if background levels of uranium have been increased by Hanford Site operations.	Based on spatial distributions of uranium-238 (U-238), the highest concentrations of uranium are located in the southern portion of the study area adjacent to the 300 Area industrial complex and in the most eastern zone of the study site bordering the Columbia River. Concentrations of U-238 in the southern portion of the study area are higher than mean concentrations of U-238 reported in control areas at the Hanford Site. While no federal or Washington State guidelines existed for levels of uranium in soil, Westinghouse Hanford Company instituted operational guidelines for management of contaminated soil. Levels of uranium isotopes detected in soil collected from the study area routinely fall at least an order of magnitude below these guidelines.	*A Survey for Elevated Levels of Uranium North of the 300 Area on the Hanford Site* (PNL-7271)
Radiological Characterization 618-10 (1993)—This report summarized and documented the results of the radiological surveys conducted from February 11 through February 17, and March 30, 1993 over the 618-10 Burial Ground. Surveys were conducted at or near 6 in. and at 3 ft from the surface soil.	No statistically elevated radiation/contamination readings were observed in any of the surveys conducted.	*618-10 Burial Ground USRADS Radiological Surveys* (WHC-SD-EN-RPT-010)
Radiological Characterization 618-11 (1993)—This report summarized and documented the results of the radiological surveys conducted from February 4 through February 10, 1993 over the 618-11 Burial Ground. Surveys were conducted at or near 6 in. and at 3 ft from the surface soil.	No statistically elevated radiation/contamination readings were observed in any of the surveys conducted.	*618-11 Burial Ground USRADS Radiological Surveys* (WHC-SD-EN-RPT-011)
Cobalt Sampling South Process Pond (1995)—Statistically based sampling was designed to provide sufficient data to state confidence and error in estimating the mean Co-60 concentrations in the South Process Pond surface soils. In total, 94 samples were collected: 73 were collected from random locations in the pond, 8 were duplicate samples, and 13 were biased samples. All samples were analyzed for Co-57, Co-60, cesium-137 (Cs-137), U-235, and U-238.	The average concentration of Co-60 was about half of the expected concentration. The question of whether there was a large area of the main South Process Pond with high Co-60 concentrations was no longer an issue. The previous high sample value of concern was 30 pCi/g. The new maximum was 19.7 pCi/g, and the average was 3.2 to 3.8 pCi/g, depending on which samples were included in the calculation.	*Sample Activity Report for Cobalt Sampling at the 300-FF-1 South Process Pond* (BHI-00618)
Radiological and Chemical Sampling Near-Shore 300 Area (2003)—Sample areas included an upriver control site and the 300 Area shoreline near four riverbank springs reported from previous studies. Water samples collected included near-shore river water, cross-river transects, river-bank spring water, and shallow groundwater collected from drive point wells. Sediment samples were collected at riverbank spring locations and at the background site. Biota samples with sufficient sample mass (100 grams or more) to detect low levels of radioactivity were analyzed for gamma-emitting isotopes, strontium-90 (Sr-90), and technetium-99 (Tc-99). For each biota, a composite sample from each site was sent to the analytical laboratory. Other sampling included radiological and chemical sampling.	This study was able to monitor the progression of contaminants in 300 Area groundwater from shallow groundwater to riverbank springs, and ultimately to river water, sediment, and biota. Discharges of riverbank spring water appeared to be the major source of 300 Area groundwater contaminants entering the river during low river flow conditions. There was evidence of groundwater upwelling into the near-shore river water at locations where no flowing riverbank springs were observed; however, river water samples from these locations had lower concentrations of contaminants than the locations with active riverbank springs. Clam samples were shown to be effective for estimating the aquatic habitat in the 300 Area with elevated concentrations of chromium, selenium, and uranium. Similar spatial profiles were observed for uranium concentrations in near-shore river water (at low river stage) and uranium in soft tissues of clams.	*Survey of Radiological and Chemical Contaminants in the Near Shore Environment at the Hanford Site 300 Area* (PNNL-13692)
Aerial Radiological Surveys - 1996 (2007)—Aerial radiological surveys of the Hanford Site and surrounding area were performed.	The results of the survey were reported as contours of the terrestrial exposure rate extrapolated to 1 m (3 ft) above ground level, contours of artificial gross count activity (characteristic of all long-lived artificial radionuclides that emit gamma radiation with energies less than 1,400 keV), and contours of Cs-137 activity. Excluding cosmic radiation (3.7 µR/h), implied exposure rates for background areas (areas undisturbed by Hanford Site radiological activities) ranged from 3 to 7 µR/h at 1 m (3 ft) above ground level. In radiologically disturbed areas, implied exposure rates in excess of background levels (as high as 500 µR/h in some cases) were observed. Typically disturbed areas were the nine deactivated reactors in the 100 Area, the Columbia Generating Station (Unit No. 2 reactor; Energy Northwest [Washington Public Power Supply System in 1996]), and the facilities and radioactive storage sites within the 200 East/West and 300 Areas.	*An Aerial Radiological Survey of the Hanford Reservation Richland Washington: Date of Survey: February 29 to March 21, 1996* (DOE-0335)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Soils and Vadose Zone Investigations		
Ground Contamination 307 Basin Transfer Line (1971)—A leak of apparently long duration was discovered on December 9, 1969, in the transfer line from the 307 Retention Basins to the 340 Contaminated Waste Systems. Soil samples were collected to determine approximate location and quantity of each radionuclide that had leaked to the soil.	Approximately 900 curies of relatively short-lived radionuclides, including 10 curies each of Sr-90 and Cs-137 inadvertently leaked to the soil as a result of the corrosion of an underground carbon steel pipe section. More than 90 percent of the contamination from this incident was confined within a cylindrical section of earth approximately 25 ft deep and 12 ft in diameter. Despite the fact that promethium and cerium were combined with complexing agents, both were retained by the soil. Any groundwater contamination from this incident was minimal, because no 300 Area groundwater samples showed detectable concentrations of the nuclides found in the soil. Since the leak existed from some time, any further migration of the activity from its sorbed position in the soil should be negligible.	*Failure of 307 Basin Transfer Line and Resultant Ground Contamination* (BNWL-CC-2617)
Process Trench Sediment Sampling 300 Area (1987)—Sediment samples were collected at the bottom of the trench every 100 ft at three separate depths. Deeper sediments were sampled by drilling wells every 300 ft between the trenches. The goal was to provide a basis for remedial action plans.	The goal of sampling at the process trenches in the 300 Area was to determine contaminant levels in the sediments between the surface and groundwater caused by past disposal of hazardous materials in the process sewer systems and to provide the basis for remedial action plans. Contaminant levels above background were found for various metals including mercury, lead, nickel, chromium, and uranium in the shallow sediments. No significant concentrations of hazardous materials were found in the deep sediments from well samples. The concentration of metals in the shallow sediments was expected based on the chemistry of the process trench environment. The concentrations were not high enough to cause the shallow sediments themselves to be considered hazardous waste. The highest concentration was for uranium. Remedial action was necessary either to remove the contamination or to stabilize the contamination in place. Among options considered, the preferred remedial action was to remove the contamination and continue to use the trenches for the disposal of nonhazardous process water.	*300 Area Process Trench Sediment Analysis Report* (WHC-SP-0193)
300 Area Process Ponds Soil Sampling (1989)—In 1987, sediment samples were collected from excavations at 14 locations in and adjacent to the 300 Area Process Ponds. The samples were analyzed for several inorganic, organic, and radioactive hazardous substances. In addition, geochemical characterization of sediments using x-ray diffraction, scanning electron microscopy, and energy-dispersive x-ray microanalysis began.	Initial RI results indicated that contamination in the process ponds was typically associated with greenish sediment that contained high gross alpha and gross beta activities, and elevated concentrations of silver, aluminum, chromium, copper, nickel, and zinc relative to background levels. Additionally, arsenic, fluorine, mercury, lead, antimony, strontium, vanadium, and nitrate were present in concentrations above background levels at several locations. Radiochemical analyses showed that the primary radiological contaminant was uranium. Co-60 and Cs-137 were also detected. Contaminant concentrations tended to decrease with distance and with depth from the former inlets to the ponds. Continued geochemical characterization of sediments was recommended.	*Status Report on Remedial Investigation of the 300 Area Process Ponds* (PNL-6442)
Soil Gas Sampling at the 618-4 and 618-5 Burial Grounds (1991)—Soil gas sampling was conducted on the 618-4 and 618-5 Burial Grounds to determine if volatile organic compounds (VOCs) were present. Sixty soil gas samples were collected from 618-4 and 24 soil gas samples were collected from 618-5.	A soil gas survey was conducted at the 618-4 and 618-5 Burial Grounds. Eighty-four soil gas samples were collected and analyzed using gas chromatography. VOCs were detected in eight locations at 618-4 and five locations at 618-5. Sample analyses indicated the presence of trichloroethylene (TCE), perchloroethane (PCE), and dichloroethene (DCE) in the 618-4 Burial Ground, and TCE and PCE in the 618-5 Burial Ground. Detected VOCs were well dispersed throughout 618-4, with a major clustering in the southwestern end of the area and a small cluster near the northeastern side. VOCs were detected near the northeastern and southeastern edges of 618-5. The highest concentrations of subsurface contamination in the burial areas might have been in the locations of detected VOCs. Additional sampling is necessary to more accurately determine if VOCs extend beyond burial ground areas. VOC concentration levels detected are not indicative of the contaminant volumes contained in the burial areas.	*Soil Gas Survey of Burial Grounds 618-4 and 618-5, 300-FF-1 Operable Unit* (WHC-MR-0288)
Drilling and Test Pit Activities 300-FF-1 Phase I (1992)—Seven characterization boreholes were drilled. Eleven test pits were excavated in seven waste management units in the 300 Area.	The investigation of the waste facilities was accomplished using the cable-tool drilling method for making boreholes and a backhoe for making test pits. Boreholes were drilled to approximately 10 ft below the water table and abandoned with bentonite chunks and bentonite crumbles. The test pit method of sample collecting was used at most of the waste sites to reduce costs, recover schedule, and provide a better sample. A field sampling plan was used as a guide for determining sample locations. Actual sampling locations were determined in the field by the geologist and the field team leader.	*Summary of Drilling and Test Pit Activities for the 300-FF-1 Operable Unit Phase I Soil Sampling Investigation* (WHC-SD-EN-TI-038)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Geophysical Surveys at Waste Burial Sites (1992)—Geophysical surveys were performed at four waste burial sites in the 300-FF-1 OU. Four instruments were used, including GPR, metal detector, electromagnetic induction ground-conductivity meter, and magnetometer. The objectives were to determine the depths of fill, identify subsurface structures such as trenches and pits, and detect and map buried waste material and other significant features within the areas of interest.	The geophysical surveys successfully detected and delineated the buried waste deposits at the four sites that were included in this characterization task. The results provided an effective basis for the selection of follow-up characterization procedures. It is important to recognize, however, that available geophysical methods could not provide subsurface information that was completely without uncertainty.	*Geophysical Surveys Performed by the Automation and Measurement Sciences Department of the Pacific Northwest Laboratory* (At Landfills 1A, 1B, 1C, and 1D)(WHC-SD-EN-TI-060)
Geophysical Surveys at Hanford Burial Grounds (1992)—Geophysical surveys were performed at the 618-4 and 618-5 Burial Grounds in 1989.	The geophysical surveys effectively detected and mapped the buried waste material in and around the 618-4 and 618-5 Burial Grounds. The GPR, magnetic, and metal detector data proved to be consistent and complementary. The results were reasonably clear, although there were certain limited areas, particularly the fringe areas around the major waste deposits, where waste materials could not be unambiguously identified. Some useful supplemental or confirmative information might be gained by performing a survey with a Geonics EM31 ground conductivity meter. The in-phase component of the EM31 data would probably be most useful at these sites. This type of survey could be performed quickly and at relatively low cost. In addition, if the surface-contaminated area on the west side of 618-4 was covered by soil and thereby made accessible, it would be appropriate to perform geophysical surveys there.	*Geophysical Surveys Performed by the Automation and Measurement Sciences Department of the Pacific Northwest Laboratory at Hanford Burial Grounds 618-4 and 618-5* (WHC-SD-EN-TI-061)
Geophysical Surveys at 307 Retention Basins and 307 Process Trench (1992)—Geophysical surveys were performed at the 307 Retention Basins and the 307 Process Trench.	The GPR survey at the 307 Retention Basin was successful in locating subsurface obstructions that could be damaged by well drilling or that could constitute a potential hazard to personnel engaged in drilling activities. At the 307 Process Trench site, environmental factors severely limited the amount of information that could be obtained about the trench boundaries. Nevertheless, a considerable amount of information relating to possible subsurface obstructions or hazards to drilling operations was obtained. These results should have been sufficient to define reasonably safe drilling locations at the east and west ends of the trench. It is important to recognize, however, that available geophysical methods cannot provide subsurface information that is completely without uncertainty.	*Geophysical Surveys at the 307 Trenches and the 307 Retention Basins in the 300-FF-1 Operable Unit* (WHC-SD-EN-TI-062)
Closed Circuit Television Survey Results (1992)—The survey of the retired Radioactive Liquid Waste Site (RLWS) was performed with color camera systems, which were introduced into the piping through various cleanouts.	The abandoned RLWS was in good condition considering the service history of this piping. It was assumed that the types and volumes of chemicals disposed of through the system would have corroded it in places. No breaches in piping were confirmed and no areas of heavy corrosion were observed.	*Final Report for the Remote CCTV Survey of the 300 Area Retired Radioactive Liquid Waste System* (WHC-SD-GN-ER-30015)
XRF Field Screening (1992) - Work consisted primarily of excavation of contaminated sediments and underlying soil in the 316-5 Process Trenches. Samples were collected before and after excavation in each trench. An x-ray fluorescence (XRF) spectrometer was used to screen samples in the field for heavy metal contamination. In addition, in situ measurements were made on soil surfaces in the west trench before and after excavation.	In general, XRF measurements exhibited evidence of heavy metal contamination, primarily zirconium, and uranium, with minor copper. Comparison of in situ measurements in the west process trench before and after the environmental risk assessment indicated that contamination was reduced to approximately background levels. The data obtained from this investigation suggested that the "scan model" approach could be used for field screening to detect anomalous concentrations of heavy metals in soils and like materials. However, reliability of this method depends on the degree of agreement between the field screening results and validated data.	*Summary of XRF Field Screening Data from 316-5 Process Trenches Expedited Response Action* (WHC-SD-EN-TI-013)
Radiological Survey of the 316-5 Process Trenches (1992)—This report summarized the results of the radiological surveys conducted over the entire surface of the 316-5 Process Trenches site. It also explained the survey methodology using the USRADS automatic data recording equipment. Two surveys were conducted at the site.	For both surveys, the entire fenced area at the process trench site was surveyed, with the exception of the steep embankments and the covered trenches themselves. The pre-remediation survey consisted of 11 individual USRADS surveys collecting 30,453 data points. The post-remediation survey also consisted of 11 surveys totaling 29,356 data points.	*316-5 Process Trenches Site USRADS Survey* (WHC-SD-EN-TI-018)
Borehole Summary (1992)—Well 699-S20-E10 was drilled approximately 20 ft into the uppermost unconfined aquifer and installed upgradient of the 300 Area. Sediment core samples were analyzed for physical properties. Estimation of aquifer recharge under natural conditions using chloride mass balance techniques from data collected on sediment samples was also completed.	The drill cuttings from 699-S20-10 were screened in the field for VOCs and beta-gamma activity by radiation control technicians. Screening revealed only natural background levels. Sediment grab samples were collected from the borehole at 5 ft intervals from ground surface to total depth. The sediment samples were used for geologic description, digital photography, and for archival purposes. In addition to grab samples, a total of 43 near continuous intact 1 ft long split-spoon core samples were collected from 7 to 63 ft bgs. Sample recovery on intact cores was good to poor. Geophysical logging detected no manufactured radionuclides in the borehole.	*Borehole Data Package for One CY 2005 CERCLA Well 699-S20-E10; 300-FF-5 Operable Unit, Hanford Site* (PNNL-15417)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
300-FF-1 OU Remedial Investigation (1993)—Data collection activities included: (1) contaminant sources within waste facilities, (2) meteorology, (3) surface hydrology and surface water, (4) geology, including characteristics and structure of bedrock and unconsolidated sediments, (5) soil characterization of the vadose zone, and (6) ecology and potential receptor organisms.	This document came to the conclusion that (1) there was no evidence of imminent and substantial endangerment to either human health or the environment from exposures to the 300-FF-1 OU contaminants, (2) no sensitive ecosystems were known to be contaminated by the 300-FF-1 OU, and (3) none of the potential contaminants of concern (COCs) were present in the form of bulk storage. Although some high-level soil contamination was present, the COCs were not readily subject to migration. Nor were weather conditions expected to arise that would result in the migration of such contamination. There was also no known threat of fire or explosion, and it appeared that the 300-FF-1 RI/Feasibility Study (FS), and any subsequent necessary remediation, could be completed in a timely manner. The effect on drinking water supplies would be evaluated at the conclusion of the 300-FF-5 OU Phase I RI. Therefore, it is recommended that no immediate removal actions be implemented, at this time, for any 300-FF-1 OU waste management unit. It is recommended, however, that this evaluation be repeated at the conclusion of the continued Phase I RI data evaluation activities, and at other appropriate points in the remedial response process.	*Phase I Remedial Investigation Report for the 300-FF-1 Operable Unit* (DOE/RL-92-43)
Surface Geophysical Study (1993)—The purpose of this study was to use geophysical techniques, particularly seismic reflection surveys, in the 300-FF-5 OU to determine feasibility to aid subsurface site characterization.	Three geologic horizons were mapped with the geophysical methods. A Holocene soil horizon, typically 0 to 4.6 m (15 ft) below the surface, appeared to separate eolian sands and silts from fluvial deposits from the Missoula floods and Columbia River. The Hanford formation/Ringold Formation contact and the lower mud unit of the Ringold Formation were the deeper horizons mapped. The top of basalt was not detected consistently to map. The seismic refraction data were used primarily for bracketing velocity values for the seismic reflecting process. The results from the GPR, electromagnetic inductance (EMI), and the refraction survey provided valuable information on the shallower sediments for processing.	*Phase I Summary of Surface Geophysical Studies in the 300-FF-5 Operable Unit* (WHC-SD-EN-TI-069)
307 Retention Basins and 307 Trenches Remedial Investigation (1994)—Investigation included the following: (1) Geophysical surveys conducted using GPR and EMI surveys. The GPR surveys were conducted along north-south and east-west oriented grid lines spaces 1 m apart and EMI surveys were conducted along north-south oriented lines spaced 2 m apart. (2) Soil sampling. Two boreholes were drilled and profiled within the 307 Retention Basins and three boreholes were completed and samples within the 307 Trenches. (3) Laboratory analyses. Soil samples collected from the RI boreholes were analyzed for organics, inorganics (metals and cyanide), general chemistry, and radionuclides.	Remedial investigations at the 307 Retention Basins and 307 Trenches (316-3) in the 300 Area were conducted as part of the 300-FF-1 OU Phase I RI in accordance with the approved RI work plan. The GPR and EMI scans revealed subsurface pipelines running to the south, east, and west of the 307 Retention Basins. Analysis and evaluation of the soil samples collected as part of this activity were included in the 300-FF-2 RI report.	*Summary of Remedial Investigations at the 307 Retention Basins and 307 Trenches (316-3), 300-FF-2 Operable Unit* (WHC-SD-EN-TI-279)
Physical Separation of Soils Study (1994)—In 1994, a pilot study for the physical separation of soils in the North Process Ponds of the 300 Area took place. The process involved first moving a pilot plant into the contamination area. Two soil types were treated during the testing—a natural soil contaminated with low levels of uranium, cesium, cobalt, and heavy metals, and a natural soil contaminated with a uranium carbonate material that was visually recognizable by the presence of a green sludge material in the soil matrix. Both source materials were treated by the plant in a manner that fed the material, produced clean gravel and sand fractions, and concentrated the contaminants in a sludge cake.	The testing was successful in that for both source waste streams, it was demonstrated that volume reductions of greater than 90 percent could be achieved while also meeting the test performance criteria. The volume reduction for the natural soils averaged 93.8 percent, while the "green" soils showed a 91.4 percent volume reduction. Based upon the success of the study, soil washing using physical separation techniques has been shown to effectively meet the test performance criteria. Therefore, soil washing has been included in the Phase III FS for the 300-FF-1 OU as an applicable remedial alternative for further evaluation.	*300-FF-1 Operable Unit Physical Separation of Soils Pilot Plant Study* (WHC-SD-EN-TI-277)
Physical Separation of Soils Study (1994)—Tests were performed to evaluate the use of water-based physical separations systems as a means of concentrating chemical and radiochemical contaminants into fine soil fractions and thereby minimizing the amount of contaminated soils.	This treatability test showed that the primary risk drivers in the 300-FF-1 OU are U-238 and U-235. In general, the physical separation system tested met the test goals, thereby demonstrating the potential to reduce the amount of contaminated soils in the 300-FF-1 OU without the use of chemical processes. Therefore, the physical separation of excavated soils prior to disposal is an alternative that should be carried into the Phase II FS.	*300-FF-1 Operable Unit Remedial Investigation Phase II Report: Physical Separation of Soils Treatability Study* (DOE/RL-93-96)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Geophysical Investigations (1995)—Geophysical investigations were conducted at the 618-10 and 618-11 Burial Grounds. Geophysical techniques were used to characterize the distribution of solid waste in the subsurface.	The survey design and interpretation philosophy were reconnaissance in nature with the exception of the southwest corner of the 618-10 Burial Ground. Therefore, many isolated anomalies were not plotted or detected. Typical depths were posted at generalized locations and do not represent the actual interpreted depth to an individual anomaly. The entire set of GPR and EMI data for both the 618-10 and 618-11 Burial Grounds can be found in the 300-FF-2 OU project file.	*Geophysical Investigations of the 618-10 and 618-11 Burial Grounds, 300-FF-2 Operable Unit* (BHI-00291)
300-FF-2 Limited Field Investigation (1996)—Twenty-four waste groups were selected to be a part of the 300-FF-2 OU Limited Field Investigation (LFI) based on priority. Within these 24 waste site groupings are 54 individual waste sites. Sites were evaluated based on physical characteristics, historical information, surface radiation surveys, surface soil sampling, surface geophysics surveys, ecological investigations, and groundwater sampling.	The following conclusions were made concerning the 618-11 Burial Ground: (1) The estimate derived from data presented was that 618-11 Burial Ground drum storage units and caissons had waste containing about 5 kg of plutonium plus other transuranic (TRU) radionuclides including slightly enriched uranium. (2) The presence of 5 kg of plutonium at 618-11 defined it as a TRU burial ground (>100nCi/g). (3) Different records showed different burial contents. Combined together, the records gave a good indication of the burial ground activity. (4) Burial ground contents included defense plutonium, plutonium-238, neptunium-237, americium-241, uranium, thorium, promethium-147, radiostrontium, radiocesium, salt cycle molten salt residues, Plutonium Recycle Test Reactor test fuel pieces, Plutonium Uranium Extraction and Reduction-Oxidation plant research and development reprocessing residues, building debris, contaminated casks, lead bricks and shielding, concrete and lead shielded drums, contaminated glassware and columns, contaminated piping, and other equipment including gloveboxes. (5) Categories of waste buried included TRU, non-TRU, contact and remote handled, low-level, and mixed waste. Trench wastes will contain both contact and remote handled waste. Much of the waste will also be mixed waste, including hazardous chemicals. An effort will be made to segregate hazardous materials. In addition, equipment and other larger waste containers will probably have to be either cut up or over packed. Wastes will have to be certified for disposal to the Waste Isolation Pilot Plant.	*Limited Field Investigation Report for the 300-FF-2 Operable Unit* (DOE/RL-96-42)
Waste Site Characterization 618-11 (1997)—The purpose of this document was to characterize the 618-11 Solid Waste Burial Ground by describing the site, burial practices, the disposed wastes, and the waste generating facilities. This document provided information showing that kilogram of plutonium were disposed to the drum storage units and caissons, making them TRU.	Different records showed different burial contents. Combined, the records gave a good indication of the burial ground activity. Categories of waste buried included TRU, non-TRU, contact and remote handled, low-level, and mixed waste. Records indicated that the waste generated in the 4.8 years the 618-11 Burial Ground was open, contained about 5 kg of plutonium. A limited amount of dose rate plutonium waste went to the 200 West burial grounds for disposal from the 308 and 325 Buildings. All other 300 Area waste went to the 618-11 Burial Ground, including most of the waste from the 325 Building and some from the 308 Building. The estimate derived from data presented is that the 618-11 Burial Ground drum storage units and caissons had waste containing about 5 kg of plutonium plus other TRU radionuclides including slightly enriched uranium. The trenches also contained hundreds of grams to kilograms of plutonium and other fissile material. The TRU curie content, however, was thought to be primarily because of the plutonium concentration.	*Characterization of the 618-11 Solid Waste Burial Ground, Disposed Waste, and Description of the Waste-Generating Facilities* (HNF-EP-0649)
618-11 Tritium Investigation (2001)—Groundwater samples were collected from six new boreholes. Four of these boreholes were completed at long-term monitoring wells to be used for tracking the tritium plume.	Drilling and completion activities took place from August 18, 2001 through September 24, 2001. A total of 440.3 ft was drilled in all boreholes. A cable tool drill rig was used to install 8 in. temporary carbon steel casing. The boreholes were advanced with a drive barrel. Groundwater samples were collected immediately after penetrating the static water level in each borehole.	*Borehole Summary Report for the 618-11 Burial Ground Tritium Investigation* (BHI-01567)
Helium-3/Helium-4 Ratios (2001)—This report presented the results of a study that measured helium-3 (He-3)/He-4 ratios relative to ambient air in soil gas samples to detect and delineate groundwater tritium plumes originating from the 618-11 Burial Ground. Seventy soil gas sampling points were installed around the perimeter of the 618-11 Burial Ground, approximately 122 m (400 ft) downgradient of Well 699-13-3A, and in four transects downgradient of the burial ground to a maximum distance of 945.5 m (3,100 ft). Soil gas samples were collected, analyzed for helium isotopes, and He-3/He-4 ratios were calculated from these 70 points. He-3/He-4 ratios determined from the sampling points showed significant enrichments compared to ambient air He-3/He-4 ratios.	The highest He-3/He-4 ratios (normalized to the abundances in ambient air) were located along the north perimeter of the burial ground. He-3/ He-4 ratios ranged from 1.0 to 62 around the burial ground. The He-3/He-4 ratios from the 4 transects downgradient of the burial ground ranged from 0.988 to 1.68. The He-3/He-4 ratios from around the burial ground suggested there was a vadose zone source of tritium along the north side of the burial ground. This vadose zone source was likely the source of tritium in the groundwater. The He-3/He-4 ratios also suggested the groundwater plume was traveling east-northeast from the burial ground and the highest groundwater tritium value may be to the north of Well 699-13-3A. Finally, there appeared to be no immediately upgradient sources of tritium affecting the burial ground since all the upgradient He-3/He-4 ratios approached or equaled the air background level of 1.0. Based on the He-3/He-4 results from the soil gas survey, six downgradient groundwater grab and well locations	*Measurement of Helium-3/Helium-4 Ratios in Soil Gas at the 618-11 Burial Ground* (PNNL-13675)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
	were identified to verify the tritium groundwater plume locations, tritium groundwater concentrations as a function of depth in aquifer, and tritium groundwater concentrations. The measurement of helium isotopes in soil gas provided a rapid and cost-effective technique to define the shape and extent of tritium contamination from the 618-11 Burial Ground.	
Sampling and Hydrogeology of 300 Area Process Ponds (2004)—Four open pits were excavated with the aid of a backhoe beneath the 300 Area Process Ponds in April 2003. Pits were excavated to the water table between 10 to 22 ft bgs. Representative sediment samples were collected with the backhoe at 2 ft increments and laid in piles on the ground next to the pit. A water sample was collected by the backhoe from the bottom of the pit.	The vadose zone sediments within the 300 Area consisted entirely of coarse-grained Hanford formation. Sediments in both pits were uniformly moist all the way to the water table, most likely from water applied at the surface in the days preceding pit excavation. Within North Process Pond Pit 2, radioactive contamination was found, associated with a greenish-colored mineral observed at and just below the surface. The mineralization was described by one onsite worker, with many years of clean-up experience in the 300 Area Process Ponds, as copper uranyl phosphate. The contamination was not found below a few feet of the surface.	*Sampling and Hydrogeology of the Vadose Zone Beneath the 300 Area Process Ponds* (PNNL-14834)
Uranium(VI) Sorption and Transport (1998) —Three sediments were evaluated to determine whether moisture content affects the measured distribution coefficient (K_d) values for U(VI) coarse sand, fine sand, and silt loam. These sediments were selected to augment the existing data for one coarse and two fine-grained sediments. Unsaturated column transport experiments were conducted using the unsaturated flow apparatus (UFA^{TM}) method at two unsaturated moisture contents for each of the three sediments (UFA is a trademark of UFA Ventures, Richland, Washington). For each moisture condition, bromide was used as a conservative, noninteractive tracer. In this investigation, a mechanistic approach was used to evaluate tracer breakthrough in an effort to evaluate hydrodynamic properties, including solute dispersion and the effective water-filled porosity (immobile versus mobile water domains). U(VI) was applied as uranyl (UO_2^{2+}) in uncontaminated Hanford Site groundwater. The entire breakthrough curve (both the leading edge and trailing edge of a pulse input) was attained to permit more detailed evaluation of the curves for determining the retardation factor and K_d. Saturated column experiments were conducted with U(VI) on the fine sand and silt loam; pentafluorobenzoic acid was used as the conservative, noninteractive tracer. Breakthrough curves, depicting the relative effluent concentration versus dimensionless time (cumulative pore volumes of water passed through the column), were constructed from the experimental data for further analysis.	Breakthrough curves exhibited nonequilibrium characteristics, particularly at the lowest moisture condition for each sediment. An approach for assessing mobile-immobile water domains was applied for the fine sand at 23 percent moisture saturation. The data were well-described with a two-region transport model. More important, the parameters for dispersion, friction of mobile water, and rate-limited mass transfer between mobile and immobile water regions were applied to predict U(VI) transport with reasonable success. Two key conclusions were made based on this study: (1) At decreasing moisture saturation, the proportion of immobile water increased in unsaturated coarse sand, fine sand, and silt loam sediments, and (2) U(W) values decreased with decreasing moisture saturation, irrespective of sediment texture. Mass transfer of solutes, including U(VI), to regions of microporosity is limited when mobile-immobile water conditions develop. Immobile water domains are associated with regions of microporosity and free-textured particles. Relationships among texture, surface are, and exchange or sorption capacity is well-established. An important implication of this research is that the effective exchange capacity of the sediment maybe reduced for solutes undergoing transport in unsaturated, sandy sediments, where immobile water domains develop. The observed decrease in K_d particularly for the sandy sediments, is consistent with limbed mass transfer to sorption sites in the immobile water region.	*Uranium(VI) Sorption and Transport in Unsaturated, Subsurface Hanford Site Sediments – Effect of Moisture Content and Sediment Texture: Final Report for Subtask 2b* (PNNL-11975)
Groundwater Investigations		
Geology and Groundwater Quality (1979)—To determine the location and concentration of groundwater contaminants in the 300 Area, data were collected by compiling existing 300 Area data, gathering information on present processes in the 300 Area that affect the groundwater system, and systematic gathering of new hydrologic data from the study area through calendar year 1977.	Groundwater entered the 300 Area from the northwest, west, and southwest. However, throughout most of the 300 Area, the flow was to the east and southeast. Groundwater flowed to the northeast only in the southern portion of the 300 Area. Water quality tests of Hanford Site groundwater adjacent to the 300 Area showed that in the area of the process water trenches and sanitary leaching trenches, calcium, magnesium, sodium, bicarbonate, and sulfate ions were more dilute, and nitrate and chloride ions were more concentrated than in surrounding areas. Fluoride, uranium, and beta emitters were more concentrated in groundwater along the bank of the Columbia River in the central and southern portions of the 300 Area near the 340 Building.	*Geology and Groundwater Quality Beneath the 300 Area, Hanford Site, Washington* (PNL-2949)
Groundwater Monitoring (1988)—This report contained data from the Hanford Site groundwater monitoring program located within the 300-FF-1 OU. It represented data from January 1985 to June 1988.	Information collected provided data on a wide range of measured groundwater parameters that were of interest to the ongoing investigation of the 300-FF-1 OU.	*The 300-FF-1 Operable Unit Well Report from Data Collected 1985 through June 1988* (WHC-MR-0081)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Borehole Completion and Seal Testing (1991)—Eight new groundwater monitoring wells were to be constructed in the upper confined aquifer beneath the 300-FF-5 OU during fiscal year 1991.	The upper confined aquifer had a head gradient significantly higher (approximately 30 ft) than the unconfined aquifer. Because of this, the U.S. Environmental Protection Agency (EPA) and the Washington State Department of Ecology requested, through review comments associated with the OU work plan, DOE to prepare a description of borehole seal emplacement and testing for this specific OU. They further requested that the resulting documentation be approved by the regulatory agencies prior to constructing the first confined aquifer monitoring well.	*Borehole Completion and Seal Testing for Upper Confined Aquifer-Monitoring Wells in the 300-FF-5 Operable Unit* (EMO-1029)
Phase I Hydrogeologic Summary (1992)—This report summarized the characterization results for fieldwork performed in the 300-FF-5 OU. The fieldwork consisted of drilling and completing 19 groundwater monitoring wells, characterizing the geology and hydrostratigraphy, installing 2 aquifer test wells, performing multiple aquifer tests, and surveying the 11 wells using radiological borehole geophysics.	Data and interpretations presented in this report were from characterization activities begun in the spring of 1991 and completed in the spring of 1992. The characterization effort focused primarily on the suprabasalt sediments with a brief description on the uppermost part of the Columbia River Basalt Group. *Note* - An engineering change notice exists for this document.	*Phase I Hydrogeologic Summary of the 300-FF-5 Operable Unit* (WHC-SD-EN-TI-052)
Groundwater Impact Assessment (1992)—The 400 Area Secondary Cooling Water stream discharged to the 4608B and 4608C percolation ponds located north of the 400 Area perimeter fence. This report satisfied Tri-Party Agreement (Ecology et al., 1989) Milestone M-17-00B, which included a requirement to assess impacts to groundwater from disposal of the process effluent to the 400 Area ponds.	There were no significant hydrologic or contaminant effects from the disposal of process sewer effluent in the 400 Area ponds. The monitoring well immediately downgradient of the 400 Area ponds may have been screened too deeply to representatively monitor the uppermost portion of the aquifer and hence the impact of the process sewer effluent on groundwater. Monitoring of the process sewer effluent directly should provide adequate monitoring for the level of impacts from this site to the underlying groundwater.	*Groundwater Impact Assessment Report for the 400 Area Ponds* (WHC-EP-0587) *Hanford Federal Facility Agreement and Consent Order* (Ecology et al., 1989)
RI/FS Report 300-FF-5 (1994)—The purpose of the 300-FF-5 OU RI was to gather and develop the necessary information to assess the nature and extent of contamination in OU environmental media, to understand the associated risks posed to human health and the environment, and to support the development and evaluation of remedial alternatives during the FS.	Contaminated groundwater from the 300 Area did not currently pose unacceptable risk to human health or the environment. The only current use of groundwater in the 300 Area was the industrial production Well 399-4-12. There was no current or planned use of 300 Area groundwater for drinking. The estimated risk in this well primarily resulted from chloroform at concentrations below the maximum contaminant level (MCL) typical of municipal water supplies.	*Remedial Investigation/Feasibility Study Report for the 300-FF-5 Operable Unit* (DOE/RL-94-85)
Soil-Gas Survey and Well Installations at the 618-10 Burial Ground (2003)—Two groundwater monitoring wells were required in the immediate vicinity of the 618-10 Burial Ground to monitor the effect, if any, that potential releases from the burial ground may have had on current groundwater conditions. A soil-gas survey was conducted to help determine the optimal locations for the two wells.	Results of the soil-gas survey indicated that tritium levels are probably similar to the levels found in the regional tritium groundwater plume; the well locations were equally spaced to provide the best coverage downgradient of the burial ground. The Wells (699-S6-E4K and 699-S6-E4L) were installed in February and March 2003. During drilling and construction of the new wells, sampling was conducted to screen for radiological contaminants in the vadose zone and to develop a preliminary hydrogeologic model for the area.	*Soil Gas Survey and Well Installations at the 618-10 Burial Ground, 300-FF-5 Operable Unit; Hanford Site, Washington* (PNNL-14320)
Contaminant Summary 300-FF-5 OU (2005)—The maximum concentration values for each COC or contaminant of potential concern (COPC) for the period 1992 through 2004 were used to show where standards are still exceeded and to illustrate trends.	Uranium in the 300 Area and tritium in the 618-11 subregion remained at concentrations well above drinking water standards. Other COPCs reveal recent concentrations near or below the standards. For many waste constituents, concentrations remain generally consistent or are decreasing. A primary contributor to concentration changes since 1992 appeared to be plume migration under natural groundwater flow conditions. Interim remedial action for the OU includes continued monitoring of groundwater that was contaminated above health-based levels and institutional controls to ensure that groundwater use was restricted.	*Contaminants of Potential Concern in the 300-FF-5 Operable Unit: Expanded Annual Groundwater Report for Fiscal Year 2004* (PNNL-15127)
Limited Field Investigation for Uranium Contamination in the 300-FF-5 OU (2007)—The four LFI borehole locations were chosen to represent various combinations of proximity to former waste disposal sites, proximity to the Columbia River, and wide ranging hydrogeologic features. The report included highly detailed descriptions of geologic features encountered during drilling facilitated reinterpretation of descriptions from earlier activities. Extensive analytical work was conducted on sediment samples collected from the continuous core recovered from each borehole, and on water samples collected from the saturated zone at depth discrete intervals during drilling. Hydrologic testing was conducted at multiple depth levels in each borehole to provide data on the ability of the sediment to transmit water. Geophysical logging of the entire borehole was conducted to provide additional details on stratigraphic features, in an attempt to identify and quantify contaminant uranium concentrations.	The principal findings, relative to the objective of this LFI, helped to re-define the hydrogeologic framework for the 300 Area. The findings deterred Phase II, which depended on using spectral gamma logging to map distribution of uranium, based on lower than expected levels of contaminant uranium encountered in the sediment samples from the vadose zone. The LFI found elevated levels of contamination in a “smear zone” near the water table that have been postulated as a source region that continues to supply uranium to the groundwater plume. Outside the objectives of the LFI, unexpected high concentrations of trichloroethene were encountered in some deep aquifer water samples from two of the boreholes.	*Limited Field Investigation Report for Uranium Contamination in the 300-FF-5 Operable Unit at the 300 Area, Hanford Site, Washington* (PNNL-16435)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
TCE Characterization Monitoring Wells (2008)—The scope of the activities described in this report included the technical data that encompassed the drilling of four boreholes and related well construction.	Drilling was performed using a cable tool drill rig with core barrel and hard tool drilling methods on two wells. Multiple water samples were collected and later tested for various physical and chemical properties. A well was then built and developed. A permanent pump was installed in the well to provide TCE monitoring.	*Borehole Summary Report for 300-FF-5 Operable Unit TCE Characterization Monitoring Wells C5575, C5706, C5707 and C5708* (SGW-36424)
Remediation Strategy for Uranium in Groundwater, 300-FF-5 OU (2008)—Two general remediation strategies were considered: (1) decrease the flux of uranium from the vadose zone to the groundwater, and (2) directly decrease the concentration of uranium in the groundwater.	The formulation of alternatives and comparative evaluation of remedies were limited by the present state of knowledge regarding (1) uranium that acts as a source to resupply the plume, and (2) implementation of a promising remediation technology. Consequently, it was premature to proceed to a FS until information that clarifies key elements of these two potential remedy components is obtained. Two data gaps included uranium contamination in the vadose zone beneath the 300 Area, and the science and engineering associated with a promising, but not yet fully developed, remediation technology; i.e., uranium stabilization in the vadose sediments using phosphate reagents. A more comprehensive description of the extent of residual inventory of uranium remaining in the environment, and an improved understanding of the processes that control uranium movement through environmental pathways, would be beneficial before commencing a FS that will lead to an effective remedy selection process. Additional site characterization efforts that would reduce uncertainties in the conceptual model include testing uranium in the vadose zone sediments, hydraulic testing of the aquifer, and using monitoring data to support simulations.	*Remediation Strategy for Uranium in Groundwater at the Hanford Site 300 Area, 300-FF-5 Operable Unit* (DOE/RL-2008-36)
Volatile Organic Compound Investigation (2008)—Four new boreholes were drilled as part of this investigation. They are located in up and down gradient groundwater flow directions from Well 399-3-20, the location where the highest concentrations of TCE were observed during the LFI. Characterization activities conducted during drilling included geologic descriptions by the well site geologist, collection of sediment and groundwater samples, depth-discrete aquifer tests, and spectral gamma and neutron moisture geophysical logging.	This report presented new information regarding the nature and extent of contamination by VOCs obtained by drilling four additional characterization boreholes to supplement the information obtained at four locations drilled during an earlier investigation in 2006. The results of the combined drilling indicated that the newly discovered contamination was limited to an interval within the Ringold Formation that contains relatively finer-grained sediment than was found in other portions of the unconfined aquifer. The lateral extent of this contamination appeared to be the area immediately east and south of the former South Process Pond. Samples collected from the finer-grained sediment at locations along the shoreline confirmed the presence of the contamination near the groundwater–river interface. Contamination was not detected in river water that flows over the area where the river channel potentially incises the finer-grained interval of aquifer sediment. The source for this contamination was not readily apparent. It was likely that large quantities of degreasing solutions were disposed to the North and South Process Ponds during the 1950s and 1960s. The infiltration of these discharges through the vadose zone was probably sufficient to cause widespread contamination of the underlying aquifer, and to depths that included the finer-grained material where contamination currently remains because of the low permeability associated with this sediment. Evidence for the earlier widespread contamination in the upper portion of the unconfined aquifer had been removed because of rapid groundwater movement through the much more transmissive sediment. Investigations to date have revealed no evidence to suggest that a dense, nonaqueous phase liquid remains undetected in the subsurface. Potential pathways for contamination to migrate from this finer-grained sediment include groundwater movement through the interval to offshore locations in the Columbia River channel, dispersion out of the finer-grained interval into the overlying transmissive sediment (again, with transport to the riverbed), and potential future withdrawal via water supply wells. However, the rate of withdrawal from a water supply well would be dominated by groundwater from the relatively uncontaminated saturated Hanford formation sediment, and any additional contaminant contribution caused by release from the finer-grained interval would likely have little effect on the quality of groundwater withdrawn.	*Volatile Organic Compounds Investigation Results, 300 Area, Hanford Site, Washington* (PNNL-17666)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Slug Test Characterization (2008)—Multiple, stress-level slug tests were performed at selected test/depth intervals within Wells 399-2-5, 399-3-22, and 399-4-14 as part of the 300 Area VOC characterization program at the Hanford Site	Analysis of the slug-tests conducted within six test/depth intervals within the Ringold Formation (Unit 5) indicated average hydraulic conductivity estimates ranging from ≤0.01 to 2.48 m/day. Hydraulic conductivity estimates for the Ringold Formation (Unit 5) were derived for test-interval sections that ranged from 0.6 to 2.9 m in length. These average hydraulic conductivity values were comparable to the lower range of 0.04 to 41.2 m/day, with a geometric mean of 2.38 m/day, for 16 other Ringold Formation test/depth intervals recently obtained for test-characterization boreholes in the 300 Area.	*300 Area VOC Program Slug Test Characterization Results for Selected Test/Depth Intervals for Wells 399-2-5, 399-3-22, and 399-4-14* (PNNL-17439)
Hanford Site Groundwater Monitoring Report for Fiscal Year 2007 (2008)—In fiscal year 2007, workers sampled 861 monitoring wells and 202 shoreline aquifer tubes to determine the distribution and movement of contaminants. A total of 4,230 samples of Hanford Site groundwater were analyzed for chromium, 2,196 for nitrate and 1,421 for tritium. Other constituents frequently analyzed include Tc-99 (1,053), uranium (991), and carbon tetrachloride (923). These totals included results for routinely samples groundwater wells, pump-and-treat operational samples, and aquifer tube samples.	This report presented results of groundwater monitoring for fiscal year 2007. Interim groundwater remediation in the 100-K, 100-D, and 100-H Areas, using a combination of pump-and-treat and in situ methods, continued to reduce the amount of chromium reaching the Columbia River. An in situ treatment system for Sr-90 was being implemented in the 100-N Area. A pump-and-treat system and a soil-gas extraction system in the northern half of the 200 West Area continued to be used to decrease the spread of the carbon tetrachloride plume. A pump-and-treat system for Tc-99 and uranium in the south part of the 200 West Area was restarted in fiscal year 2007. Groundwater monitoring remains a part of the Hanford Site baseline throughout the cleanup mission and will remain a component of long-term stewardship after remediation is completed.	*Hanford Site Groundwater Monitoring for Fiscal Year 2007* (DOE/RL-2008-01)
Hanford Site Groundwater Monitoring for Fiscal Year 2008 (2009)—In fiscal year 2008, workers sampled 865 monitoring wells and 297 shoreline aquifer tubes to determine the distribution and movement of contaminants. Many of the wells and some of the aquifer tubes were sampled multiple times during the year. A total of 3,968 samples of Hanford Site groundwater were analyzed for chromium, 2,146 for nitrate, and 1,409 for tritium. Other constituents frequently analyzed include gross beta (1,139), Tc-99 (1,068), uranium (994), gross alpha (933), and carbon tetrachloride (835). These totals included results for routinely sampled groundwater wells, pump-and-treat operational samples, and aquifer tube samples.	This report presented results of groundwater monitoring for fiscal year 2008. The most extensive of contaminant plumes at the Hanford Site were tritium, iodine-129, and nitrate. These contaminants originated from multiple sources and were mobile in groundwater. The largest portions of these plumes were migrating from the central Hanford Site to the southeast, toward the Columbia River, and concentrations generally were declining. Carbon tetrachloride and associated organic constituents formed a large plume beneath the west-central part of the Site. Hexavalent chromium (Cr(VI)) was present in plumes beneath the reactor areas along the river and beneath the central part of the Site. Sr-90 concentrations exceeded drinking water standards beneath portions of all but one of the reactor areas. Technetium-99 and uranium plumes exceeding standards were present in the 200 Area. A uranium plume exceeding standards also underlaid part of the 300 Area. Small contaminant plumes with concentrations greater than standards included carbon-14, Cs-137, cis-1,2-DCE, cyanide, fluoride, plutonium, and trichloroethene.	*Hanford Site Groundwater Monitoring for Fiscal Year 2008* (DOE/RL-2008-66)
Hanford Site Groundwater Monitoring for Fiscal Year 2009 (2010)—During the reporting period, 922 monitoring wells and 326 shoreline aquifer tubes were sampled to determine the distribution and movement of contaminants. A total of 18,899 samples were analyzed for the reporting period. During the reporting period, a total of 4,746 samples of Hanford Site groundwater were analyzed for total chromium (with a nearly equal amount of Cr(VI) analyses), 3,024 samples for nitrate, and 2,029 samples for tritium. Other constituents frequently analyzed include Tc-99 (1,502 samples), uranium (1,495 samples), and carbon tetrachloride (1,427 samples). These totals include results for routinely samples groundwater monitoring wells, pump-and-treat operational samples, and aquifer tube samples.	This report described groundwater monitoring adjacent to the Columbia River in the River Corridor. Groundwater discharges to the Columbia River in the River Corridor and is the primary exposure route for contaminants to reach human and environmental receptors. Groundwater flows from the Hanford Site aquifer to the Columbia River at a rate between 1.1 and 2.5 m^3/sec. This rate is less than 0.075 percent of the average flow of the Columbia River. The rise and fall of the Columbia River creates a zone of interaction (ZOI) that influences contaminant concentrations and groundwater flow direction. Dilution by river water decreases with depth in the unconfined aquifer. Groundwater pump-and-treat systems have been implemented in the River Corridor to clean up groundwater contamination (especially Cr(VI)).	*Hanford Site Groundwater Monitoring and Performance Report for 2009: Volumes 1 &2* (DOE/RL-2010-11)
Hydrogeology Along Southern Boundary (1994)—This study was conducted in four phases: 1) collection and review of existing hydrogeologic data, 2) establishment of a water-level monitoring network, 3) data analysis, and 4) interpretation of results. A well network was established to characterize the hydrogeology and monitor water levels in the unconfined aquifer. Field activities included installation and maintenance of continuous water-level recorders, water-level measurements, and natural gamma and borehole television logging. Field activities were conducted between June 1989 and May 1990.	Fluctuations in the Yakima and Columbia Rivers had significant influence on water levels and hydraulic gradients in the unconfined beneath the study area. Responses to fluctuations in the Columbia River could be seen at least 1,500 ft inland in the northeastern part of the study area.	*Hydrogeology Along the Southern Boundary of the Hanford Site Between the Yakima and Columbia Rivers, Washington* (PNL-10094)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Evaluation of Using Caged Clams to Monitor Contaminated Groundwater (2008)—This report described the use of caged Asiatic clams to assess seasonal differences in uranium accumulation in a near-shore environment adjacent to the 300 Area. Potential effects on clam growth, survival, and tissue condition were discussed with respect to both uranium accumulation and possible cage-related sources of variation.	The use of field-caged clams was successful in assessing general seasonal differences in uranium accumulation in the near-shore environment. This conclusion was supported by the results of continuous monitoring of specific conductance in shallow riverbed water (3 to 33 cm), which helped to confirm that seasonal mean soft-tissue concentrations of uranium did correspond with relative exposure. However, several potential sources of variation may have affected uranium accumulation in this study. The first was the design of the cages, which may have prevented clams from feeding or behaving normally, thereby affecting filtration rates and subsequent uptake of uranium in the water. The second source of variation was the time in which clams were retrieved from the river at the end of each deployment period. Results of a recent Pacific Northwest National Laboratory (PNNL) study suggest that uranium soft-tissue concentrations in clams may change significantly in relatively short periods (24 hours). Thus, it is reasonable to assume, given the daily variation in river discharge on the Hanford Reach, that the tissue concentrations of uranium measured in this study may have been influenced by the concentration of groundwater present in the riverbed at the times when clams were retrieved. Another source of variation was the potential effects on clam biology of abiotic factors such as substrate, temperature, water velocity, and depth. These factors may play a complicated role in contaminant uptake because they may influence the delivery of food and nutrients to clams, which may subsequently alter their feeding behavior. Differences in growth, survival, and tissue condition that may have been related to uranium accumulation were not apparent in this study. Growth results were considered largely inconclusive because of a large proportion of clams that experienced a reduction in shell length. These reductions in shell size are believed to be related to the cage designs, which may have affected clam behavior and made them prone to shell erosion. Interpretation of histological data also was limited because of a lack of knowledge about the physiological pathways and effects of uranium in clams.	*Evaluation of Using Caged Clams to Monitor Contaminated Groundwater Exposure in the Near-Shore Environment of the Hanford Site 300 Area* (PNNL-17270)
Surface Water Investigations/Studies		
Hanford Groundwater Seepage Into the Columbia River (1984)—The study was conducted in two sequential phases between October 1982 and September 1983. Phase I involved visual inspection of approximately 41 miles of Columbia River shoreline, within the Hanford Site, for indications of groundwater seepage. During Phase 2, water samples were collected from a distribution of 115 springs suspected of discharging groundwater and analyzed for Site-related materials known to be present in the groundwater, including tritium, nitrate, and uranium. Water samples were also collected from the Columbia River to investigate the localized effects of groundwater discharges occurring above and below the river level. These samples were collected within 2 to 4 m of the Hanford Site shoreline, and analyzed for tritium, nitrate, and uranium.	Groundwater discharges to the Columbia River were evaluated by the Hanford Site Environmental Surveillance and Groundwater Surveillance Programs via monitoring of the Columbia River and Hanford Site groundwater. Both programs concluded that Hanford Site groundwater has not adversely affected Columbia River water quality downstream from the Hanford Site, nor has it affected the public through use of the river as a source of municipal drinking water, for irrigation, or for fishing and other forms of recreation. The results of the Phase I visual inspection concluded that 115 “springs” were suspected of discharging groundwater. These springs were accessible only during periods of low water level caused by reductions in Columbia River discharge rates from Priest Rapids Dam. Phase II, which sampled 115 springs, found consistency in magnitude and distribution of concentrations measured in both the spring samples and groundwater samples taken near the sampled spring locations. Elevated contaminant concentrations were measured in river samples near areas where groundwater and spring concentrations were elevated. All concentrations were well below applicable DOE concentration guides.	*Investigation of Ground-Water Seepage from the Hanford Shoreline of the Columbia River* (PNL-5289)
Riverbank Springs Characterization (1990)—Radiological and nonradiological analyses were performed in the Columbia River. River water samples were also analyzed from upstream and downstream of the Hanford Site as well as from the immediate vicinity of the springs. In addition, irrigation return water and spring water entering the river along the shoreline opposite the Hanford Site were analyzed.	This document summarized Hanford Site-origin contaminants were detected in spring water entering the Columbia River along the Hanford Site. The type and concentrations of contaminants in the spring water were similar to those known to exist in the groundwater near the river. The location and extent of the contaminated discharges compared favorably with recent groundwater reports and predictions. Spring discharge volumes remain very small relative to the flow of the Columbia River. Downstream river sampling demonstrates the effect of groundwater discharges to be minimal to negligible in most cases. Radionuclide concentrations were below the DOE derived concentration guides with the exception of Sr-90 near the 100-N Area. Tritium, while below the derived concentration guide, was detected at concentrations above DOE drinking water standards in several springs. All other radionuclide concentrations were below drinking water standards. River water contaminant concentrations, outside of the immediate discharge zones, were below drinking water standards in all cases.	*1988 Hanford Riverbank Springs Characterization Report* (PNL-7500)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Columbia River Sediment Sampling (1993)—Forty-four sediment samples were collected from 28 locations in the Hanford Reach of the Columbia River to assess the presence of metals and manufactured radionuclides in the near shore and shoreline settings on the Hanford Site. Three locations were sampled upriver of the Hanford Site plutonium production reactors. Twenty-two locations were samples near the reactors. Three locations were sampled downstream of the reactors near the Hanford Townsite. Sediment was collected from depths of 0 to 6 in. and 12 to 14 in. below the surface.	Samples containing concentrations of metals exceeding the 95 percent upper threshold limit values are considered contaminated. Contamination by arsenic, chromium, copper, lead, and zinc was found. Zinc and lead were the most frequent contaminants; 91 and 68 percent of the samples exceeded the zinc and lead 95 percent upper threshold limit values, respectively. Arsenic, lead, and zinc contamination may not be attributable to Hanford Site activities; elevated concentrations occur in the upriver samples. Zinc and lead contamination was found in 75 percent of the upriver samples. Arsenic contamination was found in one upriver sample and in one sample from the 100-K Area. Chromium contamination was found in 25 percent of the samples. Copper contamination was found in 23 percent of the samples. Manufactured radionuclides occur in all samples except four collected opposite the Hanford Townsite. Manufactured radionuclide concentrations were generally less than 1 pCi/g. Cs-137 and europium-152 were the most frequently detected radionuclides and had the highest concentrations. Maximum concentrations of Cs-137 and europium-152 were 4.6 and 1.8 pCi/g, from a 100-H Area sample. Radionuclide varieties, abundances, and concentrations were greatest in the area from the 100-D Area to the 100-F Area Slough. Fewer radionuclide varieties and generally lower concentrations were found upriver, and at the 100-BC Area, 100-K Area, and Hanford Townsite localities.	*100 Area Columbia River Sediment Sampling* (WHC-SD-EN-TI-198)
Wells, Springs, and River Water, and Sediment Sampling in the 300-FF-5 OU (1993)—Selected wells, springs and river water, and sediments samples were collected from the 300-FF-5 OU in support of Phase I RI studies. During low flow in September 1992, water was collected from Wells 399-1-10A and 399-4-9, and five springs located along the Columbia River shoreline in the 300 Area. River samples were collected off-shore at 3, 10, and 20 ft distances at river stations located upriver, adjacent, and downriver of three selected flowing seeps. Sediment samples were collected at four spring stations at the point of spring entrance into the river. COCs for all samples included radionuclides, metals, and VOCs.	For the COCs, only total uranium was found to exceed drinking water standards at both wells and two springs. River concentration of uranium exceeded the standard at one location at the 3 ft distance. Tritium was elevated at the northern springs and decreased downriver. Sediments were not found to be an important sink for COCs.	*Sampling and Analysis of the 300-FF-5 Operable Unit Springs and Near Shore Sediments and River Water* (WHC-SD-EN-TI-125)
Zone of Groundwater/River Interaction (2001)—A numerical simulation model was developed that illustrates the water movement within the groundwater/river ZOI in the 100-H Area. Another focus on this study involved the mixing between groundwater and river water within the ZOI.	One of the key findings to this study was that the two-dimensional flow model for the 100-H Area indicated that as river water infiltrates the bank during high river stage, groundwater flow path lines were deflected downward beneath the riverbank region. In the mixing study, it was determined that the degree of mixing that occurred was a function of the stratigraphy at the interface, the amplitude of the river stage change, and the duration of the river stage change. The topical areas where information from field studies is most relevant to near-term information needs include water movement in three dimensions, contaminant attenuation in the ZOI, and methods to monitor contaminant movement through the ZOI.	*Zone of Interaction Between Hanford Site Groundwater and Adjacent Columbia River: Progress Report for the Groundwater/River Interface Task Science and Technology Groundwater/Vadose Zone Integration Project* (PNNL-13674)
Hyporheic Zone Investigation (2007)—This report documented research conducted to meet these objectives by developing baseline data for future evaluation of remedial technologies, evaluating the effects of changing river stage on near-shore groundwater chemistry, improving estimates of contaminant flux to the river, providing estimates on the extent of contaminant discharge areas along the shoreline, and providing data to support computer models used to evaluate remedial alternatives. This report summarized the activities conducted to date and provided an overview of data collected through July 2006.	At the Hanford Site, contaminated groundwater discharges to the Columbia River after passing through a groundwater/river water ZOI at the shoreline; i.e., the hyporheic zone. The remediation task of the remediation and closure science project conducts research to meet several objectives concerning the discharge of groundwater contamination into the river at the 300 Area of the Hanford Site. The general conclusions as a result of this work are listed below: ***Geology*:** A hydrostratigraphic contact between two distinct geologic layers exists in the near-shore region adjacent to the 300 Area. This contact is interpreted to be the interface between the Hanford formation (or river alluvium) and the Ringold Formation. This is consistent with recent geologic interpretations conducted inland of the Columbia River; the elevation of this contact in the near-shore region is generally consistent with the elevations mapped out inland based on well log data and it outcrops directly in the river channel in some locations. ***Water Sampling*:** Specific conductance provided a good indication of uranium concentration in water samples collected from the hyporheic zone. Concentrations of most constituents measured in water in the hyporheic zone varied proportionally with specific conductance, indicating the relative dilution of groundwater by Columbia River water. Uranium concentrations in the hyporheic zone were measured as high as 195 µg/L. There was no evidence of uranium sorption onto sediment in the hyporheic zone.	*Investigation of the Hyporheic Zone at the 300 Area, Hanford Site* (PNNL-16805)

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	The ratio of tritium to uranium in samples did not vary with specific conductance. In addition, filtered/unfiltered sample pairs had similar measured uranium concentrations; the Ringold Formation appeared to limit vertical movement of contamination for both tritium and uranium; and the uranium concentration in the hyporheic zone changed rapidly in response to changing river stages, although deeper locations responded slower than shallower locations. ***Uranium Uptake in Clam*:** The uranium concentration in clam soft tissue increased in a matter of days when the uranium concentration in water was increased; the uranium concentration in clam soft tissue decreased at a slower rate when the uranium concentration in water was decreased. ***Continuous Monitoring*:** Specific conductance, temperature, and uranium concentration change rapidly in the hyporheic zone in response to changing stages in the Columbia River; the direction of the hydraulic gradient at the water-sediment interface is determined by the river elevation and the near-shore aquifer elevation.	
Aquifer Tube Sampling (2007)—In fiscal year 2007, 319 tubes were scheduled for sampling, and 289 of these were usable for sampling. A total of 202 tubes had high enough specific conductance to collect samples.	Several 300 Area aquifer tubes detected higher levels of TCE than were detected in groundwater monitoring wells. The routinely monitored wells were completed at the top of the aquifer and deeper into the Ringold Formation, while the aquifer tubes were screened at an intermediate depth. The 300-FF-5 LFI continues to investigate the distribution of TCE with depth in the 300 Area.	*Aquifer Sampling Tube Results for Fiscal Year 2007* (SGW-35028)
Groundwater Upwelling Study (2010)—This report summarized fieldwork conducted from 2008 through 2010 throughout an approximate 64 km (40 mi) section of the Columbia River where contaminated groundwater was known or suspect. The work included preliminary mapping and measurement of Hanford Site contaminants in sediment, porewater, and surface water located in areas where groundwater upwelling were found.	This report summarized the fieldwork associated with one of the components of the RI of Hanford Site releases to the Columbia River. The focus of this component was to delineate areas where contaminated groundwater is upwelling (emerging) in the Columbia River bottom within the Hanford Reach area and to determine concentrations of radionuclides, trace metals, and organic compounds in sediment, porewater, and surface water at those locations. In the 300 Area, nine sample locations were selected for the final phase (Phase III). Concentrations of total uranium in surface water ranged from 5 to 197 µg/L, which is consistent with known plumes in the 300 Area. Data collected during this activity supported development of a conceptual site model, and was utilized for both ecological and human health risk assessments.	*Field Summary Report for Remedial Investigation of Hanford Site Releases to the Columbia River, Hanford Site, Washington: Collection of Surface Water, Pore Water, and Sediment Samples for Characterization of Groundwater Upwelling* (WCH-380)
Air Studies/Investigations		
Stack Air Emissions Deposition (2005)—This report provided historical information regarding Hanford Site stack air emissions and soil sampling study results for assessing the potential for areas of contamination from stack air emission deposition in the 100 and 300 Areas. The report also presented previous background surface soil sample locations assessing airborne contaminant deposition on the Hanford Site.	The report concluded: (1) there was no evidence that waste sites should exist in the River Corridor as a result of historical air emission deposition; (2) recent Hanford Site radiological surveys and recent onsite and offsite vegetation and soil studies had not identified any areas of elevated contamination caused by historical air emissions; and (3) the evaluation of known air emissions and nonradionuclide contaminants included in Hanford Site processes showed that deposition of hazardous or toxic materials from air emissions have been negligible.	*RCBRA Stack Air Emissions Deposition Scoping Document* (DOE/RL-2005-49)
Remedial Investigation/Feasibility Studies		
Phase I/II Feasibility Study 300-FF-1 OU (1992)—The scope of work for this Phase I/II FS included five primary tasks: (1) review existing documents and their associated data from relevant investigations and studies, (2) establish remedial action objectives and general response actions, (3) identify applicable or relevant and appropriate requirements pertinent to all general response actions (including waste disposal), (4) develop remedial alternatives (Phase I) applicable to the 300-FF-1 OU including identification and screening of technologies and process options, and assembly of remedial alternatives from representative technology types, and (5) screen alternatives (Phase II) developed in Phase I for implementability, effectiveness, and cost to identify those alternatives which warrant advancement to the detailed analysis phase (Phase III) of the FS.	The purpose of this Phase I/II FS was to develop and screen a range of alternatives for remediation of contamination present in the vadose zone of the 300-FF-1 OU. Risk assessment results from both the 300-FF-1 Preliminary Baseline Risk Assessment (PBRA) and the RI Report were reviewed and compared for the process ponds and trenches. A comparison of the results indicated that the primary sources of risk for both assessments were the same, i.e., the radionuclides, Co-60, Cs-137, and U-238. In the PBRA, the highest risk was shown to be Co-60 (cancer risk 2×10^{-3}), whereas in the RI, the highest risk was Co-60 at 2×10^{-4}, an order of magnitude lower than the PBRA for this radionuclide. The RI identified additional contaminants, which were not identified in the PBRA as follows: thorium-228 at both process trenches and South Process Pond, U-234 at the North Process Pond, benzo(a)pyrene in the pre-expedited response action process trench soils, and arsenic at the filter backwash. However, risks calculated for all these contaminants did not alter the conclusion that the principal radionuclides (Co-60, Cs-137, and U-238) pose the greatest risk in terms of human health	*Phase I and II Feasibility Study Report for the 300-FF-1 Operable Unit* (DOE/RL-92-46)

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	effects. In conclusion, the difference in risk assessment results does not affect the identification, development, and screening of remedial alternatives in this FS, because the FS was developed based on the principal contaminant types.	
Phase I Remedial Investigation 300-FF-5 (1994)—Data collected and evaluated during the RI provided information needed to develop and analyze remedial alternatives in the FS, while preliminary FS analyses provided a focus for further RI activities. The goal was to increase the initial understanding of the 300-FF-5 OU by characterizing the nature and extent of the threat to human health and the environment posed by the contamination in the groundwater and saturated sediments of the OU.	Groundwater contamination at the 300-FF-5 OU generally consisted of three main plumes. The primary plume, and the only one of the three derived from 300 Area operations, was centered in the 300-FF-1 OU, primarily near the 316-5 Process Trenches, and the 316-2 and 316-1 North and South Process Ponds. Compounds associated with this plume were the VOCs (DCE and TCE), nickel, copper, Sr-90, and the uranium isotopes. This document concluded that there was no evidence of imminent and substantial endangerment to human health from exposure to the 300-FF-5 OU contaminants. The greatest current risk to humans existed from inhalation of chloroform from the industrial onsite Well 399-4-12. All other current risk levels to humans were below an increased cancer risk of 10^{-6}. The ecological risk assessment did indicate a potential risk to aquatic organisms. Additional data to determine average near shore river concentrations of contaminants at various river stages are required for a more accurate evaluation of ecological risks. The recommendation for additional investigation included determination of valence state of chromium in 300-FF-1 sources, Columbia River sampling to determine average concentration of 300-FF-5 COCs in the river, continued monitoring of the TCE and DCE plumes in the 300-FF-5 OU, and determination of uranium fate and transport.	*Phase I Remedial Investigation Report for the 300-FF-5 Operable Unit* (DOE/RL-93-21)
Phase III Feasibility Study Report (1994)—The purpose of this Phase III FS was to develop alternatives for remediation of the 300-FF-1 OU. These alternatives provided a range of potential response actions for remediation.	Two groups of alternatives were developed and evaluated in the Phase III FS. The alternatives for the process waste units, including the process and sanitary sewers, the Sanitary Tile Field and the Sanitary Sewage Trenches, and Landfill 1b, were no action, consolidation and surface barrier, excavation and disposal, and excavation, soil washing, and fines disposal. The alternatives for Burial Grounds No. 4 and No. 5 and Landfills 1a, 1c, and 1d were no action, institutional controls, consolidation and surface barrier, and excavation and disposal.	*Phase III Feasibility Study Report for the 300-FF-1 Operable Unit* (DOE/RL-94-49)
RI/FS Report 300-FF-5 (1994)—The purpose of the 300-FF-5 OU RI was to gather and develop the necessary information to assess the nature and extent of contamination in OU environmental media, to understand the associated risks posed to human health and the environment, and to support the development and evaluation of remedial alternatives during the FS.	Contaminated groundwater from the 300 Area did not currently pose unacceptable risk to human health or the environment. The only current use of groundwater in the 300 Area is the industrial production Well 399-4-12. Groundwater in the 300 Area is not planned to be used for drinking water. The estimated risk in this well primarily results from chloroform at concentrations below the MCL typical of municipal water supplies.	*Remedial Investigation/Feasibility Study Report for the 300-FF-5 Operable Unit* (DOE/RL-94-85)
Phase I/II FS Report (1994)—The purpose of this report was to assemble and screen a list of alternatives for remediation of the 300-FF-5 OU, based on the information gathered in the Phase I RI. These alternatives will, to the degree feasible, provide a range of response actions for remediation.	Sixteen alternatives were identified for meeting remedial action objectives at the 300-FF-5 OU, including alternatives that rely on natural recovery (no action and institutional controls), alternatives that provide active remediation of the highest contaminant concentrations and natural recovery or remaining contamination, and alternatives that provide extensive active remediation. Eight of these alternatives remained after screening based on effectiveness, implementability, and cost.	*Phase I and II Feasibility Study for the 300-FF-5 Operable Unit* (DOE/RL-93-22)
300-FF-5 RI/FS Report (1995)—The RI/FS was performed to characterize the nature and extent of contamination, assess risks to human health and the environment, and develop and evaluate alternatives for remediation of contamination in the 300-FF-5 OU that has resulted from 300 Area operations.	Conclusions of the RI/FS cover the following: uranium and DCE/TCE trends in the unconfined aquifer; filtered versus unfiltered uranium analyses; evaluation of sorption-controlled release mechanism; refinement of the estimates regarding time required for uranium to reach acceptable levels; and baseline risk assessment. If groundwater extraction and treatment are included in the selected remedy, treatability studies during final design will be needed to determine parameters needed for final design of the system.	*Remedial Investigation/Feasibility Study Report for the 300-FF-5 Operable Unit* (DOE/RL-94-85)

Table N-1. Previous Investigations and Remedial Action Summary

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300-FF-2 Focused Feasibility Study (2000)—Forty 300 Area Complex source waste sites, seven outlying source waste sites, seven general content burial ground sites, and two TRU-contaminated burial ground sites are included in the remedial action scope for the 300-FF-2 OU. Groundwater assessment and remedial actions associated with groundwater contamination from these waste sites were identified as part of ongoing actions associated with the 300-FF-5 OU.	The Focused FS provided information and rationale to evaluate waste sites in the 300-FF-2 OU. The analysis was conducted using several human health exposure scenarios and known characteristics specific to OU waste sites. Three remedial alternatives were retained: no action, containment, and remove/treat/dispose. Each alternative was evaluated using the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* threshold, balancing, and state and community acceptance criteria.	*Focused Feasibility Study for the 300-FF-2 Operable Unit* (DOE/RL-99-40)
Risk Assessments		
Biota of 300-FF-1 OU Summary (1990)—In 1989 and 1990, surveys were conducted of plants, birds, and medium- to large-sized mammals at the 300-FF-1 OU. The purpose was to determine what species are present, focusing on those species that are listed by U.S. Fish and Wildlife Service or the state of Washington as threatened or endangered, are of economic importance, or that constitute significant components of the human food chain.	The plant community over most of the OU was primarily cheatgrass, Russian thistle, and grey rabbitbrush. Plant species indicated as contaminant migration pathways to humans or threatened or endangered species included mulberry, bitterbrush, cheatgrass, bulrushes, and asparagus. Twenty-five bird species were seen during the transect surveys. The bird species potentially involved in the spread of contaminants to people through dietary intakes were rock dove, mallard, Canada goose, and mourning dove. Seven medium- to large-sized mammals used the 300-FF-1 OU. The mule deer presented the most likely pathway for contaminant exposure to humans. Its mobility and use as a desirable food by humans placed it in a position of exposure risk to humans.	*Biota of the 300-FF-1 Operable Unit* (EMO-1016)
Nonradioactive Metals Concentrations (1991)—Collection sites for asparagus were identified to provide local background estimates, Hanford Site background, and regional background, as well as potentially contaminated areas. Twigs and leaves of rabbitbrush were collected by clipping the terminal few inches of branches of new growth. Sandberg's bluegrass was also collected by clipping.	The nonradioactive metals of most environmental concern to the 300-FF-1 OU are chromium, copper, lead, nickel, and zinc. Metals released in smaller amounts were silver, beryllium, cadmium, and mercury. Metal concentrations in asparagus were compared between commercial fields, abandoned fields, and wild plants growing along the shoreline of the Columbia River. Rabbitbrush plants sampled along the exclusion-zone fence had higher mean concentrations of chromium, copper, lead, nickel, and zinc than did shrubs collected at locations remote of the OU. The only metal found in concentrations above background within the Sandberg's bluegrass was zinc.	*Nonradioactive Metals Concentrations in Asparagus, Rabbitbrush, and Sandberg's Bluegrass* (WHC-MR-0255)
Small Mammals and Harvester Ants Study (1992)—A survey or burrowing rodents and harvester ants was conducted near the 300-FF-1 OU during late summer 1991.	The pocket mouse was the most abundant mammal trapped at 300 Area waste sites. Deer mice prefer green vegetation and arthropods, and tend to occupy areas in shrub cover near a water source, as evidenced by the higher percentage of deer mice captured near the river. Deep-rooted plants growing on a burial ground could, if demonstrated to uptake contaminants, provide a pathway for radionuclides and other hazardous material to reach deer mice. Ground squirrels may also be an important link in the potential transport of hazardous materials from the waste site because their diet is dependent on plant material. Unlike those from small mammals, food chain transfers from ants may lead to humans if ants are found to be contaminated. The potential exposure pathway for game birds in the area showed that contaminated insects could be eaten by game birds. Another route of exposure or movement of contaminants offsite may be initiated by harvester ants as they turn over contaminated soils. The exposed soils then would be exposed to wind and water erosion. Ants may excavate deeply buried wastes and mobilize a large amount of material.	*Small Mammals and Harvester Ants in the 300-FF-1 Operable Unit* (WHC-SD-EN-TI-028)
Metal Concentration in Vegetation (1992)—Samples of asparagus were collected from the OU, its immediate vicinity, old fields at the Hanford Townsite, and commercial fields. Grey rabbitbrush and Sandberg's bluegrass samples were collected just outside the exclusion zone fences in the OU and a control area north of the OU. Samples were dried, ground, and analyzed for metal COCs, isotopic uranium, beryllium-7, and Tc-99.	Asparagus plants growing in and just downriver from the 300-FF-1 OU contained aluminum, barium, iron, manganese, and uranium in concentrations greater than those found in samples representative of local background. For rabbitbrush samples, the only reported concentrations of chromium and nickel that were above detection limits were found in a sample of rabbitbrush from east of the process trenches. Concentrations of copper, lead, zinc, and uranium were higher in samples from the margin of the North Process Pond than anywhere else, although only lead and zinc were significantly elevated statistically in the OU versus local background. Concentrations of copper, zinc, and uranium in Sandberg's bluegrass exhibited elevated concentrations. Copper and uranium concentrations were highest in samples from the margin of Burial Ground 4.	*Metals Concentrations in Vegetation of the 300-FF-1 Operable Unit and Vicinity* (WHC-SD-EN-TI-026)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
300-FF-1 Risk Assessment (1992)—A PBRA was prepared to evaluate the potential threats posed by contaminants historically detected at 300-FF-1. The purpose was to provide COPCs at the 300-FF-1 OU to facilitate the development of the FS.	The PBRA provided a relative indication of the contaminants that pose a potential human health risk. Within the 316-5 Process Trenches, the overall risk from the external exposure pathway was the greatest with the soil ingestion pathway providing the next highest risk. The dermal exposure pathway at the process trenches was negligible. Within the 316-1 and 316-2 Process Ponds, the pathway representing the greatest risk was the external exposure pathway, followed by the fugitive dust pathway, the soil ingestion pathway, and the dermal exposure pathway. At the 307 Trenches, no radioactive contaminants of potential concern were evaluated. The highest estimated risk was associated with soil ingestion, followed by the dermal exposure and fugitive dust pathways.	*300-FF-1 Preliminary Baseline Risk Assessment* (WHC-SD-EN-RA-002)
Update to Current Conditions Portion of Baseline Risk Assessment (2007)—The scope for this assessment included only current measured environmental concentrations and potential scenarios under current access restrictions. Environmental concentrations used in this report were collected from 1994 through 2005.	Three major conclusions resulted from this risk assessment: (1) The results of this risk assessment were consistent with the 1994 baseline risk assessment for those constituents of concern included in the 1996 Record of Decision (ROD) and for current exposure scenarios. (2) Uranium was the primary contributor to ecological and human health impacts under current conditions in the 300 Area as the result of migration of uranium-contaminated groundwater to surface water exposure points where direct ingestion occurred and where uranium was incorporated into the food chain. (3) Direct exposure to groundwater is currently prevented by access restrictions in the 300-FF-5 Groundwater OU. If access restrictions are not imposed, direct ingestion of groundwater may yield hazards and risks that exceed threshold levels.	*Current Conditions Risk Assessment for the 300-FF-5 Groundwater Operable Unit* (PNNL-16454)
Risk Assessment Report for the 100 and 300 Areas (2007)—The 100 and 300 Area Component of the River Corridor Baseline Risk Assessment addressed post-remediation residual contaminant concentrations in the 100 and 300 Areas, as well as the Hanford Townsite and White Bluffs Townsite. This assessment also investigated risks related to the potential transport of Hanford Site contaminants into Columbian River riparian and near-shore environments adjacent to the operational areas.	Potential health impacts were estimated for humans who may use the Hanford Site along the Columbia River. Risk at remediated waste sites associated with soil, groundwater, and fish ingestion pathways under various exposure scenarios (Recreational, Industrial/Commercial, Resident National Monument/Refuge, Rural Resident, and Native American) were evaluated. The risk assessment results for individual waste sites sometimes exceeded protective thresholds for the exposure scenarios and health effects evaluated.	*Risk Assessment Report for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment* (DOE/RL-2007-21)
Leaching Studies		
Physical Separations Soil Washing (1993)—The physical separations soil washing test was conducted in preparation for a treatability test to be conducted in the North Process Pond of the 300-FF-1 OU. The setup test was conducted at an uncontrolled area located approximately 3.2 km northwest of the 300-FF-1 OU.	The physical separations test was considered a success because soil material was sorted cleanly into +6 in. particles, 6 in. to 1 in. particles, 1 in. to 2 mm particles, and 2 mm to 0.425 mm particles with a small percentage of fines in the separated soil. The system operated well and processed 45 tons of soil. Regulators and the DOE Richland Operation Office were able to see the system in operation and look closely at the equipment while still in an unrestricted area. As a result of the test, equipment modifications for processing in the radiation zone were identified to provide dust control and reduce splashing.	*Physical Separations Soil Washing System Cold Test Results* (WHC-SD-EN-TI-188)
Leaching Tendencies of Uranium and Regulated Trace Metals (1994)—Various leach tests were performed on the 300 Area North Process Pond sediments, a sample from outside the pond, and the fine sludges obtained by physical soil washing pond sediments. Absorption tests were performed to evaluate the potential for contaminant removal by uncontaminated sediments underlying the process pond and in the upper unconfined aquifer.	None of the leach tests performed generated leachates that exceeded limits for *Resource Conservation and Recovery Act of 1976* regulated metals that would require designating the sediments as hazardous waste. The sediment obtained outside the North Process Pond and used in the absorption tests contained significant amounts of evaporated salts that dissolved and released significant quantities of chemicals.	*Leaching Tendencies of Uranium and Regulated Trace Metals from the Hanford Site 300 Area North Process Pond Sediments* (PNL-10109)
Uranium Leach and Adsorption Project (2002)—Three batch adsorption experiments were performed to investigate the effect of uranium solution concentration, pH, and dissolved inorganic carbon solution concentration on uranium adsorption onto the uncontaminated sediment.	The objective of the 300 Area K_d/leach study was to perform controlled laboratory experiments to measure the leaching and adsorption characteristics of uranium in near-surface sediment samples collected from the 300 Area of the Hanford Site for later use in modeling uranium mobility for the 300-FF-1 and 300-FF-2 OU waste sites. The study found that less than 4 percent of the existing uranium in the contaminated near-surface sediments readily leached into "simulated" rainwater over a period of 6 months. Uranium sorption onto uncontaminated 300 Area sediment was shown to be highly variable and dependent upon solution conditions. Therefore, predicted K_d values based on site-specific conditions expected in the 300 Area ranged from a low of 0 to 1 mL/g in the near-surface vadose zone that was influenced by evapotranspiration to 2 to 4 mL/g in the unconfined aquifer sediments not influenced by dilution with Columbia River water. Although not studied in detail, adsorption K_d values in the saturated	*300 Area Uranium Leach and Adsorption Project* (PNNL-14022)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
	aquifer where dilution because of river water is present (lower total carbonate solution concentration) could create adsorption K_d values in excess of 7 mL/g.	
Treatability Studies		
Mass Transfer of the 300 Area Uranium Plume (2007)—The primary objectives included: (1) quantify the role of mass transfer in controlling U(VI) distribution under various geochemical, hydrologic, and remedial conditions in the vadose and saturated zones, (2) investigate in situ microbiologic processes that couple with mass transfer to control U(VI) fate, transport, and remediation, (3) create enduring field experimental datasets for model and field-scale hypothesis evaluation, (4) test and improve existing models of multi-reaction chemistry and multi-scale mass transfer by comparison to new, robust experimental data, and (5) proactively transfer results to site for decision making and remediation. The approach to these objectives are the following: (1) robust three dimensional geostatistical characterization of the experimental domain, (2) field experimental campaigns based on three hypotheses at an integrated vadose zone-saturated zone site, (3) modeling of different types, and (4) leverage of broad data base and other site activities.	The accomplishments of the study included: (1) Subcontracts with external collaborators were finalized. (2) Project management, field site management, quality assurance/quality control, and health and safety plans, and *National Environmental Policy Act of 1969* documentation were completed. (3) The Web site was put under development with problems. (4) The criteria was established for site selections. Geophysical surveys to aid in site placement in South Process Pond were completed. Collaboration with EM-40 on South Process Pond borehole provided data and "free well." (5) Wells near the South Process Pond were instrumented for continual monitoring to improve site hydrological model. (6) Premodeling of tracer experiments were performed to aid in site design, monitoring array, configuration, and spacing. (7) Design of experimental site and monitoring system was completed. (8) Characterization and Field Experimental Plans are underway in response to final site design. (9) The infrastructure for injection experiments were identified and needed equipment was procured. (10) The database management task was initiated. Prototype datasets for geology, geochemistry, hydrogeology, and geophysics was input to database. (11) Coordination with electromagnetic projects established. PNNL laid out anticipated outcomes for this project: an outstanding, multidisciplinary collaborative effort that could significantly advance science; enduring and accessible field experiment datasets for hypothesis and model testing; improved linked multi-scale mass transfer/biogeochemical models for reactive contaminants; and new conceptual understanding of mass transfer processes at different scales influencing field behavior.	*Multi-Scale Mass Transfer Processes Controlling Natural Attenuation and Engineered Remediation: An IFC Focused on Hanford's 300 Area Uranium Plume* (PNNL-SA-58090)
Challenges with Apatite Remediation (2008)—The objective of the treatability test was to evaluate the efficacy of using polyphosphate injections to treat uranium-contaminated groundwater in situ. A test site consisting of an injection well and 15 monitoring wells was installed in the 300 Area near the process trenches that had previously received uranium-bearing effluents.	This report described bench- and field-scale treatability testing designed to evaluate the efficacy of using polyphosphate injections to reduce uranium concentrations in the groundwater to meet drinking water standards (30 µg/L) in situ. Polyphosphate injection was selected for testing based on technology screening as part of the 300-FF-5 Phase III FS for treatment of uranium in the 300 Area. This report summarized the issues limiting the formation of apatite within the test. Two separate overarching issues affected the efficacy of apatite remediation for uranium sequestration within the 300 Area: (1) the efficacy of apatite for sequestering uranium under the present geochemical and hydrodynamic conditions, and (2) the formation and emplacement of apatite via polyphosphate technology. In addition, the long-term stability of uranium sequestered via apatite is dependent on the chemical speciation of uranium, surface speciation of apatite, and the mechanism of retention, which is highly susceptible to dynamic geochemical conditions. It is expected that uranium sequestration in the presence of hydroxyapatite would occur by sorption and/or surface complexation until all surface sites have been depleted, but the high carbonate concentrations in the 300 Area would act to inhibit the transformation of sorbed uranium to chernikovite and/or autunite. Adsorption of uranium by apatite was never considered a viable approach for in situ of uranium sequestration in of itself, because, by definition, this is a reversible reaction. The efficacy of uranium sequestration by apatite assumes that the adsorbed uranium would subsequently convert to autunite, or other stable uranium phases. Because this appears to not be the case in the 300 Area aquifer, even in locations near the river, apatite may have limited efficacy for the retention and long-term immobilization of uranium at the 300 Area site.	*Challenges Associated with Apatite Remediation of Uranium in the 300 Area Aquifer* (PNNL-17480)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Uranium Stabilization through Polyphosphate Injection (2009)—A test site consisting of an injection well and 15 monitoring wells was installed in the 300 Area near the process trenches that had previously received uranium-bearing effluent. This report summarized the work on the polyphosphate injection project, including bench-scale laboratory studies, a field injection test, and the subsequent analysis and interpretation of the results.	The baseline uranium concentration in the targeted primary treatment zone ranged from approximately 60 to 80 µg/L during the three pre-treatment monitoring events. After the injection test, aqueous uranium concentrations were routinely monitored to assess treatment performance. The initial uranium performance data indicated relatively good direct treatment of uranium through the formation of uranyl-phosphate mineral phases (i.e., autunite). Although initial post-treatment uranium concentrations decreased to below the drinking water standard of 30 µg/L, a significant rebound in uranium concentration was observed approximately 2 months after treatment. In general, uranium performance monitoring results support the hypothesis that limited long-term treatment capacity (i.e., apatite formation) was established during the injection test.	*300 Area Uranium Stabilization Through Polyphosphate Injection: Final Report* (PNNL-18529)
Other Studies/Investigations		
Unconfined Underground Radioactive Waste (1955)—This report summarized unconfined underground radioactive waste in the 300 Area, which had not been mentioned in other reports.	Short summaries of the following waste sites were included in this report: relocated burial ground, liquid waste disposal trenches for new laboratory area, old waste pond, new waste pond, various solid waste burial grounds, various burning grounds, 321 Cribs, 300 North Solid Waste Burial Ground, buried contaminated soil from the 303 Area, buried solvent wastes, P-11 Crib, and the 120 Building and immediate surrounding area.	*Unconfined Underground Radioactive Waste And Contamination in the 300 Area and Miscellaneous Areas Not Included in Other Reports* (HW-39076)
300 Area Burial Ground Characterization (1979)—Characterization of the 300 Area Burial Grounds included geophysical evaluation, geochemical analysis, fluid transport characterization and modeling, and biological transport.	The work in this task consisted of characterizing the geohydrologic system and applying a computer model to describe unsaturated zone fluid flow. Some conclusions of this project include evaporative drying, capillarity, and gravity flow are the dominant forces moving fluid through sediments at the Hanford Site. Thermally induced water flow is insignificant in subsurface sediments at the Hanford Site. Isothermal models of fluid transport are acceptable for seasonal predictions of water flow. Effects of previous rainfall history have a significant influence on the drainage of water balance. It is believed that the example simulations clarify an indispensable need for using model simulation as an approach to estimating drainage, because direct field measurements using neutron probes and other instrumentation may prove inadequate because of measurement error or uncertainty.	*Characterization of the Hanford 300 Area Burial Grounds: Task III - Fluid Transport and Modeling* (PNL-2921)
Biological Transport (1979)—This report provided an ecological description of the waste burial sites of the 300 Area and discussed major ecological pathways of radionuclide transport important to consider in the decontamination and decommissioning of dry land waste burial sites.	The potential for biological uptake and transport of buried waste in the 300 Area is low but does exist. The principal ecological mechanisms or radionuclide uptake and transport involve plant root penetration to buried waste and small mammal exposure to ionizing radiation, ingestion of contaminated plant material, and direct external contamination by utilization of cave-ins for shelter. Recommendations included a reduction in wind-induced soil erosion through soil additives, alteration of surface texture, and plantings of shallow-rooted plants, as well as establishment of biobarriers to plants and animals.	*Characterization of the Hanford 300 Area Burial Grounds: Task IV - Biological Transport* (PNL-2774)
Burial Grounds Characterization (1980)—Characterization involved the following: (1) review of pervious related investigations, (2) identification of suitable disposition alternatives for nuclear waste burial grounds, (3) review of regulatory issues, (4) survey of the general area, burial sites, and operations, (5) analysis of the geohydrologic system, potential transport pathways, and monitoring procedures, and (6) technology development and characterization.	The project consisted of a review of decontamination and decommissioning alternatives; an overview of the burial sites and operations; a description of the surrounding environment; and an assessment of radionuclide migration. Methodologies for characterizing nuclear waste burial grounds were developed and/or applied to the 300 Area.	*Characterization of the Hanford 300 Area Burial Grounds* (PNL-2557)
Hexavalent Chromium Evaluation (1992)—In order to resolve the issue regarding the existence or nonexistence of Cr(VI) in the 300-FF-1 and 300-FF-5 OUs, a close look at the sample data from the representative wells in and around 300-FF-1 was taken. Samples were collected from 20 wells and a total of 686 samples were collected during the period between June 17, 1985 and December 18, 1991.	Since Cr(VI) is soluble and hence much more mobile, it is expected that any Cr(VI) that did not reduce to Cr(III) would have long since been transported to the river via the groundwater and is no longer onsite. The amount of chromium detected in the samples was below drinking water standard (50 ppb) for 99.7 percent of the unfiltered samples. Only one sample was over 50 ppb and that sample was still under the freshwater aquatic life standard. Therefore, it can be concluded that the chromium found in the soils of 300-FF-1 and in the groundwater of 300-FF-5 will cause no significant risk to human health and the environment.	*Evaluation of Hexavalent Chromium for 300-FF-1 and 300-FF-5 Operable Units* (WHC-SD-EN-TI-039)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Contaminant Concentration vs. Particle Size in North Process Ponds (1992)—Three sediment samples from the 300 Area North Process Ponds were characterized for U-238, U-235, gamma emitters, and selected metals as a function of particle size.	Based on dry sieving, all three sediment samples were coarse with greater than 70 percent of the particles being gravel and less than 2.5 percent silt and clay. The sediments showed elevated concentrations of U-238, U-235, and numerous metals. In general, the concentrations of metals showed a progression of higher concentrations as the particle size decreases. When cleanup goals are determined, it may be necessary to adjust the amount of sediments removed by raising or lowering the split point in order to achieve a clean soil. A treatability test that simulates actual soil washing could provide additional information on this issue.	*Contaminant Concentrations Versus Particle Size for the 300 Area North Process Pond Samples* (WHC-SD-EN-TI-049)
Soil Washington Physical Separations Test 300-FF-1 (1992)—The report provided the operations approach, a field sampling plan, and laboratory procedures for a soil washing test to be conducted in the 300-FF-1 OU.	This document described specifications, responsibilities, and general procedures followed to conduct the physical separation soil treatability tests in the North Process Pond of the 300-FF-1 OU. The purpose of the test was not to prove or disprove technology but to determine effectiveness for reducing the mass of contaminated material. The test's effectiveness was discussed in a final report.	*Soil Washing Physical Separations Test Procedure for the 300-FF-1 Operable Unit* (WHC-SD-EN-TP-036)
Sediment and Process Water Characterization (1994)—The original scope included wet sieving 12 sediment samples received in a field-washed moist state within 1 gal or 5 gal paint cans, or large plastic carboys, depending upon the projected sediment particle size.	A total of 19 sediment and 1 filtered spent process water samples were analyzed. The moisture content of the coarse material shipped from the piles generated during the field washing were quite low but variable. Dry bulk density calculations were inaccurate because containers were not filled completely. Based on data collected, recommendations include changing the operating parameters such that the first vibrating screen rejects all particles larger than 9.5 mm, as opposed to larger than 1 in. Because there appeared to be a large drop in uranium activity in particles above 9.5 mm size, such a preliminary cut would allow the washing process to concentrate on the “problem” size material. The spent process water from campaigns one and two appeared to contain significant quantities of dissolved uranium. Dissolved chromium concentrations also reach 50 to 100 ppb. Based on measurements of the spent waters from the laboratory wet sieving that showed little drop in observed concentrations for water used to wash fines up to cobbles/boulders, it was suspected that much of the “dissolved” material was actually colloidal particles smaller than 0.425 µm. It was recommended that spent wash water be treated to coagulate colloids. If coagulation is not successful, then reduction processes to reduce U(VI) and Cr(VI) to U(IV) and Cr(III) would likely prove useful.	*Sediment and Process Water Characterization in Support of 300 Area North Process Pond Physical Soil Washing Test* (WHC-SD-EN-TI-214)
Vitrification Testing (1994)—Crucible scale vitrification tests were conducted on soil fines. The soil fines test included both nonradioactive surrogate from the 600 Area and actual radioactive soil fines from the 100 and 300 Areas. Both physical and chemical properties were tested. Nine different glass compositions were formulated using the surrogate material, and the results of these tests were used to choose the glass formulation for use with the radioactive test materials. Radioactive samples from both the 100 and 300 Areas were vitrified, and the resulting products were tests for durability and for processability.	It was determined that the soil fines were generally similar in composition to the bulk Hanford Site soil, although the fraction <0.025 mm in the 100 Area soil sample appeared to differ somewhat from the bulk soil composition. The soil fines were readily melted into a homogenous glass with the simple additions of calcium oxide and/or sodium oxide. The vitrified waste occupied only 60 percent of the volume of the initial untreated waste. Leach testing has shown the glasses made from the soil fines to be very durable relative to natural and artificial glasses and has demonstrated the ability of the vitrified waste to greatly reduce the release of radionuclides to the environment. Viscosity and electrical conductivity measurements indicated that the soil fines will be readily processable, although with levels of additives slightly greater than used in the radioactive melts. These tests demonstrated the applicability of vitrification to the contaminated soil fines and the exceptional performance of the waste form resulting from the vitrification of contaminated Hanford Site soils.	*Vitrification Testing of Soil Fines from Contaminated Hanford 100 Area and 300 Area Soils* (WHC-SD-EN-TI-240)
Ecological Investigation (1995)—The main objectives for this investigation were: (1) determine species composition and major species (2) identify and evaluate potential biocontamination pathways, and (3) evaluate the existing concentration levels of contaminants in plants and animals.	Common plant and animal species that could be considered as indicator species at the 300-FF-2 OU include the Great Basin pocket mouse, deer mouse, harvester ant, and Russian thistle. No plant or animal species classified as threatened or endangered by the state and/or federal governments resided at any of the high priority waste sites. Ecological surveys indicated that species of concern such as eagles, ferruginous hawks, loggerhead shrikes, and burrowing owls may use the 300-FF-2 OU on a seasonal basis, and precautions should be taken to minimize impacts during field operations.	*Ecological Investigation Technical Report for the 300-FF-2 Operable Unit* (BHI-00170)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
618-11 Burial Ground Phase I Investigation (2000)—The Phase I investigation consisted of sampling existing monitoring wells near the 618-11 Burial Ground. The sampling included wells upgradient of the burial ground, downgradient wells, Energy Northwest water supply wells, and Energy Northwest monitoring wells. The samples were analyzed for a variety of radionuclides and chemicals including water quality parameters and potential contaminants. Sampling was conducted in February 2000.	The distribution of tritium pointed strongly to a probable source within the 618-11 Burial Ground. Other sources considered included the tritium plume from the 200 East Area and Energy Northwest operations. However, the tritium levels were too high to be explained by either of these sources. The distribution was inconsistent with the 200 East Area plume. Similarly, the high tritium was located upgradient of Energy Northwest WNP-2 reactor, so known discharges from Energy Northwest were unlikely to be the source.	*Evaluation of Elevated Tritium Levels in Groundwater Downgradient from the 618-11 Burial Ground Phase I Investigations* (PNNL-13228)
Uranium Geochemistry (2005)—This report summarized research conducted to improve the conceptual model of the 300 Area uranium plume and to develop a final ROD for the 300-FF-5 OU.	The research goals included updating the conceptual model of uranium release/flux rates from the vadose zone and the migration velocity/desorption rate of uranium contamination in the aquifer by investigating the linked geochemical and hydrologic phenomena that govern those processes; identifying a geochemical reaction network that is responsible for uranium retardation in the vadose zone and groundwater, and describing the parameters of the reaction network in terms of thermodynamic and kinetic (chemical, mass transfer) variables; and integrating the conceptual model and reaction network into reactive transport simulations to evaluate vadose zone and capillary fringe fluxes and to forecast the future evolution of the uranium plume.	*Uranium Geochemistry in Vadose Zone and Aquifer Sediments from the 300 Area Uranium Plume* (PNNL-15121)
Fate and Transport of Tritium Contaminated Groundwater (2005)—Three tritium release scenarios were investigated to measure the impact expected at the primary receptor locations under different release conditions. The three cases included (1) a pulse release of tritium from the burial ground that provided the best fit between observed and simulated tritium concentrations, and (2) two alternative release scenarios designed to evaluate the effects of increasing mass release on predicted tritium concentration.	This report presented a detailed evaluation of the fate and transport of the 618-11 Burial Ground tritium plume and its potential impact on downgradient receptors. Tritium transport simulations conducted during this modeling effort indicated that mechanisms associated with dilution, dispersion, and radioactive decay have, in the past, and continue to attenuate the tritium plume from the 618-11 Burial Ground and limit the risk to the primary receptors (the Columbia River and Energy Northwest water supply wells). The alternative release scenarios include a continuing, decaying source beneath the burial ground through 2015, the milestone for source removal under the River Corridor Closure Contract, and a pulse release, similar to the best fit case, but at twice the concentration. In the best fit case, the model predicted that the maximum tritium concentration would decline to below the drinking water standard of 20,000 pCi/L by 2031. For the two alternative release scenarios, maximum tritium concentrations would decline to below the drinking water standard by 2040 and 2037, respectively. Simulations also indicated that tritium from the 618-11 Burial Ground was not expected to migrate to the primary receptor locations (the Columbia River and Energy Northwest water supply Wells MW-31 and -32) at concentrations exceeding the drinking water standard. These simulations did not consider pumping from the Energy Northwest water supply wells, which, if sustained at high rates for long periods, could increase the observed concentration at this location.	*Evaluation of the Fate and Transport of Tritium Contaminated Groundwater from the 618-11 Burial Ground* (PNNL-15293)
Uranium Contamination 300 Area (2008)—The scope described in this report reflected the iterative nature of the RI process and was limited to the following: (1) The contaminant is uranium. (2) The geographic area is the 300 Area subregion of the 300-FF-5 OU, and includes the underlying vadose zone and uppermost aquifer. (3) The media include sediment and water (moisture) in the vadose zone, the uppermost aquifer, and the interface between the aquifer and the Columbia River systems.	The persistence of uranium contamination in groundwater at concentrations that exceed the EPA drinking water stand of 30µg/L prompted additional investigation of the plume itself and of technologies that could potentially be used to reduce concentrations to meet the standard. A new discovery is that the level of contamination in the plume is not falling at a rate that would cause concentrations to drop to below the drinking water standard in a reasonable length of time. This time has in the past been defined as "by 2018," or the earliest date at which institutional controls on the use of the 300 Area may be relaxed. The conceptual model for this contamination identifies the following potential zones where contaminant uranium may be sequestered: (1) vadose zone sediment immediately adjacent to the former liquid-waste disposal sites; (2) lower portion of vadose zone beneath the footprints of formal disposal sites; (3) a vertical zone through which the water table rises and falls, which is subdivided laterally into regions immediately beneath waste sites and other more widespread regions defined by the extent of the groundwater plume; (4) groundwater and solid materials in the upper portion of the unconfined aquifer; and (5) a ZOI between the aquifer and river systems.	*Uranium Contamination in the Subsurface Beneath the 300 Area, Hanford Site*, *Washington* (PNNL-17034)
Hanford Site Environmental Report (2009)—Individual sections within this report were designed to provide detail on the following: the Hanford Site and its mission; Hanford Site compliance with all applicable DOE, federal, state, and local regulations; status and results of Hanford Site cleanup and remediation activities; Hanford Site environmental management performance; Hanford Site environmental and groundwater monitoring programs and monitoring data findings; potential radiation doses to onsite staff and the public residing in the Hanford Site vicinity; and data quality assurance methods.	This report is prepared annually by PNNL and summarizes environmental data that characterize Hanford Site environmental management performance. The report also highlights significant environmental and public protection programs and efforts. Although this report is primarily written to meet DOE reporting requirements and guidelines, it also provides useful summary information for the public, Native American tribes, public officials, regulatory agencies, and Hanford Site contractors.	*Hanford Site Environmental Report for Calendar Year 2008* (PNNL-18427)

Table N-1. Previous Investigations and Remedial Action Summary

Scope of Work and (Publication Date)	Conclusions/Implications	Reference
Borehole Completion and Conceptual Model (2009)—This report documented the details of the drilling, sampling, and well construction for 35 wells installed in 2008 over a former waste site, the South Process Pond (316-1 waste site), in the Hanford Site 300 Area.	Sediments overlying the Columbia River Basalt bedrock at the site belong to three geologic units: (1) the Ringold Formation, (2) the Hanford formation, and (3) backfill materials. The Ringold Formation ranges in age from late Miocene to Pliocene (8.5 to 3.4 million years) and consists of mostly fluvial-lacustrine sediments laid down during tectonic downwarping and infilling of the Pasco Basin. Overlying the Ringold Formation beneath the site are up to 50 ft of heterogeneous sand and gravel with variable amounts of silt and clay of the Hanford formation. The Hanford formation encompasses all the sediments deposited during Pleistocene-age cataclysmic floods. The water table lies within the Hanford formation everywhere within the site. Backfill materials consist of grayish-brown, poorly sorted, homogeneous mixtures of loose basaltic gravel and sand with lesser amounts of silt, derived from excavated and mixed, gravel-dominated facies of the Hanford formation. The thickness of the backfill varies across the site from about 5 m (16 ft) on the western side and approximately 2 m (7 ft) along the eastern side of the site.	*Borehole Completion and Conceptual Hydrogeologic Model for the IFRC Well Field, 300 Area, Hanford Site* (PNNL-18340)
Uranium Contamination in the 300 Area (2008)—The primary objectives of this characterization were to 1) determine the extent of uranium contamination in the sediments, 2) quantify the leachable (labile) concentration of uranium in the sediments, and 3) create a dataset that could be used to correlate the present data to existing 300 Area data. To meet these objectives, sediment < 2 mm in diameter collected from Wells 399-2-5 (C5708), 399-3-22 (C5706), and 399-4-14 (C5707) was analyzed for moisture content, 1:1 sediment: water extracts (which provide soil pH, electrical conductivity, cation, anion, and uranium data), total carbon and inorganic carbon content, 8 M nitric acid extracts (which provide a measure of the total leachable sediment content of contaminants and major constituents), microwave-assisted digestion (which results in total digestion of the sediment), and carbonate leaches (which provide an assessment of the concentration of labile uranium present in the sediments). Additionally, porewater present in select samples were extracted using UFA™.	Based on results from the present study, it appears that uranium contamination in the 300 Area vadose zone can be characterized using a two-source model. The first source is fairly widespread, with an area extent as large as the total 300 Area footprint that has been affected by fluctuations in river stage (i.e., elevated water table during times of high river stage). The uranium within this source is concentrated in the deeper vadose zone and capillary fringe, also known as the "smear zone," and is likely present at total concentrations ranging from 3 to 10 µg/g of sediment. The second source term is much more variable and has a much smaller footprint within the 300 Area. This source can be classified as containing "hot spots" of contaminant uranium at depths ranging from ground surface to the top of the unconfined aquifer. While uranium contamination from this second source term was not encountered as part of this investigation, previous studies (e.g., PNNL-14022) have reported concentrations in excess of 900 µg of sediment in the 300 Area.	*Uranium Contamination in the 300 Area: Emergent Data and their Impact on the Source Term Conceptual Model* (PNNL-17793)
Evaluation and Screening of Remedial Technologies for Uranium (2007) – This report documented the re-evaluation of remedies addressing persistent dissolved uranium concentrations in the upper aquifer under the 300 Area. This work was being conducted as a Phase III FS for the 300-FF-5 OU.	Fifty-three technologies or management techniques for groundwater were initially identified. Thirteen of the 53 technologies were additions to the 40 identified in the original FS, *Phase I and II Feasibility Study Report for the 300-FF-5 Operable Unit* (DOE/RL-93-22). The additions are new in situ technologies that were not known earlier. Evaluation of these technologies on the basis of criteria from the 1994 FS (DOE/RL-93-22), including adjustments for 2006 conditions and with a focus on groundwater technologies, narrowed the original 53 technologies to 29 candidate technologies for groundwater. With the consolidation of 3 institutional control actions into 1 action, 27 actions and technologies were reduced to 13 using criteria of effectiveness and implementability. The 13 remaining technologies were reduced to two active technologies and two passive management strategies using the relative cost criteria. The resulting active technologies for groundwater are in situ polyphosphate treatment and in situ calcium citrate and sodium phosphate treatment. The resulting passive management strategies for groundwater are institutional controls (land-use restrictions, access controls) and monitored natural attenuation. The 1994 FS (DOE/RL-93-22) also did not address the lower vadose zone; rather, the authors assumed that remedies deployed in the 300-FF-1 OU upper vadose zone would protect groundwater. A new list of 10 candidate technologies was identified. Using criteria of effectiveness and implementability, the 10 candidate technologies were reduced to 4 technologies. Three active technologies remained after applying relative cost criteria. The resulting active technologies for the vadose zone are more extensive excavation of sediment to the water table, vadose flushing with polyphosphate immobilizing agent, and vadose flushing with calcium citrate and sodium phosphate.	*Evaluation and Screening of Remedial Technologies for Uranium at the 300-FF-5 Operable Unit, Hanford Site, Washington* (PNNL-16761)

Table N-2. Summary of Previous 300 Area Modeling Efforts

Scope of Work and (Publication Date)	Key Findings	Reference(s)
Geohydrology and Ground-Water Quality Beneath the 300 Area (1979) — Lindberg and Bond conducted a characterization and modeling study of the 300 Area (PNL-2949). The objectives of the study were to understand groundwater flow and the extent of subsurface contamination in the 300 Area. The study was conducted over two years, consisting first of a field investigation with monitoring, data collection, and analysis, followed by a groundwater flow and contaminant transport modeling phase. The modeling phase was done to synthesize data gathered during the field investigation into a calibrated flow and transport model. The groundwater flow model was developed to simulate conditions in the 300 Area based on the Variable Thickness Transient (VTT) code developed at PNNL. The 300 Area model was based on a subregion of the Hanford site-wide model that existed at the time. The model used weekly time steps, so river stage was represented as a weekly average. This approach captured seasonal variations but not daily and hourly variations that are characteristic of the Hanford Reach and the 300 Area shoreline. The model included active discharges to disposal facilities including the process trenches, sanitary water lines, south process pond, and ash pits. Hydraulic properties were based on aquifer tests and the model was calibrated using data from the field investigations. Groundwater flow was simulated during 1977 and used as the basis for transport predictions using the Multicomponent Mass Transfer (MMT) code. Simulations were performed of a waste spill that occurred near the 325 Building in 1979 as a demonstration of the MMT transport model. The simulation included a variety of isotopes, but not uranium.	The hydrologic model captured seasonal variations in the 300 Area, but not daily or hourly changes. Columbia River water was predicted to reach inland during periods of high river stage. Five of the isotopes in the transport model were predicted to reach the river in measureable concentrations, but below limits.	*Geohydrology and Ground-Water Quality Beneath the 300 Area, Hanford, Site, Washington* (PNL-2949)
300-FF-1 Remedial Design/Remedial Action Work Plan (1994) — DOE/RL-96-70 summarizes the remedy design (excavation) and work plan for the 300-FF-1 soil operable unit. The report includes a summary of the RESRAD code (ANL, 1994) to derive soil cleanup standards protective of surface exposures and groundwater. An industrial scenario was used for the RESRAD model, defined as a worker spending 1,500 h/yr in a building located on a waste site contaminated with uranium and spending 500 hours outside on a waste site. A quantitative analysis was performed to determine protection of the groundwater and Columbia River from the 300-FF-1 OU. The quantitative analysis was based on a baseline risk assessment performed for the no action case and RESRAD modeling. The quantitative evaluation considered vadose zone and groundwater flow conditions, current groundwater conditions, vadose zone characteristics, contaminant characteristics, source mass loading, other contaminants that could impact uranium mobility, and volumetric groundwater flow rate.	A soil concentration of 350 pCi/g total uranium was calculated to correspond to a 15-mredyr dose based on the 300-FF-1 industrial scenario. Therefore, all soils containing more than 350 pCi/g total uranium were excavated. The qualitative evaluation of natural site processes concluded that they would attenuate migration of uranium and that the remedial action objective of the drinking water standard would be met.	*300-FF-1 Remedial Design Report/Remedial Action Work Plan* (DOE/RL-96-70)

Table N-2. Summary of Previous 300 Area Modeling Efforts

Scope of Work and (Publication Date)	Key Findings	Reference(s)
Protection of 300 Area Groundwater from Uranium-Contaminated Soils at Remediated Waste Sites (2002) — PNNL-14022 summarized the original basis for the 350 pCi/g uranium cleanup level, assessed the impacts of a uranium distribution coefficient (Kd)/leach study to the 350 pCi/g uranium cleanup level, and assessed in greater detail groundwater protection for uranium at the remediated 300-FF-1 and 300-FF-2 Operable Units (OUs). In the original 300-FF-1 plan, RESRAD was used to calculate dose and risk from radionuclides and to calculate radionuclide cleanup levels. Model input parameters specific to a generic site include a surface area of 10,000 m Z, a length of 100 m parallel to groundwater flow, a contaminated soil zone thickness of 4 m, and an uncontaminated soil zone thickness of 5.6 m. Literature-derived uranium Kd values of 2 mL/g were used for the contaminated zone, the uncontaminated zone, and the saturated zone. During the preparation of the 300-FF-2 OU Record of Decision, concerns were raised regarding the protectiveness of the 350 pCi/g soil cleanup level for groundwater. Because of these concerns, the Tri-Parties (i.e., the U.S. Environmental Protection Agency, the Washington State Department of Ecology, and the U.S. Department of Energy) agreed to conduct a uranium Kd/leach study, which was conducted by Pacific Northwest National Laboratory from fiscal year 2000 through fiscal year 2002. The results of column tests and groundwater batch leach tests, desorption or leach Kd values were calculated for five soil samples from representative 300 Area waste sites containing residual uranium contamination. With the exception of a single anomalous high Kd, the calculated desorption Kd values ranged from 8.9 mL/g to 11.4 mL/g. The Pacific Northwest National Laboratory study (PNNL-14022) also indicated that once uranium is in solution, adsorption onto soil is low with an adsorption Kd value of 0 to 1.8 mL/g, consistent with a solubility driven system. RESRAD was applied using a conservative Kd value of 8.9 mLg for the leaching phase of the contaminated zone and 0 mLg for the adsorption phase of the uncontaminated zone and saturated zone to predict that a revised level of 267 pCi/g of uranium in soil is protective of groundwater at the drinking water standard.	The RESRAD run, using the generic site model, predicted that 350 pCi/g of uranium corresponds to the remedial action goal dose of 15 mrem/yr. RESRAD also predicted that there would be no uranium impact to groundwater and the Columbia River from the generic site within 1,000 years. The criteria for protection of groundwater and river from uranium contamination was the drinking water maximum contaminant level of 30 pg/L. Using revised Kd values from a leach study that was performed, the soil cleanup level for uranium in the 300 Area has been reduced from 350 pCi/g to 267 pCi/g. The conceptual model was changed to use conservative Kd values measured in the laboratory for release from waste site sediments and transport through the vadose zone to groundwater.	*300 Area Uranium Leach and Adsorption Project* (PNNL-14022)
Flow and Transport in the 300 Area Vadose Zone-Aquifer-River System (2005) — A flow and transport study was conducted using the Subsurface Transport Over Multiple Phases (STOMP) simulator. The study investigated flow and transport interactions among the vadose zone, aquifer, and river in a representative area and time period to prepare for future geochemical modeling by identifying the most important transport characteristics of the flow system. A two-dimensional saturated-unsaturated water flow and tracer transport model was developed for a 1.1 km-long by 60 m-tall vertical cross section aligned west-east across the Hanford Site 300 Area, nearly perpendicular to the river. The hydrologic system was modeled for one year, from March, 1992 through February 1993, a period when hourly data were available for both groundwater and river levels. Three cases were simulated: 1) base case, 2) lower river stage (.low-river.) case, and 3) high hydraulic conductivity (.high-K.) case. The base case was the primary simulation and used well and river water level measurements for model boundary conditions and available estimates of aquifer properties. The other two cases were used to explore model sensitivity to river stage and Hanford formation permeability, respectively.	The model predictions indicated a regional gradient toward the river that results in net flow from the aquifer to the river. River levels have a strong diurnal variation due to variable releases at Priest Rapids and McNary dams from power generation operations. The mean 24-hour change in river stage during the simulated year was 0.48 m, or more than three times the average head drop of the water table from well 399-6-1 to the river, and the maximum 24-hr change was 1.32 m. Groundwater levels 1.1 km inland (well 399-6-1) are influenced by large river level variations, albeit with time lags and damped amplitudes. The simulated subsurface flow field responded strongly to these imposed diurnal changes in river stage, with large swings in simulated groundwater velocity magnitude and direction, especially within the Hanford formation. The model showed that groundwater velocity magnitude and direction were typically not sustained for more than a few hours with the short cycles of river level change, but that the duration of larger magnitude changes enhanced intrusion and mixing of river water with groundwater to the extent of 150 m inland. Waichler and Yabusaki showed it was important to capture the hourly changes because monthly time steps dampened the impacts of river-water intrusion (PNNL-15125).	*Flow and Transport in the 300 Area Vadose Zone-Aquifer-River System* (PNL-15125)

Table N-2. Summary of Previous 300 Area Modeling Efforts

Scope of Work and (Publication Date)	Key Findings	Reference(s)
Combined Estimation of Hydrogeologic Conceptual Model, Parameter, and Scenario Uncertainty with Application to Uranium Transport at the Hanford Site 300 Area (2007) — NUREG/CR-6940 describes a methodology to systematically and quantitatively assess predictive uncertainty in groundwater flow and transport modeling. The methodology combines impact of hydrogeologic conceptual model uncertainties with model parameter and scenario uncertainties. The method is based on an extension of Maximum Likelihood implementation of Bayesian Model Averaging. The uncertainty methodology was applied to the 300 Area to model groundwater flow and uranium transport using eight alternative models representing uncertainty in hydrogeologic and geochemical properties as well as temporal variability. The alternative conceptualizations were implemented using MODFLOW and MT3DMS as three-dimensional, unconfined, saturated flow and transport models. Two scenarios represented alternate future behavior of the Columbia River through treatment of boundary conditions. Geochemical uncertainties were represented by alternative K_d models based on measurements of 300 Area sediments by PNNL-15121, and a surface complexation model for uranium that was developed. Alternative models were calibrated using hydraulic head and uranium concentration observations over a seven year period, from 1997 to 2004. Parameter uncertainties for each model were based on the estimated parameter covariances resulting from the joint calibration of each alternative model to 222 observations of hydraulic head and 208 uranium concentration measurements obtained from 21 wells over the seven-year calibration period. Uranium concentrations for each scenario were predicted over a 20 year period from 2005 to 2025.	One of the alternative conceptual models based on a five-layer representation of the hydrogeology, transient river boundary conditions, and a homogeneous Kd representation dominated the other alternative models. Therefore, only the dominant model needed to be used in predictive simulations. For illustrative purposes, however, all four models were used. Prior parameter information helped produce reasonable estimates of uranium K_ds. Without the prior information, the coefficients were unreasonably large. The poor calibration results obtained without prior information suggest that the geochemical models needed to be improved. Selected uranium concentration results were shown to illustrate the model and scenario averaging. These figures and the accompanying tables illustrate the individual contributions to predictive uncertainty of the model, parameter, and scenario uncertainties. In this case, model uncertainty was negligible due to the dominance of a single model. Parameter and scenario uncertainties were significant.	*Combined Estimation of Hydrogeologic Conceptual Model, Parameter, and Scenario Uncertainty with Application to Uranium Transport at the Hanford Site 300 Area* (NUREG/CR-6940)
Treatability Test Plan for 300 Area Uranium Stabilization Through Polyphosphate Injection (2007) — A three-dimensional numerical model was developed for the polyphosphate treatability test site near the 300 Area Process Trenches. The model incorporated site characterization (geologic description, physical property measurement of sediment samples, aquifer tests, and tracer test) to help with the design and interpretation of the polyphosphate injection test. The model uses the Subsurface Transport Over Multiple Phases (STOMP) code that is a multi-fluid flow finite difference code that can simulate both the vadose zone and aquifer. The model domain covered the treatability test site and the vicinity of the North Process Ponds. It extended to, but did not reach, the Columbia River. The lateral boundary conditions of the model consisted of wells for which hydraulic heads were prescribed. Hydraulic conductivity zones were specified for the model domain and calibrated to tracer test arrival times. The calibration process was done manually by comparing simulated tracer and hydraulic heads with values measured during the tracer test and adjusting the properties.	The numerical modeling was used to assist with design of the polyphosphate injection. The simulated tracer arrivals at the downgradient wells were within the time period of bromide measured in the well during the tracer test, but the simulated tracer pulse was too short and at higher concentrations. This was postulated to be due to needing higher dispersivity or a shift in the trajectory of the tracer plume. The contrast in hydraulic properties was also noted to influence the plume trajectory.	*Treatability Test Plan for 300 Area Uranium Stabilization Through Polyphosphate Injection* (PNNL-16571)

Table N-2. Summary of Previous 300 Area Modeling Efforts

Scope of Work and (Publication Date)	Key Findings	Reference(s)
Three-Dimensional Groundwater Models of the 300 Area at the Hanford Site, Washington State (2008) — A three-dimensional groundwater flow model beneath the 300 Area was developed to help refine the conceptual site model and assist in evaluating remediation technologies focused on the uranium plume. Several different scales of models were developed. A larger domain model was developed that includes the 300 Area and extends north and south to use data from an extended water-level monitoring network. A smaller domain model was developed using water-level data from a more refined network within the 300 Area and encompassed the region between the North and South Process Ponds and Process Trenches. Both models focused on the higher permeability Hanford formation and simulate saturated and unsaturated flow and transport with the STOMP code. The models include the lower portion of the vadose zone to encompass the range of river stage and water-table elevation changes observed in the 300 Area. High-resolution water level and river stage data were used to simulate the dynamics of the 300 Area unconfined aquifer. The hydrogeologic framework was defined based on the stratigraphy, topography, and river bathymetry using the EarthVision® software. The stratigraphic units were determined from previously published interpretations of 300 Area geology, along with data from additional characterization wells. The models incorporated representations of the hyporheic zone of the Columbia River because of the importance of a layer of river alluvium. Extensive downhole probe measurements of electrical conductivity and temperature were used to interpret the extent of the groundwater/river water mixing zone. The distribution of hydraulic properties for the Hanford formation was determined by trial and error fitting of hydraulic conductivity. Both deterministic and stochastic representations of hydraulic properties were included in the model. Simulation results were assessed by comparing simulated and measured water levels within the automated water-level monitoring networks and comparing simulated and field-scale tracer tests. The report includes a review of previous 300 Area groundwater flow and contaminant transport studies.	Overall, deterministic representations of the Hanford formation subdivided into two zones, along with a river alluvium zone, resulted in the best fit based on evaluation of hydraulic head residuals. Hydraulic conductivities for the large scale models had hydraulic conductivities of 7000 m/d for the high permeability zone of the Hanford formation. The small scale model had higher hydraulic conductivities of 10,000 m/d. Simulated values of annual net flux from groundwater to the Columbia River by both the large and smaller domain models of the 300 Area were higher than other independent calculations, but demonstrated the important influence of hydraulic properties on the flux estimates. A number of recommendations were made for refinement of the 300 Area model, including the hydraulic property estimates and representations of the river alluvium zone, heterogeneous representations of hydraulic conductivity, and improvement of the stratigraphic representation in the model.	*Three-Dimensional Groundwater Models of the 300 Area at the Hanford Site, Washington State* (PNNL-17708)
Field-scale model for the natural attenuation of uranium at the Hanford 300 Area using high-performance computing (2010) and Stochastic simulation of uranium migration at the Hanford 300 Area (2011) — Hammond and Lichtner (2010) and Hammond et al. (2010) describe a three-dimensional model of groundwater flow beneath the 300 Area. These modeling studies are part of the Scientific Discovery through Advanced Computing (SciDAC) program focused on advancing high resolution, high performance computing applications. Both modeling studies used the PFLOTRAN code developed as part of SciDAC. Hammond and Lichtner (2010) modeled both labile and nonlabile U(VI) with reactive transport in a U(VI) plume extending from the source region to the river boundary, representing present-day conditions. The model represented continuous release of nonlabile U(VI) in the South Process Pond through dissolution of metatorbernite as a surrogate mineral. The model included representation of the rapid fluctuations of Columbia River stage and represented subsurface hydraulic properties as a homogeneous. Hammond et al. (2010) extended the earlier SciDAC modeling and focused on quantification of groundwater flow and subsequent U(VI) transport uncertainty due to heterogeneity in the sediment permeability at the Hanford 300 Area. U(VI) migration was simulated with multiple realizations of stochastically-generated high resolution permeability fields and comparisons are made of cumulative water and U(VI) flux to the Columbia River. Ten transient, variably-saturated groundwater flow and U(VI) transport simulations were executed with three-dimensional heterogeneous permeability fields using the multi-realization simulation capability of PFLOTRAN.	Hammond and Lichtner (2010) found that rapid fluctuations in Columbia River stage combined with slow release of nonlabile U(VI) from contaminated sediment determined the migration behavior of U(VI) with sorption being a second-order effect. A multirate model was essential in explaining breakthrough curves obtained from laboratory column experiments and was used in a later reactive transport modeling phase. The calculations demonstrate that U(VI) is discharged to the river at a highly fluctuating rate in a ratchet-like behavior as the river stage rises and falls. The high-frequency fluctuations must be resolved in the model to calculate the flux of U(VI) at the river boundary. By time averaging the instantaneous flux to average out noise superimposed on the river stage fluctuations, the cumulative U(VI) flux to the river is found to increase approximately linearly with time. Hammond et al. (2010) showed that the cumulative U(VI) flux to the Columbia River is less responsive to fine scale heterogeneity in permeability and more sensitive to the distribution of permeability within the river hyporheic zone and mean permeability of larger-scale geologic structures at the site.	"Field-Scale Modeling for the Natural Attenuation of Uranium at the Hanford 300 Area Using High-Performance Computing" (Hammond and Lichtner, 2010**)** "Stochastic Simulation of Uranium Migration at the Hanford 300 Area" (Hammond et al., 2010)

Table N-2. Summary of Previous 300 Area Modeling Efforts

Scope of Work and (Publication Date)	Key Findings	Reference(s)
Integrated Field Research Challenge (IFRC) Project (2010 – 2012) — The IFRC project uses three-dimensional, variably saturated flow (Richards Equation) and transport modeling in physically heterogeneous 300 Area sediments to provide insights on persistence of the uranium plume. The project is interested in uranium behavior and general sensitivity of uranium mobility to groundwater chemistry, specifically as rate-limited uranium(VI) surface complexation. The project has focused on describing the complex interplay of hydrologic variations that occur in the groundwater-river interaction zone with biological and geochemical processes that determine seasonal variations in groundwater concentrations, and the response of the IFRC experimental zone to perturbation from field tests. Modeling has helped to identify uncertain processes and parameters, as well as unexpected interactions and behaviors at the IFRC (Greskowiak et al., 2011; Greskowiak et al., 2010; Ma et al., 2010; Yabusaki et al., 2008). Modeling also has been used to assist with design of planned field experiments in terms of injection volumes and durations, monitoring strategies, and prediction of plume behaviors under assumed hydrologic conditions. Initial modeling at the IFRC used homogeneous physical properties for the Hanford formation but newer studies are integrating geostatistical models of hydrophysical and geochemical properties (Chen et al., 2012; Murakami et al., 2010) specific to the IFRC site. A major challenge has been how to best represent the kinetic surface complexation process at the field scale (Greskowiak et al., 2011; Ma et al., 2010). Modeling has been used to investigate the effects of spatially variable uranium inventory, high and directionally variant groundwater velocities, and temporally variable groundwater composition (pH, Ca2+, and alkalinity) caused by influx of river water to the field site on groundwater uranium concentrations. Ongoing studies seek to understand timescale effects on coupled hydrologic and geochemical interactions that occur within the lower vadose zone that regulate the magnitude and timing of uranium recharge to the groundwater plume. Lichtner and Hammond (2012) used high performance computing to understand the role of labile (mobile) and nonlabile (sorbed) uranium on longevity of the uranium plume. They included simulations that considered both components of the 300 Area uranium inventory.	Insights include prediction of a temporally and spatially dynamic zone of enhanced uranium adsorption occurring where groundwater and river water mix and recognition that oscillating groundwater compositions can enhance kinetically-limited surface complexation (adsorption and desorption) through slow/attenuated diffusive exchange of bulk and intra-grain waters with different composition (e.g. river water and groundwater). The primary known annual source of uranium resupply to groundwater in the 300 Area is a high river stage event in the spring that elevates the water table into the lower vadose zone where significant residual contamination exists beneath the former waste disposal sites. Contacting groundwater becomes enriched in soluble uranium in a spatially variable manner dominated by localized hot spots. The amount of uranium that is mobilized depends on the height and duration of water table rise and the water composition (e.g. groundwater or river water). Lichtner and Hammond (2012) found that uranium plume persistence requires consideration of both labile and nonlabile components of the inventory. Experimental observations performed on 300 Area vadose zone and saturated zone sediments display a uniform kinetic desorption curve when normalized to the total adsorbed uranium concentration (Murray et al., 2012). This curve defines a generalized, quantitative site-wide dissipation profile that asymptotically approaches background as uranium desorbs and is removed by advection. The curve is predictable with measured multi-rate, surface complexation model parameters and knowledge of water flux and direction controlled by river stage. The groundwater plume and aquifer sediments are expected to behave in this way complicated by 1) continued recharge from the vadose zone that rejuvenates uranium adsorption and 2) a spatially complex and poorly resolved inventory of sorbed uranium, and 3) river water intrusion that changes groundwater composition in a temporally and spatially complex manner.	“Three-Dimensional Bayesian Geostatistical Aquifer Characterization at the Hanford 300 Area Using Tracer Test Data” (Chen et al., 2012) “Comparsion of Parameter Sensitivities Between a Laboratory and Field-Scale Model of Uranium Transport in a Dual Domain, Distributed Rate Reactive System” (Greskowiak et al., 2010) “Simulating Adsorption of U(VI) Under Transient Groundwater Flow and Hydrochemistry: Physical Versus Chemical Nonequilibrium Model” (Greskowiak et al., 2011) “A Field-Scale Reactive Transport Model for U(VI) Migration Influenced by Coupled Multirate Mass Transfer and Surface Complexation Reactions” (Ma et al., 2010) “Bayesian Approach for Three-Dimensional Aquifer Characterization at the Hanford 300 Area” (Murakami et al., 2010) “Establishing a Geochemical Heterogeneity Model for a Contaminated Vadose Zone – Aquifer System” (Murray et al., 2012) “Building Conceptual Models of Field-Scale Uranium Reactive Transport in a Dynamic Vadose Zone-Aquifer-River System” (Yabusaki et al., 2008)

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