This document was too large to scan as a single document. It has been divided into smaller sections.

SECTION 3

Document Information			
Document #	DOE/RL-2003-64	Revision	DRAFT A REISSUE
Title	FEASIBILITY STUDY FOR THE 200-TW-1 SCAVENGED WASTE GROUP & THE 200-TW-2 TANK WASTE GROUP & THE 200-PW-5 FISSION-PRODUCT RICH WASTE GROUP OU		
Date	03/25/2004		
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References			
Keywords			
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Other Information			

Table C-40. Comparison of True Mean Deep Zone Soil Concentrations from 216-B-45 Crib to WAC 173-340-747, Method B Groundwater Protection Standard, Human Health Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Average Detected Result	WAC 173-340-747 Method B GWP Standard	Does True Mean Exceed WAC 173-340-747 Method B GWP Standard?
GENCH	Cyanide	mg/kg	14	5	36%	0.61	320	No
GENCH	Nitrate (as N)	mg/kg	5	5	100%	244	40	Yes
GENCH	Nitrite (as N)	mg/kg	5	4	80%	14	4.0	Yes
GENCH	Sulfate	mg/kg	7	7	100%	161	1,000	No
METAL	Aluminum	mg/kg	14	14	100%	7,479	45	Yes
METAL	Cadmium	mg/kg	14	8	57%	0.90	0.69	Yes
METAL	Chromium	mg/kg	14	12	86%	8.9	18	No
METAL	Cobalt	mg/kg	14	14	100%	8.3	868	No
METAL	Copper	mg/kg	14	14	100%	14	263	No
METAL	Lead	mg/kg	14	13	93%	7.3	3,000	No
METAL	Mercury	mg/kg	8	2	25%	0.084	2.1	No
METAL	Nickel	mg/kg	14	13	93%	21	130	No
METAL	Silver	mg/kg	14	2	14%	0.44	14	No
METAL	Thallium	mg/kg	14	6	43%	0.15	1.6	No
METAL	Uranium	mg/kg	14	7	50%	13	1.3	Yes
METAL	Vanadium	mg/kg	14	14	100%	44	2,240	No
SVOA	Bis(2-ethylhexyl) phthalate	mg/kg	12	9	75%	0.069	14	No
SVOA	Butylbenzylphthalate	mg/kg	12	2	17%	0.15	893	No
SVOA	Diethylphthalate	mg/kg	12	2	17%	0.15	72	No
SVOA	Di-n-butylphthalate	mg/kg	12	1	8%	0.16	11	No
SVOA	Di-n-octylphthalate	mg/kg	12	5	42%	0.12	532,000	No
VOA	Acetone	mg/kg	12	2	17%	0.0062	3.2	No
VOA	Toluene	mg/kg	12	4	33%	0.0025	7.3	No

Washington Administrative Code (WAC) 173-340-747, "Deriving Soil Concentrations for Ground Water Protection."
GENCH = general chemical.
GWP = groundwater protection.
SVOA = semi-volatile organic analyte.
VOA = volatile organic analyte.

Table C-41. Comparison of True Mean Deep Zone Soil Concentrations from 216-B-47 Crib to WAC 173-340-747, Method B Groundwater Protection Standards, Human Health Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Average Detected Result	WAC 173-340-747 Method B GWP Standard	Does True Mean Exceed WAC 173-340-747 Method B GWP Standard?
GENCH	Complex cyanide	mg/kg	3	3	100%	116	320	No
GENCH	Cyanide	mg/kg	13	6	46%	28	320	No
GENCH	Free cyanide	mg/kg	4	4	100%	1.9	320	No
GENCH	Nitrite (as N)	mg/kg	6	1	17%	0.60	4.0	No
GENCH	Sulfate	mg/kg	6	6	100%	92	1,000	No
METAL	Cadmium	mg/kg	12	8	67%	0.69	0.69	No
METAL	Lead	mg/kg	12	12	100%	5.0	3,000	No
METAL	Nickel	mg/kg	12	12	100%	24	130	No
METAL	Thallium	mg/kg	12	3	25%	0.13	1.6	No
METAL	Uranium	mg/kg	12	7	58%	61	1.3	Yes
PEST	Dichlorodiphenyltrichloro-ethane	mg/kg	12	1	8%	0.012	3.5	No
SVOA	Bis(2-ethylhexyl) phthalate	mg/kg	12	7	58%	0.13	14	No
SVOA	Di-n-butylphthalate	mg/kg	12	5	42%	0.19	11	No
SVOA	Di-n-octylphthalate	mg/kg	12	6	50%	0.11	532,000	No
SVOA	Pentachlorophenol	mg/kg	12	2	17%	0.73	0.012	Yes
VOA	1,1,1-trichloroethane	mg/kg	12	2	17%	0.0042	1.6	No
VOA	Acetone	mg/kg	12	4	33%	0.011	3.2	No
VOA	Toluene	mg/kg	12	1	8%	0.0044	7.3	No

Washington Administrative Code (WAC) 173-340-747, "Deriving Soil Concentrations for Ground Water Protection."
GENCH = general chemical.
GWP = groundwater protection.
PEST = pesticide.
RAD_D = decayed radiological.
SVOA = semi-volatile organic analyte.
VOA = volatile organic analyte.

Table C-42. Comparison of True Mean Deep Zone Soil Concentrations from 216-B-48 Crib to WAC 173-340-747, Method B Groundwater Protection Standards, Human Health Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Average Detected Result	WAC 173-340-747 Method B GWP Standard	Does True Mean Exceed WAC 173-340-747 Method B GWP Standard?
GENCH	Complex cyanide	mg/kg	3	3	100%	76	320	No
GENCH	Cyanide	mg/kg	10	4	40%	23	320	No
GENCH	Free cyanide	mg/kg	3	3	100%	1.2	320	No
GENCH	Nitrate (as N)	mg/kg	5	5	100%	276	40	Yes
GENCH	Nitrite (as N)	mg/kg	5	3	60%	9.9	4.0	Yes
GENCH	Sulfate	mg/kg	5	5	100%	151	1,000	No
METAL	Lead	mg/kg	10	10	100%	6.8	3,000	No
METAL	Mercury	mg/kg	10	6	60%	0.15	2.1	No
METAL	Nickel	mg/kg	10	10	100%	48	130	No
METAL	Selenium	mg/kg	10	1	10%	0.44	5.2	No
METAL	Thallium	mg/kg	10	5	50%	0.15	1.6	No
METAL	Uranium	mg/kg	9	7	78%	54	1.3	Yes
PEST	Dichlorodiphenyltrichloro-ethane	mg/kg	10	1	10%	0.011	3.5	No
SVOA	Bis(2-ethylhexyl) phthalate	mg/kg	10	3	30%	0.15	14	No
SVOA	Di-n-butylphthalate	mg/kg	10	1	10%	0.16	11	No
SVOA	Di-n-octylphthalate	mg/kg	10	1	10%	0.16	532,000	No
VOA	Methylene chloride	mg/kg	9	1	11%	0.0028	0.025	No
VOA	Toluene	mg/kg	9	1	11%	0.0024	7.3	No

Washington Administrative Code (WAC) 173-340-747, "Deriving Soil Concentrations for Ground Water Protection."
GWP = groundwater protection.
SVOA = semi-volatile organic analyte.
VOA = volatile organic analyte.

Table C-43. Comparison of True Mean Deep Zone Soil Concentrations from 216-B-49 Crib to WAC 173-340-747, Method B Groundwater Protection Standards, Human Health Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Average Detected Result	WAC 173-340-747 Method B GWP Standard	Does True Mean Exceed WAC 173-340-747 Method B GWP Standard?
GENCH	Complex cyanide	mg/kg	1	1	100%	21	320	No
GENCH	Cyanide	mg/kg	17	3	18%	1.9	320	No
GENCH	Free cyanide	mg/kg	1	1	100%	0.19	320	No
GENCH	Sulfate	mg/kg	1	1	100%	92	1,000	No
METAL	Copper	mg/kg	17	16	94%	14	263	No
METAL	Lead	mg/kg	17	17	100%	4.8	3,000	No
METAL	Mercury	mg/kg	16	5	31%	0.089	2.1	No
METAL	Nickel	mg/kg	17	17	100%	10	130	No
METAL	Selenium	mg/kg	17	1	6%	0.21	5.2	No
METAL	Silver	mg/kg	15	2	13%	0.93	14	No
METAL	Thallium	mg/kg	17	2	12%	0.20	1.6	No
METAL	Uranium	mg/kg	18	5	28%	10	1.3	Yes
SVOA	Bis(2-ethylhexyl) phthalate	mg/kg	11	4	36%	0.14	14	No
SVOA	Di-n-butylphthalate	mg/kg	11	4	36%	0.84	11	No
SVOA	Di-n-octylphthalate	mg/kg	11	1	9%	0.17	532,000	No
VOA	2-Butanone	mg/kg	11	1	9%	0.0054	22	No
VOA	Acetone	mg/kg	12	3	25%	0.014	3.2	No
VOA	Methylene chloride	mg/kg	12	2	17%	0.0097	0.025	No

Washington Administrative Code (WAC) 173-340-747, "Deriving Soil Concentrations for Ground Water Protection."
GENCH = general chemical.
GWP = groundwater protection.
SVOA = semi-volatile organic analyte.
VOA = volatile organic analyte.

Table C-44. Comparison of True Mean Deep Zone Soil Concentrations from 216-B-50 Crib to WAC 173-340-747, Method B Groundwater Protection Standards, Human Health Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Average Detected Result	WAC 173-340-747 Method B GWP Standard	Does True Mean Exceed WAC 173-340-747 Method B GWP Standard?
METAL	Nickel	mg/kg	8	8	100%	9.1	130	No
METAL	Silver	mg/kg	8	1	13%	1.0	14	No
METAL	Uranium	mg/kg	9	1	11%	3.3	1.3	Yes
SVOA	Bis(2-ethylhexyl) phthalate	mg/kg	2	1	50%	0.11	14	No
SVOA	Di-n-butylphthalate	mg/kg	3	1	33%	0.14	11	No
VOA	Acetone	mg/kg	2	1	50%	0.050	3.2	No
VOA	Methylene chloride	mg/kg	2	1	50%	0.019	0.025	No

Washington Administrative Code (WAC) 173-340-747, "Deriving Soil Concentrations for Ground Water Protection."
GWP = groundwater protection.
SVOA = semi-volatile organic analyte.
VOA = volatile organic analyte.

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Table C-45. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards. (16 Pages)

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-7A						
Cadmium	0.07	1	1.32E+09	5.30E-11	1.39E-05	EPC less than background
Chromium	13.5	18.5	1.32E+09	1.02E-08	2.98E-07	EPC less than background
Copper	15	22	1.32E+09	1.14E-08	—	EPC less than background
Lead	23.3	10.2	1.32E+09	1.77E-08	—	No RBC
Nickel	13.7	19.1	1.32E+09	1.04E-08	—	EPC less than background
Uranium	0.995	NA	1.32E+09	7.54E-10	—	No RBC

EPC = exposure point concentration.
VF = volatilization factor.
NA = none available.
UCL = upper confidence limit.
RBC = risk-based concentration.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*
[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*
[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"
[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-45a. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for 216-T-26 Crib.

Contaminant	EPC	Exceed Soil RBC?	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-T-26						
Cadmium	0.46	EPC less than background	1.32E+09	3.48E-10	1.39E-05	EPC less than background
Chromium	10.8	EPC less than background	1.32E+09	8.18E-09	2.98E-07	EPC less than background
Copper	14	EPC less than background	1.32E+09	1.06E-08	—	EPC less than background
Lead	10.1	EPC less than background	1.32E+09	7.65E-09	—	EPC less than background
Nickel	13	EPC less than background	1.32E+09	9.85E-09	—	EPC less than background
Uranium	1.8	No	1.32E+09	1.36E-09	—	No RBC
Phenol	0.11	No	1.32E+09	8.33E-11	—	No RBC

EPC = exposure point concentration.
VF = volatilization factor.
NA = none available.
UCL = upper confidence limit.
RBC = risk-based concentration.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*

[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*

[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"

[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-45b. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for 216-B-36 Trench.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-36 Trench						
Aluminum	7,600	11,800	1.32E+09	5.76E-06	—	EPC less than background
Cadmium	0.1	1	1.32E+09	7.58E-11	1.39E-05	EPC less than background
Calcium	9,610	NA	1.32E+09	7.28E-06	—	No RBC
Chromium	11.6	18.5	1.32E+09	8.79E-09	2.98E-07	EPC less than background
Copper	15.1	22	1.32E+09	1.14E-08	—	EPC less than background
Iron	18,100	32,600	1.32E+09	1.37E-05	—	EPC less than background

Table C-45b. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for 216-B-36 Trench.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-36 Trench (cont'd.)						
Lead	8	10.2	1.32E+09	6.06E-09	—	EPC less than background
Magnesium	3,820	NA	1.32E+09	2.89E-06	—	No RBC
Manganese	287	512	1.32E+09	2.17E-07	4.90E-05	EPC less than background
Mercury	0.089	0.33	1.32E+09	6.74E-11	—	EPC less than background
Nickel	12.1	19.1	1.32E+09	9.17E-09	—	EPC less than background
Potassium	1,140	NA	1.32E+09	8.64E-07	—	No RBC
Sodium	551	NA	1.32E+09	4.17E-07	—	No RBC
Uranium	11	NA	1.32E+09	8.33E-09	—	No RBC
Vanadium	55.1	85.1	1.32E+09	4.17E-08	—	EPC less than background
Zinc	43.9	67.8	1.32E+09	3.33E-08	—	EPC less than background

EPC = exposure point concentration.
VF = volatilization factor.
NA = none available.
UCL = upper confidence limit.
RBC = risk-based concentration.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*
[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*
[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"
[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-45c. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-46 Trench.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-46 Trench						
Aluminum	4,720	11,800	1.32E+09	3.58E-06	—	EPC less than background
Antimony	5.7	NA	1.32E+09	4.32E-09	—	No RBC
Arsenic	2.7	6.5	1.32E+09	2.05E-09	5.81E-06	EPC less than background
Barium	70.7	132	1.32E+09	5.36E-08	5.00E-04	EPC less than background
Beryllium	0.44	1.5	1.32E+09	3.33E-10	—	EPC less than background
Cadmium	1.5	1	1.32E+09	1.14E-09	1.39E-05	No
Chromium	8.5	18.5	1.32E+09	6.44E-09	2.98E-07	EPC less than background
Cobalt	9.4	15.7	1.32E+09	7.12E-09	—	EPC less than background
Copper	17.8	22	1.32E+09	1.35E-08	—	EPC less than background
Iron	16,500	32,600	1.32E+09	1.25E-05	—	EPC less than background
Lead	5.7	10.2	1.32E+09	4.32E-09	—	EPC less than background
Manganese	267	512	1.32E+09	2.02E-07	4.90E-05	EPC less than background
Mercury	0.06	0.33	1.32E+09	4.55E-11	—	EPC less than background
Nickel	10.8	19.1	1.32E+09	8.18E-09	—	EPC less than background
Potassium	1250	NA	1.32E+09	9.47E-07	—	No RBC
Sodium	450	NA	1.32E+09	3.41E-07	—	No RBC
Thallium	0.6	NA	1.32E+09	4.55E-10	—	No RBC
Uranium	1.7	NA	1.32E+09	1.29E-09	—	No RBC
Vanadium	30.3	85.1	1.32E+09	2.30E-08	—	EPC less than background
Zinc	39.1	67.8	1.32E+09	2.96E-08	—	EPC less than background
4,4'-DDT	0.034	NA	1.32E+09	2.58E-11	—	No RBC
Aroclor-1254	0.34	NA	1.32E+09	2.58E-10	4.38E-05	No

Table C-45c. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-46 Trench.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-46 Trench (cont'd)						
Gamma-BHC (Lindane)	0.017	NA	1.32E+09	1.29E-11	—	No RBC
Heptachlor	0.017	NA	1.32E+09	1.29E-11	—	No RBC
4,6-sinitro-2-methylphenol	1.7	NA	1.32E+09	1.29E-09	—	No RBC
Benzoic acid	0.041	NA	1.32E+09	3.11E-11	—	No RBC
Bis(2-ethylhexyl) phthalate	0.17	NA	1.32E+09	1.29E-10	6.30E-03	No
Di-n-butylphthalate	0.096	NA	1.32E+09	7.27E-11	3.50E-01	No

EPC = exposure point concentration.
VF = volatilization factor.
NA = none available.
UCL = upper confidence limit.
RBC = risk-based concentration.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*

[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*

[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"

[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-45d. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-57 Trench.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-57 Trench						
Aluminum	3,410	11,800	1.32E+09	2.58E-06	—	EPC less than background
Arsenic	2.2	6.5	1.32E+09	1.67E-09	5.81E-06	EPC less than background
Barium	40.6	132	1.32E+09	3.08E-08	5.00E-04	EPC less than background
Beryllium	0.35	1.5	1.32E+09	2.65E-10	—	EPC less than background
Cadmium	0.72	1	1.32E+09	5.45E-10	1.39E-05	EPC less than background
Calcium	6,984	NA	1.32E+09	5.29E-06		No RBC
Chromium	8	18.5	1.32E+09	6.06E-09	2.98E-07	EPC less than background
Cobalt	6.8	15.7	1.32E+09	5.15E-09	—	EPC less than background
Copper	11.2	22	1.32E+09	8.48E-09	—	EPC less than background

Table C-45d. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-57 Trench.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-57 Trench (cont'd.)						
Iron	8,800	32,600	1.32E+09	6.67E-06	—	EPC less than background
Lead	5.5	10.2	1.32E+09	4.17E-09	—	EPC less than background
Magnesium	2,400	NA	1.32E+09	1.82E-06	—	No RBC
Manganese	188.5	512	1.32E+09	1.43E-07	4.90E-05	EPC less than background
Nickel	8.3	19.1	1.32E+09	6.29E-09	—	EPC less than background
Potassium	932	NA	1.32E+09	7.06E-07	—	No RBC
Silver	2.2	0.73	1.32E+09	1.67E-09	—	No RBC
Sodium	184	NA	1.32E+09	1.39E-07	—	No RBC
Uranium	1.8	NA	1.32E+09	1.36E-09	—	No RBC
Vanadium	15.8	85.1	1.32E+09	1.20E-08	—	EPC less than background
Zinc	24.7	67.8	1.32E+09	1.87E-08	—	EPC less than background
Bis(2-ethylhexyl) phthalate	0.17	NA	1.32E+09	1.29E-10	6.30E-03	No
Chrysene	0.04	NA	1.32E+09	3.03E-11	—	No RBC
Di-n-butylphthalate	2.4	NA	1.32E+09	1.82E-09	3.50E-01	No
Pyrene	0.049	NA	1.32E+09	3.71E-11	—	No RBC
4-methyl-2-pentanone	0.005	NA	1.32E+09	3.79E-12	—	No RBC
Acetone	0.022	NA	12,554	1.75E-06	3.50E-01	No
Methylene chloride	0.017	NA	2,425	7.01E-06	5.30E-02	No
Toluene	0.003	NA	3,553	8.44E-07	3.90E-01	No

EPC = exposure point concentration.
VF = volatilization factor.
NA = none available.
UCL = upper confidence limit.
RBC = risk-based concentration.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*

[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*

[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"

[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-45e. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-58 Trench.

Contaminant	Max Detect C-4174	Max Detect C-4304	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-58 Trench							
Arsenic	8.8	8.8	6.5	1.32E+09	6.67E-09	5.81E-06	No
Barium	70	87	132	1.32E+09	6.56E-08	5.00E-04	Max detect less than background
Bismuth	10	NA	NA	1.32E+09	7.48E-09	—	Max detect less than background
Chromium	6.2	4.8	18.5	1.32E+09	4.66E-09	2.98E-07	Max detect less than background
Nickel	7.9	11	19.1	1.32E+09	8.18E-09	—	Max detect less than background
Selenium	7.3	4.4	0.33	1.32E+09	5.56E-09	—	Max detect less than background
Aroclor-1254	0.93	NA	NA	1.32E+09	7.05E-10	4.38E-05	Max detect less than background
Diethylphthalate	0.49	NA	NA	1.32E+09	3.71E-10	2.8	Max detect less than background
Acetone	NA	52	NA	12,554	4.14E-03	0.35	Max detect less than background
Oil and grease	NA	1,350	NA	1.32E+09	1.02E-06	—	Max detect less than background

UCL = upper confidence limit.
VF = volatilization factor.
PEF = particulate emission factor
NA = none available.
RBC = risk-based concentration.

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*

[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*

[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"

[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-45f. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-43 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-43 Crib						
Aluminum	4,530	11,800	1.32E+09	3.43E-06	—	EPC less than background
Arsenic	2.2	6.5	1.32E+09	1.67E-09	5.81E-06	EPC less than background
Barium	92	132	1.32E+09	6.97E-08	5.00E-04	EPC less than background
Beryllium	0.42	1.5	1.32E+09	3.18E-10	—	EPC less than background
Calcium	10,335	NA	1.32E+09	7.83E-06	—	No RBC
Chromium	7.1	18.5	1.32E+09	5.38E-09	2.98E-07	EPC less than background
Cobalt	8.2	15.7	1.32E+09	6.21E-09	—	EPC less than background
Copper	15	22	1.32E+09	1.14E-08	—	EPC less than background
Iron	15,239	32,600	1.32E+09	1.15E-05	—	EPC less than background
Lead	4.9	10.2	1.32E+09	3.71E-09	—	EPC less than background
Magnesium	3,641	NA	1.32E+09	2.76E-06	—	No RBC
Manganese	259	512	1.32E+09	1.96E-07	4.90E-05	EPC less than background
Nickel	8.1	19.1	1.32E+09	6.14E-09	—	EPC less than background
Potassium	1,200	NA	1.32E+09	9.09E-07	—	No RBC
Silver	2.4	0.73	1.32E+09	1.82E-09	—	No RBC
Sodium	441	NA	1.32E+09	3.51E-02	—	No RBC
Vanadium	27	85.1	1.32E+09	2.05E-08	—	EPC less than background
Zinc	31	67.8	1.32E+09	2.35E-08	—	EPC less than background
Bis(2-ethylhexyl) phthalate	0.057	NA	1.32E+09	4.32E-11	6.30E-03	No
Di-n-butyl-phthalate	0.055	NA	1.32E+09	4.17E-11	3.50E-01	No
Pentachlorophenol	0.15	NA	1.32E+09	1.14E-10	—	No RBC
Acetone	0.082	NA	12,554	6.53E-06	3.50E-01	No

Table C-45f. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-43 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-43 Crib (cont'd.)						
Methylene chloride	0.031	NA	2,425	1.28E-05	5.30E-02	No

EPC = exposure point concentration.
VF = volatilization factor.
NA = none available.
UCL = upper confidence limit.
RBC = risk-based concentration.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*
[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*
[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"
[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-45g. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-44 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-44 Crib						
Aluminum	5,004	11,800	1.32E+09	3.79E-06	—	EPC less than background
Arsenic	2.2	6.5	1.32E+09	1.67E-09	5.81E-06	EPC less than background
Barium	72	132	1.32E+09	5.45E-08	5.00E-04	EPC less than background
Beryllium	0.42	1.5	1.32E+09	3.18E-10	—	EPC less than background
Calcium	9,140	NA	1.32E+09	6.92E-06	—	No RBC
Chromium	6.5	18.5	1.32E+09	4.92E-09	2.98E-07	EPC less than background
Cobalt	9	15.7	1.32E+09	6.82E-09	—	EPC less than background
Copper	13	22	1.32E+09	9.85E-09	—	EPC less than background
Iron	14,848	32,600	1.32E+09	1.12E-05	—	EPC less than background
Lead	4.6	10.2	1.32E+09	3.48E-09	—	EPC less than background
Magnesium	3,612	NA	1.32E+09	2.74E-06	—	No RBC
Manganese	286	512	1.32E+09	2.17E-07	4.90E-05	EPC less than background
Nickel	9	19.1	1.32E+09	6.82E-09	—	EPC less than background
Potassium	1,196	NA	1.32E+09	9.06E-07	—	No RBC
Silver	1.8	0.73	1.32E+09	1.36E-09	—	No RBC

Table C-45g. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-44 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-44 Crib (cont'd.)						
Sodium	248	NA	1.32E+09	1.88E-07	—	No RBC
Uranium	1.4	NA	1.32E+09	1.06E-09	—	No RBC
Vanadium	26	85.1	1.32E+09	1.97E-08	—	EPC less than background
Zinc	31	67.8	1.32E+09	2.35E-08	—	EPC less than background
2-chloronaphthalene	0.074	NA	1.32E+09	5.61E-11	—	No RBC
Benzoic acid	0.058	NA	1.32E+09	4.39E-11	—	No RBC
Bis(2-ethylhexyl) phthalate	0.12	NA	1.32E+09	9.09E-11	6.30E-03	No
Di-n-butylphthalate	0.062	NA	1.32E+09	4.70E-11	3.50E-01	No
Phenol	0.12	NA	1.32E+09	9.09E-11	—	No RBC
Methylene chloride	0.02	NA	2,425	8.25E-06	5.30E-02	No
Toluene	0.0034	NA	3,553	9.62E-07	3.90E-01	No

EPC = exposure point concentration.
VF = volatilization factor.
NA = none available.
UCL = upper confidence limit.
RBC = risk-based concentration.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*
[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*
[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"
[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-45h. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-45 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-45 Crib						
Nitrate	5.9	52	1.32E+09	4.47E-09	—	EPC less than background
Sulfate	8.7	237	1.32E+09	6.59E-09	—	EPC less than background
Aluminum	5,979	11,800	1.32E+09	4.53E-06	—	EPC less than background
Arsenic	2	6.5	1.32E+09	1.52E-09	5.81E-06	EPC less than background
Barium	69	132	1.32E+09	5.23E-08	5.00E-04	EPC less than background

Table C-45h. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-45 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-45 Crib (cont'd.)						
Beryllium	0.73	1.5	1.32E+09	5.53E-10	—	EPC less than background
Cadmium	0.95	1	1.32E+09	7.20E-10	1.39E-05	EPC less than background
Calcium	7,890	NA	1.32E+09	5.98E-06		No RBC
Chromium	12	18.5	1.32E+09	9.09E-09	2.98E-07	EPC less than background
Cobalt	10	1537	1.32E+09	7.58E-09	—	EPC less than background
Copper	13	22	1.32E+09	9.85E-09	—	EPC less than background
Iron	19,528	32,600	1.32E+09	1.48E-05	—	EPC less than background
Lead	18	10.2	1.32E+09	1.36E-08	—	No RBC
Magnesium	4,437	NA	1.32E+09	3.36E-06	—	No RBC
Manganese	304	512	1.32E+09	2.30E-07	4.90E-05	EPC less than background
Nickel	9.3	19	1.32E+09	7.05E-09	—	EPC less than background
Potassium	1,089	NA	1.32E+09	8.25E-07	—	No RBC
Silver	1.7	0.73	1.32E+09	1.29E-09	—	No RBC
Sodium	333	NA	1.32E+09	2.52E-07	—	No RBC
Thallium	0.11	NA	1.32E+09	8.33E-11	—	No RBC
Vanadium	41	85.1	1.32E+09	3.11E-08	—	EPC less than background
Zinc	38	67.8	1.32E+09	2.88E-08	—	EPC less than background
Bis(2-ethylhexyl) phthalate	0.073	NA	1.32E+09	5.53E-11	6.30E-03	No
Diethylphthalate	0.014	NA	1.32E+09	1.06E-11	—	No RBC
Hexadecanoic acid	0.19	NA	1.32E+09	1.44E-10	—	No RBC
Toluene	0.003	NA	3,553	8.49E-07	3.90E-01	No

EPC = exposure point concentration.
VF = volatilization factor.
NA = none available.
UCL = upper confidence limit.
RBC = risk-based concentration.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*

[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*

[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"

[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables." Table 749-3.

Table C-45i. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-47 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-47 Crib						
Aluminum	4,718	11,800	1.32E+09	3.57E-06	—	EPC less than background
Arsenic	2.3	6.5	1.32E+09	1.74E-09	5.81E-06	EPC less than background
Barium	75	132	1.32E+09	5.68E-08	5.00E-04	EPC less than background
Beryllium	0.28	1.5	1.32E+09	2.12E-10	—	EPC less than background
Cadmium	1	1	1.32E+09	7.58E-10	1.39E-05	EPC less than background
Calcium	8,536	NA	1.32E+09	6.47E-06	—	No RBC
Chromium	9	18.5	1.32E+09	6.82E-09	2.98E-07	EPC less than background
Cobalt	8	15.7	1.32E+09	6.06E-09	—	EPC less than background
Copper	12	22	1.32E+09	9.09E-09	—	EPC less than background
Iron	14,578	32,600	1.32E+09	1.10E-05	—	EPC less than background
Lead	5	10.2	1.32E+09	3.79E-09	—	EPC less than background
Magnesium	3,490	NA	1.32E+09	2.64E-06	—	No RBC
Manganese	268	512	1.32E+09	2.03E-07	4.90E-05	EPC less than background
Nickel	11	19.1	1.32E+09	8.33E-09	—	EPC less than background
Potassium	11,600	NA	1.32E+09	8.79E-06	—	No RBC
Sodium	258	NA	1.32E+09	1.95E-07	—	No RBC
Uranium	1.1	NA	1.32E+09	8.33E-10	—	No RBC
Vanadium	27	85.1	1.32E+09	2.05E-08	—	EPC less than background
Zinc	30	67.8	1.32E+09	2.27E-08	—	EPC less than background
Dichlorodiphenyltrichloroethane	0.011	NA	1.32E+09	8.33E-12	—	No RBC
Bis(2-ethylhexyl) phthalate	0.22	NA	1.32E+09	1.67E-10	6.30E-03	No
Di-n-butylphthalate	0.037	NA	1.32E+09	2.80E-11	3.50E-01	No

Table C-45i. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-47 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-47 Crib (cont'd.)						
Pentachlorophenol	0.15	NA	1.32E+09	1.14E-10	—	No RBC
Toluene	0.001	NA	3,553	2.81E-07	3.90E-01	No

EPC = exposure point concentration.
VF = volatilization factor.
NA = none available.
UCL = upper confidence limit.
RBC = risk-based concentration.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*

[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*

[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"

[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-45j. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-48 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-48 Crib						
Aluminum	5,695	11,800	1.32E+09	4.31E-06	—	EPC less than background
Arsenic	2.1	6.5	1.32E+09	1.59E-09	5.81E-06	EPC less than background
Barium	76	132	1.32E+09	5.76E-08	5.00E-04	EPC less than background
Beryllium	0.38	1.5	1.32E+09	2.88E-10	—	EPC less than background
Calcium	7,550	NA	1.32E+09	5.72E-06	—	EPC less than background
Chromium	8.4	18.5	1.32E+09	6.36E-09	2.98E-07	EPC less than background
Cobalt	9.1	15.7	1.32E+09	6.89E-09	—	EPC less than background
Copper	11	22	1.32E+09	8.33E-09	—	EPC less than background
Iron	16,849	32,600	1.32E+09	1.28E-05	—	EPC less than background
Lead	5.1	10.2	1.32E+09	3.86E-09	—	EPC less than background
Magnesium	3,756	NA	1.32E+09	2.85E-06	—	No RBC
Manganese	292	512	1.32E+09	2.21E-07	4.90E-05	EPC less than background
Nickel	15	19.1	1.32E+09	1.14E-08	—	EPC less than background
Potassium	1,335	NA	1.32E+09	1.01E-06	—	No RBC

Table C-45j. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-48 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-48 Crib (cont'd.)						
Sodium	237	NA	1.32E+09	1.80E-07	—	No RBC
Uranium	2.5	3.2	1.32E+09	1.89E-09	—	EPC less than background
Vanadium	35	85.1	1.32E+09	2.65E-08	—	EPC less than background
Zinc	34	67.8	1.32E+09	2.58E-08	—	EPC less than background
Dichlorodiphenyl-trichloroethane	0.0062	NA	1.32E+09	4.70E-12	—	No RBC
Bis(2-ethylhexyl) phthalate	0.26	NA	1.32E+09	1.97E-10	6.30E-03	No
Toluene	0.001	NA	3,553	2.81E-07	3.90E-01	No

EPC = exposure point concentration.
VF = volatilization factor.
NA = none available.
UCL = upper confidence limit.
RBC = risk-based concentration.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*
[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*
[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"
[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-45k. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-49 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-49 Crib						
Aluminum	5,138	11,800	1.32E+09	3.89E-06	—	EPC less than background
Arsenic	3.2	6.5	1.32E+09	2.42E-09	5.81E-06	EPC less than background
Barium	62	132	1.32E+09	4.70E-08	5.00E-04	EPC less than background
Beryllium	0.41	1.5	1.32E+09	3.11E-10	—	EPC less than background
Cadmium	0.68	1	1.32E+09	5.15E-10	—	EPC less than background
Calcium	7,179	NA	1.32E+09	5.44E-06	—	No RBC
Chromium	11	18.5	1.32E+09	8.33E-09	2.98E-07	EPC less than background
Cobalt	10	15.7	1.32E+09	7.58E-09	—	EPC less than background

Table C-45k. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-49 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-49 Crib (cont'd.)						
Copper	77	22	1.32E+09	5.83E-08	—	No RBC
Iron	18,646	32,600	1.32E+09	1.41E-05	—	EPC less than background
Lead	7	10.2	1.32E+09	5.30E-09	—	EPC less than background
Magnesium	3,805	NA	1.32E+09	2.88E-06	—	No RBC
Manganese	285	512	1.32E+09	2.16E-07	4.90E-05	EPC less than background
Nickel	9.9	19.1	1.32E+09	7.50E-09	—	EPC less than background
Potassium	1,070	NA	1.32E+09	8.11E-07	—	No RBC
Silver	1.8	0.73	1.32E+09	1.36E-09	—	No RBC
Sodium	306	NA	1.32E+09	2.32E-07	—	No RBC
Vanadium	43	85.1	1.32E+09	3.26E-08	—	EPC less than background
Zinc	36	67.8	1.32E+09	2.73E-08	—	EPC less than background
Bis(2-ethylhexyl) phthalate	0.071	NA	1.32E+09	5.38E-11	6.30E-03	No
Di-n-butylphthalate	3.1	NA	1.32E+09	2.35E-09	3.50E-01	No
Acetone	0.059	NA	12,554	4.70E-06	3.50E-01	No
Methylene chloride	0.026	NA	2,425	1.07E-05	5.30E-02	No

EPC = exposure point concentration.
UCL = upper confidence limit.
VF = volatilization factor.
RBC = risk-based concentration.
NA = none available.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*

[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*

[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"

[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-451. Comparison of Shallow Zone Concentrations with Industrial Air Risk Standards for the 216-B-50 Crib.

Contaminant	EPC	90% UCL Background	PEF/VF[b]	Max Air Conc.	Industrial Air RBC[c]	Exceed Air RBC?
216-B-50 Crib						
Aluminum	4,437	11,800	1.32E+09	3.36E-06	—	EPC less than background
Arsenic	1.8	6.5	1.32E+09	1.36E-09	5.81E-06	EPC less than background
Barium	67	132	1.32E+09	5.08E-08	5.00E-04	EPC less than background
Beryllium	0.41	1.5	1.32E+09	3.11E-10	—	EPC less than background
Calcium	7,605	NA	1.32E+09	5.76E-06	—	No RBC
Chromium	6.3	18.5	1.32E+09	4.77E-09	2.98E-07	EPC less than background
Cobalt	7.5	15.7	1.32E+09	5.68E-09	—	EPC less than background
Copper	11	22	1.32E+09	8.33E-09	—	EPC less than background
Iron	13,737	32,600	1.32E+09	1.04E-05	—	EPC less than background
Lead	4.3	10.2	1.32E+09	3.26E-09	—	EPC less than background
Magnesium	3,273	NA	1.32E+09	2.48E-06	—	No RBC
Manganese	270	512	1.32E+09	2.05E-07	4.90E-05	EPC less than background
Nickel	8.4	19.1	1.32E+09	6.36E-09	—	EPC less than background
Potassium	1,241	NA	1.32E+09	9.40E-07	—	No RBC
Sodium	232	NA	1.32E+09	1.76E-07	—	No RBC
Uranium	1.6	3.2	1.32E+09	1.21E-09	—	EPC less than background
Vanadium	25	85.1	1.32E+09	1.89E-08	—	EPC less than background
Zinc	29	67.8	1.32E+09	2.20E-08	—	EPC less than background
Di-n-butylphthalate	0.79	NA	1.32E+09	5.98E-10	3.50E-01	No

EPC = exposure point concentration.
VF = volatilization factor.
NA = none available.
UCL = upper confidence limit.
RBC = risk-based concentration.
PEF = particulate emission factor

[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*

[b] DOE/RL-2003-11, *Remedial Investigation Report for the 200-CW-5, 200-CW-2, 200-CW-4, and 200-SC-1 Operable Units.*

[c] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"

[d] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-46. Summary of RESRAD Input Parameters, Human Health Risk Assessment. (5 Pages)

Description	Parameter	200-TW-1/200-PW-5 Value	Rationale and Citation
Exposure pathways		External gamma: active Inhalation: active Plant ingestion: suppressed Meat ingestion: suppressed Milk ingestion: suppressed Aquatic foods: suppressed Drinking water: suppressed Soil ingestion: active Radon: suppressed	Based on 200-TW-1/200-TW-2 work plan conceptual exposure model (DOE/RL-2000-38) and refinement of the model as part of the RI report (DOE/RL-2002-42); for protection of groundwater evaluation, only the drinking water pathway is active.
R011 - CZ	Area of CZ	Varies by exposure area: see Table C-48	Site-specific areas from WIDS.
	Thickness of CZ (baseline)	Varies by exposure area: see Table C-48	Assumes that site is contaminated at 95% UCL from surface to 4.6 m bgs.
	Length parallel to aquifer flow	Varies by exposure area: see Table C-48	Site-specific.
	Radiation dose limit (industrial scenario)	15 mrem/yr	Risk framework.
	Elapsed time since waste placement	0	Environmental samples were collected in 2001.
	Exposure-point concentrations	Chemical-specific	See Tables C-2 through C-8 and Tables C-9 through C-15.
Exposure-point concentrations	Cover depth (no-cover)	0	Assumes that site is contaminated at 95% UCL from surface to 4.6 m bgs.
R013 - Cover and CZ Hydrological Data	Cover depth (cover)	Varies by exposure area: see Table 2-5 in this feasibility study	Represents actual conditions of cover based on RI results.
	Cover material density (baseline)	1.6	Site-specific.
	Cover material density (cover)	1.6	Site-specific.
	Cover erosion rate	0.001	RESRAD default.
	Density of CZ	1.6	Site-specific values based on RI results.

Table C-46. Summary of RESRAD Input Parameters, Human Health Risk Assessment. (5 Pages)

Description	Parameter	200-TW-1/200-PW-5 Value	Rationale and Citation
	CZ erosion rate	0.001	RESRAD default.
	CZ total porosity	0.43	Site-specific values based on physical property samples from RI and WHC-EP-0883.
	CZ field capacity	0.09	Site-specific values based on physical property samples from RI and WHC-EP-0883.
	CZ hydraulic conductivity	6570	WHC-SD-EN-SE-004.
	CZ b parameter	4.05	ANL/EAD-4, Table E:2; CCN 070578.
	Humidity in air	8	RESRAD default.
	Evapotranspiration coefficient	0.656	EPA/910/R-97/005; WDOH/320-015.
	Wind speed	3.4	PNNL-12087.
	Precipitation	0.16	Based on 16 cm (6.3 in.) average annual rainfall (DOE/RL-92-19).
	Irrigation rate	0	Industrial exposure scenario.
	Irrigation mode	Overhead	RESRAD default.
	Runoff coefficient	0.2	RESRAD default.
	Watershed area for nearby stream or pond	1.00E+06	RESRAD default.
	Accuracy for water/soil computations	0.001	RESRAD default.
	Density of SZ	1.9	Site-specific value based on RI results and BHI-01177.
R014 - SZ Hydrological Data	SZ total porosity	0.27	Site-specific values based on physical property samples from RI and WHC-EP-0883.
	SZ effective porosity	0.23	Site-specific values based on physical property samples from RI and WHC-EP-0883.
	SZ field capacity	0.04	Site-specific values based on physical property samples from RI and WHC-EP-0883.
	SZ hydraulic conductivity	365,000	WHC-SD-EN-SE-004.
	SZ b parameter	4.05	ANL/EAD-4, Table E:2; CCN 070578.
	Water table drop rate	0.001	RESRAD default.
	Well pump intake depth below water table	4.6	Typical RCRA well screen length.

Table C-46. Summary of RESRAD Input Parameters, Human Health Risk Assessment. (5 Pages)

Description	Parameter	200-TW-1/200-PW-5 Value	Rationale and Citation
	Nondispersion or mass-balance	Nondispersion	RESRAD default.
	Well pumping rate	250	RESRAD default.
	Number of unsaturated strata	1	Site-specific.
R015 - Uncontaminated and Unsaturated Strata Hydrological Data	Thickness - Strata 1	23.2	Site-specific values based on RI results and current water table elevation data.
	Soil density	1.9	Site-specific value based on RI results and BHI-01177.
	Total porosity	0.27	Site-specific values based on physical property samples from RI and WHC-EP-0883.
	Effective porosity	0.23	Site-specific values based on physical property samples from RI and WHC-EP-0883.
	Field capacity	0.04	Site-specific values based on physical property samples from RI and WHC-EP-0883.
	Soil-specific b parameter	4.05	ANL/EAD-4, Table E:2; CCN 070578.
	Hydraulic conductivity	700	WHC-SD-EN-SE-004.
R016 - Distribution Coefficients and Leach Rates for Individual Radionuclides	Distribution coefficients (K_d) for contaminated zone, uncontaminated zone, and SZ	Am-241: 300 Co-60: 1,200 Cs-137: 1,500 Eu-152/154/155: 300 Tritium (H-3): 0 Ni-63: 300 Np-237: 15	PNNL-11800.
	Saturated leach rate	0	RESRAD default.
	Saturated solubility	0	RESRAD default.
	Inhalation rate	7,300	WDOH/320-015.
R017 - Inhalation and External Gamma	Mass loading for inhalation	0.0001	WDOH/320-015.
	Dilution length for airborne dust	3	RESRAD default.
	Exposure duration	30	WAC 173-340.
	Inhalation shielding factor	0.4	RESRAD default.

Table C-46. Summary of RESRAD Input Parameters, Human Health Risk Assessment. (5 Pages)

Description	Parameter	200-TW-1/200-PW-5 Value	Rationale and Citation
	External gamma shielding factor	0.8	WDOH/320-015
	Indoor time fraction (industrial scenario)	0.137	200 Area industrial scenario; onsite 2,000 hr/yr (indoors 60%).
	Outdoor time fraction (industrial scenario)	0.091	200 Area industrial scenario; onsite 2,000 hr/yr (outdoors 40%).
	Shape factor	1	RESRAD default.
	Fruits, vegetables, and grain consumption	110	WDOH/320-015.
R018 - Ingestion Pathway Data, Dietary Parameters	Leafy vegetable consumption	2.7	WDOH/320-015.
	Milk consumption	100	WDOH/320-015.
	Meat and poultry consumption	36	WDOH/320-015.
	Fish consumption	5	WDOH/320-015.
	Other seafood consumption	0.9	WDOH/320-015.
	Soil Ingestion	36.5	WDOH/320-015.
	Drinking water intake	730	WDOH/320-015.
	Drinking water contamination fraction	1	RESRAD default.
	Household water contamination fraction	1	RESRAD default.
	Livestock water contamination fraction	1	RESRAD default.
	Irrigation water contamination fraction	0	RESRAD default.
	Aquatic food contamination fraction	1	RESRAD default.
	Plant food contamination fraction	-1	RESRAD default.
	Meat contamination fraction	-1	RESRAD default.
	Milk contamination fraction	-1	RESRAD default.
	Livestock fodder intake for meat	68	RESRAD default.
R019 - Ingestion Pathway Data, Nondietary	Livestock fodder intake for milk	55	RESRAD default.
	Livestock water intake for meat	50	RESRAD default.
	Livestock water intake for milk	160	RESRAD default.
	Livestock intake of soil	0.5	RESRAD default.

Table C-46. Summary of RESRAD Input Parameters, Human Health Risk Assessment. (5 Pages)

Description	Parameter	200-TW-1/200-PW-5 Value	Rationale and Citation
	Mass loading for foliar deposition	0.0001	RESRAD default.
	Depth of soil mixing layer	0.15	RESRAD default.
	Depth of roots	3	RESRAD default.
	Groundwater fractional usage - drinking water	1	RESRAD default.
	Groundwater fractional usage - household usage	1	RESRAD default.
	Groundwater fractional usage - livestock water	1	RESRAD default.
	Groundwater usage - irrigation	0	RESRAD default.
R021 - Radon	—	Not used	—

ANL/EAD-4, *User's Manual for RESRAD, Version 6.*
BHI-01177, *Borehole Summary Report for the 216-B-2-2 Ditch.*
CCN 070578, *Estimation of the Soil-Specific Exponential Parameter(s).*"
DOE/RL-92-19, *200 East Groundwater Aggregate Area Management Study Report.*
DOE/RL-2000-38, *200-TW-1 Scavenged Waste Group Operable Unit and 200-TW-2 Tank Waste Group Operable Unit RI/FS Work Plan.*
DOE/RL-2002-42, *Remedial Investigation Report for the 200-TW-1 and 200-TW-2 Operable Units (Includes the 200-PW-5 Operable Unit).*
EPA/910/R-97/005, *EPA Region 10 Supplemental Ecological Risk Assessment Guidance for Superfund.*
PNNL-11800, *Composite Analysis for Low-Level Waste Disposal in the 200 Area Plateau of the Hanford Site*
PNNL-12087, *Climatological Data Summary 1998 with Historical Data.*
Resource Conservation and Recovery Act of 1976, 42 U.S.C. 6901, et seq.
WAC 173-340, "Model Toxics Control Act – Cleanup."
Waste Information Data System report, Hanford Site database.
WDOH/320-015, *Hanford Guidance for Radiological Cleanup.*
WHC-EP-0883, *Variability and Scaling of Hydraulic Properties for 200 Area Soils, Hanford Site.*
WHC-SD-EN-SE-004, *Site Characterization Report: Results of Detailed Evaluation of the Suitability of the Site Proposed for Disposal of 200 Areas Treated Effluent.*

CZ = contaminated zone.
RCRA = *Resource Conservation and Recovery Act of 1976.*
RESRAD = RESidual RADioactivity.
RI = remedial investigation.
SZ = saturated zone.
UCL = upper confidence limit.
WIDS = Waste Information Data System.

Table C-47. Native American Exposure Scenario (from Harris and Harper 1997).

Exposure Route	Subsistence Intake	Exposure Frequency (day/yr)
Soil, ingestion	200 mg/day	180
Soil, dermal	1 mg/cm^2-day, 5,000 cm^2	180
Soil, inhalation (dust)	20 m^3/day	180
Soil, external	24 hr/day	180, 12 hr/day
Air, inhalation	20 m^3/day	365
Water, ingestion	3 L/day	365
Water, inhalation	15 m^3/day	365
Water, dermal	0.17 hr/day	365
Water, external	2.6 hr/day, swimming	70
Biota, fish	0 g/day[a]	365
Biota, meat (game)	250 g/day	365
Biota, fowl	44 g/day	365
Biota, other organs	54 g/day	365
Biota, breast milk	742 mL/day	365 for 1 to 2 yrs
Biota, fruit and vegetation	8.2 g/day or 574 g/70 kg-day	365
Sweat lodge, inhalation and dermal	1 hr/day	365

[a] No contaminated fish consumption is assumed from the 200-CW-1 waste sites because the contaminants currently in the vadose zone have been shown through modeling and comparison to groundwater protection standards to not impact the groundwater. Therefore, no impacts to the river or the fish are expected from these contaminants.

Harris, S. G. and B. L. Harper, 1997, "A Native American Exposure Scenario," *Risk Analysis*, Vol. 17, No. 6, Plenum Publishing Corporation, New York, New York.

Table C-48. Site-Specific RESRAD Input Parameters.

Parameter	216-B-43	216-B-44	216-B-45	216-B-47	216-B-48	216-B-49	216-B-50
R011 - CZ							
Area of CZ	529	529	529	529	529	529	529
Thickness of CZ (baseline)	4.6	4.6	4.6	4.6	4.6	4.6	4.6
Length parallel to aquifer flow (m)	13	13	13	13	13	13	13

CZ = contaminated zone.

Table C-49. Summary of RESRAD Modeling for Radionuclide Dose Rates Industrial, Direct-Contact Scenario – Without Cover Material, Human Health Risk Assessment. (3 Pages)

Total Dose (mrem/yr)	Time (years)	Primary Radionuclide	Percentage of Total Dose	Primary Pathway
216-B-43 Crib				
3.85E+00	0	Cesium-137	42.9%	Ground
		Radium-226	56.8%	
3.81E+00	1	Cesium-137	42.3%	Ground
		Radium-226	57.3%	
2.66E+00	50	Cesium-137	19.6%	Ground
		Radium-226	80.3%	
2.04E+00	150	Radium-226	97.4%	Ground
1.54E+00	500	Radium-226	100.0%	Ground
1.07E+00	1,000	Radium-226	100.0%	Ground
216-B-44 Crib				
4.58E+00	0	Cesium-137	47.7%	Ground
		Radium-226	52.1%	
4.53E+00	1	Cesium-137	47.1%	Ground
		Radium-226	52.7%	
3.02E+00	50	Cesium-137	22.8%	Ground
		Radium-226	77.2%	
2.24E+00	150	Radium-226	97.0%	Ground
1.68E+00	500	Radium-226	100.0%	Ground
1.17E+00	1,000	Radium-226	100.0%	Ground
216-B-45 Crib				
3.11E+00	0	Cesium-137	47.4%	Ground
		Radium-226	52.4%	
3.08E+00	1	Cesium-137	46.9%	Ground
		Radium-226	53.0%	
2.06E+00	50	Cesium-137	22.6%	Ground
		Radium-226	77.4%	
1.53E+00	150	Radium-226	97.0%	Ground
1.15E+00	500	Radium-226	100.0%	Ground
7.98E-01	1,000	Radium-226	100.0%	Ground
216-B-47 Crib				
5.12E+01	0	Cesium-137	61.1%	Ground
		Radium-226	38.8%	
5.05E+01	1	Cesium-137	60.6%	Ground
		Radium-226	39.4%	

Table C-49. Summary of RESRAD Modeling for Radionuclide Dose Rates Industrial, Direct-Contact Scenario – Without Cover Material, Human Health Risk Assessment. (3 Pages)

Total Dose (mrem/yr)	Time (years)	Primary Radionuclide	Percentage of Total Dose	Primary Pathway
2.93E+01	50	Cesium-137 Radium-226	33.6% 66.3%	Ground
1.91E+01	150	Radium-226	94.9%	Ground
1.40E+01	500	Radium-226	100.0%	Ground
9.73E+00	1,000	Radium-226	100.0%	Ground
216-B-48 Crib				
4.68E+00	0	Cesium-137 Radium-226	35.3% 63.7%	Ground
4.64E+00	1	Cesium-137 Radium-226	34.8% 64.2%	Ground
3.45E+00	50	Cesium-137 Radium-226	15.1% 84.5%	Ground
2.77E+00	150	Radium-226	98.1%	Ground
2.10E+00	500	Radium-226	100.0%	Ground
1.46E+00	1,000	Radium-226	100.0%	Ground
216-B-49 Crib				
9.21E-01	0	Cesium-137	96.1%	Ground
9.00E-01	1	Cesium-137	96.1%	Ground
2.89E-01	50	Cesium-137	96.3%	Ground
2.86E-02	150	Cesium-137	96.6%	Ground
8.70E-06	500	Cesium-137	97.6%	Ground
8.27E-11	1,000	Cesium-137	98.5%	Ground
216-B-50 Crib				
4.37E+00	0	Cesium-137 Radium-226	49.9% 50.0%	Ground
4.32E+00	1	Cesium-137 Radium-226	49.4% 50.6%	Ground
2.82E+00	50	Cesium-137 Radium-226	24.4% 75.6%	Ground
2.06E+00	150	Radium-226	96.7%	Ground
1.54E+00	500	Radium-226	100.0%	Ground
1.07E+00	1,000	Radium-226	100.0%	Ground

Table C-49. Summary of RESRAD Modeling for Radionuclide Dose Rates Industrial, Direct-Contact Scenario – Without Cover Material, Human Health Risk Assessment. (3 Pages)

Total Dose (mrem/yr)	Time (years)	Primary Radionuclide	Percentage of Total Dose	Primary Pathway
216-B-26 Trench				
3.1E+05	0	Cesium-137	99%	Ground
3.1E+05	1	Cesium-137	99%	Ground
9.9E+04	50	Cesium-137	99%	Ground
9.8E+03	150	Cesium-137	99%	Ground
6.9E+00	500	Plutonium-239 Cesium-137	49% 43%	Ground
3.5E+00	1,000	Plutonium-239	94%	Ground

Table C-50. Summary of RESRAD Modeling for Radionuclide Risk Industrial, Direct-Contact Scenario – Without Cover Material, Human Health Risk Assessment. (3 Pages)

Total Risk	Time (years)	Primary Radionuclide	Percentage of Total Risk	Primary Pathway
216-B-43 Crib				
7.66E-05	0	Cesium-137 Radium-226	35.3% 64.4%	Ground
7.59E-05	1	Cesium-137 Radium-226	34.8% 64.9%	Ground
5.63E-05	50	Cesium-137 Radium-226	15.1% 84.8%	Ground
4.53E-05	150	Radium-226	98.1%	Ground
3.44E-05	500	Radium-226	100.0%	Ground
2.39E-05	1,000	Radium-226	100.0%	Ground
216-B-44 Crib				
8.97E-05	0	Cesium-137 Radium-226	39.9% 60.0%	Ground
8.88E-05	1	Cesium-137 Radium-226	39.3% 60.5%	Ground
6.34E-05	50	Cesium-137 Radium-226	17.8% 82.2%	Ground
4.96E-05	150	Radium-226	97.7%	Ground
3.75E-05	500	Radium-226	100.0%	Ground
2.60E-05	1,000	Radium-226	100.0%	Ground
216-B-45 Crib				
6.10E-05	0	Cesium-137 Radium-226	39.6% 60.3%	Ground
6.04E-05	1	Cesium-137 Radium-226	39.1% 60.8%	Ground
4.32E-05	50	Cesium-137 Radium-226	17.6% 82.3%	Ground
3.39E-05	150	Radium-226	97.8%	Ground
2.56E-05	500	Radium-226	100.0%	Ground
1.78E-05	1,000	Radium-226	100.0%	Ground
216-B-47 Crib				
9.61E-04	0	Cesium-137 Radium-226	53.3% 46.7%	Ground
9.49E-04	1	Cesium-137	52.7%	Ground
		Radium-226	47.2%	
5.95E-04	50	Cesium-137	27.1%	Ground

Table C-50. Summary of RESRAD Modeling for Radionuclide Risk Industrial, Direct-Contact Scenario – Without Cover Material, Human Health Risk Assessment. (3 Pages)

Total Risk	Time (years)	Primary Radionuclide	Percentage of Total Risk	Primary Pathway
		Radium-226	72.9%	
4.20E-04	150	Radium-226	96.2%	Ground
3.13E-04	500	Radium-226	100.0%	Ground
2.17E-04	1,000	Radium-226	100.0%	Ground
216-B-48 Crib				
9.51E-05	0	Cesium-137	28.4%	Ground
		Radium-226	70.7%	
9.44E-05	1	Cesium-137	28.0%	Ground
		Radium-226	71.1%	
7.39E-05	50	Cesium-137	11.5%	Ground
		Radium-226	88.1%	
6.14E-05	150	Radium-226	98.6%	Ground
4.69E-05	500	Radium-226	100.0%	Ground
3.25E-05	1,000	Radium-226	100.0%	Ground
216-B-49 Crib				
1.51E-05	0	Cesium-137	95.9%	Ground
1.48E-05	1	Cesium-137	95.9%	Ground
4.75E-06	50	Cesium-137	96.0%	Ground
4.69E-07	150	Cesium-137	96.4%	Ground
1.43E-10	500	Cesium-137	97.4%	Ground
1.36E-15	1,000	Cesium-137	98.4%	Ground
216-B-50 Crib				
8.50E-05	0	Cesium-137	42.0%	Ground
		Radium-226	58.0%	
8.42E-05	1	Cesium-137	41.5%	Ground
		Radium-226	58.5%	
5.90E-05	50	Cesium-137	19.1%	Ground
		Radium-226	80.9%	
4.55E-05	150	Radium-226	97.6%	Ground
3.44E-05	500	Radium-226	100.0%	Ground
2.39E-05	1,000	Radium-226	100.0%	Ground

Table C-50. Summary of RESRAD Modeling for Radionuclide Risk
Industrial, Direct-Contact Scenario – Without Cover Material,
Human Health Risk Assessment. (3 Pages)

Total Risk	Time (years)	Primary Radionuclide	Percentage of Total Risk	Primary Pathway
		216-B-26 Trench		
4.3	0	Cesium-137	99%	Ground
4.2	1	Cesium-137	99%	Ground
1.4	50	Cesium-137	99%	Ground
0.13	150	Cesium-137	99%	Ground
5.0E-05	500	Plutonium-239 Cesium-137	49% 43%	Ground
8.9E-06	1,000	Plutonium-239	94%	Ground

Table C-51. Summary of RESRAD Modeling for Radionuclide Dose Rates Native American, Direct-Contact Scenario – Without Cover Material, Human Health Risk Assessment. (3 Pages)

Total Dose (mrem/yr)	Time (years)	Primary Radionuclide	Percentage of Total Dose	Primary Pathway
216-B-43 Crib				
5.89E+01	0	Cesium-137	19.5%	Plant
		Radium-226	33.0%	
		Strontium-90	46.1%	
5.82E+01	1	Cesium-137	19.3%	Plant
		Radium-226	33.9%	
		Strontium-90	45.5%	
3.90E+01	50	Radium-226	69.7%	Plant
		Strontium-90	20.9%	
2.85E+01	150	Radium-226	96.1%	Plant
2.13E+01	500	Radium-226	100.0%	Plant
1.48E+01	1,000	Radium-226	99.9%	Plant
216-B-44 Crib				
5.28E+01	0	Cesium-137	28.7%	Ground
		Radium-226	40.1%	
		Strontium-90	31.2%	
5.24E+01	1	Cesium-137	28.3%	Ground
		Radium-226	41.1%	
		Strontium-90	30.7%	
3.94E+01	50	Cesium-137	12.1%	Plant
		Radium-226	75.3%	
		Strontium-90	12.6%	
3.08E+01	150	Radium-226	97.0%	Plant
2.32E+01	500	Radium-226	100.0%	Plant
1.61E+01	1,000	Radium-226	100.0%	Plant
216-B-45 Crib				
3.53E+01	0	Cesium-137	29.0%	Ground
		Radium-226	41.0%	
		Strontium-90	27.5%	
3.50E+01	1	Cesium-137	28.6%	Ground
		Radium-226	42.0%	
		Strontium-90	27.0%	
2.64E+01	50	Cesium-137	12.2%	Plant
		Radium-226	76.6%	
		Strontium-90	11.0%	
2.10E+01	150	Radium-226	97.2%	Plant

Table C-51. Summary of RESRAD Modeling for Radionuclide Dose Rates Native American, Direct-Contact Scenario – Without Cover Material, Human Health Risk Assessment. (3 Pages)

Total Dose (mrem/yr)	Time (years)	Primary Radionuclide	Percentage of Total Dose	Primary Pathway
1.59E+01	500	Radium-226	100.0%	Plant
1.10E+01	1,000	Radium-226	100.0%	Plant
216-B-47 Crib				
4.61E+02	0	Cesium-137	47.2%	Ground
		Radium-226	38.3%	
		Strontium-90	14.5%	
4.57E+02	1	Cesium-137	46.5%	Ground
		Radium-226	39.3%	
		Strontium-90	14.3%	
3.35E+02	50	Cesium-137	20.4%	Ground
		Radium-226	73.6%	
2.57E+02	150	Radium-226	96.7%	Plant
1.93E+02	500	Radium-226	100.0%	Plant
1.34E+02	1,000	Radium-226	100.0%	Plant
216-B-48 Crib				
1.33E+02	0	Radium-226	19.9%	Plant
		Strontium-90	71.5%	
1.31E+02	1	Radium-226	20.6%	Plant
		Strontium-90	70.9%	
6.91E+01	50	Radium-226	53.6%	Plant
		Strontium-90	41.2%	
4.02E+01	150	Radium-226	92.8%	Plant
2.90E+01	500	Radium-226	100.0%	Plant
2.01E+01	1,000	Radium-226	100.0%	Plant
216-B-49 Crib				
7.59E+01	0	Strontium-90	91.9%	Plant
7.41E+01	1	Strontium-90	91.9%	Plant
2.29E+01	50	Strontium-90	91.5%	Plant
2.07E+00	150	Strontium-90	90.7%	Plant
4.67E-04	500	Cesium-137	12.6%	Plant
		Strontium-90	87.4%	
2.95E-09	1,000	Cesium-137	19.2%	Plant
		Strontium-90	80.8%	
216-B-50 Crib				
3.82E+01	0	Cesium-137	39.7%	Ground
		Radium-226	50.8%	

Table C-51. Summary of RESRAD Modeling for Radionuclide Dose Rates Native American, Direct-Contact Scenario – Without Cover Material, Human Health Risk Assessment. (3 Pages)

Total Dose (mrem/yr)	Time (years)	Primary Radionuclide	Percentage of Total Dose	Primary Pathway
3.80E+01	1	Cesium-137	39.0%	Ground
		Radium-226	51.9%	
3.27E+01	50	Cesium-137	14.6%	Ground
		Radium-226	83.1%	
2.79E+01	150	Radium-226	98.1%	Plant
2.13E+01	500	Radium-226	100.0%	Plant
1.48E+01	1,000	Radium-226	100.0%	Plant

Table C-52. Summary of RESRAD Modeling for Radionuclide Risk Native American, Direct-Contact Scenario – Without Cover Material, Human Health Risk Assessment. (4 Pages)

Total Risk	Time (years)	Primary Radionuclide	Percentage of Total Risk	Primary Pathway
216-B-43 Crib				
9.81E-04	0	Cesium-137	19.2%	Ground
		Radium-226	34.8%	
		Strontium-90	37.3%	
9.68E-04	1	Cesium-137	19.0%	Ground
		Radium-226	35.2%	
		Strontium-90	36.9%	
6.66E-04	50	Radium-226	49.4%	Ground
		Lead-210	19.7%	
		Strontium-90	16.5%	
4.63E-04	150	Radium-226	66.0%	Ground
		Lead-210	30.5%	
3.47E-04	500	Radium-226	68.2%	Ground
		Lead-210	31.8%	
2.41E-04	1,000	Radium-226	68.2%	Ground
		Lead-210	31.8%	
216-B-44 Crib				
9.02E-04	0	Cesium-137	27.5%	Ground
		Radium-226	41.2%	
		Strontium-90	24.6%	
8.94E-04	1	Cesium-137	27.1%	Ground
		Radium-226	41.6%	
		Strontium-90	24.2%	
6.47E-04	50	Cesium-137	12.1%	Ground
		Lead-210	22.1%	
		Radium-226	55.5%	
		Strontium-90	10.3%	
5.01E-04	150	Lead-210	30.8%	Ground
		Radium-226	66.5%	
3.78E-04	500	Lead-210	31.8%	Ground
		Radium-226	68.2%	
2.63E-04	1,000	Lead-210	31.8%	Ground
		Radium-226	68.2%	
216-B-45 Crib				
6.27E-04	0	Cesium-137	26.8%	Ground
		Radium-226	40.5%	

Table C-52. Summary of RESRAD Modeling for Radionuclide Risk Native American, Direct-Contact Scenario – Without Cover Material, Human Health Risk Assessment. (4 Pages)

Total Risk	Time (years)	Primary Radionuclide	Percentage of Total Risk	Primary Pathway
		Strontium-90	20.8%	
6.20E-04	1	Cesium-137	26.4%	Ground
		Radium-226	41.0%	
		Strontium-90	20.6%	
4.76E-04	50	Cesium-137	11.1%	Ground
		Lead-210	20.6%	
		Radium-226	51.5%	
3.42E-04	150	Lead-210	30.8%	Ground
		Radium-226	66.6%	
2.59E-04	500	Lead-210	31.8%	Ground
		Radium-226	68.2%	
1.79E-04	1,000	Lead-210	31.8%	Ground
		Radium-226	68.2%	
216-B-47 Crib				
8.06E-03	0	Cesium-137	44.1%	Ground
		Radium-226	38.5%	
		Strontium-90	11.2%	
7.98E-03	1	Cesium-137	43.6%	Ground
		Radium-226	38.8%	
		Strontium-90	11.0%	
5.57E-03	50	Cesium-137	20.1%	Ground
		Lead-210	21.4%	
		Radium-226	53.6%	
4.20E-03	150	Lead-210	30.6%	Ground
		Radium-226	66.2%	
3.15E-03	500	Lead-210	31.8%	Ground
		Radium-226	68.2%	
2.19E-03	1,000	Lead-210	31.8%	Ground
		Radium-226	68.2%	
216-B-48 Crib				
2.01E-03	0	Radium-226	23.2%	Plant
		Strontium-90	63.8%	
1.98E-03	1	Radium-226	23.5%	Plant
		Strontium-90	63.2%	
1.07E-03	50	Lead-210	16.7%	Plant
		Radium-226	41.9%	

Table C-52. Summary of RESRAD Modeling for Radionuclide Risk Native American, Direct-Contact Scenario – Without Cover Material, Human Health Risk Assessment. (4 Pages)

Total Risk	Time (years)	Primary Radionuclide	Percentage of Total Risk	Primary Pathway
		Strontium-90	35.9%	
6.50E-04	150	Lead-210	29.7%	Ground
		Radium-226	64.1%	
4.73E-04	500	Lead-210	31.8%	Ground
		Radium-226	68.2%	
3.28E-04	1,000	Lead-210	31.8%	Ground
		Radium-226	68.2%	
216-B-49 Crib				
1.04E-03	0	Strontium-90	90.3%	Plant
1.02E-03	1	Strontium-90	90.3%	Plant
3.14E-04	50	Cesium-137	10.1%	Plant
		Strontium-90	89.9%	
2.85E-05	150	Cesium-137	11.0%	Plant
		Strontium-90	89.0%	
6.46E-09	500	Cesium-137	14.9%	Plant
		Strontium-90	85.1%	
4.14E-14	1,000	Cesium-137	22.4%	Plant
		Strontium-90	77.6%	
216-B-50 Crib				
7.23E-04	0	Cesium-137	34.4%	Ground
		Radium-226	47.2%	
7.16E-04	1	Cesium-137	33.9%	Ground
		Radium-226	47.6%	
6.04E-04	50	Cesium-137	12.9%	Ground
		Lead-210	21.7%	
		Radium-226	54.4%	
4.56E-04	150	Lead-210	31.0%	Ground
		Radium-226	67.1%	
3.47E-04	500	Lead-210	31.8%	Ground
		Radium-226	68.2%	
2.41E-04	1,000	Lead-210	31.8%	Ground
		Radium-226	68.2%	

Table C-53. Summary of RESRAD Modeling for Radionuclide Dose Rates Groundwater Protection Pathway, Human Health Risk Assessment. (2 Pages)

Total Dose (mrem/yr)	Time (years)	Primary Radionuclide	Percentage of Total Dose	Primary Pathway
216-B-43 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
6.83E-01	50	Technetium-99	99.9%	Drinking water
1.24E-02	150	Technetium-99	100.0%	Drinking water
1.13E-04	500	Plutonium-238	100.0%	Drinking water
5.51E-06	1,000	Plutonium-238	100.0%	Drinking water
216-B-44 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
6.50E-01	50	Technetium-99	100.0%	Drinking water
1.18E-02	150	Technetium-99	100.0%	Drinking water
7.49E-03	500	Plutonium-238	100.0%	Drinking water
3.65E-04	1,000	Plutonium-238	100.0%	Drinking water
216-B-45 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
3.25E-01	50	Technetium-99	99.9%	Drinking water
5.92E-03	150	Technetium-99	100.0%	Drinking water
1.53E-02	500	Plutonium-238	100.0%	Drinking water
7.45E-04	1,000	Plutonium-238	100.0%	Drinking water
216-B-47 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
9.12E-02	50	Technetium-99	99.8%	Drinking water
1.66E-03	150	Technetium-99	100.0%	Drinking water
2.72E-02	500	Plutonium-238	100.0%	Drinking water
1.32E-03	1,000	Plutonium-238	100.0%	Drinking water
216-B-48 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
6.50E-01	50	Technetium-99	100.0%	Drinking water
1.18E-02	150	Technetium-99	100.0%	Drinking water
8.66E-03	500	Plutonium-238	100.0%	Drinking water
4.22E-04	1,000	Plutonium-238	100.0%	Drinking water

Table C-53. Summary of RESRAD Modeling for Radionuclide Dose Rates Groundwater Protection Pathway, Human Health Risk Assessment. (2 Pages)

Total Dose (mrem/yr)	Time (years)	Primary Radionuclide	Percentage of Total Dose	Primary Pathway
		216-B-49 Crib		
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
2.96E-01	50	Technetium-99	100.0%	Drinking water
5.38E-03	150	Technetium-99	100.0%	Drinking water
8.07E-04	500	Plutonium-238	100.0%	Drinking water
3.94E-05	1,000	Plutonium-238	100.0%	Drinking water
		216-B-50 Crib		
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
4.92E-01	50	Technetium-99	100.0%	Drinking Water
7.81E-03	150	Technetium-99	100.0%	Drinking Water
6.75E-04	500	Plutonium-238	100.0%	Drinking Water
3.29E-05	1,000	Plutonium-238	100.0%	Drinking Water
		216-B-26 Trench		
0.0E+00	0	--	--	--
0.0E+00	1	--	--	--
0.0E+00	50	--	--	--
360	68	Technetium-99	100%	Drinking water
0.0E+00	150	--	--	--
0.0E+00	500	--	--	--
0.0E+00	1,000	--	--	--

Table C-54. Summary of RESRAD Modeling for Radionuclide Risk Groundwater Protection Pathway, Human Health Risk Assessment. (2 Pages)

Total Risk	Time (years)	Primary Radionuclide	Percentage of Total Risk	Primary Pathway
216-B-43 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
2.12E-04	50	Technetium-99	100.0%	Drinking water
3.18E-07	150	Technetium-99	100.0%	Drinking water
8.35E-10	500	Uranium-234	100.0%	Drinking water
3.69E-11	1,000	Uranium-234	98.5%	Drinking water
216-B-44 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
2.02E-04	50	Technetium-99	100.0%	Drinking water
3.03E-07	150	Technetium-99	100.0%	Drinking water
5.53E-08	500	Uranium-234	100.0%	Drinking water
2.44E-09	1,000	Uranium-234	98.5%	Drinking water
216-B-45 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
1.01E-04	50	Technetium-99	100.0%	Drinking water
1.52E-07	150	Technetium-99	100.0%	Drinking water
1.13E-07	500	Uranium-234	100.0%	Drinking water
4.98E-09	1,000	Uranium-234	98.5%	Drinking water
216-B-47 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
2.83E-05	50	Technetium-99	99.9%	Drinking water
4.24E-08	150	Technetium-99	100.0%	Drinking water
2.01E-07	500	Uranium-234	100.0%	Drinking water
8.86E-09	1,000	Uranium-234	98.5%	Drinking water
216-B-48 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
2.02E-04	50	Technetium-99	100.0%	Drinking water
3.03E-07	150	Technetium-99	100.0%	Drinking water
6.40E-08	500	Uranium-234	100.0%	Drinking water
2.83E-09	1,000	Uranium-234	98.5%	Drinking water

Table C-54. Summary of RESRAD Modeling for Radionuclide Risk Groundwater Protection Pathway, Human Health Risk Assessment. (2 Pages)

Total Risk	Time (years)	Primary Radionuclide	Percentage of Total Risk	Primary Pathway
216-B-49 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
9.19E-05	50	Technetium-99	100.0%	Drinking water
1.38E-07	150	Technetium-99	100.0%	Drinking water
5.97E-09	500	Uranium-234	100.0%	Drinking water
2.63E-10	1,000	Uranium-234	98.5%	Drinking water
216-B-50 Crib				
0.00E+00	0	--	--	--
0.00E+00	1	--	--	--
1.33E-04	50	Technetium-99	100.0%	Drinking water
2.00E-07	150	Technetium-99	100.0%	Drinking water
4.99E-09	500	Uranium-234	100.0%	Drinking water
2.20E-10	1,000	Uranium-234	98.5%	Drinking water
216-B-26 Trench				
0.0E+00	0	--	--	--
0.0E+00	1	--	--	--
0.0E+00	50	--	--	--
1.1E-03	68	Technetium-99	100%	Drinking water
0.0E+00	150	--	--	--
0.0E+00	500	--	--	--
0.0E+00	1,000	--	--	--

Table C-55. Summary of Soil Samples Included in the Ecological Risk Assessment, Ecological Risk Assessment. (2 Pages)

Exposure Area	Station ID	Sample ID	Depth Interval (ft)	Date Collected	Comment
216-B-43	299-E33-314	B067Y9	2 to 5	April 23, 1992	Shallow
216-B-43	299-E33-296	B015L7	2.5 to 4.5	November 7, 1991	Shallow
216-B-43	299-E33-315	B06801	3 to 5.5	April 29, 1992	Shallow
216-B-43	299-E33-314	B067Z1	10 to 13	April 23, 1992	Shallow
216-B-43	299-E33-315	B06803	10 to 12.5	April 29, 1992	Shallow
216-B-43	299-E33-296	B015M3	10.4 to 12.9	November 12, 1999	Shallow
216-B-44	299-E33-297	B01SG1	3 to 6	March 25, 1992	Shallow
216-B-44	299-E33-316	B01SD1	3 to 6	March 18, 1992	Shallow
216-B-44	299-E33-316	B01SD4	3 to 6	March 18, 1992	Shallow
216-B-44	299-E33-317	B01SJ1	3 to 6	April 3, 1992	Shallow
216-B-44	299-E33-297	B01SG5	9 to 11.5	March 25, 1992	Shallow
216-B-44	299-E33-316	B01SD5	9 to 12	March 18, 1992	Shallow
216-B-44	299-E33-317	B01SJ3	9 to 11.5	April 3, 1992	Shallow
216-B-45	299-E33-298	B01S91	2 to 5	February 28, 1992	Shallow
216-B-45	299-E33-318	B015P2	3 to 5.5	January 20, 1992	Shallow
216-B-45	299-E33-319	B01SB5	3 to 6	March 10, 1992	Shallow
216-B-45	299-E33-319	B01SB7	3 to 6	March 10, 1992	Shallow
216-B-45	299-E33-298	B01S93	10 to 13	February 28, 1992	Shallow
216-B-45	299-E33-318	B015Q0	10 to 12.5	January 20, 1992	Shallow
216-B-45	299-E33-319	B01SB9	10 to 13	March 10, 1992	Shallow
216-B-47	299-E33-320	B01SD8	2.5 to 5	April 14, 1992	Shallow
216-B-47	299-E33-321	B06817	3 to 5.5	May 6, 1992	Shallow
216-B-47	299-E33-300	B067Z7	3.2 to 5.7	April 27, 1992	Shallow
216-B-47	299-E33-320	B01SG4	11.5 to 14	April 15, 1992	Shallow
216-B-47	299-E33-321	B06819	12.5 to 15	May 7, 1992	Shallow
216-B-47	299-E33-300	B067Z9	13.5 to 16	April 28, 1992	Shallow
216-B-47	299-E33-300	B06800	13.5 to 16	April 28, 1992	Shallow
216-B-48	299-E33-323	B01SH1	3 to 5.5	March 31, 1992	Shallow
216-B-48	299-E33-322	B01SC3	9 to 11.5	March 12, 1992	Shallow
216-B-48	299-E33-301	B01SF5	10 to 12.5	March 20, 1992	Shallow
216-B-48	299-E33-323	B01SH5	10 to 12.5	March 31, 1992	Shallow
216-B-49	299-E33-313	B01S83	2 to 4.5	January 23, 1992	Shallow
216-B-49	299-E33-312	B015L9	2.5 to 5	November 8, 1991	Shallow
216-B-49	299-E33-302	B00X67	3 to 5.5	July 25, 1991	Shallow
216-B-49	299-E33-302	B00X69	8.5 to 11	July 25, 1991	Shallow
216-B-49	299-E33-313	B01S85	9 to 11.5	January 24, 1992	Shallow

Table C-55. Summary of Soil Samples Included in the Ecological Risk Assessment, Ecological Risk Assessment. (2 Pages)

Exposure Area	Station ID	Sample ID	Depth Interval (ft)	Date Collected	Comment
216-B-49	299-E33-312	B015M1	10 to 12.5	November 11, 1999	Shallow
216-B-50	299-E33-309	B015H7	3.5 to 6	October 17, 1999	Shallow
216-B-50	299-E33-308	B015L1	4.6 to 7	November 4, 1991	Shallow
216-B-50	299-E33-308	B015L3	9.8 to 11.8	November 4, 1991	Shallow
216-B-50	299-E33-309	B015J9	11 to 15	October 17, 1999	Shallow
216-B-50	299-E33-303	B015G7	12 to 16	October 2, 1991	Shallow

ID = identification.
Shallow = 0 to 4.6 m (0 to 15 ft) below ground surface.

Table C-56. Summary of Statistics for Shallow Zone Soils from 216-B-43 Crib, Nonradiological Constituents – Ecological Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	Average Concentration	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis	WAC 173-340-900, Table 749-3 Screening Value	EPC Exceed WAC 173-340-900, Table 749-3 Value?
METAL	Aluminum	mg/kg	3	3	100%	--	--	3,330	4,530	3,980	5,601	5,002	4,530	Max detect	NA	--
METAL	Arsenic	mg/kg	5	5	100%	--	--	1.6	2.3	1.9	2.2	2.2	2.2	Lognormal	7.0	No
METAL	Barium	mg/kg	5	5	100%	--	--	53	101	67	92	86	92	Lognormal	102.0	No
METAL	Beryllium	mg/kg	5	3	60%	0.31	0.36	0.35	0.42	0.31	0.63	0.43	0.42	Max detect	NA	No
METAL	Calcium	mg/kg	5	5	100%	--	--	6,220	11,400	7,936	10,335	9,865	10,335	Lognormal	NA	--
METAL	Chromium	mg/kg	5	4	80%	4.9	4.9	5.8	7.1	5.8	11	7.6	7.1	Max detect	67.0	No
METAL	Cobalt	mg/kg	5	3	60%	8.2	8.7	6.2	8.8	6.3	9.7	8.2	8.2	Normal	NA	No
METAL	Copper	mg/kg	5	5	100%	--	--	9.5	16	12	15	14	15	Lognormal	217.0	No
METAL	Iron	mg/kg	5	5	100%	--	--	10,300	15,900	12,640	15,239	14,761	15,239	Lognormal	NA	--
METAL	Lead	mg/kg	4	4	100%	--	--	3.4	4.9	4.1	5.6	5.0	4.9	Max detect	118.0	No
METAL	Magnesium	mg/kg	5	5	100%	--	--	2,750	3,800	3,250	3,711	3,641	3,641	Normal	NA	--
METAL	Manganese	mg/kg	5	5	100%	--	--	219	264	240	261	259	259	Normal	1500.0	No
METAL	Nickel	mg/kg	5	5	100%	--	--	5.7	8.3	7.2	8.3	8.1	8.1	Normal	980.0	No
METAL	Potassium	mg/kg	5	4	80%	995	995	952	1,200	949	1,503	1,208	1,200	Max detect	NA	--
METAL	Silver	mg/kg	5	1	20%	1.6	2.1	2.5	2.5	1.2	2.4	1.9	2.4	Lognormal	NA	No
METAL	Sodium	mg/kg	5	5	100%	--	--	147	441	262	540	385	441	Max detect	NA	--
METAL	Vanadium	mg/kg	5	4	80%	23	23	18	29	21	33	27	27	Normal	NA	No
METAL	Zinc	mg/kg	5	5	100%	--	--	23	32	27	31	31	31	Normal	360.0	No
SVOA	Bis(2-ethylhexyl) phthalate	mg/kg	5	1	20%	0.33	0.35	0.057	0.057	0.15	0.32	0.20	0.057	Max detect	NA	--
SVOA	Di-n-butylphthalate	mg/kg	5	1	20%	0.33	0.35	0.055	0.055	0.15	0.33	0.20	0.055	Max detect	NA	No
SVOA	Pentachlorophenol	mg/kg	5	1	20%	1.7	1.8	0.15	0.15	0.73	4.1	1.0	0.15	Max detect	4.5	No
VOA	Acetone	mg/kg	5	1	20%	0.0080	0.010	0.082	0.082	0.020	0.96	0.053	0.082	Max detect	NA	--
VOA	Methylene chloride	mg/kg	5	1	20%	0.0040	0.0060	0.031	0.031	0.0082	0.18	0.020	0.031	Max detect	NA	--

Washington Administrative Code (WAC) 173-340-900, "Tables," Table 749-3.
EPC = exposure point concentration.
NA = not available.
RAD_D = decayed radiological
SVOA = semi-volatile organic analyte.
UCL = upper confidence limit.
VOA = volatile organic analyte.

Table C-57. Summary of Statistics for Shallow Zone Soils from 216-B-44 Crib, Nonradiological Constituents – Ecological Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	Average Concentration	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis	WAC 173-340-900, Table 749-3 Screening Value	EPC Exceed WAC 173-340-900, Table 749-3 Value?
METAL	Aluminum	mg/kg	6	6	100%	--	--	3,760	5,680	4,363	5,004	4,942	5,004	Lognormal	NA	--
METAL	Arsenic	mg/kg	6	6	100%	--	--	1.1	2.2	1.9	2.5	2.2	2.2	Max detect	7.0	No
METAL	Barium	mg/kg	6	6	100%	--	--	51	80	63	72	71	72	Lognormal	102.0	No
METAL	Beryllium	mg/kg	6	6	100%	--	--	0.23	0.45	0.34	0.46	0.42	0.42	Normal	NA	No
METAL	Calcium	mg/kg	6	6	100%	--	--	6,200	10,700	7,590	9,140	8,947	9,140	Lognormal	NA	--
METAL	Chromium	mg/kg	6	6	100%	--	--	4.6	7.4	5.5	6.5	6.3	6.5	Lognormal	67.0	No
METAL	Cobalt	mg/kg	6	6	100%	--	--	6.7	10	7.8	9.0	8.9	9.0	Lognormal	NA	--
METAL	Copper	mg/kg	6	6	100%	--	--	8.9	14	11	13	13	13	Lognormal	217.0	No
METAL	Iron	mg/kg	6	6	100%	--	--	11,400	15,800	13,367	14,848	14,679	14,848	Lognormal	NA	--
METAL	Lead	mg/kg	6	6	100%	--	--	3.0	5.3	3.8	4.6	4.5	4.6	Lognormal	118.0	No
METAL	Magnesium	mg/kg	6	6	100%	--	--	2,780	3,990	3,210	3,612	3,572	3,612	Lognormal	NA	--
METAL	Manganese	mg/kg	6	6	100%	--	--	216	310	254	286	282	286	Lognormal	1,500.0	No
METAL	Nickel	mg/kg	6	6	100%	--	--	4.2	9.0	7.3	10	9.0	9.0	Max detect	980.0	No
METAL	Potassium	mg/kg	6	6	100%	--	--	733	1,380	987	1,196	1,161	1,196	Lognormal	NA	--
METAL	Silver	mg/kg	6	1	17%	1.7	2.1	2.4	2.4	1.1	1.8	1.6	1.8	Lognormal	NA	No
METAL	Sodium	mg/kg	6	6	100%	--	--	120	250	185	248	227	248	Lognormal	NA	--
METAL	Uranium	mg/kg	6	1	17%	0.50	1.0	1.5	1.5	0.55	1.4	0.94	1.4	Lognormal	NA	--
METAL	Vanadium	mg/kg	6	6	100%	--	--	20	28	23	26	26	26	Lognormal	NA	--
METAL	Zinc	mg/kg	6	6	100%	--	--	24	34	28	31	31	31	Lognormal	360.0	No
SVOA	2-chloronaphthalene	mg/kg	6	2	33%	0.34	0.38	0.065	0.074	0.14	0.27	0.19	0.074	Max detect	NA	--
SVOA	Benzoic acid	mg/kg	4	1	25%	1.6	1.9	0.058	0.058	0.66	13,589	1.1	0.058	Max detect	NA	--
SVOA	Bis(2-ethylhexyl) phthalate	mg/kg	6	1	17%	0.075	0.38	0.12	0.12	0.14	0.37	0.19	0.12	Max detect	NA	--
SVOA	Di-n-butylphthalate	mg/kg	6	1	17%	0.062	0.38	0.062	0.062	0.13	0.45	0.19	0.062	Max detect	NA	--
SVOA	Phenol	mg/kg	6	1	17%	0.33	0.38	0.12	0.12	0.17	0.19	0.19	0.12	Max detect	NA	--
VOA	Methylenechloride	mg/kg	6	1	17%	0.0080	0.019	0.022	0.022	0.0093	0.020	0.015	0.020	Lognormal	NA	--
VOA	Toluene	mg/kg	6	1	17%	0.0050	0.0060	0.0040	0.0040	0.0028	0.0034	0.0033	0.0034	Lognormal	NA	--

Washington Administrative Code (WAC) 173-340-900, "Tables," Table 749-3.
EPC = exposure point concentration.
NA = not available.
RAD_D = decayed radiological.
SVOA = semi-volatile organic analyte.
UCL = upper confidence limit.
VOA = volatile organic analyte.

Table C-58. Summary of Statistics for Shallow Zone Soils from 216-B-45 Crib, Nonradiological Constituents – Ecological Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	Average Concentration	95% UCL Lognormal Result	95% UCL Normal Result	EPC	WAC 173-340 Screening Value	WAC 173-340-900, Table 749-3 Screening Value	EPC Exceed WAC 173-340-900, Table 749-3 Value?
GENCH	Nitrate	mg/kg	1	1	100%	--	--	5.9	5.9	5.9	--	--	5.9	NA	--	Max detect
GENCH	Sulfate	mg/kg	1	1	100%	--	--	8.7	8.7	8.7	--	--	8.7	NA	--	Max detect
GENOR	Total organic carbon	mg/kg	1	1	100%	--	--	92	92	92	--	--	92	NA	--	Max detect
METAL	Aluminum	mg/kg	7	7	100%	--	--	3,520	7,130	4,790	5,979	5,780	5,979	NA	--	Lognormal
METAL	Arsenic	mg/kg	7	7	100%	--	--	1.3	2.2	1.8	2.1	2.0	2.0	7.0	No	Normal
METAL	Barium	mg/kg	7	7	100%	--	--	55	77	64	69	69	69	102.0	No	Lognormal
METAL	Beryllium	mg/kg	7	6	86%	0.20	0.20	0.23	0.73	0.36	0.74	0.50	0.73	NA	No	Max detect
METAL	Cadmium	mg/kg	7	3	43%	0.60	0.63	0.80	1.3	0.63	1.4	0.95	0.95	14.0	No	Normal
METAL	Calcium	mg/kg	7	7	100%	--	--	4,920	9,060	6,660	7,890	7,686	7,890	NA	--	Lognormal
METAL	Chromium	mg/kg	7	5	71%	4.7	6.8	4.4	12	6.2	12	8.7	12	67.0	No	Lognormal
METAL	Cobalt	mg/kg	7	7	100%	--	--	5.4	13	8.0	10	9.8	10	NA	No	Lognormal
METAL	Copper	mg/kg	7	7	100%	--	--	9.1	15	11	13	13	13	217.0	No	Lognormal
METAL	Iron	mg/kg	7	7	100%	--	--	10,100	24,700	15,129	19,528	18,667	19,528	NA	--	Lognormal
METAL	Lead	mg/kg	7	7	100%	--	--	3.1	28	7.3	18	14	18	118.0	No	Lognormal
METAL	Magnesium	mg/kg	7	7	100%	--	--	2,400	5,270	3,527	4,437	4,254	4,437	NA	--	Lognormal
METAL	Manganese	mg/kg	7	7	100%	--	--	196	368	259	304	299	304	1,500.0	No	Lognormal
METAL	Nickel	mg/kg	7	6	86%	3.8	3.8	5.7	12	7.0	14	9.3	9.3	980.0	No	Normal
METAL	Potassium	mg/kg	7	7	100%	--	--	684	1,320	931	1,089	1,071	1,089	NA	--	Lognormal
METAL	Silver	mg/kg	7	2	29%	0.14	0.85	1.6	1.7	0.72	4.6	1.2	1.7	NA	--	Max detect
METAL	Sodium	mg/kg	7	6	86%	133	133	138	436	238	529	333	333	NA	--	Normal
METAL	Thallium	mg/kg	7	1	14%	0.38	0.42	0.11	0.11	0.19	0.24	0.22	0.11	NA	--	Max detect
METAL	Vanadium	mg/kg	7	7	100%	--	--	17	47	29	41	37	41	NA	--	Lognormal
METAL	Zinc	mg/kg	7	7	100%	--	--	21	46	31	38	37	38	360.0	No	Lognormal
RAD_D	Thorium-228, decayed	pCi/g	6	6	100%	--	--	0.0069	0.0086	0.0078	0.0085	0.0084	0.0084	NA	--	Normal
SVOA	Bis(2-ethylhexyl) phthalate	mg/kg	5	3	60%	0.35	0.35	0.021	0.073	0.096	1.00	0.17	0.073	NA	--	Max detect
SVOA	Diethylphthalate	mg/kg	5	1	20%	0.34	0.35	0.014	0.014	0.14	4.2	0.21	0.014	NA	--	Max detect
SVOA	Hexadecanoic acid (9CI)	mg/kg	1	1	100%	--	--	0.19	0.19	0.19	--	--	0.19	NA	--	Max detect
VOA	Toluene	mg/kg	5	3	60%	0.0050	0.0050	0.0010	0.0030	0.0024	0.0048	0.0032	0.0030	NA	--	Max detect

Washington Administrative Code (WAC) 173-340-900, "Tables," Table 749-3

EPC = exposure point concentration.
GENCH = general chemical.
NA = not available.
PEST = pesticide.
RAD_D = decayed radiological.
SVOA = semi-volatile organic analyte.
UCL = upper confidence limit.
VOA = volatile organic analyte.

Table C-59. Summary of Statistics for Shallow Zone Soils from 216-B-47 Crib, Nonradiological Constituents – Ecological Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	Average Concentration	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis	WAC 173-340-900, Table 749-3 Screening Value	EPC Exceed WAC 173-340-900, Table 749-3 Value?
METAL	Aluminum	mg/kg	6	6	100%	--	--	3,300	4,850	4,268	4,830	4,718	4,718	Normal	NA	--
METAL	Arsenic	mg/kg	6	6	100%	--	--	1.7	2.6	2.0	2.3	2.3	2.3	Lognormal	7.0	No
METAL	Barium	mg/kg	6	6	100%	--	--	52	77	67	77	75	75	Normal	102.0	No
METAL	Beryllium	mg/kg	6	3	50%	0.20	0.39	0.26	0.30	0.22	0.36	0.28	0.28	Normal	NA	No
METAL	Cadmium	mg/kg	6	2	33%	0.78	0.83	1.1	1.3	0.67	1.4	1.0	1.0	Normal	14.0	No
METAL	Calcium	mg/kg	6	6	100%	--	--	5,990	9,690	7,267	8,536	8,371	8,536	Lognormal	NA	--
METAL	Chromium	mg/kg	6	6	100%	--	--	5.3	9.6	7.2	9.0	8.6	9.0	Lognormal	67.0	No
METAL	Cobalt	mg/kg	6	4	67%	10	10	7.3	8.0	6.9	8.5	8.0	8.0	Max detect	NA	--
METAL	Copper	mg/kg	6	6	100%	--	--	11	13	11	12	12	12	Lognormal	217.0	No
METAL	Iron	mg/kg	6	6	100%	--	--	11,800	15,400	13,100	14,578	14,435	14,578	Lognormal	NA	--
METAL	Lead	mg/kg	6	6	100%	--	--	3.0	5.8	3.9	5.0	4.8	5.0	Lognormal	118.0	No
METAL	Magnesium	mg/kg	6	6	100%	--	--	2,870	3,490	3,267	3,521	3,490	3,490	Max detect	NA	--
METAL	Manganese	mg/kg	6	6	100%	--	--	220	282	247	268	266	268	Lognormal	1500.0	No
METAL	Nickel	mg/kg	6	6	100%	--	--	6.8	14	8.7	11	11	11	Lognormal	980.0	No
METAL	Potassium	mg/kg	6	6	100%	--	--	726	11,600	2,814	18,655	6,360	11,600	Max detect	NA	--
METAL	Sodium	mg/kg	6	6	100%	--	--	111	288	194	319	258	258	Normal	NA	--
METAL	Uranium	mg/kg	6	1	17%	0.50	8.0	1.1	1.1	1.1	10	2.3	1.1	Max detect	NA	--
METAL	Vanadium	mg/kg	6	6	100%	--	--	17	29	23	28	27	27	Normal	NA	--
METAL	Zinc	mg/kg	6	6	100%	--	--	25	32	28	31	30	30	Normal	360.0	No
PEST	Dichlorodiphenyltrichloroethane	mg/kg	6	1	17%	0.032	0.034	0.011	0.011	0.016	0.019	0.018	0.011	Max detect	NA	--
SVOA	Bis(2-ethylhexyl) phthalate	mg/kg	6	2	33%	0.33	0.35	0.081	0.27	0.17	0.26	0.22	0.22	Normal	NA	--
SVOA	Di-n-butylphthalate	mg/kg	6	1	17%	0.33	0.36	0.037	0.037	0.15	0.37	0.19	0.037	Max detect	NA	--
SVOA	Pentachlorophenol	mg/kg	6	2	33%	1.6	1.8	0.059	0.15	0.60	11	0.92	0.15	Max detect	4.5	No
VOA	Toluene	mg/kg	6	1	17%	0.0050	0.0060	0.0010	0.0010	0.0023	0.0037	0.0029	0.0010	Max detect	NA	--

Washington Administrative Code (WAC) 173-340-900, "Tables," Table 749-3.
EPC = exposure point concentration.
NA = not available.
SVOA = semi-volatile organic analyte.
UCL = upper confidence limit.
VOA = volatile organic analyte.

Table C-60. Summary of Statistics for Shallow Zone Soils from 216-B-48 Crib, Nonradiological Constituents – Ecological Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	Average Concentration	95% UCL Lognormal Result	95% UCL Normal Result	EPC	WAC 173-340 Screening Value	WAC 173-340-900, Table 749-3 Screening Value	EPC Exceed WAC 173-340-900, Table 749-3 Value?
METAL	Aluminum	mg/kg	6	6	100%	--	--	3,910	6,590	4,742	5,695	5,566	5,695	NA	--	Lognormal
METAL	Arsenic	mg/kg	6	6	100%	--	--	1.0	2.1	1.8	2.3	2.1	2.1	7.0	No	Normal
METAL	Barium	mg/kg	6	6	100%	--	--	56	86	67	76	75	76	102.0	No	Lognormal
METAL	Beryllium	mg/kg	6	4	67%	0.20	0.38	0.23	0.44	0.28	0.57	0.38	0.38	NA	No	Normal
METAL	Calcium	mg/kg	6	6	100%	--	--	4,650	7,960	6,237	8,095	7,550	7,550	NA	--	Normal
METAL	Chromium	mg/kg	6	6	100%	--	--	5.1	9.8	6.7	8.4	8.1	8.4	67.0	No	Lognormal
METAL	Cobalt	mg/kg	6	5	83%	9.1	9.1	6.6	11	7.5	9.9	9.1	9.1	NA	--	Normal
METAL	Copper	mg/kg	6	6	100%	--	--	8.9	12	10	11	11	11	217.0	No	Normal
METAL	Iron	mg/kg	6	6	100%	--	--	11,600	19,100	14,200	16,849	16,470	16,849	NA	--	Lognormal
METAL	Lead	mg/kg	6	6	100%	--	--	2.9	5.4	4.4	5.5	5.1	5.1	118.0	No	Normal
METAL	Magnesium	mg/kg	6	6	100%	--	--	2,850	3,950	3,377	3,756	3,709	3,756	NA	--	Lognormal
METAL	Manganese	mg/kg	6	6	100%	--	--	226	325	259	292	289	292	1500.0	No	Lognormal
METAL	Nickel	mg/kg	6	6	100%	--	--	6.2	17	10.0	15	13	15	980.0	No	Lognormal
METAL	Potassium	mg/kg	6	6	100%	--	--	886	1,470	1,095	1,335	1,293	1,335	NA	--	Lognormal
METAL	Sodium	mg/kg	6	6	100%	--	--	100	249	185	283	237	237	NA	--	Normal
METAL	Uranium	mg/kg	6	3	50%	0.50	0.70	1.3	2.5	1.0	7.5	1.8	2.5	NA	--	Max detect
METAL	Vanadium	mg/kg	6	6	100%	--	--	20	40	27	35	33	35	NA	--	Lognormal
METAL	Zinc	mg/kg	6	6	100%	--	--	26	38	30	34	34	34	360.0	No	Lognormal
PEST	Dichlorodiphenyltrichloroethane	mg/kg	6	1	17%	0.032	0.034	0.0062	0.0062	0.015	0.023	0.018	0.0062	NA	--	Max detect
SVOA	Bis(2-ethylhexyl) phthalate	mg/kg	6	2	33%	0.34	0.56	0.10	0.28	0.20	0.31	0.26	0.26	NA	--	Normal
VOA	Toluene	mg/kg	6	2	33%	0.0050	0.0060	0.0010	0.0010	0.0021	0.0040	0.0028	0.0010	NA	--	Max detect

Washington Administrative Code (WAC) 173-340-900, "Tables," Table 749-3.
EPC = exposure point concentration.
NA = not available.
SVOA = semi-volatile organic analyte.
UCL = upper confidence limit.
VOA = volatile organic analyte.

Table C-61. Summary of Statistics for Shallow Zone Soils from 216-B-49 Crib, Nonradiological Constituents – Ecological Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	Average Concentration	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis	WAC 173-340-900, Table 749-3 Screening Value	EPC Exceed WAC 173-340-900, Table 749-3 Value?
METAL	Aluminum	mg/kg	6	6	100%	--	--	3,090	5,600	3,922	5,138	4,852	5,138	Lognormal	NA	--
METAL	Arsenic	mg/kg	6	6	100%	--	--	1.2	4.1	1.8	3.2	2.8	3.2	Lognormal	7.0	No
METAL	Barium	mg/kg	6	6	100%	--	--	47	66	55	62	61	62	Lognormal	102.0	No
METAL	Beryllium	mg/kg	6	6	100%	--	--	0.26	0.44	0.32	0.41	0.39	0.41	Lognormal	NA	No
METAL	Cadmium	mg/kg	6	1	17%	0.59	0.80	0.89	0.89	0.43	0.68	0.62	0.68	Lognormal	14.0	No
METAL	Calcium	mg/kg	6	6	100%	--	--	5,890	7,610	6,587	7,247	7,179	7,179	Normal	NA	--
METAL	Chromium	mg/kg	6	6	100%	--	--	3.8	12	6.3	11	9.0	11	Lognormal	67.0	No
METAL	Cobalt	mg/kg	6	6	100%	--	--	5.2	11	7.0	10.0	9.1	10.0	Lognormal	NA	--
METAL	Copper	mg/kg	6	6	100%	--	--	8.3	77	21	84	44	77	Max detect	217.0	No
METAL	Iron	mg/kg	6	6	100%	--	--	8,820	19,800	12,523	18,646	16,598	18,646	Lognormal	NA	--
METAL	Lead	mg/kg	6	6	100%	--	--	2.0	7.7	4.0	7.0	5.7	7.0	Lognormal	118.0	No
METAL	Magnesium	mg/kg	6	6	100%	--	--	2,370	3,980	2,993	3,805	3,628	3,805	Lognormal	NA	--
METAL	Manganese	mg/kg	6	6	100%	--	--	182	312	231	285	274	285	Lognormal	1,500.0	No
METAL	Nickel	mg/kg	6	6	100%	--	--	4.9	11	7.0	9.9	9.0	9.9	Lognormal	980.0	No
METAL	Potassium	mg/kg	6	6	100%	--	--	732	1,160	936	1,104	1,070	1,070	Normal	NA	--
METAL	Silver	mg/kg	4	2	50%	1.2	1.4	1.5	1.8	1.2	5.8	1.8	1.8	Max detect	NA	--
METAL	Sodium	mg/kg	6	6	100%	--	--	108	316	199	306	259	306	Lognormal	NA	--
METAL	Vanadium	mg/kg	6	6	100%	--	--	12	43	24	52	36	43	Max detect	NA	--
METAL	Zinc	mg/kg	6	6	100%	--	--	19	38	26	36	33	36	Lognormal	360.0	No
SVOA	Bis(2-ethylhexyl) phthalate	mg/kg	6	2	33%	0.34	0.34	0.068	0.071	0.14	0.24	0.18	0.071	Max detect	NA	--
SVOA	Di-n-butylphthalate	mg/kg	6	2	33%	0.34	0.82	2.1	3.1	1.0	31	2.1	3.1	Max detect	NA	--
VOA	Acetone	mg/kg	6	2	33%	0.010	0.013	0.018	0.059	0.016	0.12	0.034	0.059	Max detect	NA	--
VOA	Methylenechloride	mg/kg	6	2	33%	0.0050	0.0080	0.023	0.026	0.010	0.089	0.019	0.026	Max detect	NA	--

Washington Administrative Code (WAC) 173-340-900, "Tables," Table 749-3.

EPC = exposure point concentration.
NA = not available.
SVOA = semi-volatile organic analyte.
UCL = upper confidence limit.
VOA = volatile organic analyte.

Table C-62. Summary of Statistics for Shallow Zone Soils from 216-B-50 Crib, Nonradiological Constituents – Ecological Risk Assessment.

Constituent Class	Constituent Name	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	Average Concentration	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis	WAC 173-340-900, Table 749-3 Screening Value	EPC Exceed WAC 173-340-900, Table 749-3 Value?
METAL	Aluminum	mg/kg	6	6	100%	--	--	3,890	4,630	4,183	4,437	4,420	4,437	Lognormal	NA	--
METAL	Arsenic	mg/kg	6	6	100%	--	--	1.0	1.8	1.6	2.0	1.8	1.8	Max detect	7.0	No
METAL	Barium	mg/kg	6	6	100%	--	--	60	71	64	67	67	67	Lognormal	102.0	No
METAL	Beryllium	mg/kg	6	6	100%	--	--	0.28	0.44	0.35	0.41	0.40	0.41	Lognormal	NA	No
METAL	Calcium	mg/kg	6	6	100%	--	--	4,180	7,850	6,433	8,165	7,605	7,605	Normal	NA	--
METAL	Chromium	mg/kg	6	6	100%	--	--	4.5	6.8	5.5	6.3	6.2	6.3	Lognormal	67.0	No
METAL	Cobalt	mg/kg	6	6	100%	--	--	6.2	7.7	7.0	7.6	7.5	7.5	Normal	NA	--
METAL	Copper	mg/kg	6	6	100%	--	--	9.1	12	10	11	11	11	Lognormal	217.0	No
METAL	Iron	mg/kg	6	6	100%	--	--	11,200	14,500	12,617	13,867	13,737	13,737	Normal	NA	--
METAL	Lead	mg/kg	6	6	100%	--	--	2.7	4.6	3.7	4.5	4.3	4.3	Normal	118.0	No
METAL	Magnesium	mg/kg	6	6	100%	--	--	2,900	3,380	3,117	3,273	3,262	3,273	Lognormal	NA	--
METAL	Manganese	mg/kg	6	6	100%	--	--	219	283	253	273	270	270	Normal	1,500.0	No
METAL	Nickel	mg/kg	6	6	100%	--	--	5.6	9.0	7.4	8.8	8.4	8.4	Normal	980.0	No
METAL	Potassium	mg/kg	6	4	67%	905	1,000	975	1,450	925	1,651	1,241	1,241	Normal	NA	--
METAL	Sodium	mg/kg	6	6	100%	--	--	94	275	182	272	232	232	Normal	NA	--
METAL	Uranium	mg/kg	6	1	17%	0.30	0.80	1.6	1.6	0.49	1.8	0.94	1.6	Max detect	NA	--
METAL	Vanadium	mg/kg	6	6	100%	--	--	16	27	21	26	25	25	Normal	NA	--
METAL	Zinc	mg/kg	6	6	100%	--	--	24	32	27	29	29	29	Lognormal	360.0	No
SVOA	Di-n-butylphthalate	mg/kg	2	2	100%	--	--	0.082	0.79	0.44	3.33E+14	2.7	0.79	Max detect	NA	--

Washington Administrative Code (WAC) 173-340-900, "Tables," Table 749-3.

EPC = exposure point concentration.
NA = not available.
SVOA = semi-volatile organic analyte.
UCL = upper confidence limit.
VOA = volatile organic analyte.

Table C-63. Summary of Statistics for Shallow Zone Soils from 216-B-43 Crib, Radionuclides – Ecological Risk Assessment.

Constituent Class	Constituent Name	Constituent Abbrev	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	DOE Screening Level	Max Detect Exceed DOE Value?	Average Concentration	DOE Screening Level	Max Detect Exceed DOE Value?	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis
RAD_D	Cesium-137, decayed	Cs-137	pCi/g	6	6	100%	--	--	0.28	2.8	20.0	No	1.4	20.0	No	8.4	2.3	2.8	Max detect
RAD_D	Gross alpha, decayed	--	pCi/g	6	5	83%	5.0	5.0	4.7	7.8	NA	--	5.2	NA	--	7.9	6.6	6.6	Normal
RAD_D	Gross beta, decayed	--	pCi/g	6	6	100%	--	--	24	44	NA	--	34	NA	--	45	42	42	Normal
RAD_D	Plutonium-238, decayed	Pu-238	pCi/g	6	1	17%	0.010	0.060	0.036	0.036	NA	--	0.019	NA	--	0.064	0.029	0.029	Normal
RAD_D	Plutonium-239, decayed	Pu-239	pCi/g	6	1	17%	0.010	0.030	0.020	0.020	6,000.0	No	0.010	6,000.0	No	0.024	0.015	0.015	Normal
RAD_D	Potassium-40, decayed	--	pCi/g	6	6	100%	--	--	12	13	NA	--	13	NA	--	13	13	13	Normal
RAD_D	Radium-226, decayed	Ra-226	pCi/g	6	6	100%	--	--	0.79	1.3	3.0	No	0.99	3.0	No	1.1	1.1	1.1	Lognormal
RAD_D	Strontium-90, decayed	Sr-90	pCi/g	6	6	100%	--	--	0.11	2.8	20.0	No	0.73	20.0	No	6.1	1.6	2.8	Max detect
RAD_D	Technetium-99, decayed	Tc-99	pCi/g	6	1	17%	1.0	2.0	1.1	1.1	4,000.0	No	0.68	4,000.0	No	1.0	0.92	0.92	Normal
RAD_D	Thorium-228, decayed	Th-228	pCi/g	6	6	100%	--	--	0.0068	0.0088	NA	--	0.0080	NA	--	0.0088	0.0087	0.0087	Normal

DOE = U.S. Department of Energy.
EPC = exposure point concentration.
NA = not available.
RAD_D = decayed radiological.
UCL = upper confidence limit.

Table C-64. Summary of Statistics for Shallow Zone Soils from 216-B-44 Crib, Radionuclides – Ecological Risk Assessment.

Constituent Class	Constituent Name	Constituent Abbrev	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	DOE Screening Level	Max Detect Exceed DOE Value?	Average Concen-tration	DOE Screening Level	Max Detect Exceed DOE Value?	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis
RAD_D	Cesium-137, decayed	Cs-137	pCi/g	6	6	100%	--	--	0.25	3.7	20.0	No	1.6	20.0	No	12	2.7	3.7	Max detect
RAD_D	Gross alpha, decayed	--	pCi/g	6	6	100%	--	--	5.3	15	NA	--	8.2	NA	--	12	11	12	Lognormal
RAD_D	Gross beta, decayed	--	pCi/g	6	6	100%	--	--	28	48	NA	--	35	NA	--	41	41	41	Lognormal
RAD_D	Plutonium-239, decayed	Pu-239	pCi/g	6	1	17%	0.010	0.010	0.010	0.010	6,000.0	No	0.0058	6,000.0	No	0.0078	0.0075	0.0075	Normal
RAD_D	Potassium-40, decayed	--	pCi/g	6	6	100%	--	--	12	13	NA	--	13	NA	--	13	13	13	Normal
RAD_D	Radium-226, decayed	Ra-226	pCi/g	6	6	100%	--	--	0.70	1.3	3.0	No	1.0	3.0	No	1.3	1.2	1.2	Normal
RAD_D	Strontium-90, decayed	Sr-90	pCi/g	6	6	100%	--	--	0.090	1.7	20.0	No	0.55	20.0	No	3.3	1.0	1.7	Max detect
RAD_D	Thorium-228, decayed	Th-228	pCi/g	6	6	100%	--	--	0.0077	0.010	NA	--	0.0089	NA	--	0.0098	0.0097	0.0097	Normal

DOE = U.S. Department of Energy.
EPC = exposure point concentration.
NA = not available.
RAD_D = decayed radiological.
UCL = upper confidence limit.

Table C-65. Summary of Statistics for Shallow Zone Soils from 216-B-45 Crib, Radionuclides – Ecological Risk Assessment.

Constituent Class	Constituent Name	Constituent Abbrev	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	DOE Screening Level	Max Detect Exceed DOE Value?	Average Concen-tration	DOE Screening Level	Max Detect Exceed DOE Value?	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis
RAD_D	Cesium-137, decayed	Cs-137	pCi/g	7	6	86%	0.20	0.20	0.099	2.5	20.0	No	0.53	20.0	No	2.9	1.2	2.5	Max detect
RAD_D	Gross alpha, decayed	--	pCi/g	7	7	100%	--	--	1.9	15	NA	--	8.6	NA	--	20	12	12	Normal
RAD_D	Gross beta, decayed	--	pCi/g	7	7	100%	--	--	2.8	39	NA	--	29	NA	--	140	38	38	Normal
RAD_D	Plutonium-239, decayed	Pu-239	pCi/g	6	1	17%	0.010	0.010	0.010	0.010	6,000.0	No	0.0058	6,000.0	No	0.0078	0.0075	0.0075	Normal
RAD_D	Potassium-40, decayed	--	pCi/g	6	6	100%	--	--	11	13	NA	--	12	NA	--	12	12	12	Lognormal
RAD_D	Radium-226, decayed	Ra-226	pCi/g	6	5	83%	0.60	0.60	0.67	0.82	3.0	No	0.67	3.0	No	1.0	0.82	0.82	Max detect
RAD_D	Strontium-90, decayed	Sr-90	pCi/g	7	7	100%	--	--	0.20	1.3	20.0	No	0.47	20.0	No	1.0	0.75	1.0	Lognormal
RAD_D	Technetium-99, decayed	Tc-99	pCi/g	7	1	14%	0.90	70	1.0	1.0	4,000.0	No	5.5	4,000.0	No	124	15	1.0	Max detect

DOE = U.S. Department of Energy.
EPC = exposure point concentration.
NA = not available.
RAD_D = decayed radiological.
UCL = upper confidence limit.

Table C-66. Summary of Statistics for Shallow Zone Soils from 216-B-47 Crib, Radionuclides – Ecological Risk Assessment.

Constituent Class	Constituent Name	Constituent Abbrev	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	DOE Screening Level	Max Detect Exceed DOE Value?	Average Concen-tration	DOE Screening Level	Mean Detect Exceed DOE Value?	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis
RAD_D	Cesium-137, decayed	Cs-137	pCi/g	6	6	100%	--	--	0.59	53	20	Yes	10	20	No	1,844	28	53	Max detect
RAD_D	Gross alpha, decayed	--	pCi/g	6	6	100%	--	--	4.7	9.4	NA	--	7.6	NA	--	9.7	8.9	8.9	Normal
RAD_D	Gross beta, decayed	--	pCi/g	6	6	100%	--	--	31	54	NA	--	42	NA	--	52	49	52	Lognormal
RAD_D	Potassium-40, decayed	--	pCi/g	6	6	100%	--	--	11	155	NA	--	36	NA	--	265	84	155	Max detect
RAD_D	Radium-226, decayed	Ra-226	pCi/g	6	5	83%	0.70	0.70	0.57	10	3	Yes	2.4	3	No	33	5.6	10	Max detect
RAD_D	Strontium-90, decayed	Sr-90	pCi/g	6	6	100%	--	--	0.17	6.9	20	No	1.5	20	No	57	3.7	6.9	Max detect
RAD_D	Thorium-228, decayed	Th-228	pCi/g	6	6	100%	--	--	0.0077	0.13	NA	--	0.030	NA	--	0.28	0.072	0.13	Max detect

DOE = U.S. Department of Energy.
EPC = exposure point concentration.
NA = not available.
RAD_D = decayed radiological.
UCL = upper confidence limit.

Table C-67. Summary of Statistics for Shallow Zone Soils from 216-B-48 Crib, Radionuclides – Ecological Risk Assessment.

Constituent Class	Constituent Name	Constituent Abbrev	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	DOE Screening Level	Max Detect Exceed DOE Value?	Average Concentration	DOE Screening Level	Max Detect Exceed DOE Value?	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis
RAD_D	Cesium-137, decayed	Cs-137	pCi/g	6	6	100%	--	--	0.14	2.8	20.0	No	1.1	20	No	25	2.0	2.8	Max detect
RAD_D	Gross alpha, decayed	--	pCi/g	6	5	83%	3.0	3.0	4.7	7.8	NA	--	5.9	NA	--	15	7.9	7.8	Max detect
RAD_D	Gross beta, decayed	--	pCi/g	6	6	100%	--	--	30	66	NA	--	39	NA	--	52	50	52	Lognormal
RAD_D	Potassium-40, decayed	--	pCi/g	6	6	100%	--	--	10	16	NA	--	14	NA	--	15	15	15	Normal
RAD_D	Radium-226, decayed	Ra-226	pCi/g	6	5	83%	0.50	0.50	0.65	1.6	3.0	No	1.1	3	No	3.2	1.5	1.5	Normal
RAD_D	Strontium-90, decayed	Sr-90	pCi/g	6	6	100%	--	--	0.16	9.8	20.0	No	1.9	20	No	129	5.1	9.8	Max detect
RAD_D	Thorium-228, decayed	Th-228	pCi/g	6	6	100%	--	--	0.0074	0.013	NA	--	0.010	NA	--	0.013	0.012	0.012	Normal

DOE = U.S. Department of Energy.
EPC = exposure point concentration.
NA = not available.
RAD_D = decayed radiological.
UCL = upper confidence limit.

Table C-68. Summary of Statistics for Shallow Zone Soils from 216-B-49 Crib, Radionuclides – Ecological Risk Assessment.

Constituent Class	Constituent Name	Constituent Abbrev	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	DOE Screening Level	Max Detect Exceed DOE Value?	Average Concentration	DOE Screening Level	Max Detect Exceed DOE Value?	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis
RAD_D	Cesium-137, decayed	Cs-137	pCi/g	6	4	67%	0.91	1.6	0.068	1.5	20.0	No	0.58	20.0	No	6.2	1.0	1.5	Max detect
RAD_D	Gross alpha, decayed	--	pCi/g	6	4	67%	5.9	6.4	2.1	7.3	NA	--	4.0	NA	--	6.6	5.5	6.6	Lognormal
RAD_D	Gross beta, decayed	--	pCi/g	6	2	33%	27	62	32	64	NA	--	32	NA	--	60	46	60	Lognormal
RAD_D	Potassium-40, decayed	--	pCi/g	6	6	100%	--	--	10	14	NA	--	12	NA	--	13	13	13	Lognormal
RAD_D	Radium-226, decayed	Ra-226	pCi/g	6	5	83%	0.80	0.80	0.64	0.76	3.0	No	0.65	3.0	No	0.82	0.75	0.75	Normal
RAD_D	Strontium-90, decayed	Sr-90	pCi/g	6	4	67%	2.4	15	1.2	8.1	20.0	No	4.5	20.0	No	25	7.2	7.2	Normal
RAD_D	Thorium-228, decayed	Th-228	pCi/g	6	6	100%	--	--	0.0060	0.0071	NA	--	0.0065	NA	--	0.0069	0.0069	0.0069	Lognormal

DOE = U.S. Department of Energy.
EPC = exposure point concentration.
NA = not available.
RAD_D = decayed radiological.
UCL = upper confidence limit.

Table C-69. Summary of Statistics for Shallow Zone Soils from 216-B-50 Crib, Radionuclides – Ecological Risk Assessment.

Constituent Class	Constituent Name	Constituent Abbrev	Units	Number of Samples	Number of Detects	Frequency of Detection	Minimum Nondetected Result	Maximum Nondetected Result	Minimum Detected Result	Maximum Detected Result	DOE Screening Level	Max Detect Exceed DOE Value?	Average Concentration	DOE Screening Level	Max Detect Exceed DOE Value?	95% UCL Lognormal Result	95% UCL Normal Result	EPC	EPC Basis
RAD_D	Cesium-137, decayed	Cs-137	pCi/g	6	6	100%	--	--	0.39	3.7	20.0	No	1.3	20.0	No	5.0	2.3	3.7	Max detect
RAD_D	Gross alpha, decayed	--	pCi/g	6	5	83%	4.0	4.0	0.92	12	NA	--	6.0	NA	--	47	9.6	9.6	Normal
RAD_D	Gross beta, decayed	--	pCi/g	6	6	100%	--	--	12	49	NA	--	32	NA	--	59	42	42	Normal
RAD_D	Plutonium-238, decayed	Pu-238	pCi/g	6	1	17%	0.010	0.030	0.0091	0.0091	NA	--	0.0082	NA	--	0.014	0.011	0.0091	Max detect
RAD_D	Potassium-40, decayed	--	pCi/g	6	6	100%	--	--	10.0	13	NA	--	12	NA	--	13	13	13	Normal
RAD_D	Radium-226, decayed	Ra-226	pCi/g	6	5	83%	0.60	0.60	0.64	1.1	3.0	No	0.83	3.0	No	1.6	1.1	1.1	Normal
RAD_D	Strontium-90, decayed	Sr-90	pCi/g	6	3	50%	0.10	0.31	0.097	0.24	20.0	No	0.13	20.0	No	0.27	0.18	0.24	Max detect
RAD_D	Technetium-99, decayed	Tc-99	pCi/g	6	1	17%	0.70	1.1	1.7	1.7	4,000.0	No	0.68	4,000.0	No	1.4	1.1	1.4	Lognormal
RAD_D	Thorium-228, decayed	Th-228	pCi/g	6	6	100%	--	--	0.0062	0.0087	NA	--	0.0075	NA	--	0.0085	0.0083	0.0083	Normal

DOE = U.S. Department of Energy.
EPC = exposure point concentration.
NA = not available.
RAD_D = decayed radiological.
UCL = upper confidence limit.

Table C-70. Summary of Soil Concentrations for Shallow Zone Soils from 216-B-26 Trench for Radionuclides and Nonradiological Constituents - Human Health and Ecological Risk Assessment. (2 Pages)

Contaminant	Max Det C-4191	90% UCL Background	Industrial Soil RBC[a]	Exceed Ind. Soil RBC?	PEF/VF	Max Air Conc.	Industrial Air RBC[b]	Exceed Air RBC?	Ecological RBC[c]	Exceed Eco. RBC?
Nonradionuclides (mg/kg)										
Bismuth	233			No RBC	1.32E+09	1.77E-07		No RBC		No RBC
Chromium	7.1	18.5	10,500	Less than background	1.32E+09	5.38E-09	2.98E-07	Less than background	67	Less than background
Copper	20	22	130,000	Less than background	1.32E+09	1.48E-08		Less than background	217	Less than background
Hexavalent chromium	0.61		10,500	No	1.32E+09	4.62E-10	2.98E-07	No	67	No
Lead	4.3	10.2	750	Less than background	1.32E+09	3.26E-09		Less than background	118	Less than background
Manganese	641	512	490,000	No	1.32E+09	4.86E-07	4.90E-05	No	1500	No
Mercury	0.070	0.33	1,050	Less than background	1.32E+09	5.30E-11		Less than background	5.5	Less than background
Nickel	11	19.1	70,000	Less than background	1.32E+09	8.48E-09		Less than background	980	Less than background
Silver	0.24	0.73	17,500	Less than background	1.32E+09	1.82E-10		Less than background		Less than background
Uranium	57	3.21	10,500	No	1.32E+09	4.31E-08		No RBC		No RBC
Vanadium	101	85.1	24,500	No	1.32E+09	7.65E-08		No RBC		No RBC
Zinc	65	67.8	1,050,000	Less than background	1.32E+09	4.89E-08		Less than background	360	Less than background
Nitrate (as nitrate)	7.1	52	1,500,000	Less than background				Less than background		Less than background
Nitrite (as nitrite)	0.32		1,170,000	No				No RBC		No RBC
Nitrogen from nitrate and nitrite	4.9	12	350,000	Less than background				Less than background		Less than background

Table C-70. Summary of Soil Concentrations for Shallow Zone Soils from 216-B-26 Trench for Radionuclides and Nonradiological Constituents - Human Health and Ecological Risk Assessment. (2 Pages)

Contaminant	Max Det. C-4191	90% UCL Background	Exposure Point Concentration	Ecological RBC	Exceed Eco. RBC?
Radiological (pCi/g)					
Am-241	41.1		41.1	4,000	No
Cs-137	529,000	1.05	529,000	200	Yes
Ni-63	2,110		2,110	22,000,000	No
Pu-239/240	195	0.0248	195	6,000	No
Sr-90	974,000	0.178	974,000	20	Yes

PEF = particulate emission factor
RBC = risk-based concentration
UCL = upper confidence limit
VF = volatilization factor
[a] Ecology 94-145, *Cleanup Levels and Risk Calculations under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*
[b] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality"
[c] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-71. Summary of Soil Concentrations for Deep Zone Soils from 216-B-26 Trench for Radionuclides and Nonradiological Constituents - Human Health and Ecological Risk Assessment.

Contaminant	Maximum Detected Concentration	90% UCL Background	GWP RBC[a]	Exposure Point Concentration
Nonradionuclides (mg/kg)				
Bismuth	233			No RBC
Chromium	8.4	18.5	2,000	
Copper	14	22	263	
Hexavalent chromium	0.70		18	
Lead	5.1	10.2	3,000	
Manganese	641	512	50	641
Mercury	1.4	0.33	2	
Nickel	12	19.1	0.30	
Silver	0.24	0.73	14	
Uranium	57	3.21	1.3	57
Vanadium	101	85.1	2,240	
Zinc	65	67.8	5,970	
Nitrate (as nitrate)	4,090	52	174	4,090
Nitrite (as nitrite)	3		13	
Nitrogen in nitrate/nitrite	1,080	12	40	1,080
Phosphate	59			No RBC
Sulfate	142	237	1,000	

Contaminant	Maximum Detected Concentration	90% UCL Background	Exposure Point Concentration
Radionuclides (pCi/g)			
Am-241	41.1		41.1
Sb-125	2.28		2.28
Cs-137	529,000	1.05	529,000
Ni-63	2,110		2,110
Pu-239/240	195	0.0248	195
K-40	22.2	16.6	22.2
Ra-226	0.94	0.815	0.94
Ra-228	1.62	1.3	1.62
Sr-90	974,000	0.178	974,000
Tc-99	92		92
Th-228	3.01	1.3	3.01
Th-230	0.73	1.1	Less than background
Th-232	3.04	1.32	3.04
H-3	42.9	1.3	42.9
U-233/234	7.8	1.1	7.8
U-234	2.63	1.1	2.63
U-235	0.48	0.109	0.48
U-238	8.2	1.06	8.2

GWP = groundwater protection
RBC = risk-based concentration
UCL = upper confidence limit
[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations (CLARC), Version 3.1.*

Table C-72. Comparison of 216-B-58 Trench Shallow Zone Concentrations with Risk-Based Standards.

Contaminant	Max Det. C-4174	Max Det. C-4304	90% UCL Bkgd.	Industrial Soil RBC[a]	Exceed Soil RBC?	PEF/VF	Max Air Conc.	Industrial Air RBC[b]	Exceed Air RBC?	Ecological RBC[c]	Exceed Eco. RBC?
Nonradionuclides (mg/kg)											
Arsenic	8.8	8.8	20	88	No	1.32E+09	6.67E-09	5.81E-06	No	7	Yes
Barium	70	87	132	245,000	Less than background	1.32E+09	6.56E-08	5.00E-04	Less than background	102	Less than background
Bismuth	10				No RBC	1.32E+09	7.48E-09		No RBC		No RBC
Chromium	6.2	4.8	18.5	10,500	Less than background	1.32E+09	4.66E-09	2.98E-07	Less than background	67	Less than background
Nickel	7.9	11	19.1	70,000	Less than background	1.32E+09	8.18E-09		Less than background	980	Less than background
Selenium	7.3	4.4	0.33	17,500	No	1.32E+09	5.56E-09		No RBC	0.3	Yes
Ammonium	2.4	0.4		24,500	No				No RBC		No RBC
Chloride	6.4	4.6	100		Less than background				Less than background		Less than background
Nitrate (as nitrate)	6.8	40	52	1,500,000	Less than background				Less than background		Less than background
Nitrogen from nitrate and nitrite	1.9	12	12	350,000	No				No RBC		No RBC
Phosphate	4.5				No RBC				No RBC		No RBC
Sulfate	16	11	237		Less than background				Less than background		Less than background
Sulfide		33			No RBC				No RBC		No RBC
Aroclor-1254	0.93			70	No	1.32E+09	7.05E-10	4.38E-05	No	0.65	Yes
Diethylphthalate	0.49			2.80E+06	No	1.32E+09	3.71E-10	2.8	No		No RBC
Acetone		52		3,150,000	No	12,554	4.14E-06	0.35	No		No RBC
Oil and grease		1,350			No RBC				No RBC		No RBC

GWP = groundwater protection
RBC = risk-based concentration
UCL = upper confidence limit
[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulations, (CLARC), Version 3.1.*
[b] *Washington Administrative Code* (WAC) 173-340-750, "Cleanup Standards to Protect Air Quality."
[c] *Washington Administrative Code* (WAC) 173-340-900, "Tables," Table 749-3.

Table C-73. Comparison of Maximum 216-B-58 Trench Deep Zone Concentrations with the Groundwater Protection Risk-Based Standards.

Contaminant	Max Det. C-4174	Max Det. C-4304	90% UCL Background	GWP RBC[a]	Exposure Point Concentration
Nonradionuclide (mg/kg)					
arsenic	16	12.6	20	0.034	16
barium	100	150	132	923	150
bismuth	9.87				
chromium	9.4	7.7	19	2,000	9.4
copper		11.9		263	11.9
nickel	10.1	10.8	19	130	10.8
selenium	13.0	6.54	0.33	5	13.0
ammonium	3.76	6.80			
chloride	14.1	36.3		1,000	36.3
cyanide		360		1	360
nitrate (as nitrate)	13.6	255	52	174	255
Nitrogen from nitrate and nitrite	5.1	82.5	12	40	82.5
phosphate	4.54				
sulfate	27.0	61.9		1,000	61.9
sulfide		33.0			
Aroclor-1254	0.930			0.99	0.930
diethylphthalate	0.900			72	0.900
acetone		52		29	52
Radionuclides (pCi/g)					
Am-241	412	297			412
Cs-137	14,600	14	1.1		14,600
Co-60	9.96	1,700	0.0084		1,700
Eu-154	8.09	8.09	0.0034		8.09
Np-237	0.03	0.01			0.03
Ni-63	36.1	165			165
Pu-238	31	20	0.0038		31
Pu-239/240	310	240	0.0248		310
K-40	18.3	16.7	16.6		18.3
Ra-226	0.57	0.89	0.815		0.89
Ra-228	4.42	1.36	1.3		4.42
Th-228	6.89	1.51	1.3		6.89
Th-230	1.05	0.52	1.1		Less than Bkg
Th-232	4.42	1.36	1.32		4.42
Sr-90	18,400	1.01	0.178		18,400
H-3	89.4	798	1.3		798
U-233/234	0.58	0.74	1.1		Less than Bkg
U-235	0.02	0.13	0.109		0.13
U-238	0.36	0.58	1.06		Less than Bkg

GWP = groundwater protection
RBC = risk-based concentration
UCL = upper confidence level
[a] Ecology 94-145, *Cleanup Levels and Risk Calculations Under the Model Toxics Control Act Cleanup Regulation, (CLARC), Version 3.1.*

Table C-74. Dose and Risk for 216-B-58 – Industrial Exposure Scenario Without Cover.

Time (years)	mrem/yr	Risk	Primary Radionuclide	% of Total Dose	Primary Pathway
0	1.3E+04	1.3E-01	Cesium-137	65%	Ground
1	1.2E+04	1.3E-01	Cesium-137	67%	Ground
50	2.6E+03	3.5E-02	Cesium-137	98%	Ground
150	2.8E+02	3.8E-03	Cesium-137	91%	Ground
500	2.0E+01	2.6E-04	Thorium-232	61%	Ground
1,000	1.7E+01	2.4E-04	Thorium-232	70%	Ground

Table C-75. Dose and Risk for 216-B-58 – Groundwater Protection.

Time (years)	mrem/yr	Risk	Primary Radionuclide	% of Total Dose	Primary Pathway
0	0.0E+00	0.0E+00			
1	0.0E+00	0.0E+00			
50	0.0E+00	0.0E+00			
66	1.7E+00	9.0E-06	Tritium	100%	Groundwater
150	2.2E-09	1.2E-14	Tritium	100%	Groundwater
500	0.0E+00	0.0E+00			
1,000	0.0E+00	0.0E+00			

Table C-76. Comparison of 216-B-58 Trench Shallow Zone Concentrations with Risk-Based Standards.

Contaminant	Max Det. C-4174	Max Det. C-4304	90% UCL Background	Exposure Point Concentration	Ecological RBC	Exceed Eco. RBC?
Radionuclides (pCi/g)						
Am-241	412	297		412	4,000	No
Cs-137	14,600	14	1.05	14,600	200	Yes
Co-60	9.96	1,700	0.00842	1,700	700	Yes
Eu-154	8.09	8.09	0.0334	8	1,000	No
Np-237	0.03	0.01		0.03	1,900	No
Ni-63	36.1	165		165	22,000,000	No
Pu-238	31	20	0.00378	31	5,400	No
Pu-239/240	310	240	0.0248	310	6,000	No
K-40	18.3	15.6	16.6	18	5,400	No
Ra-226	0.57		0.815	Less than background	50	Less than background
Ra-228	4.42		1.3	4	40	No
Th-228	6.89	1.51	1.3	7	2,200	No
Th-230	0.5	0.37	1.1	Less than background		Less than background
Th-232	4.42	0.89	1.32	4	2,000	No
Sr-90	18,400	0.41	0.178	18,400	20	Yes
H-3	0.91	10.2	1.3	10	5,400	No
U-233/234	0.31	0.74	1.1	Less than background	5,000	Less than background
U-235	0.020	0.13	0.109	0.13	3,000	No
U-238	0.26	0.58	1.06	Less than background	2,000	Less than background

RBC = risk-based concentration
UCL = upper confidence limit

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APPENDIX D

COST ESTIMATE BACKUP

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CONTENTS

FIGURE

TABLES

TERMS

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
ERDF	Environmental Restoration Disposal Facility
FS	feasibility study
G&A	general and administrative
HEPA	high-efficiency particulate air (filter)
HIC	high-integrity container
LLDPE	linear low-density polyethylene
OMB	Office of Management and Budget
PPE	personnel protection equipment
PVC	polyvinyl chloride
QA/QC	quality assurance and quality control
RA	remedial action
RCRA	*Resource Conservation and Recovery Act of 1976*
RI	remedial investigation
TBP	to be provided
WIPP	Waste Isolation Pilot Plant

APPENDIX D

COST ESTIMATE BACKUP

D1.0 INTRODUCTION

Cost estimates for this feasibility study (FS) have an accuracy of +50 percent, -30 percent, which is the accuracy specified in the EPA/540/G-89/004, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final, the Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA). The cost estimates provide a discriminator for deciding between similar protective and implementable alternatives for a specific waste site. Therefore, the costs are relational costs for the evaluation of the alternatives, not absolute costs. Cost estimates were made by waste site with the exception of eight groups that were developed based on logistics. Two of the eight groups are representative sites. Refer to Table D-103 for a listing of the group sites. This FS does not evaluate the economies associated with implementing multiple sites or groups with a common alternative or aggregated remediation. They will be considered in the future as part of long-range planning and through the post-record-of-decision activities, such as remedial design. Potential areas of cost sharing to reduce overall remediation costs include the following:

- Remediating all waste sites with a common preferred alternative at the same time
- Sharing mobilization/demobilization costs
- Sharing surveillance and maintenance costs
- Sharing barrier performance monitoring costs.

D2.0 ALTERNATIVE COST ESTIMATES

This section describes the cost estimates based on the remedial alternatives developed in Chapter 6 of this FS. Appendix D summarizes the alternatives considered, the total present-worth costs, and provides summary and backup information for costs by waste site or group.

Present-net-worth 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*, which is effective through the end of January 2004. Programs with durations longer than 30 years use the 30-year interest rate of 3.2 percent. Present-net-worth costs are discussed for each alternative in the following sections.

D2.1 ALTERNATIVE 1 – NO ACTION

The no-action alternative represents a situation where no legal restrictions, access controls, or active remedial measures are applied to the waste site. Taking no action implies "walking away from the waste site" and allowing the waste to remain in its current configuration, affected only by natural processes. No maintenance or other activities would be instituted or continued. Chapter 6 describes the no-action alternative.

Because the no-action alternative assumes no further actions will be taken at a waste site, costs are assumed to be zero.

D2.2 ALTERNATIVE 2 – MAINTAIN EXISTING SOIL COVER, INSTITUTIONAL CONTROLS, AND MONITORED NATURAL ATTENUATION

Chapter 6 of this FS provides a description of the Maintain the Existing Soil Cover, Institutional Controls, and Monitored Natural Attenuation alternative. Cost models for each representative site are discussed in detail in Section D3. The primary costs associated with this alternative are surveillance and cover maintenance and monitored natural attenuation costs. This alternative also includes the cost of maintaining the existing soil cover. The costs for these controls were estimated based on the area of the individual waste sites or groups. Details of the cost estimates are provided in Tables D-1 through D-32.

The unit cost for surveillance and maintenance was assumed to be the same as the current unit cost for surveillance and maintenance activities conducted annually on the waste sites. The unit cost accounts for such activities as site radiation surveys, and repair of the existing soil cover on the sites where it is present. Because the existing soil cover is maintained annually, costs for replacing all or large portions of the existing cover at specified intervals (i.e., every 20 years) are considered unnecessary.

The costs associated with natural attenuation monitoring are divided into three components: radiological surveys of surface soils, spectral gamma logging of vadose zone boreholes, and groundwater monitoring. The costs to perform radiological surveys of surface soils at waste sites are assumed to be similar to those for current survey practices at the sites and are included in the surveillance and maintenance costs.

Vadose zone monitoring costs assume spectral gamma logging of one borehole per waste site to 15 m (50 ft) depth once every 5 years until the site meets all preliminary remediation goals. This monitoring is considered for sites with high concentrations of contaminants in the shallow zone or near the bottom of crib and trench structures. It also assumes that the service life of vadose zone boreholes is 30 years. Costs are included for logging and periodic replacement of these boreholes until all preliminary remediation goals are met for the site.

Groundwater monitoring costs will likely be incurred for sites that have high concentrations of mobile contaminants deep within the vadose zone and/or where groundwater contamination is known to have occurred. However, the cost estimate assumes that the groundwater monitoring costs are institutional costs and are not considered in the cost models.

The cost model used for this alternative consisted of a simple spreadsheet. Durations were used for the representative sites based on the length of time required to reach preliminary remediation goals. Because the analogous sites do not have data to support the time needed to reach preliminary remediation goals, costs for institutional controls at analogous waste sites were estimated using the time from the associated representative site.

The present-net-worth costs for surveillance and maintenance and natural attenuation monitoring are added to the periodic costs to reach the total present-worth cost for this alternative. The real discount rate of 3.2 percent is used for discounting real (constant-dollar) flows for the duration until all preliminary remediation goals are reached at each site.

D2.3 ALTERNATIVE 3 – REMOVE AND DISPOSE

Chapter 6 of this FS describes the remove-and-dispose alternative. Cost models for each representative site are discussed in detail in Section D3. Cost estimate inputs for the remove and dispose alternative are provided in Tables D-33 through D-46.

Institutional control costs were not added to the remove and dispose alternative because the contaminants are assumed to be removed to concentrations at or below the preliminary remediation goals. If some contaminants remain after excavation, institutional controls may be needed. Because deep vadose zone contaminants will not be removed, it is assumed that groundwater monitoring still will be required at selected waste sites. The costs assumed for groundwater monitoring are assumed to be covered under a separate Operable Unit.

All costs associated with the remove and dispose alternative are present-net-worth costs.

D2.4 ALTERNATIVE 4 – CAPPING

Chapter 6 of this FS provides a description of the capping alternative. Cost estimate inputs for the capping alternative are included in Tables D-47 through D-78. Figure D-1 shows details of the assumed cap design for the modified RCRA subtitle C barrier.

Operation and maintenance costs for the capping alternative include barrier performance monitoring and repair costs. For purposes of this FS, annual repairs to the cap (replacement of 15.2 cm [2 ft] of topsoil layer and revegetation over 10 percent of the barrier area) are assumed. This is considered a conservative estimate because the barrier has been designed to require minimal maintenance, particularly after vegetation has been established. The real discount rate of 3.2 percent is used for discounting real (constant-dollar) flows for operation and maintenance costs for the period until all preliminary remediation goals are reached at each site to obtain the present-net-worth cost for the alternative.

Institutional controls are an integral component of the capping alternative and would be required to prevent both intrusion to the capped area and activities that might alter the integrity and effectiveness of the cap. Groundwater monitoring would likely be a part of the capping alternative. However, the cost estimate considers groundwater sampling institutional costs. Therefore, they are not considered in the cost estimates. As part of the capping alternative, costs for dynamic compaction have been included to eliminate any void spaces within the site. This will ensure that a firm subgrade will be provided to prevent future cap settling.

The present-net-worth costs for the alternative are added to institutional control costs to reach the total present-worth cost for this alternative. The real discount rate of 3.2 percent is used for discounting real (constant-dollar) flows for the duration until all preliminary remediation goals are reached at each site.

D2.5 ALTERNATIVE 5 - PARTIAL EXCAVATION AND CAPPING

Under Alternative 5, contaminants would be removed to the maximum depths listed in Table 2-7. Following excavation, the waste site would be backfilled with clean borrow soil and capped as discussed above. These activities would remove a fraction of the near-surface contaminant load. The removal, treatment, disposal, and capping activities would be the same as or similar to those described in Chapter 4.0 of the FS and the preceding subsections. However, removal activities would not be aimed at removing all contaminants in the vadose zone. They would be aimed at reducing the mass of contaminants associated with the bottom of the waste site, which would, in turn, reduce the potential intruder risk. The disposal options would be the same. The required cap would be less rigorous than if these contaminants were left in place, because the inadvertent intruder risk is significantly reduced. For example, instead of a Hanford Barrier, a monofill soil barrier may be appropriate. The actual design of the barrier would be determined through the detailed design activities.

Table 5-3 of the FS lists the contamination zone for each representative site and for those analogous sites with sampling data. If contaminants are not in the 0 to 4.6 m (0 to 15-ft) zone, then the resulting risk reduction to humans and ecological receptors from direct contact to shallow-zone contamination would be zero. The point of compliance for direct exposure is the 0 to 4.6 m (0 to 15-ft) zone, so contaminants deeper than this only would reduce the risk to intruders. Contaminants that impact the groundwater are located deeper in the vadose zone than 6.1 m (20 ft). Therefore, the removal of contaminants from the 0 to 6 (0 to 20-ft) zone would not significantly change the risk to groundwater. The capping activity provided in this alternative would address the protection of groundwater from the remaining contaminants to the vadose zone. Institutional controls would be an additional requirement for this alternative, because contamination above PRGs are left on site.

D3.0 ASSUMPTIONS

Assumptions for the representative sites and selected analogous sites for Alternatives 2, 3, and 4 are documented in the following sections.

D3.1 GLOBAL ASSUMPTIONS

D3.1.1 Labor and Markup

Each cost item described includes one or a combination of, material costs, equipment costs, labor costs, and subcontract costs. In addition, each cost estimate contains a variety of markups. Labor rates and markups were developed for the Contractor and Fluor Hanford personnel as follows:

Contractor. The contractor is assumed to be performing all the excavation, earth moving, construction, decontamination, and container-lining activities on site for each of the alternatives evaluated.

When the contractor performs work, costs are associated with support personnel, laborers, equipment operators, oilers, and truck drivers performing the work (rates obtained from Fluor Hanford):

- Support personnel
  - Superintendent = $50.00/hour
  - Site foreman = $50.00/hour
  - Site engineer = $50.00/hour
  - Site health and safety person = $50.00/hour
  - Timekeeper-clerk = $37.00/hour
- Construction
  - Equipment operator = $37.00/hour
  - Laborer = $37.00/hour
  - Truck driver (Teamster) = $37.00/hour
  - Oiler = $37.00/hour.

In addition to on-site personnel, the contractor will have office staff. When contractor office support is referred to, the following is assumed (rate obtained from Fluor Hanford):

- Office support
  - Engineer = $50.00/hour

Fluor Hanford. It is assumed that Flour Hanford personnel will perform construction oversight and annual inspections. When construction oversight is used, it shall refer to the following individuals at the following rates (rates obtained from Fluor Hanford):

• Project management and oversight	=	$75/hour
• Radiation Control Technician (RCT)	=	$56/hour
• Health and safety personnel	=	$56/hour
• Quality Assurance, quality control (QA/QC) and scheduling	=	$56/hour
• Field engineer	=	$56/hour
• Sample Technician	=	$56/hour.

D3.1.2 Mark Ups

The following mark ups (obtained from Fluor Hanford) will be added as indicated.

• Fluor Hanford	
– General and administrative (G&A) on labor, materials, and equipment	15% each
• Contractor	
– G&A on labor, materials, and equipment	26.5%
– Direct mark up on labor	25%
– Direct mark up on material	10%
– Direct mark up on subcontractors	10%
– Fluor Hanford mark up on contractor G&A	15%
• Contingency	
– Excavation alternative	40%
– Capping alternative	20%.

D3.1.3 General Assumptions

The following general assumptions also apply to all of the cost estimates:

- All of the cost estimates include costs associated with the alternative starting with construction mobilization. Although the cost estimates do include annual operation and maintenance (O&M)-type costs if applicable and costs associated with preparing closeout documents, the cost estimates do not include costs for design, work plan preparation, or any other preparation costs normally associated with activities occurring before field mobilization.

- When costing equipment rental rates, it is assumed that each month contains 21 days.

- When costing equipment operation, the cost is based on an 8-hour day.
- When calculating project durations, it is assumed that 5 days consist of a week.

D3.2 ALTERNATIVE 2 – MAINTAIN EXISTING SOIL COVER, INSTITUTIONAL CONTROLS, AND MONITORED NATURAL ATTENUATION

D3.2.1 General Assumptions

The general assumptions for Alternative 2 are as follows:

- Fencing and monuments/signs for institutional controls and fencing maintenance are considered institutional costs and are not considered in this cost estimate.
- Groundwater monitoring is performed for another operable unit. The cost associated with periodic groundwater sampling is considered an institutional cost and is not considered in this cost estimate.
- Surface soil is not affected. Therefore, Level C, B, or A personal protection equipment is not needed for this alternative.
- Alternative 2 consists of five general activities: institutional controls implementation, site inspection and surveillance, existing cover maintenance, natural attenuation monitoring, and site reviews. These activities are described for the representative sites in the following sections.

D3.2.2 Representative Site 216-T-26 Crib (Cost tables D-1 through D-4)

Institutional Controls Implementation: Preparing and implementing institutional controls is a capital cost and includes office or administrative costs to implement deed restrictions, land-use restrictions, and groundwater-use restrictions. Costs presented in the cost estimates are based on the following:

- Time to produce institutional controls = 200 hours (assumption)
- Labor rate = $56/hour (assumption).

Site Inspection and Surveillance: The costs associated with site inspection and surveillance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The activities included under site inspection and surveillance are assumed to be the same as the activities currently being performed. These activities include conducting site radiation surveys of surface soil and physical site inspection. Activities may include control of deeply burrowing animals and deep-rooted plants by using herbicide or by physical removal (cost for these items are not included).

For costing purposes, sites 50,000 ft^2 or smaller are assumed to require a team of two inspectors, two 8-hour days (16 crew hours) to perform the activities associated with site inspection and surveillance. An additional 16 crew hours will be needed for site inspection and surveillance for every additional 50,000 ft^2 of site area. Costs are based on the following:

- Area of representative site = 900 ft^2 (FS description)
- Time to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
- Hourly rate for team = $112/hour ($56/hour/team member)
- Radiation surveys of surface soil = $1,000/event ($1,000 for every 5,000 ft^2).

Existing Cover Maintenance: The costs associated with existing cover maintenance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. Because cover maintenance is performed annually, including costs for replacing all or large portions of the existing cover at specified intervals is unnecessary. Rather, cover maintenance is assumed to include replacing cover soils over 10 percent of the area to a depth of 2 ft. Costs are based on the following:

- Area of representative site = 900 ft^2
- Area requiring repair (10% of total area) = 90 ft^2 = 10 yd^2
- Oversight = 1 day (8 hours/day @ $56/hour).

In addition to the soil material and transportation costs, cover maintenance includes placing and compacting soil cover material and reseeding.

Monitoring for Natural Attenuation: The costs associated with natural attenuation monitoring are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The cost for natural attenuation monitoring includes spectral gamma logging of vadose zone boreholes.

Vadose zone monitoring costs assume spectral gamma logging of one borehole per waste site to a depth of 50 ft once every 5 years. The service life of a vadose zone borehole is assumed to be 30 years. Therefore, every 30 years a replacement borehole will be drilled. Costs are based on the following:

- Unit cost for vadose zone monitoring = $75/ft of borehole
- Length of borehole drilling = 50 ft
- Cost of vadose zone monitoring = $75/ft x 50 ft = $3,750
- Installation cost of borehole = $45/linear ft
- Length of borehole installation = 50 ft
- Oversight = 1 day = 8 hours ($56/hour).

Groundwater monitoring costs are assumed to be institutional costs and are not considered part of this cost estimate.

Site Reviews: The cost associated with site reviews is an operation-and-maintenance cost. This cost will be incurred every 5 years as long as the alternative is being used. Site reviews will be conducted to assess site conditions and to evaluate the selected alternative and determine whether additional steps toward remediation are required.

D3.2.3 Representative Site 216-B-46 Crib (Cost tables D-5 through D-8)

This representative site is a group site containing sites 216-B-46, 216-B-43, 216-B-44, 216-B-45, 216-B-47, 216-B-48, 216-B-49, and 216-B-50.

Implementation of Institutional Controls: Preparing and implementing institutional controls is a capital cost and includes office or administrative costs to implement deed restrictions, land-use restrictions, and groundwater-use restriction. Costs presented in the cost estimates are based on the following:

- Time to produce institutional controls = 200 hours (assumption)
- Labor rate = \$56/hour (assumption).

Site Inspection and Surveillance: The costs associated with site inspection and surveillance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The activities included under site inspection and surveillance are assumed to be the same as the activities currently being performed. These activities include site radiation surveys of surface soil and physical site inspection. Activities may include control of deeply burrowing animals and deep-rooted plants by using herbicide or by physical removal (cost for these items not included).

For costing purposes, sites 50,000 ft^2 or smaller are assumed to require a team of two inspectors, two 8-hour days (16 crew hours) to perform the activities associated with site inspection and surveillance. An additional 16 crew hours will be needed for site inspection and surveillance for every additional 50,000 ft^2 of site area. The cost of site inspection and surveillance can be figured as follows:

- Area of representative site = 61,152 ft^2 (FS description)
- Time to complete inspections = 32 hours (16 hours for every 50,000 ft^2)
- Hourly rate for team = \$112/hour (\$56/hour/team member)
- Radiation surveys of surface soil = \$13,000/event (\$1,000 for every 5,000 ft^2).

Existing Cover Maintenance: The costs associated with existing cover maintenance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. Because cover maintenance is performed annually, including costs for replacing all or large portions of the existing cover at specified intervals is unnecessary. Rather, cover maintenance is assumed to include replacing cover soils over 10 percent of the area to a depth of 2 ft. Costs are based on the following:

- Area of representative site = 61,152 ft^2
- Area requiring repair (10% of total area) = 6,115 ft^2 = 679 yd^2
- Oversight = 3 days (8 hours/day @ \$56/hour).

In addition to the soil material and transportation costs, cover maintenance includes placing and compacting soil cover material and reseeding.

Monitoring For Natural Attenuation: The costs associated with natural attenuation monitoring are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The cost for natural attenuation monitoring includes spectral gamma logging of vadose zone boreholes.

Vadose zone monitoring costs assume spectral gamma logging of one borehole per waste site to a depth of 50 ft once every 5 years. The service life of a vadose zone borehole is assumed to be 30 years. Therefore, every 30 years a replacement borehole will be drilled. Costs are based on the following:

- Unit cost for vadose zone monitoring = \$75/ft of borehole
- Length of borehole drilling = 50 ft
- Cost of vadose zone monitoring = \$75/ft x 50 ft = \$3,750
- Installation cost of borehole = \$45/linear ft
- Length of borehole installation = 50 ft
- Oversight = 1 day = 8 hours (\$56/hour).

Groundwater monitoring costs are assumed to be institutional costs and are not considered part of this cost estimate.

Site Reviews: The cost associated with site reviews is an operation-and-maintenance cost. This cost will be incurred every 5 years as long as the alternative is being used. Site reviews will be conducted to assess site conditions and to evaluate the selected alternative and determine whether additional steps toward remediation are required.

D3.2.4 Representative Site 216-B-5 Reverse Well (Cost tables D-9 through D-12)

Site 216-B-5 is a reverse-well waste site. For this cost estimate, the reverse well will be abandoned and a 40-ft by 40-ft area is assumed to be included in the area to receive institutional controls and to be evaluated or inspected annually.

Implementation of Institutional Controls: Preparing and implementing institutional controls is a capital cost and includes office or administrative costs to implement deed restrictions, land-use restrictions, and groundwater-use restrictions. Costs presented in the cost estimates are based on the following:

- Time to produce institutional controls = 200 hours (assumption)
- Labor rate = \$56/hour (assumption).

Reverse Well Abandonment: Site work project duration was estimated to be 2 weeks (0.5 month) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 3 days, includes mobilizing equipment and personnel, constructing a temporary haul road, and performing decontamination setup.
- Abandon well: 4 days
- Restore Site: 2 days
- Demobilize: 1 day, includes demobilizing equipment and personnel and final site cleanup.

Total construction duration = 10 days = 2 weeks = 0.5 months.

Site Description: The site consists of a 7 inch diameter reverse well. The area of disturbance, assuming 20 ft in all directions from the site, is a 40-ft x 40-ft area (1,600 ft^2).

Fluor Hanford Oversight: Fluor Hanford will provide contractor oversight. Personnel used to perform contractor oversight include a project manager (1 person full time), health and safety manager (1 person half time), QA/QC representative and scheduler (1 person full time), and a radiation control technician (RCT) (1 person full time). This oversight crew will be used when the contractor is in operation. Using the wage rates discussed in Section D3.1, this crew has an hourly rate of $215. The cost of Fluor Hanford oversight is calculated as follows:

- *Duration of Fluor Hanford oversight* = 10 days
- Fluor Hanford oversight rate = $215/hour = $1,720/day (see general assumptions).

Fluor Hanford will also provide a crew of four RCTs for decontamination activities. Using the wage rates discussed in Section D3.1 ($56/hour), the crew has an hourly rate of $224 or $1,792/day.

Mobilization, Demobilization, and Field Support: Mobilization and demobilization of the drill rig to be used for well abandonment will be included in the cost.

Temporary blaze orange fence will be placed around the site for protection from the construction area. The cost of the temporary fence is based on the following:

Length of temporary fence = 2 x (width + length) + 20% =
2 x (40 ft + 40 ft) + 20% = 192 linear ft.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in gravel. The cost of materials for the haul road is based on the following:

- Length of haul road = 1,500 ft
- Haul road construction = *$7.36 / yd^2*
- Width of haul road = 24 ft
- Gravel = *24 ft x 1,500 ft + 10% = 39,600 ft^2 = 4,400 yd^2.*

Decontamination Pad: A decontamination pad will be constructed to clean drilling equipment before demobilization. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump, and a pump. It is assumed that the drilling equipment can be decontaminated in one day. Based on the Alternative 3 assumption for decontamination pad water use (1,000 gallons per month), 50 gallons of water are required for one day of decontamination activity. Therefore, it is assumed that a temporary water source can be obtained for decontamination activities and large storage tanks will not be required. It is also assumed that the sump can adequately store the rinse water prior to using for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	= 600 ft^2	
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	= 402 linear ft	= 0.402 m board ft
• Plastic sheeting (60 mil LLDPE)	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	= 1,188 ft^2	
• 3-in. PVC pipe	=	5 linear ft.		

All equipment rented for the decontamination pad will be rented for the duration of the RA activities in the event that the decontamination pad is needed. It is assumed that the drilling equipment can be decontaminated for reuse.

The decontamination pad will be staffed for one day to decontaminate the drilling equipment following well abandonment. The decontamination crew will consist of four laborers. This crew of laborers will construct the decontamination pad, provide decontamination services, and remove the decontamination pad during demobilization activities (labor provided under miscellaneous costs).

- Duration to construct and remove = 2 days
- Duration of decontamination activity = 1 day.

Abandonment: A hydraulic backhoe will be used to excavate around the reverse well to a depth of 5 ft. It is assumed that the excavation area will be 5-ft by 5-ft. The excavated soil will be stockpiled near the site until backfilling. The amount of excavated soil is calculated as follows:

Volume of overburden soil to excavate = 5 ft x 5 ft x 5 ft = 125 ft^3 = 5 yd^3.

A subcontractor will be hired to abandon the reverse well. The casing will be cut at 5 ft below the surface and removed. The well will be tremie grouted (302 ft) with a Portland cement grout.

Transportation and Disposal: The waste material obtained for disposal will be the 5 ft of casing removed from the well. It is assumed that the casing will be placed in a plastic-lined container. It is assumed that only 1 container will be needed for this operation. Once the container is loaded, the liner is sealed, the container is decontaminated then screened by the Fluor Hanford radiological screening crew, and transported to the ERDF. The cost for transportation and disposal of contaminated material at the ERDF is $1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profits of Environmental Restoration CERCLA Disposal Facilities", July 1999.

Site Restoration: Site restoration will consist of backfilling the excavation area with the clean overburden soil previously excavated. Backfilling will be performed using a backhoe. The backfill of previously excavated soil is assumed to take 1 day.

- Time to backfill overburden soil = 1 day
- Labor (one operator) = \$37/hour x 8 hours/day = \$296/day.

Following backfill, the area will be revegetated. The production rate assumed for revegetation is 1,000 yd^2/day.

Area to revegetate (excavation area + haul road area)	=	[5 ft x 5 ft] + [39,600 ft^2]	= 39,625 ft^2
	=	4,402 yd^2.	

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site (see global assumptions). Support personnel include four laborers that will perform general activities including, but not limited to, maintenance and decontamination. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 10 days
- Contractor support rate = \$237/hour = \$1,896/day (see global assumptions)
- Four Laborers (daily rate) = \$37/hour x 8hours/day x 4 laborers = \$1,184/day
- Time to prepare post-construction documents = 80 hours (assumption)
- Labor rate for post-construction documents = \$50/hour (assumption).

Site Inspection and Surveillance: The costs associated with site inspection and surveillance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The activities included under site inspection and surveillance are assumed to be the same as the activities currently being performed. These activities include site radiation surveys of surface soil and physical site inspection. Activities may include control of deeply burrowing animals and deep-rooted plants by using herbicide or by physical removal (cost for these items are not included).

For costing purposes, sites 50,000 ft^2 or smaller are assumed to require a team of two inspectors, two 8-hour days (16 crew hours) to perform the activities associated with site inspection and surveillance. An additional 16 crew hours will be needed for site inspection and surveillance for every additional 50,000 ft^2 of site area. Costs are based on the following:

- Area of representative site = 1,600 ft^2 (FS description)
- Time to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
- Hourly rate for team = \$112/hour (\$56/hour/team member)
- Radiation surveys of surface soil = \$1,000/event (\$1,000 for every 5,000 ft^2).

Existing Cover Maintenance: The costs associated with existing cover maintenance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. Because cover maintenance is performed annually, including costs for replacing all or large portions of the existing cover at specified intervals is not necessary. Rather, cover maintenance is assumed to include replacing cover soils over 10% of the area to a depth of 2 ft. Costs are based on the following:

- Area of representative site = 1,600 ft^2
- Area requiring repair (10% of total area) = 160 ft^2 = 18 yd^2
- Oversight = 1 day (8 hours/day @ $56/hour).

In addition to the soil material and transportation costs, cover maintenance includes placing and compacting soil cover material and reseeding.

Monitoring For Natural Attenuation: The costs associated with natural attenuation monitoring are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The cost for natural attenuation monitoring includes spectral gamma logging of vadose zone boreholes.

Vadose zone monitoring costs assume spectral gamma logging of one borehole per waste site to a depth of 50 ft once every 5 years. The service life of a vadose zone borehole is assumed to be 30 years. Therefore, every 30 years a replacement borehole will be drilled. The costs are based on the following:

- Unit cost for vadose zone monitoring = $75/ft of borehole
- Length of borehole drilling = 50 ft
- Cost of vadose zone monitoring = $75/ft x 50 ft = $3,750
- Installation cost of borehole = $45/linear ft
- Length of borehole installation = 50 ft
- Oversight = 1 day = 8 hours ($56/hour).

Groundwater monitoring costs are assumed to be institutional costs and are not considered part of this cost estimate.

Site Reviews: The cost associated with site reviews is an operation and maintenance cost. This cost will be incurred every 5 years as long as the alternative is being used. Site reviews will be conducted to assess site conditions and to evaluate the selected alternative and determine whether additional steps toward remediation are required.

D3.2.5 Representative Site 216-B-7A&B Crib (Cost Tables D-13 through D-16)

Implementation of Institutional Controls: Preparing and implementing institutional controls is a capital cost and includes office or administrative costs to implement deed restrictions, land-use restrictions, and groundwater-use restrictions. Costs presented in the cost estimates are based on the following:

- Time to produce institutional controls = 200 hours (assumption)

- Labor rate = \$56/hour (assumption).

Site Inspection and Surveillance: The costs associated with site inspection and surveillance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The activities included under site inspection and surveillance are assumed to be the same as the activities currently being performed. These activities include site radiation surveys of surface soil and physical site inspection. Activities may include control of deeply burrowing animals and deep-rooted plants by using herbicide or by physical removal (costs for these items are not included).

For costing purposes, sites 50,000 ft^2 or smaller are assumed to require a team of two inspectors, two 8-hour days (16 crew hours) to perform the activities associated with site inspection and surveillance. An additional 16 crew hours will be needed for site inspection and surveillance for every additional 50,000 ft^2 of site area.

- Area of representative site = 672 ft^2 (FS description)
- Time to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
- Hourly rate for team = \$112/hour (\$56/hour/team member)
- Radiation surveys of surface soil = \$1,000/event (\$1,000 for every 5,000 ft^2).

Existing Cover Maintenance: The costs associated with existing cover maintenance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. Because cover maintenance is performed annually, including costs for replacing all or large portions of the existing cover at specified intervals is unnecessary. Rather, cover maintenance is assumed to include replacement of cover soils over 10% of the area to a depth of 2 ft.

- Area of representative site = 672 ft^2
- Area requiring repair (10% of total area) = 67 ft^2 = 7.5 yd^2
- Oversight = 1 day (8 hours/day @ \$56/hour).

In addition to the soil material and transportation costs, cover maintenance includes placing and compacting soil cover material and reseeding.

Monitoring For Natural Attenuation: The costs associated with natural attenuation monitoring are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The cost for natural attenuation monitoring includes spectral gamma logging of vadose zone boreholes.

Vadose zone monitoring costs assume spectral gamma logging of one borehole per waste site to a depth of 50 ft once every 5 years. The service life of a vadose zone borehole is assumed to be 30 years. Therefore, every 30 years a replacement borehole will be drilled. The costs are based on the following:

- Unit cost for vadose zone monitoring = \$75/ft of borehole
- Length of borehole drilling = 50 ft
- Cost of vadose zone monitoring = \$75/ft x 50 ft = \$3,750

- Installation cost of borehole = \$45/linear ft
- Length of borehole installation = 50 ft
- Oversight = 1 day = 8 hours (\$56/hour).

Groundwater monitoring costs are assumed to be institutional costs and are not considered as part of this cost estimate.

Site Reviews: The cost associated with site reviews is an operation and maintenance cost. This cost will be incurred every 5 years as long as the alternative is being used. Site reviews will be conducted to assess site conditions and to evaluate the selected alternative and determine whether additional steps toward remediation are required.

D3.2.6 Representative Site 216-B-38 Trench (Cost tables D-17 through D-20)

This representative site is a group site containing sites 216-B-38, 216-B-35, 216-B-36, 216-B-37, 216-B-39, 216-B-40, and 216-B-41.

Implementation of Institutional Controls: Preparing and implementing institutional controls is a capital cost and includes office or administrative costs to implement deed restrictions, land-use restrictions, and groundwater-use restrictions. Costs presented in the cost estimates are based on the following:

- Time to produce institutional controls = 200 hours (assumption)
- Labor rate = \$56/hour (assumption).

Site Inspection and Surveillance: The costs associated with site inspection and surveillance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The activities included under site inspection and surveillance are assumed to be the same as the activities currently being performed. These activities include site radiation surveys of surface soil and physical site inspection. Activity may include control of deeply burrowing animals and deep-rooted plants by using herbicide or physical removal (cost for these items are not included).

For costing purposes, sites 50,000 ft^2 or smaller are assumed to require a team of two inspectors, two 8-hour (16 crew hours) days to perform the activities associated with site inspection and surveillance. An additional 16 crew hours will be needed for site inspection and surveillance for every additional 50,000 ft^2 of site area. The costs are based on the following:

- Area of representative site = 165,850 ft^2 (FS description)
- Time to complete inspections = 528 hours (16 hours for every 50,000 ft^2)
- Hourly rate for team = \$112/hour (\$56/hour/team member)
- Radiation surveys of surface soil = \$33,000/event (\$1,000 for every 5,000 ft^2).

Existing Cover Maintenance: The costs associated with existing cover maintenance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. Because cover maintenance is performed annually, including costs for replacing all or large portions of the existing cover at specified intervals is unnecessary. Rather, cover maintenance is assumed to include replacement of cover soils over 10 percent of the area to a depth of 2 ft. Costs are based on the following:

- Area of representative site = 165,850 ft^2
- Area requiring repair (10% of total area) = 16,585 ft^2 = 1,843 yd^2
- Oversight = 10 days (8 hours/day @ $56/hour).

In addition to the soil material and transportation costs, cover maintenance also includes placing and compacting soil cover material and reseeding.

Monitoring For Natural Attenuation: The costs associated with natural attenuation monitoring are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The cost for natural attenuation monitoring includes spectral gamma logging of vadose zone boreholes.

Vadose zone monitoring costs assume spectral gamma logging of one borehole per waste site to a depth of 50 ft, once every 5 years. The service life of a vadose zone borehole is assumed to be 30 years. Therefore, every 30 years a replacement borehole will be drilled. The costs are based on the following:

- Unit cost for vadose zone monitoring = $75/ft of borehole
- Length of borehole drilling = 50 ft
- Cost of vadose zone monitoring = $75/ft x 50 ft = $3,750
- Installation cost of borehole = $45/linear ft
- Length of borehole installation = 50 ft
- Oversight = 1 day = 8 hours ($56/hour).

Groundwater monitoring costs are assumed to be institutional costs and are not considered as part of this cost estimate.

Site Reviews: The cost associated with site reviews is an operation and maintenance cost. This cost will be incurred every 5 years as long as the alternative is being used. Site reviews will be conducted to assess site conditions and to evaluate the selected alternative and determine whether additional steps toward remediation are required.

D3.2.7 Representative Site 216-B-57 Crib (Cost Tables D-21 through D-24)

Implementation of Institutional Controls: Preparing and implementing institutional controls is a capital cost and includes office or administrative costs to implement deed restrictions, land-use restrictions, and groundwater-use restrictions. Costs presented in the cost estimates are based on the following:

- Time to produce institutional controls = 200 hours (assumption)
- Labor rate = \$56/hour (assumption).

Site Inspection and Surveillance: The costs associated with site inspection and surveillance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The activities included under site inspection and surveillance are assumed to be the same as the activities currently being performed. These activities include site radiation surveys of surface soil and physical site inspection. Activities may include control of deeply burrowing animals and deep rooted plants by using herbicide or by physical removal (cost for these items are not included).

For costing purposes, sites 50,000 ft^2 or smaller will require a team of two inspectors, two 8-hour days (16 crew hours) to perform the activities associated with site inspection and surveillance. An additional 16 crew hours will be needed for site inspection and surveillance for every additional 50,000 ft^2 of site area. The costs are based on the following:

- Area of representative site = 3,000 ft^2 (FS description)
- Time to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
- Hourly rate for team = \$112/hour (\$56/hour/team member)
- Radiation surveys of surface soil = \$1,000/event (\$1,000 for every 5,000 ft^2).

Existing Cover Maintenance: The costs associated with existing cover maintenance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. Because cover maintenance is performed annually, including costs for replacing all or large portions of the existing cover at specified intervals is unnecessary. Rather, cover maintenance is assumed to include replacement of cover soils over 10 percent of the area to a depth of 2 ft.

- Area of representative site = 3000 ft^2
- Area requiring repair (10% of total area) = 300 ft^2 = 34 yd^2
- Oversight = 1 day (8 hours/day @ \$56/hour).

In addition to the soil material and transportation costs, cover maintenance includes placing and compacting soil cover material and reseeding.

Monitoring For Natural Attenuation: The costs associated with natural attenuation monitoring are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The cost for natural attenuation monitoring includes spectral gamma logging of vadose zone boreholes.

Vadose zone monitoring costs assume spectral gamma logging of one borehole per waste site to a depth of 50 ft once every 5 years. The service life of a vadose zone borehole is assumed to be 30 years. Therefore, every 30 years a replacement borehole will be drilled. The costs are based on the following:

- Unit cost for vadose zone monitoring = \$75/ft of borehole
- Length of borehole drilling = 50 ft
- Cost of vadose zone monitoring = \$75/ft x 50 ft = \$3,750
- Installation cost of borehole = \$45/linear ft
- Length of borehole installation = 50 ft
- Oversight = 1 day = 8 hours (\$56/hour).

Groundwater monitoring costs are assumed to be institutional costs and are not considered as part of this cost estimate.

Site Reviews: The cost associated with site reviews is an operation and maintenance cost. This cost will be incurred every 5 years as long as the alternative is being used. Site reviews will be conducted to assess site conditions and to evaluate the selected alternative and determine whether additional steps toward remediation are required.

D3.2.8 Representative Site 241-B-361 Settling Tank (Cost tables D-25 through D-28)

Sludge Removal: To remove sludge from the 241-B-361 settling tanks, it is proposed to use the same process as that proposed for the 241-Z-361 Settling Tank that is described in DOE/RL-2003-52, Rev. 0, Tank 241-Z-361 Engineering Evaluation/Cost Analysis. A AEAT Fluidics™ retrieval system will be used to remove sludge from the tank and transfer it into proper shipping containers. Absorbent will be added to these containers to dry the waste that is believed to possess approximately 60-75% water. The closed container possesses a HEPA vent. The container will then be transferred to interim on site storage prior to ultimate disposition.

The cost to transfer the sludge from the tank into containers and absorb associated liquid is \$6,000,000 per DOE/RL-2003-52. This cost does not include costs associated with interim on site storage and ultimate disposal. The cost does include all necessary markups.

Implementation of Institutional Controls: Preparing and implementing institutional controls is a capital cost and includes office or administrative costs to implement deed restrictions, land-use restrictions, and groundwater-use restrictions. Costs presented in the cost estimates are based on the following:

- Time to produce institutional controls = 200 hours (assumption)
- Labor rate = \$56/hour (assumption).

Site Inspection and Surveillance: The costs associated with site inspection and surveillance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The activities included under site inspection and surveillance are assumed to be the same as the activities currently being performed. These activities include site radiation surveys of surface soil and physical site inspections. Activities may include control of deeply burrowing animals and deep-rooted plants by using herbicide or by physical removal (cost for these items are not included).

For costing purposes, sites 50,000 ft^2 or smaller are assumed to require a team of two inspectors, two 8-hour days (16 crew hours) to perform the activities associated with site inspection and surveillance. An additional 16 crew hours will be needed for site inspection and surveillance for every additional 50,000 ft^2 of site area.

- Area of representative site = 314 ft^2 (20 ft diameter tank on end)
- Time to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
- Hourly rate for team = $112/hour ($56/hour/team member)
- Radiation surveys of surface soil = $1,000/event ($1,000 for every 5,000 ft^2).

Existing Cover Maintenance: The costs associated with existing cover maintenance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. Because cover maintenance is performed annually, including costs for replacing all or large portions of the existing cover at specified intervals is unnecessary. Rather, cover maintenance is assumed to include replacement of cover soils over 10% of the area to a depth of 2 ft.

- Area of representative site = 314 ft^2
- Area requiring repair (10% of total area) = 32 ft^2 = 4 yd^2
- Oversight = 1 day (8 hours/day @ $56/hour).

In addition to the soil material and transportation costs, cover maintenance includes placing and compacting soil cover material and reseeding.

Monitoring For Natural Attenuation: The costs associated with natural attenuation monitoring are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The cost for natural attenuation monitoring includes spectral gamma logging of vadose zone boreholes.

Vadose zone monitoring costs assume spectral gamma logging of one borehole per waste site to a depth of 50 ft once every 5 years. The service life of a vadose zone borehole is assumed to be 30 years. Therefore, every 30 years a replacement borehole will be drilled. The costs are based on the following:

- Unit cost for vadose zone monitoring = $75/ft of borehole
- Length of borehole drilling = 50 ft
- Cost of vadose zone monitoring = $75/ft x 50 ft = $3,750
- Installation cost of borehole = $45/linear ft
- Length of borehole installation = 50 ft
- Oversight = 1 day = 8 hours ($56/hour).

Groundwater monitoring costs are assumed to be institutional costs and are not considered as part of this cost estimate.

Site Reviews. The cost associated with site reviews is an operation and maintenance cost. This cost will be incurred every 5 years as long as the alternative is being used. Site reviews will be conducted to assess site conditions and to evaluate the selected alternative and determine whether additional steps toward remediation are required.

D3.2.9 Representative Site 216-B-58 Trench (Cost tables D-29 through D-32)

Implementation of Institutional Controls: Preparing and implementing institutional controls is a capital cost and includes office or administrative costs to implement deed restrictions, land-use restrictions, and groundwater-use restrictions. Costs presented in the cost estimates are based on the following:

- Time to produce institutional controls = 200 hours (assumption)
- Labor rate = $56/hour (assumption)

Site Inspection and Surveillance: The costs associated with site inspection and surveillance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The activities included under site inspection and surveillance are assumed to be the same as the activities currently being performed. These activities include site radiation surveys of surface soil and physical site inspections. Activities may include control of deeply burrowing animals and deep-rooted plants by using herbicide or by physical removal (cost for these items are not included).

For costing purposes, sites 50,000 ft^2 or smaller are assumed to require a team of two inspectors, two 8-hour days (16 crew hours) to perform the activities associated with site inspection and surveillance. An additional 16 crew hours will be needed for site inspection and surveillance for every additional 50,000 ft^2 of site area.

- Area of representative site = 2,000 ft^2 (200 ft x 10 ft)
- Time to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
- Hourly rate for team = $112/hour ($56/hour/team member)
- Radiation surveys of surface soil = $1,000/event ($1,000 for every 5,000 ft^2)

Existing Cover Maintenance: The costs associated with existing cover maintenance are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. Because cover maintenance is performed annually, including costs for replacing all or large portions of the existing cover at specified intervals is unnecessary. Rather, cover maintenance is assumed to include replacement of cover soils over 10% of the area to a depth of 2 ft.

- Area of representative site = 2,000 ft^2
- Area requiring repair (10% of total area) = 200 ft^2 = 22 yd^2
- Oversight = 1 day (8 hours/day @ $56/hour)

In addition to the soil material and transportation costs, cover maintenance includes placing and compacting soil cover material and reseeding.

Monitoring For Natural Attenuation: The costs associated with natural attenuation monitoring are operation and maintenance costs. These costs will be incurred annually as long as the alternative is being used. The cost for natural attenuation monitoring includes spectral gamma logging of vadose zone boreholes.

Vadose zone monitoring costs assume spectral gamma logging of one borehole per waste site to a depth of 50 ft once every 5 years. The service life of a vadose zone borehole is assumed to be 30 years. Therefore, every 30 years a replacement borehole will be drilled. The costs are based on the following:

- Unit cost for vadose zone monitoring = $75/ft of borehole
- Length of borehole drilling = 50 ft
- Cost of vadose zone monitoring = $75/ft x 50 ft = $3,750
- Installation cost of borehole = $45/linear ft
- Length of borehole installation = 50 ft
- Oversight = 1 day = 8 hours ($56/hour).

Groundwater monitoring costs are assumed to be institutional costs and are not considered as part of this cost estimate.

Site Reviews: The cost associated with site reviews is an operation and maintenance cost. This cost will be incurred every 5 years as long as the alternative is being used. Site reviews will be conducted to assess site conditions and to evaluate the selected alternative and determine whether additional steps toward remediation are required.

D3.3 ALTERNATIVE 3 – REMOVE AND DISPOSE

D3.3.1 General Assumptions

The general assumptions for Alternative 3 are as follows:

- The contractor will perform all the excavation, decontamination, and restoration activities for this alternative. Personnel used to complete these tasks include support personnel, laborers, equipment operators, oilers, and truck drivers (teamsters). The support personnel will include a superintendent, a site foreman, a site engineer, a site health and safety manager, and a timekeeper-clerk. This support crew will be on site from mobilization through demobilization. Using the wages discussed in Section D3.1, this crew has an hourly rate of $237 ($1,896 daily rate). The number of laborers, equipment operators, oilers, and truck drivers are defined under the activities discussed in the following paragraphs.

- Fluor Hanford will provide contractor oversight, collect all samples, and perform all screening of material and containers leaving the site. Personnel used to perform contractor oversight include a project manager , a radiation control technician (RCT), a health and safety manager (half time), and a QA/QC representative and scheduler. This oversight crew will be used whenever the contractor is in operation. Using the wages discussed in Section D3.1, this crew has an hourly rate of $215 ($1,720 daily rate).

Personnel used to perform all screening of material and containers leaving the site include one RCT for each excavator and four RCT for the decontamination pad. One RCT has been included in the contractor oversight crew as a substitute and one RCT accompanies each soil and sediment sampler as specified below.

- Air samples will be taken during excavation of overburden and contaminated soil. It is assumed that one air sample will be collected each day. The air sampling costs have been developed as follows:

  - Equipment cost = \$500 per day
  - Analytical cost = \$1,000/sample
  - Labor (sampler) = Full time
  - Labor (RCT) = Full time.

- Soil samples will be taken for the overburden soil excavated, the contaminated soil excavated, and for certification at the completion of excavation. The number of site certification samples collected is based on the total surface area of excavation, including the excavation floor and side slopes. The total number of off site QC samples equals 5% of the total number of samples collected. The soil sampling costs have been developed as follows:

- Overburden soil	Number of samples	=	6 samples per site
	Cost per sample	=	\$1,100 each (on site)
			\$5,000 each (off site)
	Labor (sampler)	=	1 half time
	Labor (RCT)	=	1 full time.
- Contaminated soil (LLW samples)	Number of samples	=	1 sample per 845 yd^3
			(6 samples minimum)
	Cost per sample	=	\$5,000 each (on site)
			\$5,000 each (off site)
	Labor (sampler)	=	1 half time
	Labor (RCT)	=	1 full time.
- Certification samples	Number of samples	=	1 sample per 6,264 ft^2
			(6 samples minimum)
	Cost per sample	=	\$5,000 each (on site)
			\$5,000 each (off site)
	Labor (sampler)	=	3 samples per hour
	Labor (RCT)	=	3 samples per hour.

- The cost for transportation and disposal of contaminated material at the ERDF is \$1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs.

- Groundwater monitoring is performed under a separate operable unit. The costs associated with periodic groundwater sampling are considered institutional costs and are not considered in this cost estimate.

- The prices that make up the cost estimate were obtained from one of the following sources:

  - *ECHOS Environmental Remediation Cost Data – Unit Price*, 8th Annual Edition (Means 2002a).

  - *Site Work and Landscape Cost Data*, 21st Annual Edition (Means 2002b).

  - Experience on similar projects.

D3.3.2 Representative Site 216-T-26 Crib (Cost tables D-33 and D-34)

The site work was estimated to take 12.8 weeks (3.1 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, performing the site survey, and performing decontamination setup.

- Excavate: 30 days (6 weeks)

- Restore site: 19 days (3.8 weeks)

- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total construction duration = 64 days = 12.8 weeks = 3.1 months.

Site Description: The basis for the following information can be found on Table D-103.

- Area of contaminant mass = 30 ft x 30 ft = 900 ft^2
- Depth of clean overburden soil = 18 ft bgs
- Total Excavation depth = 52 ft bgs
- Volume of contaminated soil = 1,133 yd^3
- Based on 1.5H:1V excavation side slopes, total excavation volume = 26,370 yd^3
- Based on 1.5H:1V excavation side slopes, volume of overburden soil = 25,236 yd^3

- Volume of contaminated soil requiring blending = (40 ft – 18 ft) x 30 ft x 30ft
  = 19,800 ft^3 = 734 yd^3
- Volume of soil needed to blend at a ratio of 5:1 = 734 yd^3 x 5 parts clean/1 part dirty
  = 3,670 yd^3
- Total volume of material to dispose = 734 yd^3 + 3,670 yd^3
  = 4,404 yd^3
- Volume of overburden soil used in blend = 3,670 yd^3 - [1,133 yd^3 - 734 yd^3]
  = 3,271 yd^3
- Volume of overburden soil remaining on site = 25,236 yd^3 – 3,271 yd^3
  = 21,965 yd^3
- Volume of material required from Pit 30 to backfill = Total volume of material to dispose
  = 4,404 yd^3.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of construction oversight = 64 days = 12.8 weeks
- Construction oversight rate = $215/hour = $1,720/day (see general assumptions)
- Duration of RCT on excavator = 2 excavators x 30 days (equal to excavation time)
  = 60 days
- RCT rate = $56/hour = $448/day
- Duration of RCT decontamination crew = 16 days (equal to contaminated soil excavation time)
- RCT rate = $56/hour x 4 people = $224/hour = $1,792/day.

Fluor Hanford Sampling Crews and Sampling: Fluor Hanford will perform all sampling required. A bulking factor of 15% was applied to the contaminated soil volume to calculate the number of contaminated (LLW) samples. Sampling is calculated as follows:

- Overburden samples = 6 per site
- Contaminated (LLW) samples = 1,133 yd^3 x 15% x 1 sample/845 yd^3 = 1.6
  = Assume 6 samples (minimum)
- Site certification samples = 29,725 ft^2 x 1 sample/6,264 ft^2 = 4.7
  = Assume 6 samples (minimum)
- QC samples = (6 + 6 + 6) x 5% = 1 sample
- Duration of air sampling crew = 30 days (equal to excavation time)

- Air sampling crew rate (Sampler and RCT) = \$56/hour x 2 people = \$112/hour = \$896/day
- Duration of soil/sediment sampling crew = 30 days (equal to excavation time)
- Soil/sediment sampling crew rate (Sampler 50% and RCT) = \$56/hour x 50% + \$56/hour = \$84/hour = \$672/day.

Fluor Hanford Transportation and Disposal: As mentioned in the general assumptions, the cost for transportation and disposal of contaminated material at the ERDF is \$1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

- Total volume to dispose = 4,404 yd^3 (see Site Description)
- Number of containers = 4,404 yd^3 x 1 container/11 yd^3 = 401 containers.

Mobilization, Demobilization, and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operating costs of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- Site
  - Two hydraulic excavators and two operators
  - One bulldozer and one operator
  - One front-end loader and one operator
  - One water truck and one operator
  - Four laborers
  - One office trailer
  - One storage trailer.
- Pit 30
  - One hydraulic excavator and one operator
  - One front-end loader and one operator
  - Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

- Mobilization and demobilization time = (1 mob + 1 demob) x 8 hours/day x \$37/hour = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

- Area of construction survey = area of excavation + 20% = 186 ft x 186 ft + 20% = 41,515 ft^2 = 0.95 acre.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

- Length of temporary fence = 2 x (width + length) + 20% = 2 x (186 ft + 186 ft) + 20% = 893 linear ft.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

• Length of haul road	=	600 ft		
• Width of haul road	=	24 ft		
• Gravel	=	24 ft x 600 ft + 10%	= 15,840 ft^2	= 1,760 yd^2.

Decontamination Pad: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, polyvinyl chloride (PVC) pipe, a sump with a pump and hoses, and two 1,000 gallon storage tanks. Labor to construct and remove the decontamination pad has been included in the decontamination pad cost. The spent decontamination water is assumed to be used for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	= 600 ft^2	
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	= 402 linear ft	= 0.402 m board ft
• Plastic sheeting (60 mil linear low-density polyethylene [LLDPE])	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	= 1,188 ft^2	
• 3-in. PVC pipe	=	5 linear ft.		

The amount of decontamination water is assumed to be 1,000 gal/month for the time decontamination is needed (during excavation of contaminated soil = 9 days).

Decontamination water = 1,000 gal/month x 16 days x 1 month/21 days = 800 gal.

It is assumed that all equipment can be decontaminated for reuse.

The decontamination pad will be staffed for the duration of contaminated soil excavation. It is assumed that the decontamination crew will consist of four laborers.

• Duration of contaminated soil excavation	=	16 days = 0.8 months
• Monthly rate for 4 laborers	=	\$37/hour/laborer x 4 laborers
	=	\$148/hour x 8 hours/day
	=	\$1,184/day x 21 days/month
	=	\$24,864/month.

Excavation: The overburden excavation will be performed using two hydraulic excavators and one front-end loader. Overburden soil will be excavated by removing noncontaminated soil and placing it on the ground next to the excavation. A loader then will be used to move the soil to a nearby stock pile. The excavation of noncontaminated soil is expected to proceed at a rate of 120 yd^3/hour and the two excavators are operational for 8 hours/day or 1,920 yd^3/day. Labor for overburden excavation consists of an equipment operator each for both hydraulic excavators and front-end loader. The stock pile for the overburden soil is expected to be close enough to the excavation to allow the loader to meet or exceed the production rate of the excavator.

• Volume of overburden soil	=	25,236 yd^3 (see Site Description)
• Days to excavate overburden soil	=	25,236 yd^3 / 1,920 yd^3/day = 14 days

Contaminated soil will be excavated using two hydraulic excavators and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator will be able to excavate the contaminated material and load it directly into the disposal containers. It is estimated that 40 containers can be sent to the ERDF on a daily basis. With 11 yd^3 of material per container, a total of 440 yd^3 of material will be sent to ERDF daily. Higher concentrations of contaminated soil will require blending in order to meet ERDF WAC requirements. The volume of material requiring blending is based on the table located in the general assumptions of Alternative 5. A blending ratio of 5 parts clean to 1 part contaminated has been assumed for this soil. Due to the blending ratio provided, of the 440 yd^3 being sent to the ERDF only 73 yd^3 of this material is highly contaminated soil (440 yd^3 / 6 parts total = 73 yd^3/day). Therefore, the duration of contaminated soil excavation is determined by dividing the total volume of contaminated soil by 73 yd^3/day.

• Volume of contaminated soil	=	1,133 yd^3 (see Site Description)
• Days to excavate contaminated soil	=	1,133 yd^3 / 73 yd^3/day = 16 days.

The cost for excavating and loading the soil is based on the following:

• Excavation time (overburden and contaminated)	=	14 days + 16 days = 30 days
• Labor (operator) x pieces of equipment	=	\$37/hour x 8 hours/day = \$296/day x pieces of equipment.

Concrete culverts within the excavation area are assume to be removed by the hydraulic excavator, broken if necessary, and placed with the waste.

To minimize the generation of on site fugitive dust, a water truck will be rented for the duration of the excavation process.

Water truck rental = 30 days.

Site Restoration: Site restoration will consist of backfilling the excavation area with the clean overburden soil previously excavated and fill material obtained from the local borrow pit (Pit 30). Backfilling of overburden soil will be performed using a front-end loader and a bulldozer. It is assumed that the overburden soil can be backfilled at a rate of 185 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,480 yd^3/day. Labor for overburden soil backfill consists of equipment operators for every piece of equipment being used. The cost is based on the following:

• Volume of remaining overburden soil to backfill	=	21,965 yd^3 (see Site Description)
• Time to backfill overburden soil	=	21,965 yd^3 / 1,480 yd^3/day = 15 days
• Labor (operator) x pieces of equipment	=	$37/hour x 8 hours/day = $296/day x pieces of equipment.

The remaining volume of backfill material will be obtained from Pit 30 using a hydraulic excavator and front-end loader. Five trucks will transport the material from Pit 30 to the site. Backfilling will be performed using a front-end loader and bulldozer on site. This material will make up for the volume of contaminated soil previously excavated from the site and overburden soil used for the blend. It is assumed that the borrow material from Pit 30 can be placed at a rate of 160 yd^3/hour. Operating the equipment for 8 hours/day the production rate is 1,280 yd^3/day. Labor for backfill consists of equipment operators for every piece of equipment being used and five truck drivers.

• Offsite borrow material required	=	4,404 yd^3 (see Site Description)
• Days to backfill borrow material	=	4,404 yd^3 / 1,280 yd^3/day = 4 days
• Labor (operator) x pieces of equipment	=	$37/hour x 8 hours/day = $296/day x pieces of equipment
• Truck drivers (teamsters)	=	$37/hour x 8 hours/day = $296/day x number of teamsters.

The cost of backfilling is based on the following:

Restoration time (overburden and borrow material) = 15 days + 4 days = 19 days.

It is assumed that no characterization sampling of borrow material is needed.

To minimize the generation of on site dust during backfill operations and to water the revegetated area, a water truck will be rented for the duration of the backfilling process.

Water truck rental = 19 days.

Following backfill, the area will be revegetated. Revegetation will be conducted while backfilling is occurring, if feasible, and during demobilization. Revegetation costs are based on the following.

• Area to Revegetate (Area of excavation + 20%)	=	186 ft x 186 ft + 20%
	=	41,515 ft^2 = 4,613 yd^2
• Production rate	=	$1,000 yd^2/day

- Days to revegetate = 4,613 yd² x 1 day/1,000 yd² = 5 days.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization and demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 64 days
- Contractor support rate = $237/hour = $1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate = $50/hour (assumption).

Annual Cost: No annual costs are associated with Alternative 3. No site monitoring is required because all of the contaminated waste will be removed. No groundwater monitoring is required because groundwater is evaluated under a separate operable unit.

D3.3.3 Representative Site 216-B-46 Crib (Cost tables D-35 and D-36)

This representative site is a group site containing sites 216-B-46, 216-B-43, 216-B-44, 216-B-45, 216-B-47, 216-B-48, 216-B-49, and 216-B-50. The site work was estimated to take 238.4 weeks (56.8 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 15 days (3 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, and performing the site survey, and performing decontamination setup.

- Excavate: 1,026 days (205.2 weeks)

- Restore site: 141 days (28.2 weeks)

- Demobilize: 10 days (2 weeks), includes demobilizing facilities, equipment, and personnel; performing the as-built site survey, and performing final site cleanup.

Total construction duration = 1,192 days = 238.4 weeks = 56.8 months.

Site Description: The basis for the following information can be found on Table D-103.

- Area of contaminant mass = 312 ft x 196 ft = 61,152 ft^2
- Depth of clean overburden soil = 18 ft bgs
- Total excavation depth = 49 ft bgs
- Volume of contaminated soil = 70,212 yd^3
- Based on 1.5H:1V excavation side slopes, total excavation volume = 191,590 yd^3
- Based on 1.5H:1V excavation side slopes, volume of overburden soil = 121,378 yd^3
- Volume of contaminated soil requiring blending = (25ft – 18ft) x 312ft x 196ft = 428,064 ft^3 = 15,855 yd^3
- Volume of soil needed to blend at a ratio of 5:1 = 15,855 yd^3 x 5 parts clean/1 part dirty = 79,275 yd^3
- Total volume of material to dispose = 15,855 yd^3 + 79,275 yd^3 = 95,130 yd^3
- Volume of overburden soil used in blend = 79,275 yd^3 – (70,212 yd^3 – 15,855 yd^3) = 24,918 yd^3
- Volume of overburden soil remaining on site = 121,378 yd^3 – 24,918 yd^3 = 96,460 yd^3
- Volume of material required from Pit 30 to backfill = Total volume of material to dispose = 95,130 yd^3.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of construction oversight = 1,192 days = 238.4 weeks
- Construction oversight rate = $215/hour = $1,720/day (see general assumptions)
- Duration of RCT on excavator = 2 excavators x 1,026 days (equal to excavation time) = 2,052 days
- RCT rate = $56/hour = $448/day
- Duration of RCT decontamination crew = 962 days (equal to contaminated soil excavation time)
- RCT rate = $56/hour x 4 people = $224/hour = $1,792/day.

Fluor Hanford Sampling Crews and Sampling: Fluor Hanford will perform all sampling required. A bulking factor of 15% was applied to the contaminated soil volume to calculate the number of contaminated (LLW) samples. Sampling is calculated as follows:

• Overburden samples	= 6 per site
• Contaminated (LLW) samples	= 70,212 yd^3 x 15% x 1 sample/845 yd^3
	= 96 samples
• Site certification samples	= 166,508 ft^2 x 1 sample/6,264 ft^2
	= 27 samples
• QC samples	= (6 + 96 + 27) x 5% = 7 samples
• Duration of air sampling crew	= 516 days (equal to excavation time)
• Air sampling crew rate (sampler and RCT)	= \$56/hour x 2 people = \$112/hour
	= \$896/day
• Duration of soil/sediment sampling crew	= 1,026 days (equal to excavation time)
• Soil/sediment sampling crew rate (Sampler 50% and RCT)	= \$56/hour x 50% + \$56/hour = \$84/hour
	= \$672/day.

Fluor Hanford Transportation and Disposal. As mentioned in the general assumptions, the cost for transportation and disposal of contaminated material at the ERDF is \$1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

• Total volume to dispose	=	95,130 yd^3 (see Site Description)
• Number of containers	=	95,130 yd^3 x 1 container/11 yd^3
	=	8,649containers.

Mobilization and Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operating costs of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- Site
  - Two hydraulic excavators and two operators
  - One bulldozer and one operator
  - One front-end loader and one operator
  - One water truck and one operator

- Four laborers
- One office trailer
- One storage trailer.

- Pit 30
  - One hydraulic excavator and one operator
  - One front-end loader and one operator
  - Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

- Mobilization and demobilization time = (1 mob + 1 demob) x 8 hour/day x \$37/hour = *\$592/person.*

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

- Area of construction survey = area of excavation + 20% = 459 ft x 343 ft + 20% = 188,924 ft^2 = 4.34 acres.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

- Length of temporary fence = 2 x (width + length) + 20% = 2 x (459 ft + 343 ft) + 20% = 1,925 linear ft.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

• Length of haul road	=	1,500 ft		
• Width of haul road	=	24 ft		
• Gravel	=	24 ft x 1,500 ft + 10%	= 39,600 ft^2	= 4,400 yd^2.

Decontamination Pad: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump with a pump and hoses, and two 1,000 gallon temporary storage tanks. Labor to construct and remove the decontamination pad has been included in the decontamination pad cost. The spent decontamination water is assumed to be used for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	= 600 ft^2
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	= 402 linear ft = 0.402 m board ft
• Plastic sheeting (60 mil LLDPE)	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	= 1,188 ft^2
• 3-in. PVC pipe	=	5 linear ft.	

The amount of decontamination water is assumed to be 1,000 gal/month for the time decontamination is needed (during excavation of contaminated soil = 962 days).

Decontamination water = 1,000 gal/month x 962 days x 1 month/21 days = 45,900 gal.

It is assumed that all equipment can be decontaminated for reuse.

The decontamination pad will be staffed for the duration of contaminated soil excavation. The decontamination crew is expected to consist of four laborers.

• Duration of contaminated soil excavation	=	962 days = 45.9 months
• Monthly rate for four laborers	=	\$37/hour/laborer x 4 laborers
	=	\$148/hour x 8 hours/day
	=	\$1,184/day x 21 days/month
	=	\$24,864/month.

Excavation: The overburden excavation will be performed using two hydraulic excavators and one front-end loader. Overburden soil will be excavated by removing noncontaminated soil and placing it on the ground next to the excavation. A loader then will be used to move the soil to a nearby stock pile. The excavation of noncontaminated soil is expected to proceed at a rate of 120 yd^3/hour and the two excavators are operational for 8 hours/day or 1,920 yd^3/day. Labor for overburden excavation consists of an equipment operator each for both hydraulic excavators and front-end loader. The stock pile for the overburden soil is expected to be close enough to the excavation to allow the loader to meet or exceed the production rate of the excavators.

• Volume of overburden soil	=	121,378 yd^3 (see Site Description)
• Days to excavate overburden soil	=	121,378 yd^3 / 1,920 yd^3/day = 64 days

Contaminated soil will be excavated using two hydraulic excavators and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator will be able to excavate the contaminated material and load it directly into the disposal containers. It is estimated that 40 containers can be sent to the ERDF on a daily basis. With 11 yd^3 of material per container, a total of 440 yd^3 of material will be sent to ERDF daily. Higher concentrations of contaminated soil will require blending in order to meet ERDF WAC requirements. The volume of material requiring blending is based on the table located in the general assumptions of Alternative 5. A blending ratio of 5 parts clean to 1 part contaminated has been assumed for this soil. Due to the blending ratio provided, of the 440 yd^3 being sent to the ERDF only 73 yd^3 of this material is highly contaminated soil (440 yd^3 / 6 parts total = 73 yd^3/day). Therefore, the duration of contaminated soil excavation is determined by dividing the total volume of contaminated soil by 73 yd^3/day.

- Volume of contaminated soil = 70,212 yd^3 (see Site Description)
- Days to excavate contaminated soil = 70,212 yd^3 / 73 yd^3/day = 962 days.

The cost for excavating and loading the soil is based on the following:

- Excavation time (overburden and contaminated) = 64 days + 962 days = 1,026 days = 205.2 weeks
- Labor (operator) x pieces of equipment = $37/hour x 8 hours/day = $296/day x pieces of equipment.

Concrete culverts within the excavation area are assumed to be removed by the hydraulic excavators, broken if necessary, and placed with the waste.

To minimize the generation of on site fugitive dust, a water truck will be rented for the duration of the excavation process.

Water truck rental = 516 days.

Site Restoration: Site restoration will consist of backfilling the excavation area with clean overburden soil previously excavated and fill material obtained from the local borrow pit (Pit 30). Backfilling of overburden soil will be performed using a front-end loader and a bulldozer. It is assumed that the overburden soil can be backfilled at a rate of 185 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,480 yd^3/day. Labor for overburden soil backfill consists of equipment operators for every piece of equipment being used. The cost is based on the following::

- Volume of remaining overburden soil to backfill = 96,460 yd3 (see Site Description)
- Time to backfill overburden soil = 96,460 yd3 / 1,480 yd3/day = 66 days
- Labor (operator) x pieces of equipment = $37.00/hour x 8 hours/day = $296/day x pieces of equipment

The remaining volume of backfill material will be obtained from Pit 30 using a hydraulic excavator and front-end loader. Five trucks will transport the material from Pit 30 to the site. Backfilling will be performed using a front-end loader and bulldozer on site. This material will make up for the volume of contaminated soil previously excavated from the site and overburden soil used for the blend. It is assumed that the borrow material from Pit 30 can be placed at a rate of 160 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,280 yd^3/day. Labor for backfill consists of equipment operators for every piece of equipment being used and five truck drivers.

- Off site borrow material required = 95,130 yd^3 (see Site Description)
- Days to backfill borrow material = 95,130 yd^3 / 1,280 yd^3/day = 75 days
- Labor (operator) x pieces of equipment = \$37.00/hour x 8 hours/day = \$296/day x pieces of equipment
- Truck drivers (teamsters) = \$37/hour x 8 hours/day = \$296/day x number of teamsters.

The cost of backfilling is based on the following:

- Restoration time (overburden and borrow material) = 66 days + 75 days = 141days.

It is assumed that no characterization sampling of borrow material is needed.

To minimize the generation of on site dust during backfill operations and to water the revegetated area, a water truck will be rented for the duration of the backfilling process.

- Water truck rental = 141 days.

Following backfill, the area will be revegetated. Revegetation will be conducted while backfilling is occurring, if feasible, and during demobilization. Revegetation costs are based on the following:

- Area to Revegetate (Area of Excavation + 20%) = 459 ft x 343 ft + 20% = 188,924 ft^2 = 20,992 yd^2
- Production rate = 1,000 yd^2/day
- Days to revegetate = 20,992 yd^2 x 1 day/1,000 yd^2 = 21 days.

Miscellaneous. Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 1,192 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 320 hours (assumption)
- Labor rate = \$50/hour (assumption).

Annual Cost. No annual costs are associated with Alternative 3. No site monitoring is required because all of the contaminated waste will be removed. No groundwater monitoring is required because groundwater is evaluated under a separate operable unit.

D3.3.4 Representative Site 216-B-5 Reverse Well

Alternative 3 for this representative site is not evaluated because the alternative is not applicable.

D3.3.5 Representative Site: 216-B-7A&B Crib (Cost tables D-37 and D-38)

The site work was estimated to take 14 weeks (3.4 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 15 days (3 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, performing the site survey, and performing decontamination setup.
- Excavate: 35 days (7 weeks)
- Restore site: 10 days (2 weeks)
- Demobilize: 10 days (2 weeks), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total construction duration = 70 days = 14 weeks = 3.4 months.

Site Description: The basis for the following information can be found on Table D-103.

• Area of contaminant mass	=	48 ft x 14 ft = 672 ft^2
• Depth of clean overburden soil	=	15 ft bgs
• Total excavation depth	=	38 ft bgs
• Volume of contaminated soil	=	572 yd^3
• Based on 1.5H:1V excavation side slopes, total excavation volume	=	11,794 yd^3
• Based on 1.5H:1V excavation side slopes, volume of overburden soil	=	11,222 yd^3
• Volume of contaminated soil requiring blending at 10:1	=	(22 ft – 15 ft) x 48 ft x 14 ft 4,704 ft^3 = 175 yd^3
• Volume of soil needed to blend at a ratio of 10:1	=	175 yd^3 x 10 parts clean / 1part dirty = 1,750 yd^3
Volume of contaminated soil requiring blending at 5:1)	=	(28 ft – 22 ft) x 48 ft x 14 ft
	=	4,032 ft^3 = 150 yd^3
• Volume of soil needed to blend at a ratio of 5:1	=	150 yd^3 x 5 parts clean/1 part dirty
	=	750 yd^3
• Total volume of material to dispose	=	175yd^3 + 1,750yd^3 + 150yd^3
	=	750 yd^3

- Volume of overburden soil used in blend = ($1,750yd^3 + 750yd^3$) – ($572yd^3 - 175yd^3 - 150yd^3$)
  = 2,253 yd^3
- Volume of overburden soil remaining on site = 11,222 yd^3 – 2,253 yd^3
  = 8,969 yd^3
- Volume of material required from Pit 30 to backfill = Total volume of material to dispose
  = 2,825 yd^3.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). It is anticipated that representative site 216-B-7A&B will have elevated levels of contaminating. Therefore, additional RCTs, an RCT supervisor, and a radiological engineer will be required during excavation. The cost of Fluor Hanford oversight is calculated as follows:

- Duration of construction oversight = 70 days = 142 weeks
- Construction oversight rate = $215/hour = $1,720/day (see general assumptions)
- Duration of RCT on excavator = 2 excavators 35 days (equal to excavation time) = 70 days
- RCT rate = $56/hour = $448/day
- Duration of RCT decontamination crew = 29 days (equal to contaminated soil excavation time)
- RCT rate = $56/hour x 4 people = $224/hour
  = $1,792/day
- Duration of additional RCT, RCT supervisor, and radiological engineer = 35 days (equal to excavation time)
- RCT supervisor rate = $72.61/hour = $580.88/day
- Radiological engineer rate = $62.78/hour = $502.24/day.

Fluor Hanford Sampling Crews and Sampling: Fluor Hanford will perform all sampling required. A bulking factor of 15% was applied to the contaminated soil volume to calculate the number of contaminated (LLW) samples. Sampling is calculated as follows:

- Overburden samples = 6 per site
- Contaminated (LLW) samples = 572 yd^3 x 15% x 1 sample/845 yd^3 = 0.8
  = Assume 6 samples (minimum)
- Site certification samples = 18,553 ft^2 x 1 sample/6,264 ft^2 = 3
  = Assume 6 samples (minimum)
- QC samples = (6 + 6 + 6) x 5% = 1 sample
- Duration of air sampling crew = 35 days (equal to excavation time)

• Air sampling crew rate (Sampler and RCT)	=	\$56/hour x 2 people = \$112/hour
	=	\$896/day
• Duration of soil/sediment sampling crew	=	35 days (equal to excavation time)
• Soil/sediment sampling crew rate (Sampler 50% and RCT)	=	\$56/hour x 50% + \$56/hour = \$84/hour
	=	\$672/day.

Fluor Hanford Transportation and Disposal: As mentioned in the general assumptions, the cost for transportation and disposal of contaminated material at the ERDF is \$1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

• Total volume to dispose	=	2,825 yd^3 (see Site Description)
• Number of containers	=	2,825 yd^3 x 1 container/11 yd^3
	=	257 containers.

Mobilization and Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operating costs of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- Site
  - Two hydraulic excavators and two operators
  - One bulldozer and one operator
  - One front-end loader and one operator
  - One water truck and one operator
  - Four laborers
  - One office trailer
  - One storage trailer.
- Pit 30
  - One hydraulic excavator and one operator
  - One front-end loader and one operator
  - Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time = (1 mob + 1 demob) x 8 hour/day x \$37/hour = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = area of excavation + 20% = 162 ft x 128 ft + 20% = 24,883 ft^2 = 0.57 acre.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

Length of temporary fence = 2 x (width + length) + 20% = 2 x (162 ft + 128 ft) + 20% = 696 linear ft.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

- Length of haul road = 600 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 600 ft + 10% = 15,840 ft^2 = 1,760 yd^2.

Decontamination Pad: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump with a pump and hoses, and two 1,000 gallon temporary storage tanks. Labor to construct and remove the decontamination pad has been included in the decontamination pad cost. The spent decontamination water is assumed to be used for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	= 600 ft^2	
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	= 402 linear ft	= 0.402 m board ft
• Plastic sheeting (60 mil LLDPE)	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	= 1,188 ft^2	
• 3-in. PVC pipe	=	5 linear ft.		

The amount of decontamination water is assumed to be 1,000 gal/month for the time decontamination is needed (during excavation of contaminated soil = 29 days).

Decontamination water = 1,000 gal/month x 29 days x 1 month/21 days = 1,400 gal.

It is assumed that all equipment can be decontaminated for reuse.

The decontamination pad will be staffed for the duration of contaminated soil excavation. The decontamination crew is expected to consist of four laborers.

- Duration of contaminated soil excavation = 29 days = 1.4 months

- Monthly rate for four laborers = \$37/hour/laborer x 4 laborers
  = \$148/hour x 8 hours/day
  = \$1,184/day x 21 days/month
  = \$24,864/month.

Excavation: The overburden excavation will be performed using two hydraulic excavators and one front-end loader. Overburden soil will be excavated by removing noncontaminated soil and placing it on the ground next to the excavation. A loader then will be used to move the soil to a nearby stock pile. The excavation of noncontaminated soil is expected to proceed at a rate of 120 yd^3/hour and the two excavators are operational for 8 hours/day or 1,920 yd^3/day. Labor for overburden excavation consists of an equipment operator each for both hydraulic excavators and front-end loader. The stock pile for the overburden soil is expected to be close enough to the excavation to allow the loader to meet or exceed the production rate of the excavators.

- Volume of overburden soil = 11,222 yd^3 (see Site Description)
- Days to excavate overburden soil = 11,222 yd^3 / 960 yd^3/day = 9 days

Contaminated soil will be excavated using two hydraulic excavators and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator will be able to excavate the contaminated material and load it directly into the disposal containers. It is assumed that two zones of contamination exist at 216-B-7A&B that will require different blending ratios. At 15 ft bgs to 22 ft bgs, a blending ratio of 10 parts clean to 1 part contaminated has been determined as the requirement to meet ERDF WAC. At 28 ft bgs to 22 ft bgs, a blending ratio of 5 parts clean to 1 part contaminated has been determined as the requirement to meet ERDF WAC (see general assumptions of Alternative 5). Due to the elevated levels of contamination at this site, it is estimated that 20 containers can be sent to the ERDF on a daily basis. With 11 yd^3 of material per container, a total of 220 yd^3 of material will be sent to ERDF daily. Due to the blending ratio provided for highly contaminated soil, of the 220 yd^3 being sent to the ERDF only 20 yd^3 of this material is highly contaminated soil (220 yd^3 / 11 parts total = 20 yd^3/day). Therefore, the duration of contaminated soil excavation is determined by dividing the total volume of contaminated soil by 20 yd^3/day.

- Volume of contaminated soil = 572 yd^3 (see Site Description)
- Days to excavate contaminated soil = 572 yd^3 / 20 yd^3/day = 29 days.

The cost for excavating and loading the soil is based on the following:

- Excavation time (overburden and contaminated) = 6 days + 29 days = 35 days
- Labor (operator) x pieces of equipment = \$37/hour x 8 hours/day
  = \$296/day x pieces of equipment.

Any timbers within the excavation area are assume to be removed (broken if necessary) by the hydraulic excavator and placed with the waste.

To minimize the generation of on site fugitive dust, a water truck will be rented for the duration of the excavation process.

Water truck rental = 35 days.

Site Restoration: Site restoration will consist of backfilling the excavation area with clean overburden soil previously excavated and common fill obtained from the local borrow pit (Pit 30). Backfilling of overburden soil will be performed using one front-end loader and one bulldozer. It is assumed that the overburden soil can be backfilled at a rate of 185 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,480 yd^3/day. Labor for overburden soil backfill consists of equipment operators for every piece of equipment being used. The cost is based on the following:

- Volume of remaining overburden soil to backfill = 8,969 yd^3 (see Site Description)
- Time to backfill overburden soil = 8,969 yd^3 / 1,480 yd^3/day = 7 days
- Labor (operator) x pieces of equipment = $37.00/hour x 8 hours/day = $296/day x pieces of equipment.

The remaining volume of backfill material will be obtained from Pit 30 using a hydraulic excavator and front-end loader. Five trucks will transport the material from Pit 30 to the site. Backfilling will be performed using a front-end loader and bulldozer on site. This material will make up for the volume of contaminated soil previously excavated from the site and overburden soil used for the blend. It is assumed that the borrow material from Pit 30 can be placed at a rate of 160 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,280 yd^3/day. Labor for backfill consists of equipment operators for every piece of equipment being used and five truck drivers.

- Off site borrow material required = 2,825 yd^3 (see site description)
- Days to backfill borrow material = 2,825 yd^3 / 1,280 yd^3/day = 3 days
- Labor (operator) x pieces of equipment = $37.00/hour x 8 hours/day = $296/day x pieces of equipment
- Truck drivers (teamsters) = $37/hour x 8 hours/day = $296/day x number of teamsters.

The cost of backfilling is based on the following:

- Restoration time (overburden and borrow material) = 7 days + 3 days = 10 days.

It is assumed that no characterization sampling of borrow material is needed.

To minimize the generation of on site dust during backfill operations and to water the revegetated area, a water truck will be rented for the duration of the backfilling process.

- Water truck rental = 10 days.

Following backfill, the area will be revegetated. Revegetation will be conducted while backfilling is occurring, if feasible, and during demobilization. Revegetation costs are based on the following:

- Area to Revegetate (Area of Excavation + 20%) = 162 ft x 128 ft + 20% = 24,883 ft^2 = 2,765 yd^2
- Production rate = 1,000 yd^2/day
- Days to revegetate = 2,765 yd^2 x 1 day/1,000 yd^2 = 3 days.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 70 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate = \$50/hour (assumption).

Annual Cost: No annual costs are associated with Alternative 3. No site monitoring is required because all of the contaminated waste will be removed. No groundwater monitoring is required because groundwater is evaluated under a separate operable unit.

D3.3.6 Representative Site 216-B-38 Trench (Cost tables D-39 and D-40)

This representative site is a group site containing sites 216-B-38, 216-B-35, 216-B-36, 216-B-37, 216-B-39, 216-B-40, and 216-B-41.

The site work was estimated to take 495.4 weeks (118 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 15 days (3 weeks), includes mobilizing equipment and personnel installing and constructing temporary facilities, performing the site survey, and performing decontamination setup.

- Excavate: 2,195 days (439 weeks)

- Restore site: 257 days (51.4 weeks)

- Demobilize: 10 days (2 weeks), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total construction duration = 2,477 days = 495.4 weeks = 118 months.

Site Description: The basis for the following information can be found on Table D-103.

- Area of contaminant mass = 535 ft x 310 ft = 165,850 ft^2

• Depth of clean overburden soil	=	15 ft bgs
• Total excavation depth	=	40 ft bgs
• Volume of contaminated soil	=	153,565 yd^3
• Based on 1.5H:1V excavation side slopes, total excavation volume	=	327,718 yd^3
• Based on 1.5H:1V excavation side slopes, volume of overburden soil	=	174,153 yd^3
• Volume of contaminated soil requiring blending	=	(25 ft – 15 ft) x 535 ft x 310 ft
	=	1,658,500 ft^3 = 61,426 yd^3
• Volume of soil needed to blend at a ratio of 5:1	=	61,426 yd^3 x 5 parts clean/1 part dirty
	=	307,130 yd^3
• Total volume of material to dispose	=	61,426 yd^3 + 307,130 yd^3
	=	368,556 yd^3
• Volume of soil needed in blend	=	307,130 yd^3 – (153,565 yd^3 – 61,426 yd^3)
	=	214,991 yd^3.

The amount of soil needed to blend at a ratio of 5:1 exceeds the amount of overburden material available (214,991 yd^3 needed, 174,153 yd^3 available). Therefore, borrow material from Pit 30 will have to be used for the blend.

• Volume of material from Pit 30 required for blend	=	214,991 yd^3 – 174,153 yd^3
	=	40,838 yd^3
• Volume of material required from Pit 30 to backfill	=	Overburden volume + contaminated volume
	=	174,153 yd^3 + 153,565 yd^3
	=	327,718 yd^3.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

• Duration of construction oversight	=	2,477 days = 495.4 weeks
• Construction oversight rate	=	\$215/hour = \$1,720/day (see general assumptions)
• Duration of RCT on excavator	=	2 excavators x 2,195 days (equal to excavation time)
	=	4,390 days
• RCT rate	=	\$56/hour = \$448/day
• Duration of RCT decontamination crew	=	2,104 days (equal to contaminated soil excavation time)
• RCT rate	=	\$56/hour x 4 people = \$224/hour = \$1,792/day.

Fluor Hanford Sampling Crews and Sampling: Fluor Hanford will perform all sampling required. A bulking factor of 15% was applied to the contaminated soil volume to calculate the number of contaminated (LLW) samples. Sampling is calculated as follows:

- Overburden samples = 6 per site
- Contaminated (LLW) samples = 153,565 yd^3 x 15% x 1 sample/845 yd^3 = 209 samples
- Site certification samples = 298,118 ft^2 x 1 sample/6,264 ft^2 = 48 samples
- QC samples = (6 + 209 + 48) x 5% = 14 samples
- Duration of air sampling crew = 2,195 days (equal to excavation time)
- Air sampling crew rate (Sampler and RCT) = \$56/hour x 2 people = \$112/hour = \$896/day
- Duration of soil/sediment sampling crew = 2,195 days (equal to excavation time)
- Soil/sediment sampling crew rate (Sampler 50% and RCT) = \$56/hour x 50% + \$56/hour = \$84/hour = \$672/day.

Fluor Hanford Transportation and Disposal: As mentioned in the general assumptions, the cost for transportation and disposal of contaminated material at the ERDF is \$1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

- Total volume to dispose = 368,556 yd^3 (see Site Description)
- Number of containers = 368,556 yd^3 x 1 container/11 yd^3 = 33,505 containers.

Mobilization and Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operating cost of a generator (site utilities cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- Site
  - Two hydraulic excavators and two operators
  - One bulldozer and one operator
  - One front-end loader and one operator
  - One water truck and one operator
  - Four laborers

- One office trailer
- One storage trailer.

- Pit 30
  - One hydraulic excavator and one operator
  - One front-end loader and one operator
  - Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time = (1 mob + 1 demob) x 8 hours/day x \$37/hour = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = area of excavation + 20% = 655 ft x 430 ft + 20% = 337,980 ft^2 = 7.76 acres.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

Length of temporary fence = 2 x (width + length) + 20% = 2 x (655 ft + 430 ft) + 20% = 2,604 linear ft.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 1,500 ft + 10% = 39,600 ft^2 = 4,400 yd^2.

Decontamination Pad: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump with a pump and hoses, and two 1,000 gallon temporary storage tanks. Labor to construct and remove the decontamination pad has been included in the decontamination pad cost. The spent decontamination water is assumed to be used for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	= 600 ft^2	
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	= 402 linear ft	= 0.402 m board ft
• Plastic sheeting (60 mil LLDPE)	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	= 1,188 ft^2	
• 3-in. PVC pipe	=	5 linear ft.		

The amount of decontamination water is assumed to be 1,000 gal/month for the time decontamination is needed (during excavation of contaminated soil = 2,104 days).

Decontamination water = 1,000 gal/month x 2,104 days x 1 month/21 days = 100,200 gal.

It is assumed that all equipment can be decontaminated for reuse.

The decontamination pad will be staffed for the duration of contaminated soil excavation. The decontamination crew is expected to consist of four laborers.

• Duration of contaminated soil excavation	=	2,104 days = 100.2 months
• Monthly rate for four laborers	=	\$37/hour/laborer x 4 laborers
	=	\$148/hour x 8 hours/day
	=	\$1,184/day x 21 days/month
	=	\$24,864/month.

Excavation: The overburden excavation will be performed using two hydraulic excavators and one front-end loader. Overburden soil will be excavated by removing noncontaminated soil and placing it on the ground next to the excavation. A loader then will be used to move the soil to a nearby stock pile. The excavation of noncontaminated soil is expected to proceed at a rate of 120 yd^3/hour and the two excavators are operational for 8 hours/day or 1,920 yd^3/day. Labor for overburden excavation consists of an equipment operator each for both hydraulic excavators and front-end loader. The stock pile for the overburden soil is expected to be close enough to the excavation to allow the loader to meet or exceed the production rate of the excavators.

• Volume of overburden soil	=	174,153 yd^3 (see Site Description)
• Days to excavate overburden soil	=	174,153 yd^3 / 1,920 yd^3/day = 91 days

Contaminated soil will be excavated using two hydraulic excavators and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator will be able to excavate the contaminated material and load it directly into the disposal containers. It is estimated that 40 containers can be sent to the ERDF on a daily basis. With 11 yd^3 of material per container, a total of 440 yd^3 of material will be sent to ERDF daily. Higher concentrations of contaminated soil will require blending in order to meet ERDF WAC requirements. The volume of material requiring blending is based on the table located in the general assumptions of Alternative 5. A blending ratio of 5 parts clean to 1 part contaminated has been assumed for this soil. Due to the blending ratio provided, of the 440 yd^3 being sent to the ERDF only 73 yd^3 of this material is highly contaminated soil (440 yd^3 / 6 parts total = 73 yd^3/day). Therefore, the duration of contaminated soil excavation is determined by dividing the total volume of contaminated soil by 73 yd^3/day.

- Volume of contaminated soil = 153,565 yd^3 (see Site Description)
- Days to excavate contaminated soil = 153,565 yd^3 / 73 yd^3/day = 2,104 days.

The cost for excavating and loading the soil is based on the following:

- Excavation time (overburden and contaminated) = 91 days + 2,104 days = 2,195 days
- Labor (operator) x pieces of equipment = \$37/hour x 8 hours/day = \$296/day x pieces of equipment.

As mentioned under Site Description, borrow material from Pit 30 is required in the 5:1 blend of contaminated soil. The material will be obtained using a hydraulic excavator and front-end loader. Five trucks will transport the material from Pit 30 to the site. Backfilling will be performed using a front-end loader and bulldozer on site. It is assumed that the borrow material from Pit 30 can be placed at a rate of 160 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,280 yd^3/day. Labor for backfill consists of equipment operators for every piece of equipment being used.

- Off site borrow material required = 40,838 yd^3 (see Site Description)
- Days to bring in borrow material for blend = 40,838 yd^3 / 1,280 yd^3/day = 32 days
- Labor (operator) x pieces of equipment = \$37.00/hour x 8 hours/day = \$296/day x pieces of equipment
- Truck drivers (teamsters) = \$37/hour x 8 hours/day = \$296/day x number of teamsters.

To minimize the generation of on site fugitive dust, a water truck will be rented for the duration of the excavation process.

Water truck rental = 2,195 days.

Site Restoration: Site restoration will consist of backfilling the excavation area with material obtained from Pit 30 using a hydraulic excavator and front-end loader. Five trucks will transport the material from Pit 30 to the site. Backfilling will be performed using a front-end loader and bulldozer on site. This material will make up for the volume of contaminated soil previously excavated from the site and the overburden soil used for the blend. It is assumed that the borrow material from Pit 30 can be placed at a rate of 160 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,280 yd^3/day. Labor for backfill consists of equipment operators for every piece of equipment being used and five truck drivers.

- Off site borrow material required = 327,718 yd^3 (see Site Description)
- Days to backfill borrow material = 327,718 yd^3 / 1,280 yd^3/day = 257 days
- Labor (operator) x pieces of equipment = \$37.00/hour x 8 hours/day = \$296/day x pieces of equipment
- Truck drivers (teamsters) = \$37/hour x 8 hours/day = \$296/day x number of teamsters.

It is assumed that no characterization sampling of borrow material is needed.

To minimize the generation of on site dust during backfill operations and to water the revegetated area, a water truck will be rented for the duration of the backfilling process.

- Water truck rental = 257 days.

Following backfill, the area will be revegetated. Revegetation will be conducted while backfilling is occurring, if feasible, and during demobilization. Revegetation costs are based on the following:

- Area to Revegetate (Area of Excavation + 20%) = 655 ft x 430 ft + 20%
  = 337,980 ft^2 = 37,553 yd^2.
- Production rate = 1,000 yd^2/day
- Days to revegetate = 37,553 yd^2 x 1 day/1,000 yd^2 = 38 days.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 2,477 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 320 hours (assumption)
- Labor rate = \$50/hour (assumption).

Annual Cost: No annual costs are associated with Alternative 3. No site monitoring is required because all of the contaminated waste will be removed. No groundwater monitoring is required because groundwater is evaluated under a separate operable unit.

D3.3.7 Representative Site: 216-B-57 Crib (Cost tables D-41 and D-42)

The site work was estimated to take 25 weeks (6 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel installing and constructing temporary facilities, performing the site survey, and performing decontamination setup.
- Excavate: 76 days (15.2 weeks)
- Restore site: 34 days (6.8 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total construction duration = 125 days = 25 weeks = 6 months.

Site Description: The following information can be found on Table D-103.

• Area of contaminant mass	=	200 ft x 15 ft = 3,000 ft^2
• Depth of clean overburden soil	=	15 ft bgs
• Total excavation depth	=	50 ft bgs
• Volume of contaminated soil	=	3,889 yd^3
• Based on 1.5H:1V excavation side slopes, total excavation volume	=	45,625 yd^3
• Based on 1.5H:1V excavation side slopes, volume of overburden soil	=	41,736 yd^3
• Volume of contaminated soil requiring blending	=	(45 ft – 15 ft) x 200 ft x 15 ft
	=	90,000 ft^3 = 3,334 yd^3
• Volume of soil needed to blend at a ratio of 5:1	=	3,334 yd^3 x 5 parts clean/1 part dirty
	=	16,670 yd^3
• Total volume of material to dispose	=	3,334 yd^3 + 16,670 yd^3
	=	20,004 yd^3
• Volume of overburden soil used in blend	=	16,670 yd^3 – (3,889 yd^3 – 3,334 yd^3)
	=	16,115 yd^3
• Volume of overburden soil remaining on site	=	41,736 yd^3 – 16,115 yd^3
	=	25,621 yd^3
• Volume of material required from Pit 30 to backfill	=	Total volume of material to dispose
	=	20,004 yd^3.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of construction oversight = 125 days = 25 weeks
- Construction oversight rate = \$215/hour = \$1,720/day (see general assumptions)
- Duration of RCT on excavator = 2 excavators x 76 days (equal to excavation time)
  = 152 days
- RCT rate = \$56/hour = \$448/day
- Duration of RCT decontamination crew = 54 days (equal to contaminated soil excavation time)
- RCT rate = \$56/hour x 4 people = \$224/hour = \$1,792/day.

Fluor Hanford Sampling Crews and Sampling. Fluor Hanford will perform all sampling required. A bulking factor of 15% was applied to the contaminated soil volume to calculate the number of contaminated (LLW) samples. Sampling is calculated as follows:

- Overburden samples = 6 per site
- Contaminated (LLW) samples = 3,889 yd^3 x 15% x 1 sample/845 yd^3 = 6
- Site certification samples = 58,010 ft^2 x 1 sample/6,264 ft^2 = 10
- QC samples = (6 + 6 + 10) x 5% = 2 samples
- Duration of air sampling crew = 76 days (equal to excavation time)
- Air sampling crew rate (Sampler and RCT) = \$56/hour x 2 people = \$112/hour
  = \$896/day
- Duration of soil/sediment sampling crew = 76 days (equal to excavation time)
- Soil/sediment sampling crew rate (Sampler 50% and RCT) = \$56/hour x 50% + \$56/hour = \$84/hour
  = \$672/day.

Fluor Hanford Transportation and Disposal. As mentioned in the general assumptions, the cost for transportation and disposal of contaminated material at the ERDF is \$1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

- Total volume to dispose = 20,004 yd^3 (see Site Description)
- Number of containers = 20,004 yd^3 x 1 container/11 yd^3
  = 1,819 containers.

Mobilization and Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operating cost of a generator (site utilities cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment will be included in the cost:

- Site
  - Two hydraulic excavators and two operators
  - One bulldozer and one equipment operator
  - One front-end loader and one equipment operator
  - One water truck and one operator
  - Four laborers
  - One office trailer
  - One storage trailer.
- Pit 30
  - One hydraulic excavator and one operator
  - One front-end loader and one equipment operator
  - Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time = (1 mob + 1 demob) x 8 hours/day x \$37/hour = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = area of excavation + 20% = 350 ft x 165 ft + 20% = 69,300 ft^2 = 1.59 acres.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

Length of temporary fence = 2 x (width + length) + 20% = 2 x (350 ft + 165 ft) + 20% = 1,236 linear ft.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 1,500 ft + 10% = 39,600 ft^2 = 4,400 yd^2.

Decontamination Pad: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump with a pump and hoses, and two 1,000 gallon temporary storage tanks. Labor to construct and remove the decontamination pad has been included in the decontamination pad cost. The spent decontamination water is assumed to be used for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	= 600 ft^2	
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	= 402 linear ft	= 0.402 m board ft
• Plastic sheeting (60 mil LLDPE)	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	= 1,188 ft^2	
• 3-in. PVC pipe	=	5 linear ft.		

The amount of decontamination water is assumed to be 1,000 gal/month for the time decontamination is needed (during excavation of contaminated soil = 54 days).

Decontamination water = 1,000 gal/month x 54 days x 1 month/21 days = 2,600 gal.

It is assumed that all equipment can be decontaminated for reuse.

The decontamination pad will be staffed for the duration of contaminated soil excavation. The decontamination crew is expected to consist of four laborers.

• Duration of contaminated soil excavation	=	54 days = 2.6 months
• Monthly rate for four laborers	=	$37/hour/laborer x 4 laborers
	=	$148/hour x 8 hours/day
	=	$1,184/day x 21 days/month
	=	$24,864/month.

Excavation: The overburden excavation will be performed using two hydraulic excavators and one front-end loader. Overburden soil will be excavated by removing noncontaminated soil and placing it on the ground next to the excavation. A loader then will be used to move the soil to a nearby stock pile. The excavation of noncontaminated soil is expected to proceed at a rate of 120 yd^3/hour and the two excavators are operational for 8 hours/day or 1,920 yd^3/day. Labor for overburden excavation consists of an equipment operator each for both hydraulic excavators and front-end loader. The stock pile for the overburden soil is expected to be close enough to the excavation to allow the loader to meet or exceed the production rate of the excavators.

- Volume of overburden soil = 41,736 yd^3 (see Site Description)
- Days to excavate overburden soil = 41,736 yd^3 / 1,920 yd^3/day = 22 days

Contaminated soil will be excavated using two hydraulic excavators and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator will be able to excavate the contaminated material and load it directly into the disposal containers. It is estimated that 40 containers can be sent to the ERDF on a daily basis. With 11 yd^3 of material per container, a total of 440 yd^3 of material will be sent to ERDF daily. Higher concentrations of contaminated soil will require blending in order to meet ERDF WAC requirements. The volume of material requiring blending is based on the table located in the general assumptions of Alternative 5. A blending ratio of 5 parts clean to 1 part contaminated has been assumed for this soil. Due to the blending ratio provided, of the 440 yd^3 being sent to the ERDF only 73 yd^3 of this material is highly contaminated soil (440 yd^3 / 6 parts total = 73 yd^3/day). Therefore, the duration of contaminated soil excavation is determined by dividing the total volume of contaminated soil by 73 yd^3/day.

- Volume of contaminated soil = 3,889 yd^3 (see Site Description)
- Days to excavate contaminated soil = 3,889 yd^3 / 73 yd^3/day = 54 days.

The cost for excavating and loading the soil is estimated as follows:

- Excavation time (overburden and contaminated = 22 days + 54 days = 76 days
- Labor (operator) x pieces of equipment = \$37/hour x 8 hours/day = \$296/day x pieces of equipment.

To minimize the generation of on site fugitive dust, a water truck will be rented for the duration of the excavation process.

Water truck rental = 76 days.

Site Restoration: Site restoration will consist of backfilling the excavation area with clean overburden soil previously excavated and fill material obtained from the local borrow pit (Pit 30). Backfilling of the overburden soil will be performed using a front-end loader and a bulldozer. It is assumed that the overburden soil can be backfilled at a rate of 185 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,480 yd^3/day. Labor for overburden soil backfill consists of equipment operators for every piece of equipment being used. The cost is based on the following:

- Volume of remaining overburden soil to backfill = 25,621 yd^3 (see Site Description)
- Time to backfill overburden soil = 25,621 yd^3 / 1,480 yd^3/day = 18 days
- Labor (operator) x pieces of equipment = \$37.00/hour x 8 hours/day = \$296/day x pieces of equipment.

The remaining volume of backfill material will be obtained from Pit 30 using a hydraulic excavator and front-end loader. Five trucks will transport the material from Pit 30 to the site. Backfilling will be performed using a front-end loader and bulldozer on site. This material will make up for the volume of contaminated soil previously excavated from the site and overburden soil used for the blend. It is assumed that the borrow material from Pit 30 can be placed at a rate of 160 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,280 yd^3/day. Labor for backfill consists of equipment operators for every piece of equipment being used and five truck drivers.

- Off site borrow material required = 20,004 yd^3 (see Site Description)
- Days to backfill borrow material = 20,004 yd^3 / 1,280 yd^3/day = 16 days
- Labor (operator) x pieces of equipment = \$37.00/hour x 8 hours/day = \$296/day x pieces of equipment
- Truck drivers (teamsters) = \$37/hour x 8 hours/day = \$296/day x number of teamsters.

The cost of backfilling is based on the following:

- Restoration time (overburden and borrow material) = 18 days + 16 days = 34 days.

It is assumed that no characterization sampling of borrow material is needed.

To minimize the generation of on site dust during backfill operations and to water the revegetation are, a water truck will be rented for the duration of the backfilling process.

- Water truck rental = 34 days.

Following backfill, the area will be revegetated. Revegetation will be conducted while backfilling is occurring, if feasible, and during demobilization. Revegetation costs are based on the following:

- Area to Revegetate (Area of Excavation + 20%) = 350 ft x 165 ft + 20% = 69,300 ft^2 = 7,700 yd^2
- Production Rate = 1,000 yd^2/day
- Days to revegetate = 7,700 yd^2 x 1 day/1,000 yd^2 = 8 days.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 125 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate = \$50/hour (assumption).

Annual Cost: No annual costs are associated with Alternative 3. No site monitoring is required because all of the contaminated waste will be removed. No groundwater monitoring is required because groundwater is evaluated under a separate operable unit.

D3.3.8 Site 241-B-361 Settling Tank (Cost tables D-43 and D-44)

To remove sludge from the 241-B-361 Settling Tanks, it is proposed to use the same process as that proposed for the 241-Z-361 Settling Tank that is described in DOE/RL-2003-52, Rev. 0, Tank 241-Z-361 Engineering Evaluation/Cost Analysis. A AEAT Fluidics™ retrieval system will be used to remove sludge from the tank and transfer it into proper shipping containers. Absorbent will be added to these containers to dry the waste that is believed to possess approximately 60-75% water. The closed container possesses a HEPA vent. The container will then be transferred to interim on site storage prior to ultimate disposition.

The cost to transfer the sludge from the tank into containers and absorb associated liquid is $6,000,000 per DOE/RL-2003-52. This cost does not include costs associated with interim on site storage and ultimate disposal. The cost does include all necessary markups.

Since the cost of sludge removal is a lump sum number, Alternative 3 costs include activities such as excavation to the bottom of the settling tank, tank demolition, and tank transportation and disposal to the ERDF.

The site work was estimated to take 11 weeks (2.7 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here. Additionally, the time needed for sludge removal was not considered for the project duration.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel installing and constructing temporary facilities, performing the site survey, and performing decontamination setup.

- Excavate: 12 days (2.4 weeks)

- Tank Demolition: 10 days (2 weeks)

- Restore site: 9 days (1.8 weeks)

- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total construction duration = 46 days = 9.2 weeks = 2.2 months.

Site Description: The following information can be found on the analogous site tables located in Section 2.0 of the FS.

• Diameter of settling tank	=	20 ft
• Height of settling tank	=	19 ft
• Depth of overburden soil above tank	=	6 ft
• Thickness of tank walls	=	6 inches = 0.5 ft
• Composition of tank	=	Reinforced, pre-stressed concrete.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of construction oversight = 46 days = 9.2 weeks
- Construction oversight rate = \$215/hour = \$1,720/day (see general assumptions)
- Duration of RCT on excavator = 22 days (equal to excavation and tank demolition time)
- RCT rate = \$56/hour = \$448/day
- Duration of RCT decontamination crew = 10 days (equal to tank demolition time)
- RCT rate = \$56/hour x 4 people = \$224/hour = \$1,792/day.

Fluor Hanford Sampling Crews and Sampling: Fluor Hanford will perform all sampling required. A bulking factor of 15% was applied to the contaminated soil volume to calculate the number of contaminated (LLW) samples. Sampling is calculated as follows:

- Overburden samples = 6 per site
- Site certification samples = $\pi/4 \times (20\ ft + 2 \times 15\ ft)^2 \times 1$ sample/6,264 $ft^2 = 0.3$
  = Assume 6 samples (minimum)
- QC samples = (6 + 6) x 5% = 1 sample
- Duration of air sampling crew = 22 days (equal to excavation and tank demolition time)
- Air sampling crew rate (Sampler and RCT) = \$56/hour x 2 people = \$112/hour
  = \$896/day
- Duration of soil/sediment sampling crew = 22 days (equal to excavation and tank demolition time)
- Soil/sediment sampling crew rate (Sampler 50% and RCT) = \$56/hour x 50% + \$56/hour = \$84/hour
  = \$672/day.

Fluor Hanford Transportation and Disposal: As mentioned in the general assumptions, the cost for transportation and disposal of contaminated material at the ERDF is \$1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. Since concrete is denser than soil, it is assumed that only 9 yd^3 on concrete can fit into one container. The number of containers for disposal is calculated as follows:

• Total volume to dispose	=	Volume of tank = 2 x volume of top + volume of sides
	=	$2 \times \pi/4 \times (20\ ft)^2 \times 0.5\ ft + \pi \times 20\ ft \times 19\ ft \times 0.5\ ft$
	=	$911\ ft^3 = 34\ yd^3$
• Number of containers	=	$34\ yd^3 \times 1$ container/$9\ yd^3$
	=	4 containers.

Mobilization and Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operating cost of a generator (site utilities cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment will be included in the cost:

- Site
  - Three hydraulic excavators and two operators (one excavator for overburden and two excavators for tank demolition)
  - One bulldozer and one equipment operator
  - One front-end loader and one equipment operator
  - One water truck and one operator
  - Four laborers
  - One office trailer
  - One storage trailer.
- Pit 30
  - One hydraulic excavator and one operator
  - One front-end loader and one equipment operator
  - Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time = (1 mob + 1 demob) x 8 hours/day x $37/hour = $592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = area of excavation + 20% = $\pi/4 \times (185\ ft)^{2+}$ 20% = 32,256 ft^2 = 0.74 acres.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

Length of temporary fence = circumference + 20% = $2\pi \times 185$ ft + 20% = 1,395 linear ft.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

- Length of haul road = 600 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 600 ft + 10% = 15,840 ft^2 = 1,760 yd^2.

Decontamination Pad: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump with a pump and hoses, and two 1,000 gallon temporary storage tanks. Labor to construct and remove the decontamination pad has been included in the decontamination pad cost. The spent decontamination water is assumed to be used for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	= 600 ft^2	
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	= 402 linear ft	= 0.402 m board ft
• Plastic sheeting (60 mil LLDPE)	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	= 1,188 ft^2	
• 3-in. PVC pipe	=	5 linear ft.		

The amount of decontamination water is assumed to be 1,000 gal/month for the time decontamination is needed (during tank demolition = 10 days).

Decontamination water = 1,000 gal/month x 10 days x 1 month/21 days = 500 gal.

It is assumed that all equipment can be decontaminated for reuse.

The decontamination pad will be staffed for the duration of tank demolition. The decontamination crew is expected to consist of four laborers.

• Duration of contaminated soil excavation	=	10 days = 0.5 months
• Monthly rate for four laborers	=	\$37/hour/laborer x 4 laborers
	=	\$148/hour x 8 hours/day
	=	\$1,184/day x 21 days/month
	=	\$24,864/month.

Excavation: The overburden excavation will be performed using one hydraulic excavator and one front-end loader. Overburden soil will be excavated by removing noncontaminated soil and placing it on the ground next to the excavation. A loader then will be used to move the soil to a nearby stock pile. The excavation of noncontaminated soil is expected to proceed at a rate of 120 yd^3/hour and the excavator is operational for 8 hours/day or 960 yd^3/day. Labor for overburden excavation consists of an equipment operator each for the hydraulic excavator and front-end loader. The stock pile for the overburden soil is expected to be close enough to the excavation to allow the loader to meet or exceed the production rate of the excavator.

The excavation of overburden soil is expected to be carried out in four steps. Step one excavates to a depth of 6 ft and includes a 10 ft bench. Step two excavates an additional 5.5 (11.5 ft bgs) feet and includes a bench of 10 ft around the site. Step three excavates an additional 7 ft (18.5 ft bgs) and includes a 10 ft bench. The final step excavates an additional 6.5 ft to the bottom of the tank (25 ft bgs) and includes a 15 ft bench. Assuming 1.5H:1V side slopes, the volume of overburden soil is 10,998 yd^3.

- Volume of overburden soil = 10,998 yd^3
- Days to excavate overburden soil = 10,998 yd^3 / 960 yd^3/day = 12 days

To minimize the generation of on site fugitive dust, a water truck will be rented for the duration of the excavation process.

Water truck rental = 12 days.

Tank Demolition: The tank demolition will be performed using two large excavators with a bucket thumb and a grapple attachment and a front-end loader. It is assumed that the excavators will break apart the reinforced, pre-stressed concrete and the front-end loader with load the concrete in to containers for transportation and disposal at the ERDF. It is assumed that tank demolition can be completed in 10 days.

Site Restoration: Site restoration will consist of backfilling the excavation area with clean overburden soil previously excavated and fill material obtained from the local borrow pit (Pit 30). Backfilling of the overburden soil will be performed using a front-end loader and a bulldozer. It is assumed that the overburden soil can be backfilled at a rate of 185 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,480 yd^3/day. Labor for overburden soil backfill consists of equipment operators for every piece of equipment being used. The cost is based on the following:

- Volume of remaining overburden soil to backfill = 10,998 yd^3 (see Excavation)
- Time to backfill overburden soil = 10,998 yd^3 / 1,480 yd^3/day = 8 days
- Labor (operator) x pieces of equipment = \$37.00/hour x 8 hours/day
  = \$296/day x pieces of equipment.

The remaining volume of backfill material will be obtained from Pit 30 using a hydraulic excavator and front-end loader. Five trucks will transport the material from Pit 30 to the site. Backfilling will be performed using a front-end loader and bulldozer on site. This material will make up for the volume that the settling tank occupied. It is assumed that the borrow material from Pit 30 can be placed at a rate of 160 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,280 yd^3/day. Labor for backfill consists of equipment operators for every piece of equipment being used and five truck drivers.

- Off site borrow material required = Volume of tank = $\pi/4 \times D^2 \times H$
  = $\pi/4 \times (20\ ft)^2 \times 19\ ft = 5{,}969\ ft^3 = 221\ yd^3$
- Days to backfill borrow material = $221\ yd^3 / 1{,}280\ yd^3/day$ = 1 day
- Labor (operator) x pieces of equipment = \$37.00/hour x 8 hours/day = \$296/day x pieces of equipment
- Truck drivers (teamsters) = \$37/hour x 8 hours/day = \$296/day x number of teamsters.

The cost of backfilling is based on the following:

- Restoration time (overburden and borrow material) = 8 days + 1 day = 9 days.

It is assumed that no characterization sampling of borrow material is needed.

To minimize the generation of on site dust during backfill operations and to water the revegetation area, a water truck will be rented for the duration of the backfilling process.

- Water truck rental = 9 days.

Following backfill, the area will be revegetated. Revegetation will be conducted while backfilling is occurring, if feasible, and during demobilization. Revegetation costs are based on the following:

- Area to Revegetate (Area of Excavation + 20%) = $\pi/4 \times (185\ ft)^2 + 20\%$
  = $32{,}256\ ft^2 = 3{,}584\ yd^2$
- Production Rate = $1{,}000\ yd^2/day$
- Days to revegetate = $3{,}584\ yd^2 \times 1\ day/1{,}000\ yd^2$
  = 4 days.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 46 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate = \$50/hour (assumption).

Annual Cost: No annual costs are associated with Alternative 3. No site monitoring is required because all of the settling tank will be removed. No groundwater monitoring is required because groundwater is evaluated under a separate operable unit.

D3.3.9 Representative Site 216-B-58 Trench (Cost tables D-45 and D-46)

The site work was estimated to take 8.8 weeks (2.1 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, performing the site survey, and performing decontamination setup.

- Excavate: 21 days (4.2 weeks)

- Restore site: 8 days (1.6 weeks)

- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total construction duration = 44 days = 8.8 weeks = 2.1 months.

Site Description: The basis for the following information can be found on Table D-103.

• Area of contaminant mass	=	200 ft x 10 ft = 2,000 ft^2
• Depth of clean overburden soil	=	10 ft bgs
• Total Excavation depth	=	25 ft bgs
• Volume of contaminated soil	=	1,111 yd^3
• Based on 1.5H:1V excavation side slopes, total excavation volume	=	9,942 yd^3
• Based on 1.5H:1V excavation side slopes, volume of overburden soil	=	8,831 yd^3
• Volume of contaminated soil requiring blending	=	(17 ft – 10 ft) x 200 ft x 10 ft
	=	14,000 ft^3 = 519 yd^3
• Volume of soil needed to blend at a ratio of 5:1	=	519 yd^3 x 5 parts clean/1 part dirty
	=	2,595 yd^3
• Total volume of material to dispose	=	519 yd^3 + 2,595 yd^3
	=	3,114 yd^3
• Volume of overburden soil used in blend	=	2,595 yd^3 – (1,111 yd^3 – 519 yd^3)
	=	2,003 yd^3
• Volume of overburden soil remaining on site	=	8,831 yd^3 – 2,003 yd^3
	=	6,828 yd^3
• Volume of material required from Pit 30 to backfill	=	Total volume of material to dispose
	=	3,114 yd^3.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of oversight = 44 days = 8.8 weeks
- Construction oversight rate = \$215/hour = \$1,720/day (see general assumptions)
- Duration of RCT on excavator = 2 excavators x 21 days (equal to excavation time)
- RCT rate = \$56/hour = \$448/day
- Duration of RCT decontamination crew = 16 days (equal to contaminated soil excavation time)
- RCT rate = \$56/hour x 4 people = \$224/hour = \$1,792/day.

Fluor Hanford Sampling Crews and Sampling: Fluor Hanford will perform all sampling required. A bulking factor of 15% was applied to the contaminated soil volume to calculate the number of contaminated (LLW) samples. Sampling is calculated as follows:

- Overburden samples = 6 per site
- Contaminated (LLW) samples = 1,111 yd^3 x 15% x 1 sample/845 yd^3 = 1.5
  = Assume 6 samples (minimum)
- Site certification samples = 24,992 ft^2 x 1 sample/6,264 ft^2 = 4
  = Assume 6 samples (minimum)
- QC samples = (6 + 6 + 6) x 5% = 1 sample
- Duration of air sampling crew = 21 days (equal to excavation time)
- Air sampling crew rate (Sampler and RCT) = \$56/hour x 2 people = \$112/hour
  = \$896/day
- Duration of soil/sediment sampling crew = 21 days (equal to excavation time)
- Soil/sediment sampling crew rate (Sampler 50% and RCT) = \$56/hour x 50% + \$56/hour = \$84/hour
  = \$672/day.

Fluor Hanford Transportation and Disposal: As mentioned in the general assumptions, the cost for transportation and disposal of contaminated material at the ERDF is \$1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

- Total volume to dispose = 3,114 yd^3 (see Site Description)
- Number of containers = 3,114 yd^3 x 1 container/11 yd^3
  = 284 containers.

Mobilization, Demobilization, and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operating costs of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- Site
  - - Two hydraulic excavators and two operators
  - - One bulldozer and one operator
  - - One front-end loader and one operator
  - - One water truck and one operator
  - - Four laborers
  - - One office trailer
  - - One storage trailer.
- Pit 30
  - - One hydraulic excavator and one operator
  - - One front-end loader and one operator
  - - Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

> Mobilization and demobilization time = (1 mob + 1 demob) x 8 hours/day x \$37/hour = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

> Area of construction survey = area of excavation + 20% = 275 ft x 85 ft + 20% = 28,050 ft^2 = 0.64 acre.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

> Length of temporary fence = 2 x (width + length) + 20% = 2 x (275 ft + 85 ft) + 20% = 864 linear ft.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

- Length of haul road = 600 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 600 ft + 10% = 15,840 ft^2 = 1,760 yd^2.

Decontamination Pad: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump with a pump and hoses, and two 1,000 gallon storage tanks. Labor to construct and remove the decontamination pad has been included in the decontamination pad cost. The spent decontamination water is assumed to be used for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	= 600 ft^2	
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	= 402 linear ft	= 0.402 m board ft
• Plastic sheeting (60 mil linear low-density polyethylene [LLDPE])	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	= 1,188 ft^2	
• 3-in. PVC pipe	=	5 linear ft.		

The amount of decontamination water is assumed to be 1,000 gal/month for the time decontamination is needed (during excavation of contaminated soil = 16 days).

Decontamination water = 1,000 gal/month x 16 days x 1 month/21 days = 800 gal.

It is assumed that all equipment can be decontaminated for reuse.

The decontamination pad will be staffed for the duration of contaminated soil excavation. It is assumed that the decontamination crew will consist of four laborers.

• Duration of contaminated soil excavation	=	16 days = 0.8 months
• Monthly rate for 4 laborers	=	\$37/hour/laborer x 4 laborers
	=	\$148/hour x 8 hours/day
	=	\$1,184/day x 21 days/month
	=	\$24,864/month.

Excavation: The overburden excavation will be performed using two hydraulic excavators and one front-end loader. Overburden soil will be excavated by removing noncontaminated soil and placing it on the ground next to the excavation. A loader then will be used to move the soil to a nearby stock pile. The excavation of noncontaminated soil is expected to proceed at a rate of 120 yd^3/hour and the two excavators are operational for 8 hours/day or 1,920 yd^3/day. Labor for overburden excavation consists of an equipment operator each for both hydraulic excavators and front-end loader. The stock pile for the overburden soil is expected to be close enough to the excavation to allow the loader to meet or exceed the production rate of the excavators.

• Volume of overburden soil	=	8,831 yd^3 (see Site Description)
• Days to excavate overburden soil	=	8,331 yd^3 / 1,920 yd^3/day = 5 days

Contaminated soil will be excavated using two hydraulic excavators and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator will be able to excavate the contaminated material and load it directly into the disposal containers. It is estimated that 40 containers can be sent to the ERDF on a daily basis. With 11 yd^3 of material per container, a total of 440 yd^3 of material will be sent to ERDF daily. Higher concentrations of contaminated soil will require blending in order to meet ERDF WAC requirements. The volume of material requiring blending is based on the table located in the general assumptions of Alternative 5. A blending ratio of 5 parts clean to 1 part contaminated has been assumed for this soil. Due to the blending ratio provided, of the 440 yd^3 being sent to the ERDF only 73 yd^3 of this material is highly contaminated soil (440 yd^3 / 6 parts total = 73 yd^3/day). Therefore, the duration of contaminated soil excavation is determined by dividing the total volume of contaminated soil by 73 yd^3/day.

- Volume of contaminated soil = 1,111 yd^3 (see Site Description)
- Days to excavate contaminated soil = 1,111 yd^3 / 73 yd^3/day = 16 days.

The cost for excavating and loading the soil is based on the following:

- Excavation time (overburden and contaminated) = 5 days + 16 days = 21 days
- Labor (operator) x pieces of equipment = \$37/hour x 8 hours/day = \$296/day x pieces of equipment.

Concrete culverts within the excavation area are assumed to be removed by the hydraulic excavator, broken if necessary, and placed with the waste.

To minimize the generation of on site fugitive dust, a water truck will be rented for the duration of the excavation process.

Water truck rental = 21 days.

Site Restoration: Site restoration will consist of backfilling the excavation area with the clean overburden soil previously excavated and fill material obtained from the local borrow pit (Pit 30). Backfilling of overburden soil will be performed using a front-end loader and a bulldozer. It is assumed that the overburden soil can be backfilled at a rate of 185 yd^3/hour. Operating the equipment for 8 hours/day, the production rate is 1,480 yd^3/day. Labor for overburden soil backfill consists of equipment operators for every piece of equipment being used. The cost is based on the following:

- Volume of remaining overburden soil to backfill = 6,828 yd^3 (see Site Description)
- Time to backfill overburden soil = 6,828 yd^3 / 1,480 yd^3/day = 5 days
- Labor (operator) x pieces of equipment = \$37/hour x 8 hours/day = \$296/day x pieces of equipment.

The remaining volume of backfill material will be obtained from Pit 30 using a hydraulic excavator and front-end loader. Five trucks will transport the material from Pit 30 to the site. Backfilling will be performed using a front-end loader and bulldozer on site. This material will make up for the volume of contaminated soil previously excavated from the site and overburden soil used for the blend. It is assumed that the borrow material from Pit 30 can be placed at a rate of 160 yd^3/hour. Operating the equipment for 8 hours/day the production rate is 1,280 yd^3/day. Labor for backfill consists of equipment operators for every piece of equipment being used and five truck drivers.

- Offsite borrow material required = 3,114 yd^3 (see Site Description)
- Days to backfill borrow material = 3,114 yd^3 / 1,280 yd^3/day = 3 days
- Labor (operator) x pieces of equipment = \$37/hour x 8 hours/day = \$296/day x pieces of equipment
- Truck drivers (teamsters) = \$37/hour x 8 hours/day = \$296/day x number of teamsters.

The cost of backfilling is based on the following:

- Restoration time (overburden and borrow material) = 5 days + 3 days = 8 days.

It is assumed that no characterization sampling of borrow material is needed.

To minimize the generation of on site dust during backfill operations and to water the revegetated area, a water truck will be rented for the duration of the backfilling process.

Water truck rental = 8 days.

Following backfill, the area will be revegetated. Revegetation will be conducted while backfilling is occurring, if feasible, and during demobilization. Revegetation costs are based on the following.

- Area to Revegetate (Area of excavation + 20%) = 275 ft x 85 ft + 20% = 28,050 ft^2 = 3,117 yd^2
- Production rate = \$1,000 yd^2/day
- Days to revegetate = 3,117 yd^2 x 1 day/1,000 yd^2 = 4 days.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 44 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate = \$50/hour (assumption).

Annual Cost: No annual costs are associated with Alternative 3. No site monitoring is required because all of the contaminated waste will be removed. No groundwater monitoring is required because groundwater is evaluated under a separate operable unit.

D3.4 ALTERNATIVE 4 – CAPPING

D3.4.1 General Assumptions

The following general assumptions apply to Alternative 4:

- The contractor will perform all the site preparation, capping, decontamination, and restoration activities for this alternative. Personnel used to complete these tasks are support personnel, laborers, equipment operators, oilers, and truck drivers. The support personnel will consist of a superintendent, a site foreman, a site engineer, a site health and safety manager, and a timekeeper-clerk. This support crew will be on site from mobilization to demobilization. Using the wage rates discussed in Section D3.1, this crew has an hourly rate of $237 ($1,896/day). The number of laborers, equipment operators, oilers, and truck drivers are identified under the activities discussed in the following paragraphs.

- Fluor Hanford will provide contractor oversight, collect samples, and perform all radiation screening. Personnel used to perform contractor oversight include a project manager (1 person full time), health and safety manager (1 person half time), a QA/QC representative and scheduler (1 person full time), and a radiation control technician (RCT) (1 person full time). This oversight crew will be used when ever the contractor is in operation. Using the wage rates discussed in Section D3.1, this crew has an hourly rate of $215 ($1,720/day).

- Fluor Hanford will provide a crew of four RCTs for decontamination activities. Using the wage rates discussed in Section D3.1, the crew has an hourly rate of $224 ($1,792/day).

- Fluor Hanford will provide a crew of one sample technician and one RCT to collect air samples during dynamic compaction and installation of the first cap layer at a rate of one composite air sample per day. Using the wage rates discussed in Section D3.1, the crew has an hourly rate of $112 ($896/day). The analytical cost for air samples is assumed to equal $1,000/sample.

- Fencing for institutional controls, fencing maintenance, and monuments/signs are considered institutional costs and are not considered in this cost estimate.

- Groundwater monitoring is performed under a separate operable unit. The costs associated with periodic groundwater sampling are considered an institutional cost and are not considered in this cost estimate.

Dynamic compaction will be the only construction activity occurring prior to constructing the first cap layer. To construct the first cap layer, material will be placed on the outer edges of the site and pushed into place to avoid running equipment over the site without the first layer of cap material in place.

- Surface soil is not affected. Therefore, Level C, B, or A PPE is not needed for this alternative.

- The prices that make up the cost estimate were obtained from one of the following sources:

  - *ECHOS Environmental Remediation Cost Data – Unit Price*, 8th Annual Edition (Means 2002a).

  - *Site Work and Landscape Cost Data*, 21st Annual Edition (Means 2002b).

  - Experience on similar projects.

D3.4.2 Representative Site 216-T-26 Crib (Cost tables D-47 through D-50)

The site work was estimated to take 5.6 weeks (1.4 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, performing the site survey, and evaluating landfill limits.

- Prepare site: 3 days (0.6 week)

- Capping: 8 days (1.6 weeks)

- Revegetation: 1 day (0.2 weeks)

- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total construction duration = 27 days = 5.4 weeks = 1.4 months.

Site Description: The following information can be found on Table D-103.

- Area of contaminant mass = 30 ft x 30 ft = 900 ft^2
- Area of cap with 20-ft overrun = (30 ft + 2 x 20 ft) x (30 ft + 2 x 20 ft) = 4,900 ft^2
- Slope of rise and run = 2H:1V
- Length of rise = 40 in./12 in./ft x 2 ft = 6.7 ft
- Length of run = 108 in./12 in./ft x 2 ft = 18 ft
- Length and width of total cap area = 70 ft + 2 x 6.7 ft + 2 x 18 ft = 119.3 ft.
- Total area of cap = 119.3 ft x 119.3 ft = 14,232 ft^2 = 0.33 acre.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of Fluor Hanford oversight = 5.4 weeks = 27 days
- Fluor Hanford oversight rate = $215/hour = $1,720/day (see general assumptions).

Mobilization/Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operating cost of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- One hydraulic excavator and one operator
- One bulldozer and one operator
- Two front-end loaders and two operators
- One water truck and one driver
- Five dump trucks and five drivers
- One vibratory roller and one operator
- Four laborers
- One office trailer
- One storage trailer.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time = (1 mob + 1 demob) x 8 hour/day x $37/hour = $592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = area of cap footprint + 20% = 14,232 ft^2 + 20% = 17,078 ft^2 = 0.39 acre.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 1,500 ft + 10% = 39,600 ft^2 = 4,400 yd^2
- Haul Road Construction = \$7.36/yd^2.

Decontamination Pad: A decontamination pad will be constructed to clean the dynamic compaction equipment. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump, and a pump. It is assumed that the dynamic compaction equipment can be decontaminated in one day. Based on the Alternative 3 assumption for decontamination pad water use (1,000 gallons per month), 50 gallons of water are required for one day of decontamination activity. Therefore, it is assumed that a temporary water source can be obtained for decontamination activities and large storage tanks will not be required. It is also assumed that the sump can adequately store the rinse water prior to using for dust suppression on contaminated sites. Decontamination pad components are as follows:

- Pad area = 20 ft x 30 ft = 600 ft^2
- Timber grates (2 in. x 4 in.) = 2 x 5 x 30 ft + 2 x 17 x 3 ft = 402 linear ft = 0.402 m board ft
- Plastic sheeting (60 mil LLDPE) = [20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10% = 1,188 ft^2
- 3-in. PVC pipe = 5 linear ft.

All equipment rented for the decontamination pad will be rented for the duration of the RA activities, in the event that the decontamination pad is needed. It is assumed that equipment can be decontaminated for reuse.

The decontamination pad will be staffed for one day to decontaminate the dynamic compaction equipment following site stabilization. The decontamination crew will consist of four laborers. This crew will construct the decontamination pad, provide decontamination services, and remove the decontamination pad during demobilization activities (labor provided under miscellaneous costs).

- Duration to construct and remove = 2 days
- Duration of decontamination activities = 1 day.

Site Preparation: Costs associated with site preparation are capital costs. Before installing the cap system, the site surface must be prepared. Surface preparation includes stabilization of the cap area using dynamic compaction. The FS indicates a need to ensure compaction of soils at depth (i.e., compaction of soil deeper than 2 ft). To avoid the time delay associated with surcharging the area, a crane will be used to drop a large weight over the cap area. Dynamic compaction was selected during the FS process as a baseline technology and for costing purposes; other compaction processes may be selected during the design process. The cost of site preparation is calculated as follows:

- Footprint of cap = 14,232 ft^2
- Production Rate = 5,000 ft^2/day (assumed)
- Time to compact = 3 days.
- Air sampling crew (1 sample technician and 1 RCT) = 3 days
- Number of air samples = 1 sample per day ($1,000/sample).

Allowing 1 day for decontamination, the dynamic compactor, operator, and oiler are required on site for 4 days.

Installation of Cap System: Representative Site 216-T-26 crib requires a Modified RCRA Subtitle C Barrier. The Modified RCRA Subtitle C Barrier design consists of, from bottom to top, the following layers:

- Graded fill layer (40 in. thick)
- Asphalt base course (4 in. thick)
- Low-permeability asphalt layer (6 in. thick)
- Lateral drainage layer (6 in. thick)
- Gravel filter layer (6 in. thick)
- Sand filter layer (6 in. thick)
- Non-woven geotextile
- Compacted silt loam (20 in. thick)
- Silt loam topsoil with pea gravel admixture (20 in. thick)
- Vegetation.

Total cap thickness = 108 in = 9 ft.

The volume of material for these layers is calculated using the area of the site and adding a 20-ft overrun in each direction to ensure complete site coverage. Assume 2H:1V side slopes. Refer to Table D-103 for site dimensions. These areas and volumes will be used for the cost estimate:

- Area of the site = 900 ft^2
- Total area of the cap (area of cap + 20-ft overrun) = 4,900 ft^2
- Footprint of capped area = 14,232 ft^2
- Graded fill (40 in. sloped at 2%) = 1,570 yd^3
- Asphalt base course (4 in.) = 1,248 yd^2
- Low-permeability asphalt (6 in.) = 1,248 yd^2
- Lateral drainage layer (6 in.) = 190 yd^3
- Gravel filter layer (6 in.) = 184 yd^3
- Sand filter layer (6 in.) = 133 yd^3
- Nonwoven geotextile = 7,160 ft^2 = 796 yd^2

- Compacted silt loam (20 in.) = 330 yd^3
- Silt loam topsoil with pea gravel admixture (20 in.) = 400 yd^3
  - 10% of mix is pea gravel = 40 yd^3
- Graded fill for cap berm = 363 yd^3.

During the construction of the cap system, a cap performance monitoring system will be constructed. To account for the performance monitoring system cost, an assumed $5,000 lump sum amount is provided in the cost estimate.

The side slopes of the cap will be armored with riprap material. This material will be placed 12 in. thick around the entire perimeter of the site.

- Material placement scale = 50 yd^3/hr
- Area of riprap apron 405.2 ft long by 20 ft wide = 8,104 ft^2
- Volume of riprap material needed = 301 yd^3.

The following list of equipment and labor is assumed for cap construction:

One excavator and operator	(Pit 30 borrow area)
One loader and one operator	(Pit 30 borrow area)
Five trucks and drivers	(Pit 30 to Site, 16 yd^3/truck, 2 trips/hr)
One loader and operator	(on site)
One dozer and operator	(on site)
One vibratory roller and operator	(on site).

The production rate assumes that the haul rate for the cap materials is 160 cy/hour (purchased material and Pit 30 material). The rate at which the cap materials can be placed is assumed equal to the rate material is delivered (160 cy/hour). The geotextile layer production rate based on 4 laborers per crew is assumed to be 0.02 hours/yd^2.

Revegetation: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following:

- Area to be revegetated = 6,939 ft^2 = 771 yd^2
- Revegetation (includes lime, fertilizer, and seed) = $1.63/$yd^2$
- Production rate = 1,000 yd^2/day = 1 day.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. In addition, four laborers will be on site from mobilization through demobilization. These laborers will perform general activities including, but not limited to maintenance, decontamination, and placing geotextile. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 5.4 weeks = 27 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Four Laborers (daily rate) = \$37/hour x 8 hrs/day x 4 laborers \$1,184/day
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post construction documents = \$50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alterative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system (including berm) = 14,232 ft^2
  - Team hours to complete inspections = 16 hours (16 hours for every 50,000 ft^2).
  - Hourly rate for team (2 people/team) = \$112/hour (\$56/hour/team member)
  - Radiation surveys of surface soil = \$3,000/event (\$1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system (including berm) = 14,232 ft^2
  - Area requiring repair (10% of total area) = 1,423 ft^2 = 158 yd^2
  - Oversight = 1 day (8 hours/day @ \$56/hour).

Monitoring: Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.4.3 Representative Site: 216-B-46 Crib (Cost tables D-51 through D-54)

This representative site is a group site containing sites 216-B-46, 216-B-43, 216-B-44, 216-B-45, 216-B-47, 216-B-48, 216-B-49, and 216-B-50.

The site work was estimated to take 25.2 weeks (6 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, performing the site survey, and evaluating landfill limits.
- Prepare site: 23 days (4.6 weeks)
- Capping: 78 days (15.6 weeks)
- Revegetation: 10 days (2 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total construction duration = 126 days = 25.2 weeks = 6 months.

Site Description: The following information can be found on Table D-103.

- Area of contaminant mass = 196 ft x 312 ft = 61,152 ft^2
- Area of cap with 20-ft overrun = (312 ft + 2 x 20 ft) x (196 ft + 2 x 20 ft) = 83,072 ft^2
- Slope of rise and run = 2H:1V
- Length of rise = 40 in./12 in./ft x 2 ft = 6.7 ft
- Length of run = 108 in./12 in./ft x 2 ft = 18 ft
- Length of total cap area = 352 ft + 2 x 6.7 ft + 2 x 18 ft = 401.3 ft
- Width of total cap area = 236 ft + 2 x 6.7 ft + 2 x 18 ft = 285.3 ft
- Total area of cap = 401.3 ft x 285.3 ft = 114,514 ft^2= 2.63 acres.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of Fluor Hanford oversight = 25.2 weeks = 126 days
- Fluor Hanford oversight rate = $215/hour = $1,720/day (see general assumptions).

Mobilization/Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental and operating cost of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- One hydraulic excavator and one operator

- One bulldozer and one operator
- Two front-end loaders and two operators
- One water truck and one driver
- Five dump trucks and five drivers
- One vibratory roller and one operator
- Four laborers
- One office trailer
- One storage trailer.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time = (1 mob + 1 demob) x 8 hour/day x $37/hour = $592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = area of cap footprint + 20% = 114,514 ft^2 + 20% = 137,416 ft^2 = 3.15 acres.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 1,500 ft + 10% = 39,600 ft^2 = 4,400 yd^2
- Haul Road Construction = $7.36/$yd^2$.

Decontamination: A decontamination pad will be constructed to clean the dynamic compaction equipment. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump, and a pump. It is assumed that the dynamic compaction equipment can be decontaminated in one day. Based on the Alternative 3 assumption for decontamination pad water use (1,000 gallons per month), 50 gallons of water are required for one day of decontamination activity. Therefore, it is assumed that a temporary water source can be obtained for decontamination activities and large storage tanks will not be required. It is also assumed that the sump can adequately store the rinse water prior to using for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	=	600 ft^2
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	=	402 linear ft = 0.402 m board ft
• Plastic sheeting (60 mil LLDPE)	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	=	1,188 ft^2
• 3-in. PVC pipe	=	5 linear ft.		

All equipment rented for the decontamination pad will be rented for the duration of the RA activities, in the event that the decontamination pad is needed. It is assumed that dynamic compaction equipment can be decontaminated for reuse.

The decontamination pad will be staffed for one day to decontaminate the dynamic compaction equipment following site stabilization. The decontamination crew will consist of four laborers. This crew of laborers would construct the decontamination pad, provide decontamination services, and remove the decontamination pad during demobilization activities (labor provided under miscellaneous costs).

- Duration to construct and remove = 2 days
- Duration of decontamination activities = 1 day.

Site Preparation: Costs associated with site preparation are capital costs. Before installing the cap system, the site surface must be prepared. Surface preparation includes stabilization of the cap area using dynamic compaction. The FS indicates a need to ensure compaction of soils at depth (i.e., compaction of soil deeper than 2 ft). To avoid the time delay associated with surcharging the area, a crane will be used to drop a large weight over the cap area. Dynamic compaction was selected during the FS process as a baseline technology and for costing purposes; other compaction processes may be selected during the design process. The cost of site preparation is calculated as follows:

- Footprint of cap = 114,514 ft^2
- Production Rate = 5,000 ft^2/day (assumed)
- Time to compact = 25 days
- Air Sampling Crew (1 sample technician and 1 RCT) = 23 days
- Number of air samples = 1 sample per day at $1,000/sample

Allowing one day for decontamination, the dynamic compactor, operator, and oiler are required on site for 24 days.

Installation of Cap System: Representative Site 216-B-46 Crib requires a Modified RCRA Subtitle C Barrier. Modified RCRA Subtitle C Barrier design consists of, from bottom to top, the following layers:

- Graded fill layer (40 in. thick)
- Asphalt base course (4 in. thick)
- Low-permeability asphalt layer (6 in. thick)

- Lateral drainage layer (6 in. thick)
- Gravel filter layer (6 in. thick)
- Sand filter layer (6 in. thick)
- Non-woven geotextile
- Compacted silt loam (20 in. thick)
- Silt loam topsoil with pea gravel admixture (20 in. thick)
- Vegetation.

Total cap thickness = 108 in = 9 ft.

The volume of material for these layers is calculated using the area of the site and adding a 20-ft overrun in each direction to ensure complete site coverage. Assume 2H:1V side slopes. Refer to Table D-103 for site dimensions. These areas and volumes will be used for the cost estimate:

- Area of the site = 61,152 ft^2
- Total area of the cap (area of cap+ 20-ft overrun) = 83,072 ft^2
- Footprint of capped area = 114,514 ft^2
- Graded fill (40 in. sloped at 2%) = 13,583 yd^3
- Asphalt base course (4 in.) = 11,726 yd^2
- Low-permeability asphalt (6 in.) = 11,726 yd^2
- Lateral drainage layer (6 in.) = 1,902 yd^3
- Gravel filter layer (6 in.) = 1,878 yd^3
- Sand filter layer (6 in.) = 1,704 yd^3
- Nonwoven geotextile = 92,036 ft^2 = 10,266 yd^2
- Compacted silt loam (20 in.) = 5,250 yd^3
- Silt loam topsoil with pea gravel admixture (20 in.) = 5,498 yd^3
  - 10% of mix is pea gravel = 550 yd^3
- Graded fill for cap berm = 1,338 yd^3.

During the construction of the cap system, a cap performance monitoring system will be constructed. To account for the performance monitoring system cost, an assumed $5,000 lump sum amount is provided in the cost estimate.

The side slopes of the cap will be armored with riprap material. This material will be placed 12 in. thick around the entire perimeter of the site.

- Material placement rate = 50 yd^3/hr
- Area of riprap 1,302 ft long by 20.12 ft wide = 26,189 ft^2
- Volume of riprap material needed = 970 yd^3.

The following list of equipment and labor is assumed for cap construction:

- One excavator and operator (Pit 30 borrow area)

• One loader and one operator	(Pit 30 borrow area)
• Five trucks and drivers	(Pit 30 to Site, 16 yd^3/truck, 2 trips/hr)
• One loader and operator	(on site)
• One dozer and operator	(on site)
• One vibratory roller and operator	(on site)

The production rate assumes that the haul rate for the cap materials is 160 cy/hour (purchased material and Pit 30 material). The rate at which the cap materials can be placed is assumed equal to the rate material is delivered (160 cy/hour). The geotextile layer production rate based on 4 laborers per crew is assumed to be 0.02 labor hours/yd^2.

Revegetation: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following:

• Area to be revegetated	=	91,090 ft^2	=	10,121 yd^2
• Revegetation (includes lime, fertilizer, and seed)	=	\$1.63/yd^2		
• Production rate	=	1,000 yd^2/day	=	10 days.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. In addition, four laborers will be on site from mobilization through demobilization. These laborers will perform general activities including, but not limited to, maintenance, decontamination and placing geotextile. Miscellaneous costs are calculated as follows:

• Duration of contractor support	=	25.2 weeks = 126 days
• Contractor support rate	=	\$237/hour = 1,896/day (see general assumption)
• Four laborers (daily rates)	=	\$37/hour x 8 hr/day x 4 laborers
	=	\$1,184/day
• Time to prepare post-construction documents	=	160 hours (assumption)
• Labor rate for post-construction documents	=	\$50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alterative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system (including berm) = 114,514 ft^2
  - Team hours to complete inspections = 48 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = \$112/hour (\$56/hour/team member)
  - Radiation surveys of surface soil = \$23,000/event (\$1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system (including berm) = 114,514 ft^2
  - Area requiring repair (10% of total area) = 11,415 ft^2 = 1,272 yd^2
  - Oversight = 5 days (8 hours/day @ \$56/hour).

Monitoring: Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.4.4 Representative Site 216-B-5 Reverse Well (Cost tables D-55 through D-56)

The site work was estimated to take 5.7 weeks (1.4 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, performing the site survey, and evaluating landfill limits.
- Prepare site: 4 days (0.8 weeks)
- Capping: 8.5 days (1.7 weeks)
- Revegetation: 1 day (0.2 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total construction duration = 28.5 days = 5.7 weeks = 1.4 months.

Site Description: (The following information can be found on Table D-99)

- Area of contaminant mass = Injection well (70 in. diameter)
- Area of cap with 20-ft overrun = (0 ft + 2 x 20 ft) x (0 ft + 2 x 20 ft) = 1,600 ft^2

• Slope of rise and run	=	2H:1V
• Length of rise	=	98 in./12 in./ft x 2 ft = 16.33 ft
• Length of run	=	198 in./12 in./ft x 2 ft = 33 ft
• Length and width of total cap area	=	40 ft + 2 x 16.33 ft + 2 x 33 ft = 138.66 ft
• Total area of cap	=	138.66 ft x 138.66 ft = 19,226 ft^2= 0.44 acre.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). the cost of Fluor Hanford oversight is calculated as follows:

• Duration of Fluor Hanford oversight	=	5.7 weeks = 28.5 days
• Fluor Hanford oversight rate	=	\$215/hour = \$1,720/day (see general assumptions).

Mobilization/Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental and operating cost of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- One hydraulic excavator and one operator
- One bulldozer and one operator
- Two front-end loaders and two operators
- One water truck and one driver
- Five - dump trucks and five drivers
- One vibratory roller and one operator
- One office trailer
- One storage trailer
- Four laborers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time = (1 mob + 1 demob) x 8 hour/day x \$37/hour = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = area of cap footprint + 20% = 19,226 ft^2 + 20% = 23,071 ft^2 = 0.53 acre.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 1,500 ft + 10% = 39,600 ft^2 = 4,400 yd^2
- Haul Road Construction = \$7.36/yd^2.

Decontamination: A decontamination pad will be constructed to clean the dynamic compaction equipment leaving the site. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump, and a pump. It is assumed that the dynamic compaction equipment can be decontaminated in one day. Based on the Alternative 3 assumption for decontamination pad water use (1,000 gallons per month), 50 gallons of water are required for one day of decontamination activity. Therefore, it is assumed that a temporary water source can be obtained for decontamination activities and large storage tanks will not be required. It is also assumed that the sump can adequately store the rinse water prior to using for dust suppression on contaminated sites. Decontamination pad components are as follows:

- Pad area = 20 ft x 30 ft = 600 ft^2
- Timber grates (2 in. x 4 in.) = 2 x 5 x 30 ft + 2 x 17 x 3 ft = 402 linear ft = 0.402 m board ft
- Plastic sheeting (60 mil LLDPE) = [20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10% = 1,188 ft^2
- 3-in. PVC pipe = 5 linear ft.

All equipment rented for the decontamination pad will be rented for the duration of the RA activities in the event that the decontamination pad is needed. It is assumed that dynamic compaction equipment can be decontaminated for reuse.

The decontamination pad will be staffed for one day to decontaminate the dynamic compaction equipment following site stabilization. The decontamination crew will consist of four laborers. This crew of laborers would construct the decontamination pad, provide decontamination services, and remove the decontamination pad during demobilization activities (labor provided under miscellaneous costs).

- Duration to construct and remove = 2 days
- Duration of decontamination activities = 1 day.

Site Preparation: Costs associated with site preparation are capital costs. Before installing the cap system, the site surface must be prepared. Surface preparation includes stabilization of the cap area using dynamic compaction. The FS indicates a need to ensure compaction of soils at depth (i.e., compaction of soil deeper than 2 ft). To avoid the time delay associated with surcharging the area, a crane will be used to drop a large weight over the cap area. Dynamic compaction was selected during the FS process as a baseline technology and for costing purposes; other compaction processes may be selected during the design process. The cost of site preparation is calculated as follows:

- Footprint of cap = 19,226 ft^2
- Production Rate = 5,000 ft^2/day (assumed)
- Time to compact = 4 days.
- Air sampling crew (1 sample technician and 1 RCT) = 5 days
- Number of Air Samples = 1 sample/day at $1,000/sample.

Installation of Cap System: Representative Site 216-B-5 Reverse Well requires a Hanford Barrier. Hanford barrier design consists of, from bottom to top, the following layers:

- Compacted soil foundation (18 in. avg.)
- Top course (4 in.)
- Low-permeability asphalt layer (6 in.)
- Drainage gravel/cushion (12 in.)
- Fractured basalt riprap (60 in.)
- Gravel filter (12 in.)
- Sand filter (6 in.)
- Compacted silt loam (40 in.)
- Silt loam with pea gravel admixture
- Vegetation.

Total cap thickness = 198 in = 16.5 ft.

The volume of material for these layers is calculated using the area of the site and adding a 20-ft overrun in each direction to ensure complete site coverage. Assumes 2H:1V side slopes. Refer to Table D-103 for site dimensions. These areas and volumes will be used for the cost estimate:

- Area of the site = 7-inch diameter well
- Total area of cap (area of cap + 20 ft overrun) = 1,600 ft^2
- Footprint of capped area = 19,226 ft^2
- Soil foundation (18 in avg. sloped at 2%) = 1,020 yd^3
- Top course (4 in.) = 1,955 yd^2
- Low-permeability asphalt = 1,955 yd^2
- Drainage gravel/cushion (12 in.) = 600 yd^3
- Fractured basalt riprap = (volume of total cap + berms) = 4,030 yd^3
- Gravel filter (12 in.) = 130 yd^3
- Sand filter (6 in.) = 70 yd^3

- Compacted silt loam (40 in.) = 350 yd^3
- Silt loam with pea gravel admixture (40 in) = 540 yd^3
  - 10% of mix is peagravel = 54 yd^3.

During the construction of the cap system, a cap performance monitoring system will be constructed. To account for the performance monitoring system cost, an assumed $5,000 lump sum amount is provided in the cost estimate.

The following list of equipment and labor is assumed for cap construction:

- One excavator and operator (Pit 30 borrow area)
- One loader and one operator (Pit 30 borrow area)
- Five trucks and drivers (Pit 30 to Site, 16 yd^3/truck, 2 trips/hr)
- One loader and operator (on site)
- One dozer and operator (on site)
- One vibratory roller and operator (on site)

The production rate assumes that the haul rate for the cap materials is 160 cy/hour (purchased material and Pit 30 material). The rate at which the cap materials can be placed is assumed equal to the rate material is delivered (160 cy/hour).

Revegetation: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following:

- Area to be revegetated = 5,280 ft^2 = 586 yd^2
- Revegetation (includes lime, fertilizer, and seed) = $1.63/$yd^2$
- Production rate = 1,000 yd^2/day = 1 day

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. In addition, four laborers will be on site from mobilization through demobilization. These laborers will perform general activities including, but limited to, maintenance, and decontamination. Miscellaneous costs are calculated as follows:

- Four laborers (daily rate) = $37/hour x 8 hours/day x 4 laborers
  = $1,184/day
- Duration of contractor support = 5.7 weeks = 28.5 days
- Contractor support rate = $237/hour = $1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post-construction documents = $50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alterative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system (cap footprint) = 19,226 ft^2
  - Team hours to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = $112/hour ($56/hour/team member)
  - Radiation surveys of surface soil = $5,000/event ($1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system (cap footprint) = 19,226 ft^2
  - Area requiring repair (10% of total area) = 1,923 ft^2 = 214 yd^2
  - Oversight = 1 day (8 hours/day @ $56/hour).

Monitoring: Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.4.5 Representative Site 216-B-7A&B Crib (Cost tables D-59 through D-62)

The site work was estimated to take 6.6 weeks (1.6 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, performing the site survey, and evaluating landfill limits.
- Prepare site: 6 days (1.2 week)
- Capping: 11 days (2.2 weeks)
- Revegetation: 1 day (0.2 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total project duration = 33 days = 6.6 weeks = 1.6 months.

Site Description: The following information can be found on Table D-103

- Area of contaminant mass = 48 ft x 14 ft = 672 ft^2
- Area of cap with 20-ft overrun = (48 ft + 2 x 20 ft) x (14 ft + 2 x 20 ft) = 4,752 ft^2
- Slope of rise and run = 2H:1V
- Length of rise = 98 in./12 in./ft x 2 ft = 16.33 ft
- Length of run = 198 in./12 in./ft x 2 ft = 33 ft
- Length of total cap area = 88 ft + 2 x 16.33 ft + 2 x 33 ft = 186.67 ft
- Width of total cap area = 54 ft + 2 x 16.33 ft + 2 x 33 ft = 152.67 ft
- Total area of cap = 186.67 ft x 152.67 ft = 28,498 ft^2 = 0.65 acres.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of Fluor Hanford oversight = 6.6 weeks = 33 days
- Fluor Hanford oversight rate = $214/hour = $1,720/day (see general assumptions).

Mobilization/Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental and operating cost of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- One hydraulic excavator and one operator
- One bulldozer and one operator
- Two front-end loaders and two operators
- One water truck and one driver
- Five dump trucks and five drivers
- One vibratory roller and one operator
- One office trailer
- One storage trailer
- Four laborers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time = (1 mob + 1 demob) x 8 hour/day x $37/hour = $592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = area of cap footprint + 20% = 28,498 ft^2 + 20% = 34,198 ft^2 = 0.79 acre.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 1,500 ft + 10% = 39,600 ft^2 = 4,400 yd^2
- Haul Road Construction = $7.36/$yd^2$.

Decontamination: A decontamination pad will be constructed to clean the dynamic compaction equipment leaving the site. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump, and a pump. It is assumed that the dynamic compaction equipment can be decontaminated in one day. Based on the Alternative 3 assumption for decontamination pad water use (1,000 gallons per month), 50 gallons of water are required for one day of decontamination activity. Therefore, it is assumed that a temporary water source can be obtained for decontamination activities and large storage tanks will not be required. It is also assumed that the sump can adequately store the rinse water prior to using for dust suppression on contaminated sites. Decontamination pad components are as follows:

- Pad area = 20 ft x 30 ft = 600 ft^2
- Timber grates (2 in. x 4 in.) = 2 x 5 x 30 ft + 2 x 17 x 3 ft = 402 linear ft = 0.402 m board ft
- Plastic sheeting (60 mil LLDPE) = [20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10% = 1,188 ft^2
- 3-in. PVC pipe = 5 linear ft.

All equipment rented for the decontamination pad will be rented for the duration of the RA activities, in the event that the decontamination pad is needed. It is assumed that dynamic compaction equipment can be decontaminated for reuse.

The decontamination pad will be staffed for one day to decontaminate the dynamic compaction equipment following site stabilization. The decontamination crew will consist of 4 laborers. This crew of laborers would construct the decontamination pad, provide decontamination services, and remove the decontamination pad during demobilization activities (labor provided under miscellaneous costs).

- Duration to construct and remove = 2 days
- Duration of decontamination activities = 1 day.

Site Preparation: Costs associated with site preparation are capital costs. Before installing the cap system, the site surface must be prepared. Surface preparation includes stabilization of the cap area using dynamic compaction. The FS indicates a need to ensure compaction of soils at depth (i.e., compaction of soil deeper than 2 ft). To avoid the time delay associated with surcharging the area, a crane will be used to drop a large weight over the cap area. Dynamic compaction was selected during the FS process as a baseline technology and for costing purposes other compaction processes may be selected during the design process. The cost of site preparation is calculated as follows:

- Footprint of cap = 28,498 ft^2
- Production Rate = 5,000 ft^2/day (assumed)
- Time to compact = 6 days
- Air sampling crew (1 sample technician and 1 RCT) = 6 days
- Number of air samples = 1 sample/day at $1,000/sample.

Allowing one day for decontamination, the dynamic compactor, operator, and oiler are required on site for 7 days.

Installation of Cap System: Representative Site 216-B-74 Crib requires a Hanford Barrier. Hanford Barrier design contains, from bottom to top, the following layers:

- Compacted soil foundation (18 in. avg.)
- Top course (4 in.)
- Low-permeability asphalt layer (6 in.)
- Drainage gravel/cushion (12 in.)
- Fractured basalt riprap (60 in.)
- Gravel filter (12 in.)
- Sand filter (6 in.)
- Compacted silt loam (40 in.)
- Silt loam with pea gravel admixture
- Vegetation.

Total cap thickness = 198 in = 16.5 ft.

The volume of material for these layers is calculated using the area of the site and adding a 20-ft overrun in each direction to ensure complete site coverage. Assumes 2H:1V side slopes. Refer to Table D-103 for site dimensions. These areas and volumes will be used for the cost estimate:

- Area of the site = 672 ft^2
- Total area of cap (area of cap + 20 ft overrun) = 4,752 ft^2
- Footprint of capped area = 28,498 ft^2
- Soil foundation (18 in. sloped at 2%) = 1,528 yd^3
- Top course (4 in.) = 2,944 yd^2

- Low-permeability asphalt = 2,944 yd^2
- Drainage gravel/cushion (12 in.) = 918 yd^3
- Fractured basalt riprap = (volume of total cap + berms) = 5,855 yd^3
- Gravel filter (12 in.) = 412 yd^3
- Sand filter (6 in.) = 206 yd^3
- Compacted silt loam (40 in.) = 834 yd^3
- Silt loam with pea gravel admixture (40 in) = 1,131 yd^3
    - 10% of mix is peagravel = 113 yd^3.

During the construction of the cap system, a cap performance monitoring system will be constructed. To account for the performance monitoring system cost, an assumed $5,000 lump sum amount is provided in the cost estimate.

The following list of equipment and labor is assumed for cap construction:

- One excavator and operator (Pit 30 borrow area)
- One loader and one operator (Pit 30 borrow area)
- Five trucks and drivers (Pit 30 to Site, 16 yd^3/truck, 2 trips/hr)
- One loader and operator (on site)
- One dozer and operator (on site)
- One vibratory roller and operator (on site).

The production rate assumes that the haul rate for the cap materials is 160 cy/hour (purchased material and Pit 30 material). The rate at which the cap materials can be placed is assumed equal to the rate material is delivered (160 cy/hour). The geotextile layer production rate based on 4 laborers per crew is assumed to be 0.02 labor hours/yd^2.

Revegetation: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following:

- Area to be revegetated = 10,458 ft^2 = 1,162 yd^2
- Revegetation (includes lime, fertilizer, and seed) = $1.63/$yd^2$
- Production rate = 1,000 yd^2/day = 1 day.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on-site. In addition, four laborers will be on-site from mobilization through demobilization. These laborers will perform general activities including, but limited to, maintenance, and decontamination. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 6.6 weeks = 33 days
- Contractor support rate = $237/hour = $1,896/day (see general assumptions)
- Four laborers (daily rate) = $37/hour x 8 hours/day x 4 laborers = $1,184/day
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post-construction documents = $50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alterative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system (cap footprint) = 28,498 ft^2
  - Team hours to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = $112/hour ($56/hour/team member)
  - Radiation surveys of surface soil = $6,000/event ($1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system (cap footprint) = 28,498 ft^2
  - Area requiring repair (10% of total area) = 2,850 ft^2 = 317 yd^2
  - Oversight = 2 day (8 hours/day @ $56/hour).

Monitoring: Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.4.6 Representative Site 216-B-38 Trench (Cost tables D-63 through D-66)

This representative site is a group site containing sites 216-B-38, 216-B-35, 216-B-36, 216-B-37, 216-B-39, 216-B-40, and 216-B-41.

The site work was estimated to take 45.5 weeks (10.8 months) based on the following breakdown. Note: Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, performing the site survey, and evaluating landfill limits.
- Prepare site: 50 days(10 weeks)
- Capping: 135.5 days (27.1 weeks)
- Revegetation: 27 days (5.4 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total project duration = 227.5 days = 45.5 weeks = 10.8 months.

Site Description: The following information can be found on Table D-99

- Area of contaminant mass = 310 ft x 535 ft = 165,850 ft^2
- Area of cap with 20-ft overrun = (310 ft + 2 x 20 ft) x (535 ft + 2 x 20 ft) = 201,250 ft^2
- Slope of rise and run = 2H:1V
- Length of rise = 40 in./12 in./ft x 2 ft = 6.7 ft
- Length of run = 108 in./12 in./ft x 2 ft = 18 ft
- Length of total cap area = 575 ft + 2 x 6.7 ft + 2 x 18 ft = 624.33 ft
- Width of total cap area = 350 ft + 2 x 6.7 ft + 2 x 18 ft = 399.33 ft
- Total area of cap = 624.33 ft x 399.33 ft = 249,314 ft^2 = 5.72 acres.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of Fluor Hanford oversight = 45.5 weeks = 227.5 days
- Fluor Hanford oversight rate = \$215/hour = \$1,720/day (see general assumptions).

Mobilization/Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental and operating cost of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- One hydraulic excavator and one operator
- One bulldozer and one operator
- Two front-end loaders and two operators
- One water truck and one driver
- Five dump trucks and five drivers
- One vibratory roller and one operator
- One office trailer
- One storage trailer
- Four laborers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time = (1 mob + 1 demob) x 8 hour/day x \$37/hour = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = area of cap footprint + 20% = 249,314 ft^2 + 20% = 299,177 ft^2 = 6.87 acres.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is calculated as follows:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 1,500 ft + 10% = 39,600 ft^2 = 4,400 yd^2
- Haul Road Construction = \$7.36/yd^2

Decontamination: A decontamination pad will be constructed to clean the dynamic compaction equipment leaving the site. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump, and a pump. It is assumed that the dynamic compaction equipment can be decontaminated in one day. Based on the Alternative 3 assumption for decontamination pad water use (1,000 gallons per month), 50 gallons of water are required for one day of decontamination activity. Therefore, it is assumed that a temporary water source can be obtained for decontamination activities and large storage tanks will not be required. It is also assumed that the sump can adequately store the rinse water prior to using for dust suppression on contaminated sites. Decontamination pad components are as follows:

- Pad area = 20 ft x 30 ft = 600 ft^2
- Timber grates (2 in. x 4 in.) = 2 x 5 x 30 ft + 2 x 17 x 3 ft = 402 linear ft = 0.402 m board ft
- Plastic sheeting (60 mil = [20 ft x 30 ft + 2 x 8 ft = 1,188 ft^2

LLDPE)		overlap x 30 ft] + 10%
• 3-in. PVC pipe	=	5 linear ft.

All equipment rented for the decontamination pad will be rented for the duration of the RA activities, in the event that the decontamination pad is needed. It is assumed that dynamic compaction equipment can be decontaminated for reuse.

The decontamination pad will be staffed for one day to decontaminate the dynamic compaction equipment following site stabilization. The decontamination crew will consist of 4 laborers. This crew of laborers would construct the decontamination pad, provide decontamination services, and remove the decontamination pad during demobilization activities (labor provided under miscellaneous costs).

- Duration to construct and remove = 2 days
- Duration of decontamination activities = 1 day.

Site Preparation: Costs associated with site preparation are capital costs. Before installing the cap system, the site surface must be prepared. Surface preparation includes stabilization of cap area using dynamic compaction. The FS indicates a need to ensure compaction of soils at depth (i.e., compaction of soil deeper than 2 ft). To avoid the time delay associated with surcharging the area, a crane will be used to drop a large weight over the cap area. Dynamic compaction was selected during the FS process as a baseline technology and for costing purposes other compaction processes may be selected during the design process. The cost of site preparation is calculated as follows:

- Footprint of cap = 249,314 ft^2
- Production rate = 5,000 ft^2/day (assumed)
- Time to compact = 50 days
- Air sampling crew (1 sample technician and 1 RCT) = 50 days
- Number of air samples = 1 sample/day at $1,000/sample.

Allowing one day for decontamination, the dynamic compactor, operator, and oiler are required on site for 51 days.

Installation of Cap System: Representative Site 216-B-38 Trench requires a Modified RCRA Subtitle C Barrier. Modified RCRA Subtitle C barrier design contains, from bottom to top, the following layers:

- Graded fill layer (40 in. thick)
- Asphalt base course (4 in. thick)
- Low-permeability asphalt layer (6 in. thick)
- Lateral drainage layer (6 in. thick)
- Gravel filter layer (6 in. thick)
- Sand filter layer (6 in. thick)
- Nonwoven geotextile

- Compacted silt loam (20 in. thick)
- Silt loam topsoil with pea gravel admixture (20 in. thick)
- Vegetation.

Total cap thickness = 108 in = 9 ft.

The volume of material for these layers is calculated using the area of the site and adding a 20-ft overrun in each direction to ensure site coverage. Assume 2H:1V side slopes. Refer to Table D-103 for site dimensions. These areas and volumes will be used for the cost estimate:

- Area of the site = 165,850 ft^2
- Total area of cap (area of cap + 20 ft overrun) = 201,250 ft^2
- Footprint of capped area = 249,314 ft^2
- Graded fill (40 in. sloped at 2%) = 29,950 yd^3
- Asphalt base course (4 in.) = 26,205 yd^2
- Low-permeability asphalt (6 in.) = 26,205 yd^2
- Lateral drainage layer (6 in.) = 4,290 yd^3
- Gravel filter layer (6 in.) = 4,250 yd^3
- Sand filter layer (6 in.) = 3,980 yd^3
- Nonwoven geotextile = 215,099 ft^2 = 23,900 yd^2
- Compacted silt loam (20 in.) = 12,610 yd^3
- Silt loam with pea gravel admixture (20 in.) = 13,000 yd^3
  - 10% of mix is pea gravel = 1,300 yd^3
- Graded fill for cap berm = 1,550 yd^3.

During the construction of the cap system, a cap performance monitoring system will be constructed. To account for the performance monitoring system cost, an assumed $5,000 lump sum amount is provided in the cost estimate.

The side slopes of the cap will be armored with riprap material. This material will be placed 12 in. thick around the entire perimeter of the site.

- Material placement rate = 50 yd^3/hr
- Area of riprap apron 1,975 ft long by 20 ft wide = 39,743 ft^2
- Volume of riprap material needed = 1,470 yd^3.

The following list of equipment and labor is assumed for cap construction:

- One excavator and operator (Pit 30 borrow area)
- One loader and one operator (Pit 30 borrow area)
- Five trucks and drivers (Pit 30 to Site, 16 yd^3/truck, 2 trips/hr)
- One loader and operator (on site)
- One dozer and operator (on site)

- One vibratory roller and operator (on site).

The production rate assumes that the haul rate for the cap materials is 160 cy/hour (purchased material and Pit 30 material). The rate at which the cap materials can be placed is assumed equal to the rate material is delivered (160 cy/hour). The geotextile layer production rate based on 4 laborers per crew is assumed to be 0.02 labor hours/yd^2.

Revegetation: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following:

- Area to be revegetated = 235,130 ft^2 = 26,126 yd^2
- Revegetation (includes lime, fertilizer, and seed) = \$1.63/yd^2
- Production rate = 1,000 yd^2/day = 27 days.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. In addition, four laborers will be on site from mobilization through demobilization. These laborers will perform general activities including, but limited to, maintenance, decontamination, and placing geotextile. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 45.5 weeks = 227.5 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Four Laborers (daily rate) = \$37/hour x 8 hours/day x 4 laborers = \$1,184/day
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post-construction documents = \$50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alterative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system (including berm) = 249,314 ft^2
  - Team hours to complete inspections = 80 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = \$112/hour (\$56/hour/team member)
  - Radiation surveys of surface soil = \$50,000/event (\$1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)

– Area of cap system (including berm) = 249,314 ft^2
– Area requiring repair (10% of total area) = 24,931 ft^2 = 2,770 yd^2
– Oversight = 7 days (8 hours/day @ $56/hour).

Monitoring: Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.4.7 Representative Site 216-B-57 Trench (Cost tables D-67 through D-70)

The site work was estimated to take 6.9 weeks (1.7 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, performing the site survey, and evaluating landfill limits.
- Prepare site: 6 days (1.2 week)
- Capping: 11.5 days (2.3 weeks)
- Revegetation: 2 days (0.4 weeks)
- Demobilize: 5 days (1 week), Includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

Total construction duration = 34.5 days = 6.9 weeks = 1.7 months.

Site Description: The following information can be found on Table D-103.

- Area of contaminant mass = 15 ft x 200 ft = 3,000 ft^2
- Area of cap with 20-ft overrun = (15 ft + 2 x 20 ft) x (200 ft + 2 x 20 ft) = 13,200 ft^2
- Slope of rise and run = 2H:1V
- Length of rise = 40 in./12 in./ft x 2 ft = 6.7 ft
- Length of run = 108 in./12 in./ft x 2 ft = 18 ft
- Length of total cap area = 240 ft + 2 x 6.7 ft + 2 x 18 ft = 289.3 ft.
- Width of total cap area = 55 ft + 2 x 6.7 ft + 2 x 18 ft = 104.3 ft.
- Total area of cap = 289.3 ft x 104.3 ft = 30,186 ft^2 = 0.69 acre.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of Fluor Hanford oversight = 6.9 weeks = 34.5 days

- Fluor Hanford oversight rate = \$215/hour = \$1,720/day (see general assumptions).

Mobilization/Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental and operating cost of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- One hydraulic excavator and one operator
- One bulldozer and one operator
- Two front-end loaders and two operators
- One water truck and one driver
- Five dump trucks and five drivers
- One vibratory roller and one operator
- One office trailer
- One storage trailer
- Four laborers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time = (1 mob + 1 demob) x 8 hour/day x \$37/hour = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = area of cap footprint + 20% = 30,186 ft^2 + 20%
= 36,223 ft^2
= 0.83 acre.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 1,500 ft + 10% = 39,600 ft^2 = 4,400 yd^2
- Haul road construction = \$7.36/yd^2.

Decontamination Pad: A decontamination pad will be constructed to clean the dynamic compaction equipment. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump, and a pump. It is assumed that the dynamic compaction equipment can be decontaminated in one day. Based on the Alternative 3 assumption for decontamination pad water use (1,000 gallons per month), 50 gallons of water are required for one day of decontamination activity. Therefore, it is assumed that a temporary water source can be obtained for decontamination activities and large storage tanks will not be required. It is also assumed that the sump can adequately store the rinse water prior to using for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	= 600 ft^2	
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	= 402 linear ft	= 0.402 m board ft
• Plastic sheeting (60 mil LLDPE)	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	= 1,188 ft^2	
• 3-in. PVC pipe	=	5 linear ft.		

All equipment rented for the decontamination pad will be rented for the duration of the RA activities, in the event that the decontamination pad is needed. It is assumed that dynamic compaction equipment can be decontaminated for reuse.

The decontamination pad will be staffed for one day to decontaminate the dynamic compaction equipment following site stabilization. The decontamination crew will consist of four laborers. This crew will construct the decontamination pad, provide decontamination services, and remove the decontamination pad during demobilization activities (labor provided under miscellaneous costs).

- Duration to construct and remove = 2 days
- Duration of decontamination activities = 1 day.

Site Preparation: Costs associated with site preparation are capital costs. Before installing the cap system, the site surface must be prepared. Surface preparation includes stabilization of the cap area using dynamic compaction. The FS indicates a need to ensure compaction of soils at depth (i.e., compaction of soil deeper than 2 ft). To avoid the time delay associated with surcharging the area, a crane will be used to drop a large weight over the cap area. Dynamic compaction was selected during the FS process as a baseline technology and for costing purposes; other compaction processes may be selected during the design process. The cost of site preparation is calculated as follows:

- Footprint of cap = 30,186 ft^2
- Production rate = 5,000 ft^2/day
- Time to compact = 6 days
- Air sampling crew = 6 days (1 sample tech. and 1 RCT)
- Number of samples = 1 sample/day ($1,000/sample).

Allowing one day for decontamination, the dynamic compactor, operator, and oiler are required on site for 7 days.

Installation of Cap System: Representative Site 216-B-57 requires a Modified RCRA Subtitle C Barrier. Modified RCRA Subtitle C Barrier design consists of, from bottom to top, the following layers:

- Graded fill layer (40 in. thick)
- Asphalt base course (4 in. thick)
- Low-permeability asphalt layer (6 in. thick)
- Lateral drainage layer (6 in. thick)
- Gravel filter layer (6 in. thick)
- Sand filter layer (6 in. thick)
- Non-woven geotextile
- Compacted silt loam (20 in. thick)
- Silt loam topsoil with pea gravel admixture (20 in. thick)
- Vegetation.

Total cap thickness = 108 in = 9 ft.

The volume of material for these layers is calculated using the area of the site and adding a 20-ft overrun in each direction to ensure complete site coverage. Assume 2H:1V side slopes. Refer to Table D-103 for site dimensions. These areas and volumes will be used for the cost estimate:

- Area of the site = 3,000 ft^2
- Total area of the cap (area of cap + 20-ft overrun) = 13,200 ft^2
- Footprint of capped area = 30,186 ft^2
- Graded fill (40 in. sloped at 2%) = 3,410 yd^3
- Asphalt base course (4 in.) = 2,790 yd^2
- Low-permeability asphalt (6 in.) = 2,790 yd^2
- Lateral drainage layer (6 in.) = 440 yd^3
- Gravel filter layer (6 in.) = 420 yd^3
- Sand filter layer (6 in.) = 330 yd^3
- Nonwoven geotextile = 17,824 ft^2 = 1,980 yd^2
- Compacted silt loam (20 in.) = 880 yd^3
- Silt loam topsoil with pea gravel admixture (20 in.) = 1,000 yd^3
  - 10% of mix is pea gravel = 100 yd^3
- Graded fill for cap berm = 520 yd^3.

During the construction of the cap system, a cap performance monitoring system will be constructed. To account for the performance monitoring system cost, an assumed $5,000 lump sum amount is provided in the cost estimate.

The side slopes of the cap will be armored with riprap material. This material will be placed 12 inches thick around the entire perimeter of the site.

- Material placement rate = 50 yd^3/hour
- Area of riprap apron 715 ft long by 20.12 ft wide = 14,385 ft^2
- Volume of riprap material needed = 530 yd^3

The following list of equipment and labor is assumed for cap construction;

- One excavator and operator (Pit 30 borrow area)
- One loader and one operator (Pit 30 borrow area)
- Five trucks and drivers (Pit 30 to Site, 16 yd^3/truck, 2 trips/hr)
- One loader and operator (on site)
- One dozer and operator (on site)
- One vibratory roller and operator (on site).

The production rate assumes that the haul rate for the cap materials is 160 cy/hour (purchased material and Pit 30 material). The rate at which the cap materials can be placed is assumed equal to the rate material is delivered (160 cy/hour). The geotextile layer production rate based on 4 laborers per crew is assumed to be 0.02 hours/yd^2.

Revegetation: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following;

- Area to be revegetated = 17,310 ft^2 = 1,923 yd^2
- Revegetation (includes lime, fertilizer, and seed) = \$1.63/yd^2
- Production rate = 1,000 yd^2/day = 2 days.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. In addition, four laborers will be on site from mobilization through demobilization. These laborers will perform general activities including, but not limited to, maintenance, decontamination, and placing geotextile. Miscellaneous costs are calculated as follows:

- Four Laborers (daily rate) = \$37/hour x 8 hr/day x 4 laborers = \$1,184/day
- Duration of contractor support = 6.9 weeks = 34.5 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post-construction documents = \$50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alterative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system (including berm) = 30,186 ft^2
  - Team hours to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = $112/hour ($56/hour/team member)
  - Radiation surveys of surface soil = $6,000/event ($1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system (including berm) = 30,186 ft^2
  - Area requiring repair (10% of total area) = 3,019 ft^2 = 335 yd^2
  - Oversight = 1 day (8 hours/day @ $56/hour).

Monitoring: Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.4.8 Site 241-B-361 Settling Tank (Cost tables D-71 through D-74)

Sludge Removal: To remove sludge from the 241-B-361 Settling Tanks, it is proposed to use the same process as that proposed for the 241-Z-361 Settling Tank that is described in DOE/RL-2003-52, Rev. 0, Tank 241-Z-361 Engineering Evaluation/Cost Analysis. A AEAT Fluidics™ retrieval system will be used to remove sludge from the tank and transfer it into proper shipping containers. Absorbent will be added to these containers to dry the waste that is believed to possess approximately 60-75% water. The closed container possesses a HEPA vent. The container will then be transferred to interim on site storage prior to ultimate disposition.

The cost to transfer the sludge from the tank into containers and absorb associated liquid is $6,000,000 per DOE/RL-2003-52. This cost does not include costs associated with interim on site storage and ultimate disposal. The cost does include all necessary markups.

The site work was estimated to take 6.5 weeks (1.6 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, performing the site survey, and evaluating landfill limits)
- Prepare site: 5 days (1 week)
- Capping: 11.5 days (2.3 weeks)

- Revegetation: 1 days (0.2 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup).

Total construction duration = 32.5 days = 6.5 weeks = 1.6 months.

Site Description: The tank is a 20-foot diameter tank installed on end. The following information can be found on Table D-103.

- Area of contaminant mass = 20 ft x 20 ft = 400 ft^2
- Area of cap with 20-ft overrun = (20 ft + 2 x 20 ft) x (20 ft + 2 x 20 ft) = 3,600 ft^2
- Slope of rise and run = 2H:1V
- Length of rise = 98 in./12 in./ft x 2 ft = 16.3 ft
- Length of run = 198 in./12 in./ft x 2 ft = 33 ft
- Length of total cap area = 60 ft + 2 x 16.3 ft + 2 x 33 ft = 158.6 ft.
- Width of total cap area = 60 ft + 2 x 16.3 ft + 2 x 33 ft = 158.6 ft.
- Total area of cap = 158.6 ft x 158.6 ft = 25,173 ft^2 = 0.58 acre.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of Fluor Hanford oversight = 6.5 weeks = 32.5 days
- Fluor Hanford oversight rate = $215/hour = $1,720/day (see general assumptions).

Mobilization/Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental and operating cost of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- One hydraulic excavator and one operator
- One bulldozer and one operator
- Two front-end loaders and two operators
- One water truck and one driver
- Five dump trucks and five drivers
- One vibratory roller and one operator
- One office trailer

- One storage trailer
- Four laborers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time	= 8 hour/day x \$37/hour x 2 (mob/demob)
	= \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following;

Area of construction survey	= area of cap footprint + 20% = 25,173 ft^2 + 20%
	= 30,208 ft^2
	= 0.69 acre.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following;

• Length of haul road	=	1,500 ft		
• Width of haul road	=	24 ft		
• Gravel	=	24 ft x 1,500 ft + 10%	= 39,600 ft^2	= 4,400 yd^2
• Haul road construction	=	\$7.36/yd^2.		

Decontamination Pad: A decontamination pad will be constructed to clean the dynamic compaction equipment. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump, and a pump. It is assumed that the dynamic compaction equipment can be decontaminated in one day. Based on the Alternative 3 assumption for decontamination pad water use (1,000 gallons per month), 50 gallons of water are required for one day of decontamination activity. Therefore, it is assumed that a temporary water source can be obtained for decontamination activities and large storage tanks will not be required. It is also assumed that the sump can adequately store the rinse water prior to using for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	= 600 ft^2	
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	= 402 linear ft	= 0.402 m board ft
• Plastic sheeting (60 mil LLDPE)	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	= 1,188 ft^2	
• 3-in. PVC pipe	=	5 linear ft.		

All equipment rented for the decontamination pad will be rented for the duration of the RA activities, in the event that the decontamination pad is needed. It is assumed that dynamic compaction equipment can be decontaminated for reuse.

The decontamination pad will be staffed for one day to decontaminate the dynamic compaction equipment following site stabilization. The decontamination crew will consist of four laborers. This crew will construct the decontamination pad, provide decontamination services, and remove the decontamination pad during demobilization activities (labor provided under miscellaneous costs).

- Duration to construct and remove = 2 days
- Duration of decontamination activities = 1 day.

Site Preparation: Costs associated with site preparation are capital costs. Before installing the cap system, the abandoned underground storage tank must be filled with sand and the site surface must be prepared.

Filling tank with sand will be performed using a delivery system that blows the sand into the storage tank to ensure that all of the void spaces within the tank are filled. As indicated in Table D-103 the tank at Representative Site 216-B-341 is a 136,000 liter tank (35,929 gallons). The cost to fill the tank is based on the following.

- Volume of underground storage tank = 35,929 gallons
- Unit cost to fill storage tank with sand = $0.23 / gallon (ECHOS cost)

Surface preparation includes stabilization of the cap area using dynamic compaction. The FS indicates a need to ensure compaction of soils at depth (i.e., compaction of soil deeper than 2 ft). To avoid the time delay associated with surcharging the area, a crane will be used to drop a large weight over the cap area. Dynamic compaction was selected during the FS process as a baseline technology and for costing purposes; other compaction processes may be selected during the design process. The cost of site preparation is calculated as follows:

- Footprint of cap = 25,173 ft^2
- Production rate = 5,000 ft^2/day
- Time to compact = 5 days
- Air sampling crew = 5 days (1 sample tech. and 1 RCT)
- Number of samples = 1 sample/day ($1,000/sample).

Allowing one day for decontamination, the dynamic compactor, operator, and oiler are required on site for 6 days.

Installation of Cap System: Representative Site 241-B-361 Settling Tank requires a Hanford Barrier. Hanford barrier design consists of, from bottom to top, the following layers:

- Compacted soil foundation (18 in. avg.)
- Top course (4 in.)
- Low-permeability asphalt layer (6 in.)
- Drainage gravel/cushion (12 in.)
- Fractured basalt riprap (60 in.)
- Gravel filter (12 in.)
- Sand filter (6 in.)
- Compacted silt loam (40 in.)

- Silt loam with pea gravel admixture
- Vegetation.

Total cap thickness = 198 in = 16.5 ft.

The volume of material for these layers is calculated using the area of the site and adding a 20-ft overrun in each direction to ensure complete site coverage. Assumes 2H:1V side slopes. Refer to Table D-103 for site dimensions. These areas and volumes will be used for the cost estimate:

- Area of the site = 400 ft^2
- Total area of cap (area of cap + 20 ft overrun) = 3,600 ft^2
- Footprint of capped area = 25,173 ft^2
- Soil foundation (18 in avg. sloped at 2%) = 1,350 yd^3
- Top course (4 in.) = 2,590 yd^2
- Low-permeability asphalt = 2,590 yd^2
- Drainage gravel/cushion (12 in.) = 800 yd^3

- Fractured basalt riprap = (volume of total cap + berms) = 5,260 yd^3
- Gravel filter (12 in.) = 270 yd^3
- Sand filter (6 in.) = 130 yd^3
- Compacted silt loam (40 in.) = 660 yd^3
- Silt loam with pea gravel admixture (40 in) = 920 yd^3
  - 10% of mix is peagravel = 92 yd^3.

During the construction of the cap system, a cap performance monitoring system will be constructed. To account for the performance monitoring system cost, an assumed $5,000 lump sum amount is provided in the cost estimate.

The following list of equipment and labor is assumed for cap construction:

- One excavator and operator (Pit 30 borrow area)
- One loader and one operator (Pit 30 borrow area)
- Five trucks and drivers (Pit 30 to Site, 16 yd^3/truck, 2 trips/hr)
- One loader and operator (on site)
- One dozer and operator (on site)
- One vibratory roller and operator (on site).

The production rate assumes that the haul rate for the cap materials is 160 cy/hour (purchased material and Pit 30 material). The rate at which the cap materials can be placed is assumed equal to the rate material is delivered (160 cy/hour).

Revegetation: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following:

- Area to be revegetated = 8,586 ft^2 = 954 yd^2
- Revegetation (includes lime, fertilizer, and seed) = $1.63/$yd^2$
- Production rate = 1,000 yd^2/day = 1day.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. In addition, four laborers will be on site from mobilization through demobilization. These laborers will perform general activities including, but limited to, maintenance, and decontamination. Miscellaneous costs are calculated as follows:

- Four laborers (daily rate) = $37/hour x 8 hours/day x 4 laborers
  = $1,184/day
- Duration of contractor support = 6.5 weeks = 32.5 days
- Contractor support rate = $237/hour = $1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post-construction documents = $50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alterative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system (cap footprint) = 25,173 ft^2
  - Team hours to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = $112/hour ($56/hour/team member)
  - Radiation surveys of surface soil = $5,000/event ($1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system (cap footprint) = 25,173 ft^2
  - Area requiring repair (10% of total area) = 2,517 ft^2 = 280 yd^2
  - Oversight = 1 day (8 hours/day @ $56/hour).

Monitoring: Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.4.9 Representative Site: 216-B-58 Trench

The site work was estimated to take 7.6 weeks (1.8 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and constructing temporary facilities, performing the site survey, and evaluating landfill limits.
- Prepare site: 6 days (1.2 week)
- Capping: 15 days (3 weeks)
- Revegetation: 2 day (0.4 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey; and performing final site cleanup.

Total construction duration = 38 days = 7.6 weeks = 1.8 months.

Site Description: The following information can be found on Table D-103.

- Area of contaminant mass = 200 ft x 10 ft = 2,000 ft^2
- Area of cap with 20-ft overrun = (200 ft + 2 x 20 ft) x (10 ft + 2 x 20 ft) = 12,000 ft^2
- Slope of rise and run = 2H:1V
- Length of rise = 40 in./12 in./ft x 2 ft = 6.67 ft
- Length of run = 108 in./12 in./ft x 2 ft = 18 ft
- Length of total cap area = 240 ft + 2 x 6.67 ft + 2 x 18 ft = 289.33 ft.
- Width of total cap area = 50 ft + 2 x 6.67 ft + 2 x 18 ft = 99.33 ft
- Total area of cap = 289.33 ft x 99.33 ft = 28,739 ft^2= 0.66 acre.

Fluor Hanford Oversight: Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). The cost of Fluor Hanford oversight is calculated as follows:

- Duration of Fluor Hanford oversight = 7.6 weeks = 38 days
- Fluor Hanford oversight rate = \$215/hour = \$1,720/day (see general assumptions).

Mobilization/Demobilization and Field Support: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operating cost of a generator (site utilities on cost table) during the construction period. Field office support consists of office trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- One hydraulic excavator and one operator
- One bulldozer and one operator
- Two front-end loaders and two operators
- One water truck and one driver
- Five dump trucks and five drivers
- One vibratory roller and one operator
- One office trailer
- One storage trailer
- Four laborers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

Mobilization and demobilization time = (1 mob + 1 demob) x 8 hour/day x \$37/hour = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = area of cap footprint + 20% = 28,739 ft^2 + 20% = 34,487 ft^2 = 0.79 acre.

A haul road is assumed to be installed from a main road to the site. The haul road will consist of 6 in. of 1.5-in. gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = 24 ft x 1,500 ft + 10% = 39,600 ft^2 = 4,400 yd^2.
- Haul Road Construction = \$7.36/yd^2.

Decontamination Pad: A decontamination pad will be constructed to clean the dynamic compaction equipment. The decontamination pad will be of a sufficient length and width to accommodate construction equipment. The decontamination pad will consist of timber grates, plastic sheeting, PVC pipe, a sump, and a pump. It is assumed that the dynamic compaction equipment can be decontaminated in one day. Based on the Alternative 3 assumption for decontamination pad water use (1,000 gallons per month), 50 gallons of water are required for one day of decontamination activity. Therefore, it is assumed that a temporary water source can be obtained for decontamination activities and large storage tanks will not be required. It is also assumed that the sump can adequately store the rinse water prior to using for dust suppression on contaminated sites. Decontamination pad components are as follows:

• Pad area	=	20 ft x 30 ft	= 600 ft^2	
• Timber grates (2 in. x 4 in.)	=	2 x 5 x 30 ft + 2 x 17 x 3 ft	= 402 linear ft	= 0.402 m board ft
• Plastic sheeting (60 mil LLDPE)	=	[20 ft x 30 ft + 2 x 8 ft overlap x 30 ft] + 10%	= 1,188 ft^2	
• 3-in. PVC pipe	=	5 linear ft.		

All equipment rented for the decontamination pad will be rented for the duration of the RA activities, in the event that the decontamination pad is needed. It is assumed that equipment can be decontaminated for reuse.

The decontamination pad will be staffed for one day to decontaminate the dynamic compaction equipment following site stabilization. The decontamination crew will consist of four laborers. This crew will construct the decontamination pad, provide decontamination services, and remove the decontamination pad during demobilization activities (labor provided under miscellaneous costs).

- Duration to construct and remove = 2 days
- Duration of decontamination activities = 1 day.

Site Preparation: Costs associated with site preparation are capital costs. Before installing the cap system, the site surface must be prepared. Surface preparation includes stabilization of the cap area using dynamic compaction. The FS indicates a need to ensure compaction of soils at depth (i.e., compaction of soil deeper than 2 ft). To avoid the time delay associated with surcharging the area, a crane will be used to drop a large weight over the cap area. Dynamic compaction was selected during the FS process as a baseline technology and for costing purposes; other compaction processes may be selected during the design process. The cost of site preparation is calculated as follows:

- Footprint of cap = 28,739 ft^2
- Production Rate = 5,000 ft^2/day (assumed)
- Time to compact = 6 days.
- Air sampling crew (1 sample technician and 1 RCT) = 6 days
- Number of air samples = 1 sample per day ($1,000/sample).

Allowing 1 day for decontamination, the dynamic compactor, operator, and oiler are required on site for 7 days.

Installation of Cap System: Representative Site 216-T-26 crib requires a Modified RCRA Subtitle C Barrier. The Modified RCRA Subtitle C Barrier design consists of, from bottom to top, the following layers:

- Graded fill layer (40 in. thick)
- Asphalt base course (4 in. thick)
- Low-permeability asphalt layer (6 in. thick)
- Lateral drainage layer (6 in. thick)
- Gravel filter layer (6 in. thick)
- Sand filter layer (6 in. thick)
- Non-woven geotextile
- Compacted silt loam (20 in. thick)
- Silt loam topsoil with pea gravel admixture (20 in. thick)
- Vegetation.

Total cap thickness = 108 in = 9 ft.

The volume of material for these layers is calculated using the area of the site and adding a 20-ft overrun in each direction to ensure complete site coverage. Assume 2H:1V side slopes. Refer to Table D-103 for site dimensions. These areas and volumes will be used for the cost estimate:

- Area of the site = 1,200 ft^2
- Total area of the cap (area of cap + 20-ft overrun) = 12,000 ft^2
- Footprint of capped area = 28,739 ft^2
- Graded fill (40 in. sloped at 2%) = 3,240 yd^3
- Asphalt base course (4 in.) = 2,640 yd^2
- Low-permeability asphalt (6 in.) = 2,640 yd^2
- Lateral drainage layer (6 in.) = 410 yd^3
- Gravel filter layer (6 in.) = 400 yd^3
- Sand filter layer (6 in.) = 305 yd^3
- Nonwoven geotextile = 16,477 ft^2 = 1,830 yd^2
- Compacted silt loam (20 in.) = 800 yd^3
- Silt loam topsoil with pea gravel admixture (20 in.) = 930 yd^3
    - 10% of mix is pea gravel = 93 yd^3
- Graded fill for cap berm = 514 yd^3.

During the construction of the cap system, a cap performance monitoring system will be constructed. To account for the performance monitoring system cost, an assumed $5,000 lump sum amount is provided in the cost estimate.

The side slopes of the cap will be armored with riprap material. This material will be placed 12 in. thick around the entire perimeter of the site.

- Material placement scale = 50 yd³/hr
- Area of riprap apron 705 ft long by 20 ft wide = 14,185 ft^2
- Volume of riprap material needed = 525 yd^3.

The following list of equipment and labor is assumed for cap construction:

- One excavator and operator (Pit 30 borrow area)
- One loader and one operator (Pit 30 borrow area)
- Five trucks and drivers (Pit 30 to Site, 16 yd^3/truck, 2 trips/hr)
- One loader and operator (on site)
- One dozer and operator (on site)
- One vibratory roller and operator (on site).

The production rate assumes that the haul rate for the cap materials is 160 cy/hour (purchased material and Pit 30 material). The rate at which the cap materials can be placed is assumed equal to the rate material is delivered (160 cy/hour). The geotextile layer production rate based on 4 laborers per crew is assumed to be 0.02 hours/yd^2.

Revegetation: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following:

- Area to be revegetated = 16,043 ft^2 = 1,783 yd^2
- Revegetation (includes lime, fertilizer, and seed) = \$1,63/yd^2
- Production rate = 1,000 yd^2/day = 2 day.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. In addition, four laborers will be on-site from mobilization through demobilization. These laborers will perform general activities including, but not limited to maintenance, decontamination, and placing geotextile. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 7.6 weeks = 38 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Four Laborers (daily rate) = \$37/hour x 8 hrs/day x 4 laborers \$1,184/day
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post construction documents = \$50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alterative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system (including berm) = 28,739 ft^2
  - Team hours to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = $112/hour ($56/hour/team member)
  - Radiation surveys of surface soil = $6,000/event ($1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system (including berm) = 28,739 ft^2
  - Area requiring repair (10% of total area) = 2,874 ft^2 = 320 yd^2
  - Oversight = 1 day (8 hours/day @ $56/hour).

Monitoring: Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.5 ALTERNATIVE 5 – PARTIAL EXCAVATION AND CAPPING

D3.5.1 General Assumptions

The general assumptions for Alternative 5 are as follows:

- Fluor Hanford will provide contractor oversight. Personnel used to perform contractor oversight include a project manager (1 person full time), health and safety manager (1 person half time), QA/QC representative and scheduler (1 person full time), and a RCT (1 person full time). This oversight crew will be used when ever the contractor is in operation. Using the wage rates discussed in Section D3.1, this crew has an hourly rate of $215 or $1,720/day.

- Fluor Hanford will provide a crew of four RCTs for decontamination activities. Using the wage rates discussed in Section D3.1, the crew has an hourly rate of $224 or $1,792/day.

- Fluor Hanford will provide a crew of one sample technician (full time) and one RCT (full time) to collect one air samples each day during excavation, backfilling the first layer of soil, and dynamic compaction. Using the wage rates discussed in Section D3.1, the crew has an hourly rate of $112 or $896/day. The analytical cost for air samples is assumed to equal $1,000/sample. Air samples will be collected using equipment at a cost of $500/day.

- Fluor Hanford will provide a crew of one sample technician (full time) and one RCT (full time) to collect one air samples each day during excavation, backfilling the first layer of soil, and dynamic compaction. Using the wage rates discussed in Section D3.1, the crew has an hourly rate of $112 or $896/day. The analytical cost for air samples is assumed to equal $1,000/sample. Air samples will be collected using equipment at a cost of $500/day.

- Fluor Hanford will provide a crew of one sample technician (full time) and one RCT (full time) to collect one air samples each day during excavation, backfilling the first layer of soil, and dynamic compaction. Using the wage rates discussed in Section D3.1, the crew has an hourly rate of $112 or $896/day. The analytical cost for air samples is assumed to equal $1,000/sample. Air samples will be collected using equipment at a cost of $500/day.

- Fluor Hanford will provide a crew of one sample technician (half time) and one RCT (full time) to collect soil samples during excavation activities. Using the wage rates discussed in Section D3.1, the crew has an hourly rate of $84 or $672/day. The analytical costs for soil samples is assumed to equal $1,100 for overburden soil samples tested on-site, $5,000 for contaminated soil samples tested on-site, and $5,000 for overburden or contaminated soil samples tested off-site.

- Fencing and monuments/signs for institutional controls and fencing maintenance are considered institutional costs are not considered in this cost estimate.

- Groundwater monitoring is performed for another operable unit. The cost associated with periodic groundwater sampling is considered an institutional cost and in not considered in this costs estimate.

- Following excavation, contaminated soil will remain in place. To keep equipment and personnel off the contaminated soils, it is assumed that the first 10 feet of soil will be placed with out significant compaction. Following the placement of the 10 feet of soil, the soil will be dynamically compacted. The remainder of the excavation will then be backfilled with fill soil to a depth that is 40 inches (3.33 feet) below finished grade.

- Because the highly contaminated soils will be removed from the site, the cap system need only consist of two soil components. These components consist of 20 inches of silt loam and 20 inches of silt loam and pea gravel. In addition, vegetation will be applied to the surface to protect against erosion.

- Excavation depths for Alternative 5 are based on the information presented in the table below. The thickness of the contaminated soil is calculated by subtracting the depth of clean overburden soil from the total depth of excavation. The volume is then calculated by multiplying the area of contamination provided in Table D-103 by the depth. These intervals were developed based on analytical data gathered during the Remedial Investigation.

- The contaminated soil interval for removal in Alternative 5 is equal to the interval of contaminated soil in Alternative 3 that required blending. Therefore, it is assumed that all of the excavated contaminated soil in Alternative 5 will require a blending ratio of 5:1 (5 parts clean to 1 part contaminated).

Representative Site	Depth of Clean Overburden Soil (bgs)	Depth of Contaminated Soil (bgs)	Total Depth of Excavation (bgs)
216-T-26 Crib	18	52	40
216-B-46 Crib	18	49	25
216-B-7A&B Crib	15	37.5	28
216-B-38 Trench	15	40	25
216-B-57 Crib	15	50	45
216-B-58 Crib	10	25	17

Notes:

1. Alternative 4 is not applicable because partial excavation of a well is not applicable or feasible.
2. Because it is not desired to partially remove the tank at Site 241-B-361, Site 241-B-361 is not considered for Alternative 5.

- Cap materials will be placed over the entire excavation area and not just the area represented by the site area plus twenty feet of overrun.

- After backfill and placement of fill material and the two cap layers, remaining overburden material shall remain stockpiled on-site. No costs will be attributed to left over overburden materials.

- Alternative 5 consist of five general activities; excavation, disposal, capping, restoration, and periodic maintenance. These activities, along with activities performed during construction mobilization and demobilization, are described for the representative sites in the following sections.

D3.5.2 Representative Site 216-T-26 Crib (Cost Tables D-79 through D-82)

This site work was estimated to take 9.8 weeks (2.3 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and construction temporary facilities, performing the site survey, and performing decontamination setup.
- Excavate/dispose: 17.5 days (3.5 weeks)

- Restore/Cap: 16.5 days (3.3 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

The total construction duration = 49 days = 9.8 weeks = 2.3 months.

Site Description: The following information can be found in Table D-103 or on the table presented under general assumptions.

- Area of contaminant mass = 30 ft x 30 ft = 900 ft^2
- Depth of overburden soil = 18 ft bgs
- Total depth of excavation = 40 ft bgs
- Area of disturbance = 150 ft x 150 ft = 22,500 ft^2.

The following volumes have been calculated using the site information. This information and quantities used to generate this information is also provided in Table D-104.

- *Total excavation volume (based on 1.5H:1V side slopes)* = 17,333 yd^3
- Depth of contaminated soil (40ft - 18ft) = 22 ft
- Volume of contaminated soil (900ft^2 x 22ft) / 27 = 733 yd^3
- Volume of overburden soil (based on 1.5H:1V side slopes) = 16,600 yd^3
- Volume of material needed for blend (733 yd^3 x 5) = 3,667 yd^3
- Volume of Pit 30 material needed for blend = 0 yd^3
- Volume of material to ERDF (733 yd^3 + 3,667 yd^3) = 4,400 yd^3
- Overburden available for backfill = 12,933 yd^3
- Total backfill volume required = 17,333 yd^3
- Cap material: Compacted Silt loam (from Pit 30) = 1254 yd^3
  - Silt loam & Pea Gravel = 1,343 yd^3
  - Pea Gravel (10% of mix) = 134 yd^3
  - Silt loam (from Pit 30) = 1,209 yd^3
- Total fill soil needed = 14,736 yd^3
- Using 12,933 yd^3 overburden, Pit 30 fill soil needed = 1,803 yd^3.

Fluor Hanford Oversight: As indicated in the general assumptions, Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization).

- Duration of construction oversight = 49 days
- Construction oversight rate = \$215/hour or \$1,720/day.

During decontamination activities, Fluor Hanford will provide four RCTs to scan materials and equipment leaving the site.

- RCTs (4 at decon pad) = \$56/hour x 8 hours/day x 4 RCTs

= $1,792/day.

During all excavation activities on site, Fluor Hanford will provide one RCT per excavator to scan the soil coming from the excavation to determine if the soil is considered overburden or contaminated.

- RCT (1 per on site excavator) = $56/hour x 8 hours/day
  = $448/day.

Fluor Hanford Sampling: Soil samples and air samples will be collected throughout the duration of construction. The frequency of each type of sample is described below.

Soil Sampling: Soil samples will be collected during the excavation of overburden soil and contaminated soil. The rate at which these samples will be collected equals six samples per site within the overburden soil, and one sample for every 845 yd^3 of excavated contaminated soil (bulked by 15%). These samples will be analyzed in an on-site laboratory. Quality control samples will be sent to an off-site laboratory at a rate of 1 for every 20 samples collected (5% of samples collected) or a minimum of one per site. Labor to collect soil samples includes one sample technician (half time) and one RCT (full time).

- Number of overburden samples = 6 samples
- Cost per sample (on-site lab) = $1,100 / sample
- Cost per sample (off-site lab) = $5,000 / sample
- Volume of contaminated soil + 15% = 733 yd^3 + 15%
- Number of contaminated soil samples = 843 yd^3 /845 yd^3
  = 1 sample
- Cost per sample (on-site lab) = $5,000 / sample
- Cost per sample (off-site lab) = $5,000 / sample
- Labor (sample tech) = ($56/hour) x (8 hours/day) x 1/2
  = $224/day
- Labor (RCT) = ($56/hour) x (8 hours/day)
  = $448/day
- Labor (total) = $672/day
- Days of sampling = 17.5 days.

Air Sampling: Air samples will be collected during excavation activities, placement of first layer of backfill material, and dynamic compaction. The rate at which air samples will be collected equals one air sample per day in which the above referenced activities are taking place. Each sample collected will cost 1,000 to analyze plus labor to collect the samples and $500 per sample in sampling equipment. Labor to collect air samples includes one sample technician (full time) and one RCT (full time).

- Number of days for excavation = 17.5 days

- Number of days to backfill first layer = 0.5 days
- Number of days for dynamic compaction = 1 days
- Number of air samples collected = 19 samples
- Labor (one sample tech and one RCT) = (\$56/hour) x (8 hours/day) x 2 = \$896/day.

Fluor Hanford Transportation and Disposal: As mentioned in the general assumptions for Alternative 3, the cost for transportation and disposal of contaminated material at the ERDF is \$1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

- Volume of contaminated soil = 4,400 yd^3
- Volume of soil to ERDF = 4,400 yd^3 (see Site Description)
- Number of containers = 4,400 yd^3 x 1 container/11 yd^3 = 400 containers.

Mobilization/Demobilization: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operation costs of a generator (site utilities on cost table) during the construction period. Field office support consists of trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- Site

  One hydraulic excavator and one operator

  One bulldozer and one operator

  One front-end loader and one operator

  One water truck and one driver

  One office trailer

  One storage trailer

  Four laborers.
- Pit 30

  One hydraulic excavator and one operator

  One front-end loader and one operator

  Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

- Mobilization and demobilization = (1 mob + 1 demob) x 8 hrs/day x \$37/hr
  = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

- Area of construction survey = Area of disturbance + 20%
  = (22,500 ft^2) / (43,560 ft^2/acre) x 1.2
  = 0.62 acres
- Cost to perform survey = \$1,748/acre.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

- Length of temporary fence = 2 x (width + length) + 20%
  = 2 x (150 ft + 150 ft) x 1.2
  = 720 ft.

A haul road is assumed to be installed from the main road to the site. The haul road will consist of 6 inches of 1.5 inch gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = [(24ft x 1,500ft) + 10%] = 39,600 ft^2 = 4,400 yd^2
- Cost when place at 6" = \$7.36/yd^2.

Decontamination: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad constructed for Alternative 5 is the same pad discussed in Alternative 3. Refer to Alternative 3 for decontamination pad descriptions.

The rate of decontamination water usage is assumed to be 1,000 gallon/month. The time that the decontamination pad is in use (during excavation of contaminated soils) equals 10 days.

- Decontamination water = (1,000 gal/month)(1month/21days)(10 days)
  = 500 gal.

The decontamination pad will be staffed for the duration of contaminated soil excavation. It is assumed that the decontamination crew will consist of four laborers.

- Duration of Contaminated soil excavation = 10 days
- Labor rates (4 laborers) = \$37/hour/laborer x 4 laborers
  = \$148/hour x 8 hours/day
  = \$1,184/day.

Excavation: The overburden excavation will be performed using one hydraulic excavator and one front-end loader. Overburden soil will be excavated by removing non-contaminated soil and placing it on the ground next to the excavation. A front-end loader will be used to move the soil to a nearby stock pile. Due to screening requirements (radiation screening of excavated soil), the excavation of overburden soil is expected to proceed at a rate of 120 yd^3/hour or 960 yd^3/day. It is assumed that the overburden stockpile can be placed close enough to the excavation to allow the production rate of the front-end loader to meet or exceed that of the excavator. Labor for overburden excavation consists of two operators (one for the excavator and one for the front-end loader) and one RCT to screen the excavated soil.

- Volume of overburden soil = 16,600 yd^3
- Days to excavate overburden soil = 16,600 yd^3 / 960 yd^3/day
  = 17.5 days
- Labor (2 operators) = $37/hr x 8 hrs/day/person
  = $296/day/person.

Contaminated soil will be excavated using one hydraulic excavator and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator can excavate the contaminated material and load it directly into the disposal containers mounted on the trucks. Due to blending requirements (5 parts clean to 1 part contaminated), the limited number of containers that can be taken to the ERDF on a daily basis (40 containers), and the limited volume of soil per container (11 yd^3/container), the excavation of contaminated soil is expected to proceed at a rate of 73 yd^3/day (based on 440 yd^3/day and 5:1 blending ratio). The excavator will be used to bring overburden soil back to the excavation for blending purposes. It is assumed that the front-end loader can meet or exceed the excavation production rate. Labor for contaminated soil excavation consists of two operators (one for the excavator and one for the front-end loader), one RCT with the excavator to screen the excavated soil, four laborers to perform decontamination activities, and four RCTs to screen decontaminated containers and trucks.

- Volume of contaminated soil = 733 yd^3
- Days to excavate contaminated soil = 733 yd^3 / 73yd^3/day
  = 10 days
- Labor (4 laborers & 2 operators) = $37/hr x 8hrs/day/person
  = $296/day/person.

During all excavation activities, it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

- Days required for excavation = 17.5 days + 10 days = 27.5 days
- Labor (one driver) = $37/hour x 8 hours/day
  = $296/day.

Site Restoration: Site restoration will consist of backfilling the excavation to within 40 inches of final grade with fill soil [consists of clean overburden soil previously excavated if available and/or fill materials obtained from the local borrow pit (Pit 30)]. Once ten feet of fill soil is placed into the excavation using a front-end loader and a bulldozer, the material will be dynamically compacted. Following dynamic compaction, fill soil will be placed to the desired depth (final grade minus 40 inches) using a front-end loader, a bulldozer, and vibratory roller for compaction. Following the placement of the fill soil, cap soils will be placed to final grade. Cap soils consist of 20 inches of compacted silt loam (obtained from Pit 30) and 20 inches of a silt loam pea gravel mixture (silt loam obtained from Pit 30 and pea gravel purchased). The compacted silt loam layer will be placed using a front-end loader, a bulldozer, and a vibratory roller. The silt loam pea gravel layer will be placed with a front-end loader and bulldozer (no compaction required).

Based on the information provided under Site Description, backfill volumes are as follows:

- Total backfill volume = 17,333 yd^3
- Required volume of compacted silt loam (Pit 30) = 1,254 yd^3
- Required volume of silt loam (Pit 30) = 1,209 yd^3
- Required volume of pea gravel = 134 yd^3
- Volume of fill soil needed = 14,736 yd^3
- Available Overburden material = 12,933 yd^3
- Required fill soil from Pit 30 = 1,803 yd^3
- Fill soil needed to achieve first 10 foot lift = 833 yd^3.

Dynamic Compaction: To avoid contact with the contaminated soil left in place, ten feet of fill soil will be placed on top of the remaining contaminated soil. This material will then be dynamically compacted using a crane with a large weight. To achieve compaction, the crane will drop the weight onto the backfill material. The assumed production rate is 5,000 ft^2/day. Labor for dynamic compaction includes one operator and one oiler.

- Area requiring dynamic compaction = 3,600 ft^2
- Compaction rate = 5,000 ft^2/day
- Days to perform dynamic compaction = 1 day
- Labor (one operator and one oiler) = \$37/hr x 8 hr/day/person
  = \$296/day/person.

Overburden Material: It is assumed that the overburden soil can be backfilled at a rate equal to 185 yd^3/hour. Operating the equipment for 8 hours each day, the production rate equals 1,480 yd^3/day. Labor for backfilling overburden material includes operators for each of the two pieces of equipment being used. If there is enough volume of overburden soil to place in the excavation following dynamic compaction, that soil will be placed at the same production rate using a front-end loader, a bulldozer, and a vibratory roller.

- Volume needed to place 10 feet = 833 yd^3
- Days to place first 10 feet = 833 yd^3 / 1,480 yd^3/day
  = 0.5 days
- Labor (2 operators) = \$37/hr x 8 hrs/day/person
  = \$296/day/person
- Remaining overburden = 12,100 yd^3

- Days to place remaining overburden = 12,100 yd^3 / 1,480 yd^3/day
  = 8.5 days
- Labor (3 operators) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

Pit 30 Fill Soil: Because Pit 30 fill soil needs to be trucked to the site, it is assumed that the fill soil from Pit 30 can be backfilled at a rate equal to 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator and one front-end loader at Pit 30, and one front-end loader, one bulldozer, and one vibratory roller on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. Labor for backfilling Pit 30 fill soil includes operators for each of the five pieces of equipment (three on site and two at Pit 30), and five drivers for the trucks. If fill soil is being placed within the first 10 feet of the excavation, the production rate is the same but there will be no vibratory roller to provide compaction.

- Remaining Pit 30 fill soil = 1,803 yd^3
- Days to place remaining fill soil = 1,803 yd^3 / 1,280 yd^3/day
  = 1.5 day
- Labor (5 operators and 5 drivers) = \$37/hr x 8 hrs/day/person
  = \$296/day/persion.

Compacted Silt Loam: Compacted silt loam can be obtained from Pit 30 and must be trucked to the site. Therefore, it is assumed that the compacted silt loam from Pit 30 can be backfilled at a rate of 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator, and one front-end loader at Pit 30, and one front-end loader, one bulldozer, and one vibratory roller on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. Labor for backfilling Pit 30 silt loam includes operators for each of the five pieces of equipment (three on site and two at Pit 30), and five drivers for the trucks.

- Compacted silt loam (Pit 30) = 1,254 yd^3
- Days to place compacted silt loam = 1,254 yd^3 / 1,280 yd^3/day
  = 1 day
- Labor (5 operators and 5 drivers) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

Silt Loam and Pea Gravel: The silt loam for this layer can be obtained from Pit 30. Like the fill soil, Pit 30 silt loam needs to be trucked to the site, it is assumed that the silt loam from Pit 30 can be backfilled at a rate equal to 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator and one front-end loader at Pit 30, and one front-end loader and one bulldozer on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. The pea gravel for this layer must be purchased off-site and will need to be delivered to the site. It is assumed that the pea gravel can be delivered to the site, blended with the silt loam, and placed in the excavation at a rate of 160

yd^3/hour. Labor for backfilling silt loam and pea gravel includes operators for each of the four pieces of equipment (two on site and two at Pit 30), and five drivers for the trucks.

- Silt loam (Pit 30) = 1,209 yd^3
- Pea gravel (purchased) = 134 yd^3
- Total volume to backfill = 1,343 yd^3
- Days to place compacted silt loam = 1,343 yd^3 / 1,280 yd^3/day = 1 days
- Pit 30 labor (2 op. and 5 drivers) = \$37/hr x 8 hrs/day/person = \$296/day/person
- On site labor (2 operators) = \$37/hr x 8 hrs/day/person = \$296/day/person.

Revegetation: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following;

- Area to be revegetated = 22,500 ft^2 = 2,500 yd^2
- Revegetation (includes lime, fertilizer, and seed) = \$1.63/yd^2
- Production rate = 1,000 yd^2/day = 3 days.

During all restoration activities (backfilling, compaction, and revegetation), it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

- Days required for restoration = 16.5 days
- Labor (one driver) = \$37/hour x 8 hours/day = \$296/day.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 9.8 weeks = 49 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post-construction documents = \$50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alternative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system = 22,500 ft^2
  - Team hours to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = $112/hour ($56/hour/team member)
  - Radiation surveys of surface soil = $5,000/event ($1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system = 22,500 ft^2
  - Area requiring repair (10% of total area) = 2,250 ft^2 = 250 yd^2
  - Oversight (cap material 32 yd^3/hour) = 1 day (8 hours/day @ $56/hour)
  - Oversight (planting 1,000 yd^2/day) = 1 day (8 hours/day @ $56/hour).

Monitoring. Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.5.3 Representative Site 216-B-46 Crib (Cost Tables D-83 through D-86)

This site work was estimated to take 80 weeks (19 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and construction temporary facilities, performing the site survey, and performing decontamination setup.
- Excavate/dispose: 297 days (59.4 weeks)
- Restore/Cap: 88 days (17.6 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

The total construction duration = 400 days = 80 weeks = 19 months.

Site Description: The following information can be found in Table D-103 or on the table presented under general assumptions.

- Area of contaminant mass = 312 ft x 196 ft = 61,152 ft^2
- Depth of overburden soil = 18 ft bgs
- Total depth of excavation = 25 ft bgs
- Area of disturbance = 387 ft x 271 ft = 104,877 ft^2.

The following volumes have been calculated using the site information. This information and quantities used to generate this information is also provided in Table D-104.

- Total excavation volume (based on 1.5H:1V side slopes) = 76,865 yd^3
- Depth of contaminated soil (25ft -18ft) = 7 ft
- Volume of contaminated soil (76,865ft^2 x 7ft) / 27 = 15,854 yd^3
- Volume of overburden soil (based on 1.5H:1V side slopes) = 61,011 yd^3
- Volume of material needed for blend (15,854 yd^3 x 5) = 76,271 yd^3
- Volume of Pit 30 material needed for blend = 18,260 yd^3
- Volume of material to ERDF (15,854 yd^3 + 79,271 yd^3) = 95,125 yd^3
- Overburden available for backfill = 0 yd^3
- Total backfill volume required = 76,865 yd^3
- Cap material: Compacted Silt loam (from Pit 30) = 6,173 yd^3
  - Silt loam & Pea Gravel = 6,373 yd^3
  - Pea Gravel (10% of mix) = 637 yd^3
  - Silt loam (from Pit 30) = 5,736 yd^3
- Total fill soil needed = 64,319 yd^3
- Using 0 yd^3 overburden, Pit 30 fill soil needed = 64,319 yd^3.

Fluor Hanford Oversight: As indicated in the general assumptions, Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization).

- Duration of construction oversight = 400 days
- Construction oversight rate = \$215/hour or \$1,720/day.

During decontamination activities, Fluor Hanford will provide four RCTs to scan materials and equipment leaving the site.

- RCTs (4 at decon pad) = \$56/hour x 8 hours/day x 4 RCTs = \$1,792/day.

During all excavation activities on site Fluor Hanford will provide one RCT per excavator to scan the soil coming from the excavation to determine if the soil is considered overburden or contaminated.

- RCT (1 per on site excavator) = \$56/hour x 8 hours/day = \$448/day.

Fluor Hanford Sampling: Soil samples and air samples will be collected throughout the duration of construction. The frequency of each type of sample is described below.

Soil Sampling: Soil samples will be collected during the excavation of overburden soil and contaminated soil. The rate at which these samples will be collected equals six samples per site within the overburden soil, and one sample for every 845 yd^3 of excavated contaminated soil (bulked by 15%). These samples will be analyzed in an on site laboratory. Quality control samples will be sent to an off site laboratory at a rate of 1 for every 20 samples collected (5% of samples collected) or a minimum of one per site. Labor to collect soil samples includes one sample technician (half time) and one RCT (full time).

- Number of overburden samples = 6 samples
- Cost per sample (on site lab) = $1,100 / sample
- Cost per sample (off site lab) = $5,000 / sample
- Volume of contaminated soil + 15% = 15,854 cy + 15%
- Number of contaminated soil samples = 18,232 cy/845cy
  = 22 samples
- Cost per sample (on site lab) = $5,000 / sample
- Cost per sample (off site lab) = $5,000 / sample
- Labor (sample tech) = $56/hour x 8 hours/day x ½ time
  = $224/day
- Labor (RCT) = ($56/hour) x (8 hours/day)
  = $448/day
- Labor (total) = $672/day
- Days of sampling = 145 days.

Air Sampling: Air samples will be collected during excavation activities, placement of first layer of backfill material, and dynamic compaction. The rate at which air samples will be collected equals one air sample per day in which the above referenced activities are taking place. Each sample collected will cost $1,000 to analyze plus labor to collect the samples and $500 per sample in sampling equipment. Labor to collect air samples includes one sample technician (full time) and one RCT (full time).

- Number of days for excavation = 297 days
- Number of days to backfill first layer = 20 days
- Number of days for dynamic compaction = 16 days
- Number of days = 333 days
- Number of air samples collected = 333 samples
- Labor (one sample tech and one RCT) = ($56/hour) x (8 hours/day) x 2
  = $896/day.

Fluor Hanford Transportation and Disposal: As mentioned in the general assumptions for Alternative 3, the cost for transportation and disposal of contaminated material at the ERDF is

$1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

- Volume of contaminated soil = 15,854 yd^3
- Volume of soil to ERDF = 95,125 yd^3 (see Site Description)
- Number of containers = 95,125 yd^3 x 1 container/11 yd^3 = 8,648 containers.

Mobilization/Demobilization: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operation costs of a generator (site utilities on cost table) during the construction period. Field office support consists of trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- Site
  - One hydraulic excavator and one operator
  - One bulldozer and one operator
  - One front-end loader and one operator
  - One water truck and one driver
  - One office trailer
  - One storage trailer
  - Four laborers
- Pit 30
  - One hydraulic excavator and one operator
  - One front-end loader and one operator
  - Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows

Mobilization and demobilization = (1 mob + 1 demob) x 8 hrs/day x $37/hr
= $592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

Area of construction survey = Area of disturbance + 20%
= (104,877 ft^2) / (43,560 ft^2/acre) x 1.2
= 2.89 acres

Cost to perform survey = \$1,784/acre.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

Length of temporary fence = 2 x (width + length) + 20%
= 2 x (387ft + 271ft) x 1.2
= 1,579 ft.

A haul road is assumed to be installed from the main road to the site. The haul road will consist of 6 inches of 1.5 inch gravel. The cost of the haul road is based on the following:

Length of haul road = 1,500 ft
Width of haul road = 24 ft
Gravel = [(24ft x 1,500ft) + 10%] = 39,600 ft^2 = 4,400 yd^2
Cost when place at 6-in = \$7.36/yd^2.

Decontamination: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad constructed for Alternative 5 is the same pad discussed in Alternative 3. Refer to Alternative 3 for decontamination pad descriptions.

The rate of decontamination water usage is assumed to be 1,000 gallon/month. The time that the decontamination pad is in use (during excavation of contaminated soils) equals 217 days.

Decontamination water = (1,000 gal/month)(1month/21days)(217 days)
= 10,3500 gal.

The decontamination pad will be staffed for the duration of contaminated soil excavation. It is assumed that the decontamination crew will consist of four laborers.

- Duration of Contaminated soil excavation = 217 days
- Labor rates (4 laborers) = \$37/hour/laborer x 4 laborers
= \$148/hour x 8 hours/day
= \$1,184/day.

Excavation: The overburden excavation will be performed using one hydraulic excavator and one front-end loader. Overburden soil will be excavated by removing non-contaminated soil and placing it on the ground next to the excavation. A front-end loader will be used to move the soil to a nearby stock pile. Due to screening requirements (radiation screening of excavated soil), the excavation of overburden soil is expected to proceed at a rate of 120 yd^3/hour or 960 yd^3/day. It is assumed that the overburden stockpile can be placed close enough to the excavation to allow the production rate of the front-end loader to meet or exceed that of the excavator. Labor for overburden excavation consists of two operators (one for the excavator and one for the front-end loader) and one RCT to screen the excavated soil.

Volume of overburden soil = 76,865 yd^3
Days to excavate overburden soil = 76,865 yd^3 / 960 yd^3/day

	= 80 days
Labor (2 operators)	= \$37/hr x 8 hrs/day/person
	= \$296/day/person.

Contaminated soil will be excavated using one hydraulic excavator and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator can excavate the contaminated material and load it directly into the disposal containers mounted on the trucks. Due to blending requirements (5 parts clean to 1 part contaminated), the limited number of containers that can be taken to the ERDF on a daily basis (40 containers), and the limited volume of soil per container (11 yd^3/container), the excavation of contaminated soil is expected to proceed at a rate of 73 yd^3/day (based on 440 yd^3/day and 5:1 blending ratio). The excavator will be used to bring overburden soil back to the excavation for blending purposes. It is assumed that the front-end loader can meet or exceed the excavation production rate. Labor for contaminated soil excavation consists of two operators (one for the excavator and one for the front-end loader), one RCT with the excavator to screen the excavated soil, four laborers to perform decontamination activities, and four RCTs to screen decontaminated containers and trucks.

Volume of contaminated soil	= 15,854 yd^3
Days to excavate contaminated soil	= 15,854 yd^3 / 73yd^3/day
	= 217 days
Labor (4 laborers & 2 operators)	= \$37/hr x 8hrs/day/person
	= \$296/day/person.

During all excavation activities, it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

Days required for excavation	= 80 days + 217 days = 297 days
Labor (one driver)	= \$37/hour x 8 hours/day
	= \$296/day.

Site Restoration: Site restoration will consist of backfilling the excavation to within 40 inches of final grade with fill soil [consists of clean overburden soil previously excavated if available and/or fill materials obtained from the local borrow pit (Pit 30)]. Once ten feet of fill soil is placed into the excavation using a front-end loader and a bulldozer, the material will be dynamically compacted. Following dynamic compaction, fill soil will be placed to the desired depth (final grade minus 40 inches) using a front-end loader, a bulldozer, and vibratory roller for compaction. Following the placement of the fill soil, cap soils will be placed to final grade. Cap soils consist of 20 inches of compacted silt loam (obtained from Pit 30) and 20 inches of a silt loam pea gravel mixture (silt loam obtained from Pit 30 and pea gravel purchased). The compacted silt loam layer will be placed using a front-end loader, a bulldozer, and a vibratory roller. The silt loam pea gravel layer will be placed with a front-end loader and bulldozer (no compaction required).

Based on the information provided under Site Description, backfill volumes are as follows:

Total backfill volume	= 76,865 yd^3

Required volume of compacted silt loam (Pit 30)	= 6,173 yd^3
Required volume of silt loam (Pit 30)	= 5,736 yd^3
Required volume of pea gravel	= 637 yd^3
Volume of fill soil needed	= 64,319 yd^3
Available Overburden material	= 0 yd^3
Required fill soil from Pit 30	= 64,319 yd^3
Fill soil needed to achieve first 10 foot lift	= 25,638 yd^3.

Dynamic Compaction: To avoid contact with the contaminated soil left in place, ten feet of fill soil will be placed on top of the remaining contaminated soil. This material will then be dynamically compacted using a crane with a large weight. To achieve compaction, the crane will drop the weight onto the backfill material. The assumed production rate is 5,000 ft^2/day. Labor for dynamic compaction includes one operator and one oiler.

- Area requiring dynamic compaction = 77,292 ft^2
- Compaction rate = 5,000 ft^2/day
- Days to perform dynamic compaction = 16 days
- Labor (one operator and one oiler) = \$37/hr x 8 hr/day x 2 people
  = \$592/day.

Pit 30 Fill Soil: Because Pit 30 fill soil needs to be trucked to the site, it is assumed that the fill soil from Pit 30 can be backfilled at a rate equal to 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator, and one front-end loader at Pit 30, and one front-end loader, one bulldozer, and one vibratory roller on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. Labor for backfilling Pit 30 fill soil includes operators for each of the five pieces of equipment (three on site and two at Pit 30), and five drivers for the trucks. If fill soil is being placed within the first 10 feet of the excavation, the production rate is the same but there will be no vibratory roller to provide compaction.

- Volume of fill soil for first 10 feet = 25,638 yd^3
- Days to place fill soil in first 10 feet = 25,638 yd^3 / 1,280 yd^3/day
  = 20 days
- Labor (4 operators and 5 drivers) = \$37/hr x 8 hrs/day/person
  = \$296/day/person
- Remaining Pit 30 fill soil = 38,681 yd^3
- Days to place remaining fill soil = 38,681 yd^3 / 1,280 yd^3/day
  = 30 days
- Labor (5 operators and 5 drivers) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

Compacted Silt Loam: Compacted silt loam can be obtained from Pit 30 and must be trucked to the site. Therefore, it is assumed that the compacted silt loam from Pit 30 can be backfilled at a rate of 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator, and one front-end loader at Pit 30, and one front-end loader, one bulldozer, and one vibratory roller on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. Labor for backfilling Pit 30 silt loam includes operators for each of the five pieces of equipment (three on site and two at Pit 30), and five drivers for the trucks.

- Compacted silt loam (Pit 30) = 6,173 yd^3
- Days to place compacted silt loam = 6,173 yd^3 / 1,280 yd^3/day
  = 5 days
- Labor (5 operators and 5 drivers) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

<u>Silt Loam and Pea Gravel</u>: The silt loam for this layer can be obtained from Pit 30. Like the fill soil, Pit 30 silt loam needs to be trucked to the site, it is assumed that the silt loam from Pit 30 can be backfilled at a rate equal to 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator and one front-end loader at Pit 30, and one front-end loader and one bulldozer on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. The pea gravel for this layer must be purchased off-site and will need to be delivered to the site. It is assumed that the pea gravel can be delivered to the site, blended with the silt loam, and placed in the excavation at a rate of 160 yd^3/hour. Labor for backfilling silt loam and pea gravel includes operators for each of the four pieces of equipment (two on site and two at Pit 30), and five drivers for the trucks.

- Silt loam (Pit 30) = 5,736 yd^3
- Pea gravel (purchased) = 637 yd^3
- Total volume to backfill = 6,373 yd^3
- Days to place compacted silt loam = (6,373 yd^3) / (1,280 yd^3/day)
  = 5 days
- Pit 30 labor (2 op. and 5 drivers) = \$37/hr x 8 hrs/day x 7 people
  = \$2,072/day
- On site labor (2 operators) = \$37/hr x 8 hrs/day x 2 people
  = \$592/day.

<u>Revegetation</u>: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following;

- Area to be revegetated = 104,877 ft^2 = 11,653 yd^2
- Revegetation (includes lime, fertilizer, and seed) = \$1.63/yd^2
- Production rate = 1,000 yd^2/day = 12 days.

During all restoration activities (backfilling, compaction, and revegetation), it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

- Days required for restoration = 72 days
- Labor (one driver) = \$37/hour x 8 hours/day = \$296/day.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 80 weeks = 400 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post-construction documents = \$50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alternative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system = 104,877 ft^2
  - Team hours to complete inspections = 48 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = \$112/hour (\$56/hour/team member)
  - Radiation surveys of surface soil = \$21,000/event (\$1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system = 104,877 ft^2
  - Area requiring repair (10% of total area) = 10,488 ft^2 = 1,165 yd^2
  - Oversight (cap material 32yd^3/hr) = 3 day (8 hours/day @ \$56/hour)
  - Oversight (planting 1,000 yd^2/day) = 2 day (8hours/day @ \$56/hour).

Monitoring. Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.5.4 Representative Site 216-B-7A Crib (Cost Tables D-87 through D-90)

This site work was estimated to take 8.8 weeks (2.1 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and construction temporary facilities, performing the site survey, and performing decontamination setup.

- Excavate/Dispose: 22 days (4.4 weeks)

- Restore/Cap: 6.5 days (1.3 weeks)

- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

The total construction duration = 44 days = 8.8 weeks = 2.1 months.

Site Description: The following information can be found in Table D-103 or on the table *presented under general assumptions.*

- Area of contaminant mass = 48 ft x 14 ft = 672 ft^2
- Depth of overburden soil = 15 ft bgs
- Depth of high contamination = 22 ft bgs
- Total depth of excavation = 28 ft bgs
- Area of disturbance = 132 ft x 98 ft = 12,936 ft^2.

The following volumes have been calculated using the site information. This information and quantities used to generate this information is also provided in Table D-104.

- Total excavation volume (based on 1.5H:1V side slopes) = 5,082 yd^3
- Depth of high contaminated soil (22ft -15ft) = 7 ft
- Depth of low contaminated soil (28ft – 22ft) = 6 ft
- Volume of high contaminated soil (672ft^2 x 7ft) / 27 = 174 yd^3
- Volume of low contaminated soil (672ft^2 x 6ft) / 27 = 149 yd^3
- Volume of overburden soil (based on 1.5H:1V side slopes) = 4,758 yd^3
- Volume of material needed for blend (5:1) = 747 yd^3
- Volume of material needed for blend (10:1) = 1,742 yd^3
- Volume of Pit 30 material needed for blend = 0 yd^3
- Volume of material to ERDF = 2,812 yd^3
- Total backfill volume required = 5,082 yd^3
- Cap material: Compacted Silt loam (from Pit 30) = 696 yd^3

Silt loam & Pea Gravel	= 764 yd^3
Pea Gravel (10% of mix)	= 76 yd^3
Silt loam (from Pit 30)	= 687 yd^3

- Volume of fill soil needed = 3,622 yd^3
- Overburden available for backfill = 2,270 yd^3
- Pit 30 fill needed = 1,353 yd^3.

Fluor Hanford Oversight: As indicated in the general assumptions, Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization). It is anticipated that representative site 216-B-7A&B will have elevated levels of contaminating. Therefore, additional RCTs, an RCT supervisor, and a radiological engineer will be required during excavation.

- Duration of construction oversight = 44 days
- Construction oversight rate = \$215/hour or \$1,720/day.

During decontamination activities, Fluor Hanford will provide four RCTs to scan materials and equipment leaving the site.

- RCTs (4 at decon pad) = \$56/hour x 8 hours/day x 4 RCTs
  = \$1,792/day.

During all excavation activities on site, Fluor Hanford will provide one RCT per excavator to scan the soil coming from the excavation to determine if the soil is considered overburden or contaminated.

- RCT (1 per on site excavator) = \$56/hour x 8 hours/day
  = \$448/day.

Additional RCT oversight.

- Duration of additional RCT = 22 days (equal to excavation time)
- RCT supervisor rate = \$72.61/hour
  = \$580.88/day
- Radiological engineer rate = \$62.78/hour
  = \$502.24/day

Fluor Hanford Sampling: Soil samples and air samples will be collected throughout the duration of construction. The frequency of each type of sample is described below.

Soil Sampling: Soil samples will be collected during the excavation of overburden soil and contaminated soil. The rate at which these samples will be collected equals six samples per site within the overburden soil, and one sample for every 845 yd^3 of excavated contaminated soil (bulked by 15%). These samples will be analyzed in an on site laboratory. Quality control samples will be sent to an off site laboratory at a rate of 1 for every 20 samples collected (5% of samples collected) or a minimum of one per site. Labor to collect soil samples includes one sample technician (half time) and one RCT (full time).

- Number of overburden samples = 6 samples
- Cost per sample (on site lab) = \$1,100 / sample
- Cost per sample (off site lab) = \$5,000 / sample
- Volume of contaminated soil + 15% = 324 yd^3 + 15%
- Number of contaminated soil samples = 373 yd^3/845 yd^3 = 1 sample
- Cost per sample (on site lab) = \$5,000 / sample
- Cost per sample (off site lab) = \$5,000 / sample
- Labor (sample tech) = (\$56/hour) x (8 hours/day) x ½ time = \$224/day
- Labor (RCT) = (\$56/hour) x (8 hours/day) = \$448/day
- Labor (total) = \$672/day
- Days of sampling = 22 days.

Air Sampling: Air samples will be collected during excavation activities, placement of first layer of backfill material, and dynamic compaction. The rate at which air samples will be collected equals one air sample per day in which the above referenced activities are taking place. Each sample collected will cost \$1,000 to analyze plus labor to collect the samples and \$500 per sample in sampling equipment. Labor to collect air samples includes one sample technician (full time) and one RCT (full time).

- Number of days for excavation = 22 days
- Number of days to backfill first layer = 0.5 days
- Number of days for dynamic compaction = 1 days
- Number of air samples collected = 24 samples
- Labor (one sample tech and one RCT) = (\$56/hour) x (8 hours/day) x 2 = \$896/day.

Fluor Hanford Transportation and Disposal: As mentioned in the general assumptions for Alternative 3, the cost for transportation and disposal of contaminated material at the ERDF is \$1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

- Total volume to dispose = 2,812 yd^3 (see Site Description)
- Number of containers = 2,812 yd^3 x 1 container/11 yd^3 = 256 containers.

Mobilization/Demobilization: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operation costs of a generator (site utilities on cost table) during the construction period. Field office support consists of trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- Site
  - One hydraulic excavator and one operator
  - One bulldozer and one operator
  - One front-end loader and one operator
  - One water truck and one driver
  - One office trailer
  - One storage trailer
  - Four laborers.
- Pit 30
  - One hydraulic excavator and one operator
  - One front-end loader and one operator
  - Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows

- Mobilization and demobilization = (1 mob + 1 demob) x 8 hrs/day x $37/hr
  = $592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

- Area of construction survey = Area of disturbance + 20%
  = (12,936 ft^2) / (43,560 ft^2/acre) x 1.2
  = 0.36 acres
- Cost to perform survey = $1,748/acre.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

- Length of temporary fence = 2 x (length + width) + 20%
  = 2 x (132ft + 98ft) x 1.2
  = 552 ft.

A haul road is assumed to be installed from the main road to the site. The haul road will consist of 6 inches of 1.5 inch gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = (24ft x 1,500ft) + 10% = 39,600 ft^2 = 4,400 yd^2
- Cost when place at 6-in. = \$7.36/yd^2.

Decontamination: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad constructed for Alternative 5 is the same pad discussed in Alternative 3. Refer to Alternative 3 for decontamination pad descriptions.

The rate of decontamination water usage is assumed to be 1,000 gallon/month. The time that the decontamination pad is in use (during excavation of contaminated soils) equals 17 days.

Decontamination water = (1,000 gal/month)(1month/21days)(17 days)
= 810 gal.

The decontamination pad will be staffed for the duration of contaminated soil excavation. It is assumed that the decontamination crew will consist of four laborers.

- Duration of Contaminated soil excavation = 17 day
- Labor rates (4 laborers) = \$37/hour/laborer x 4 laborers
  = \$148/hour x 8 hours/day
  = \$1,184/day.

Excavation: The overburden excavation will be performed using one hydraulic excavator and one front-end loader. Overburden soil will be excavated by removing non-contaminated soil and placing it on the ground next to the excavation. A front-end loader will be used to move the soil to a nearby stock pile. Due to screening requirements (radiation screening of excavated soil), the excavation of overburden soil is expected to proceed at a rate of 120 yd^3/hour or 960 yd^3/day. It is assumed that the overburden stockpile can be placed close enough to the excavation to allow the production rate of the front-end loader to meet or exceed that of the excavator. Labor for overburden excavation consists of two operators (one for the excavator and one for the front-end loader) and one RCT to screen the excavated soil.

- Volume of overburden soil = 4,758 yd^3
- Days to excavate overburden soil = 4,758 yd^3 / 960 yd^3/day
  = 5 days
- Labor (3 operators) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

Contaminated soil will be excavated using one hydraulic excavator and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator can excavate the contaminated material and load it directly into the disposal containers mounted on the trucks. Due to blending requirements (10 parts clean to 1 part contaminated), the high contamination levels, and the limited volume of soil per container (11 yd^3/container), the excavation of contaminated soil is expected to proceed at a rate of 20 yd^3/day [based on 20 containers a day holding 11 yd^3 each and 10:1 blending ratio(220 yd^3/day)]. The excavator will be used to bring overburden soil back to the excavation for blending purposes. It is assumed that the front-end loader can meet or exceed the excavation production rate. Labor for contaminated soil excavation consists of two operators (one for the excavator and one for the front-end loader), one RCT with the excavator to screen the excavated soil, four laborers to perform decontamination activities, and four RCTs to screen decontaminated containers and trucks.

- Volume of contaminated soil = 323 yd^3
- Days to excavate contaminated soil = 323 yd^3 / 20yd^3/day = 17 days
- Labor (4 laborers & 3 operators) = \$37/hr x 8hrs/day/person = \$296/day/person.

During all excavation activities, it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

Days required for excavation	= 5 days + 17 day = 22 days
Labor (one driver)	= \$37/hour x 8 hours/day
	= \$296/day.

Site Restoration: Site restoration will consist of backfilling the excavation to within 40 inches of final grade with fill soil [consists of clean overburden soil previously excavated if available and/or fill materials obtained from the local borrow pit (Pit 30)]. Once ten feet of fill soil is placed into the excavation using a front-end loader and a bulldozer, the material will be dynamically compacted. Following dynamic compaction, fill soil will be placed to the desired depth (final grade minus 40 inches) using a front-end loader, a bulldozer, and vibratory roller for compaction. Following the placement of the fill soil, cap soils will be placed to final grade. Cap soils consist of 20 inches of compacted silt loam (obtained from Pit 30) and 20 inches of a silt loam pea gravel mixture (silt loam obtained from Pit 30 and pea gravel purchased). The compacted silt loam layer will be placed using a front-end loader, a bulldozer, and a vibratory roller. The silt loam pea gravel layer will be placed with a front-end loader and bulldozer (no compaction required).

Based on the information provided under Site Description, backfill volumes are as follows:

- Total backfill volume = 5,082 yd^3
- Required volume of compacted silt loam (Pit 30) = 696 yd^3
- Required volume of silt loam (Pit 30) = 687 yd^3
- Required volume of pea gravel = 76 yd^3
- Volume of fill soil needed = 3,622 yd^3
- Available Overburden material = 2,270 yd^3
- Required fill soil from Pit 30 = 1,353 yd^3
- Fill soil needed to achieve first 10 foot lift = 760 yd^3.

Dynamic Compaction: To avoid contact with the contaminated soil left in place, ten feet of fill soil will be placed on top of the remaining contaminated soil. This material will then be dynamically compacted using a crane with a large weight. To achieve compaction, the crane will drop the weight onto the backfill material. The assumed production rate is 5,000 ft^2/day. Labor for dynamic compaction includes one operator and one oiler.

- Area requiring dynamic compaction = 3,432 ft^2
- Compaction rate = 5,000 ft^2/day
- Days to perform dynamic compaction = 1 day
- Labor (one operator and one oiler) = \$37/hr x 8 hr/day x 2 people = \$592/day.

Overburden Material: It is assumed that the overburden soil can be backfilled at a rate equal to 185 yd^3/hour. Operating the equipment for 8 hours each day, the production rate equals 1,480 yd^3/day. Labor for backfilling overburden material includes operators for each of the two pieces of equipment being used. If there is enough volume of overburden soil to place in the excavation following dynamic compaction, that soil will be placed at the same production rate using a front-end loader, a bulldozer, and a vibratory roller.

- Volume needed to place 10 feet = 760 yd^3
- Days to place first 10 feet = 760 yd^3 / 1,480 yd^3/day = 0.5 days
- Labor (3 operators) = \$37/hr x 8 hrs/day/person = \$296/day/person
- Remaining overburden = 1,510 yd^3
- Days to place remaining overburden = 1,510 yd^3 / 1,480 yd^3/day = 1 day
- Labor (3 operators) = \$37/hr x 8 hrs/day/person = \$296/day/person
- Pit 30 material needed = 1,353 yd^3
- Days to place compacted silt loam = 1,353 yd^3 / 1,280 yd^3/day = 1 day
- Pit 30 labor (2 op. and 5 drivers) = \$37/hr x 8 hrs/day/person = \$296/day/person
- On site labor (2 operators) = \$37/hr x 8 hrs/day/person = \$296/day/person.

Compacted Silt Loam: Compacted silt loam can be obtained from Pit 30 and must be trucked to the site. Therefore, it is assumed that the compacted silt loam from Pit 30 can be backfilled at a rate of 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator, and one front-end loader at Pit 30, and one front-end loader, one bulldozer, and one vibratory roller on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. Labor for backfilling Pit 30 silt loam includes operators for each of the five pieces of equipment (three on site and two at Pit 30), and five drivers for the trucks.

- Compacted silt loam (Pit 30) = 696 yd^3
- Days to place compacted silt loam = 696 yd^3 / 1,280 yd^3/day
  = 0.5 days
- Labor (5 operators and 5 drivers) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

Silt Loam and Pea Gravel: The silt loam for this layer can be obtained from Pit 30. Like the fill soil Pit 30 silt loam needs to be trucked to the site, it is assumed that the silt loam from Pit 30 can be backfilled at a rate equal to 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator and one front-end loader at Pit 30, and one front-end loader and one bulldozer on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. The pea gravel for this layer must be purchased off-site and will need to be delivered to the site. It is assumed that the pea gravel can be delivered to the site, blended with the silt loam, and placed in the excavation at a rate of 160 yd^3/hour. Labor for backfilling silt loam and pea gravel includes operators for each of the four pieces of equipment (two on site and two at Pit 30), and five drivers for the trucks.

- Silt loam (Pit 30) = 687 yd^3
- Pea gravel (purchased) = 76 yd^3
- Total volume to backfill = 764 yd^3
- Days to place compacted silt loam = 563 yd^3 / 1,280 yd^3/day
  = 0.5 days
- Pit 30 labor (2 op. and 5 drivers) = \$37/hr x 8 hrs/day/person
  = \$296/day/person
- On site labor (2 operators) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

Revegetation: Following the installation of the cap, the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following:

- Area to be revegetated = 12,936 ft^2 = 1,437 yd^2
- Revegetation (includes lime, fertilizer, and seed) = \$1.63/yd^2
- Production rate = 1,000 yd^2/day = 2 days.

During all restoration activities (backfilling, compaction, and revegetation) it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

- Days required for restoration = 5.5 days
- Labor (one driver) = \$37/hour x 8 hours/day
  = \$296/day.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 8.8 weeks = 44 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post-construction documents = \$50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alternative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system = 12,936 ft^2
  - Team hours to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = \$112/hour (\$56/hour/team member)
  - Radiation surveys of surface soil = \$3,000/event (\$1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system (including berm) = 12,936 ft^2
  - Area requiring repair (10% of total area) = 1,294 ft^2 = 143 yd^2
  - Oversight (cap material, 32 yd^3/hour) = 1 day (8 hours/day @ \$56/hour)
  - Oversight (planting 1,000 yd^2/day) = 1 day (8 hours/day @ \$56/hour).

Monitoring. Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.5.5 Representative Site 216-B-38 Trench (Cost Tables D-91 through D-94)

This site work was estimated to take 239.4 weeks (57 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and construction temporary facilities, performing the site survey, and performing decontamination setup.
- Excavate/dispose: 972 days (194.4 weeks)
- Restore/Cap: 210 days (42 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

The total construction duration = 1,197 days = 239.4 weeks = 57 months.

Site Description: The following information can be found in Table D-103 or on the table presented under general assumptions.

- Area of contaminant mass = 535 ft x 310 ft = 165,850 ft^2
- Depth of overburden soil = 15 ft bgs
- Total depth of excavation = 25 ft bgs
- Area of disturbance = 610 ft x 385 ft = 234,850 ft^2.

The following volumes have been calculated using the site information. This information and quantities used to generate this information is also provided in Table D-104.

- Total excavation volume (based on 1.5H:1V side slopes) = 185,509 yd^3
- Depth of contaminated soil (25ft -15ft) = 10 ft
- Volume of contaminated soil (165,850ft^2 x 10ft) / 27 = 61,426 yd^3
- Volume of overburden soil (based on 1.5H:1V side slopes) = 124,083 yd^3
- Volume of material needed for blend (61,426 yd^3 x 5) = 307,130 yd^3
- Volume of Pit 30 material needed for blend = 183,047 yd^3
- Volume of material to ERDF (61,426yd^3 + 307,130yd^3) = 368,556 yd^3
- Overburden available for backfill = 0 yd^3
- Total backfill volume required = 185,509 yd^3
- Cap material: Compacted Silt loam (from Pit 30) = 14,040 yd^3
  - Silt loam & Pea Gravel = 14,344 yd^3
  - Pea Gravel (10% of mix) = 1,434 yd^3
  - Silt loam (from Pit 30) = 12,910 yd^3
- Total fill soil needed = 157,125 yd^3
- Using 0 yd^3 of overburden, Pit 30 fill soil needed = 157,125 yd^3.

Fluor Hanford Oversight: As indicated in the general assumptions, Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization).

- Duration of construction oversight = 1,197 days
- Construction oversight rate = \$215/hour or \$1,720/day.

During decontamination activities, Fluor Hanford will provide four RCTs to scan materials and equipment leaving the site.

- RCTs (4 at decon pad) = \$56/hour x 8 hours/day x 4 RCTs
  = \$1,792/day.

During all excavation activities on site, Fluor Hanford will provide one RCT per excavator to scan the soil coming from the excavation to determine if the soil is considered overburden or contaminated.

- RCT (1 per on site excavator) = \$56/hour x 8 hours/day
  = \$448/day.

Fluor Hanford Sampling: Soil samples and air samples will be collected throughout the duration of construction. The frequency of each type of sample is described below.

Soil Sampling: Soil samples will be collected during the excavation of overburden soil and contaminated soil. The rate at which these samples will be collected equals six samples per site within the overburden soil, and one sample for every 845 yd^3 of excavated contaminated soil (bulked by 15%). These samples will be analyzed in an on site laboratory. Quality control samples will be sent to an off site laboratory at a rate of 1 for every 20 samples collected (5% of samples collected) or a minimum of one per site. Labor to collect soil samples includes one sample technician (half time) and one RCT (full time).

- Number of overburden samples = 6 samples
- Cost per sample (on-site lab) = \$1,100 / sample
- Cost per sample (off-site lab) = \$5,000 / sample
- Volume of contaminated soil + 15% = 61,426 yd^3 + 15%
- Number of contaminated soil samples = 70,640 yd^3/845 yd^3
  = 84 samples
- Cost per sample (on-site lab) = \$5,000 / sample
- Cost per sample (off-site lab) = \$5,000 / sample
- Labor (sample tech) = (\$56/hour) x (8 hours/day) x ½ time
  = \$224/day
- Labor (RCT) = (\$56/hour) x (8 hours/day)
  = \$448/day

- Labor (total) = $672/day
- Days of sampling = 972 days.

Air Sampling: Air samples will be collected during excavation activities, placement of first layer of backfill material, and dynamic compaction. The rate at which air samples will be collected equals one air sample per day in which the above referenced activities are taking place. Each sample collected will cost 1,000 to analyze plus labor to collect the samples and $500 per sample in sampling equipment. Labor to collect air samples includes one sample technician (full time) and one RCT (full time).

- Number of days for excavation = 972 days
- Number of days to backfill first layer = 52 days
- Number of days for dynamic compaction = 39 days
- Number of air samples collected = 1,063 samples
- Labor (one sample tech and one RCT) = ($56/hour) x (8 hours/day) x 2

  = $896/day.

Fluor Hanford Transportation and Disposal: As mentioned in the general assumptions for Alternative 3, the cost for transportation and disposal of contaminated material at the ERDF is $1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

- Volume of contaminated soil = 61,426 yd^3
- Volume of soil to ERDF = 368,556 (see Site Description)
- Number of containers = 368,556 yd^3 x 1 container/11 yd^3

  = 33,505 containers.

Mobilization/Demobilization: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operation costs of a generator (site utilities on cost table) during the construction period. Field office support consists of trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- Site

  One hydraulic excavator and one operator

  One bulldozer and one operator

One front-end loader and one operator

One water truck and one driver

One office trailer

One storage trailer

Four laborers.

- Pit 30

  One hydraulic excavator and one operator

  One front-end loader and one operator

  Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows

- Mobilization and demobilization = (1 mob + 1 demob) x 8 hrs/day x \$37/hr
  = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

- Area of construction survey = Area of disturbance + 20%
  = 234,850 ft^2 / 43,560 ft^2/acre x 1.2
  = 6.47 acres
- Cost to perform survey = \$1,748/acre.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

- Length of temporary fence = 2 x (width + length) + 20%
  = 2 x (610 ft + 385 ft) x 1.2
  = 2,388 ft.

A haul road is assumed to be installed from the main road to the site. The haul road will consist of 6 inches of 1.5 inch gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = (24ft x 1,500ft) + 10% = 39,600 ft^2 = 4,400 yd^2
- Cost when place at 6-in = \$7.36/yd^2.

Decontamination: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad constructed for Alternative 5 is the same pad discussed in Alternative 3. Refer to Alternative 3 for decontamination pad descriptions.

The rate of decontamination water usage is assumed to be 1,000 gallon/month. The time that the decontamination pad is in use (during excavation of contaminated soils) equals 842 days.

- Decontamination water = (1,000 gal/month)(1month/21days)(842 days)
  = 40,100 gal.

The decontamination pad will be staffed for the duration of contaminated soil excavation. It is assumed that the decontamination crew will consist of four laborers.

- Duration of Contaminated soil excavation = 842 days
- Labor rates (4 laborers) = \$37/hour/laborer x 4 laborers
  = \$148/hour x 8 hours/day
  = \$1,184/day.

Excavation: The overburden excavation will be performed using one hydraulic excavator and one front-end loader. Overburden soil will be excavated by removing non-contaminated soil and placing it on the ground next to the excavation. A front-end loader will be used to move the soil to a nearby stock pile. Due to screening requirements (radiation screening of excavated soil), the excavation of overburden soil is expected to proceed at a rate of 120 yd^3/hour or 960 yd^3/day. It is assumed that the overburden stockpile can be placed close enough to the excavation to allow the production rate of the front-end loader to meet or exceed that of the excavator. Labor for overburden excavation consists of two operators (one for the excavator and one for the front-end loader) and one RCT to screen the excavated soil.

- Volume of overburden soil = 124,083 yd^3
- Days to excavate overburden soil = 124,083 yd^3 / 960 yd^3/day
  = 130 days
- Labor (2 operators) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

Contaminated soil will be excavated using one hydraulic excavator and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator can excavate the contaminated material and load it directly into the disposal containers mounted on the trucks. Due to blending requirements (5 parts clean to 1 part contaminated), the limited number of containers that can be taken to the ERDF on a daily basis (40 containers), and the limited volume of soil per container (11 yd^3/container), the excavation of contaminated soil is expected to proceed at a rate of 73 yd^3/day (based on 440 yd^3/day and 5:1 blending ratio). The excavator will be used to bring overburden soil back to the excavation for blending purposes. It is assumed that the front-end loader can meet or exceed the excavation production rate. Labor for contaminated soil excavation consists of two operators (one for the excavator and one for the front-end loader), one RCT with the excavator to screen the excavated soil, four laborers to perform decontamination activities, and four RCTs to screen decontaminated containers and trucks.

- Volume of contaminated soil = 61,426 yd^3
- Days to excavate contaminated soil = 61,426 yd^3 / 73yd^3/day

= 842 days

- Labor (4 laborers & 2 operators) = \$37/hr x 8hrs/day/person
  = \$296/day/person

During all excavation activities it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

- Days required for excavation = 130 days + 842 days = 972 days
- Labor (one driver) = \$37/hour x 8 hours/day
  = \$296/day.

Site Restoration: Site restoration will consist of backfilling the excavation to within 40 inches of final grade with fill soil [consists of clean overburden soil previously excavated if available and/or fill materials obtained from the local borrow pit (Pit 30)]. Once ten feet of fill soil is placed into the excavation using a front-end loader and a bulldozer, the material will be dynamically compacted. Following dynamic compaction, fill soil will be placed to the desired depth (final grade minus 40 inches) using a front-end loader, a bulldozer, and vibratory roller for compaction. Following the placement of the fill soil, cap soils will be placed to final grade. Cap soils consist of 20 inches of compacted silt loam (obtained from Pit 30) and 20 inches of a silt loam pea gravel mixture (silt loam obtained from Pit 30 and pea gravel purchased). The compacted silt loam layer will be placed using a front-end loader, a bulldozer, and a vibratory roller. The silt loam pea gravel layer will be placed with a front-end loader and bulldozer (no compaction required).

Based on the information provided under Site Description, backfill volumes are as follows:

- Total backfill volume = 185,509 yd^3
- Required volume of compacted silt loam (Pit 30) = 14,040 yd^3
- Required volume of silt loam (Pit 30) = 12,910 yd^3
- Required volume of pea gravel = 1,434 yd^3
- Volume of fill soil needed = 157,125 yd^3
- Available Overburden material = 0 yd^3
- Required fill soil from Pit 30 = 157,125 yd^3
- Fill soil needed to achieve first 10 foot lift = 66,287 yd^3.

<u>Dynamic Compaction</u>: To avoid contact with the contaminated soil left in place, ten feet of fill soil will be placed on top of the remaining contaminated soil. This material will then be dynamically compacted using a crane with a large weight. To achieve compaction, the crane will drop the weight onto the backfill material. The assumed production rate is 5,000 ft^2/day. Labor for dynamic compaction includes one operator and one oiler.

Area requiring dynamic compaction	= 192,100 ft^2
Compaction rate	= 5,000 ft^2/day
Days to perform dynamic compaction	= 39 days
Labor (one operator and one oiler)	= \$37/hr x 8 hr/day/person

= \$296/day/person.

Pit 30 Fill Soil: Because Pit 30 fill soil needs to be trucked to the site, it is assumed that the fill soil from Pit 30 can be backfilled at a rate equal to 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator, and one front-end loader at Pit 30, and one front-end loader, one bulldozer, and one vibratory roller on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. Labor for backfilling Pit 30 fill soil includes operators for each of the five pieces of equipment (three on site and two at Pit 30), and five drivers for the trucks. If fill soil is being placed within the first 10 feet of the excavation, the production rate is the same but there will be no vibratory roller to provide compaction.

- Volume of fill soil for first 10 feet = 66,287 yd^3
- Days to place fill soil in first 10 feet = 66,287 yd^3 / 1,280 yd^3/day = 52 days
- Labor (4 operators and 5 drivers) = \$37/hr x 8 hrs/day/person = \$296/day/person
- Remaining Pit 30 fill soil = 90,838 yd^3
- Days to place remaining fill soil = 90,838 yd^3 / 1,280 yd^3/day = 71 days
- Labor (5 operators and 5 drivers) = \$37/hr x 8 hrs/day/person = \$296/day/person.

Compacted Silt Loam: Compacted silt loam can be obtained from Pit 30 and must be trucked to the site. Therefore, it is assumed that the compacted silt loam from Pit 30 can be backfilled at a rate of 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator, and one front-end loader at Pit 30, and one front-end loader, one bulldozer, and one vibratory roller on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. Labor for backfilling Pit 30 silt loam includes operators for each of the five pieces of equipment (three on site and two at Pit 30), and five drivers for the trucks.

- Compacted silt loam (Pit 30) = 14,040 yd^3
- Days to place compacted silt loam = 14,040 yd^3 / 1,280 yd^3/day = 11 days
- Labor (5 operators and 5 drivers) = \$37/hr x 8 hrs/day/person = \$296/day/person.

Silt Loam and Pea Gravel: The silt loam for this layer can be obtained from Pit 30. Like the fill soil, Pit 30 silt loam needs to be trucked to the site, it is assumed that the silt loam from Pit 30 can be backfilled at a rate equal to 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator and one front-end loader at Pit 30, and one front-end loader and one bulldozer on site. Operating the equipment for

8 hours each day, the production rate equals 1,280 yd^3/day. The pea gravel for this layer must be purchased off-site and will need to be delivered to the site. It is assumed that the pea gravel can be delivered to the site, blended with the silt loam, and placed in the excavation at a rate of 160 yd^3/hour. Labor for backfilling silt loam and pea gravel includes operators for each of the four pieces of equipment (two on site and two at Pit 30), and five drivers for the trucks.

- Silt loam (Pit 30) = 12,910 yd^3
- Pea gravel (purchased) = 1,434 yd^3
- Total volume to backfill = 14,344 yd^3
- Days to place compacted silt loam = 14,344 yd^3 / 1,280 yd^3/day

  = 11 days
- Pit 30 labor (2 op. and 5 drivers) = \$37/hr x 8 hrs/day/person

  = \$296/day/person
- On site labor (2 operators) = \$37/hr x 8 hrs/day/person

  = \$296/day/person.

<u>Revegetation</u>: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following;

- Area to be revegetated = 234,850 ft^2 = 26,094 yd^2
- Revegetation (includes lime, fertilizer, and seed) = \$1.63/yd^2
- Production rate = 1,000 yd^2/day = 26 days.

During all restoration activities (backfilling, compaction, and revegetation), it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

- Days required for restoration = 210 days
- Labor (one driver) = \$37/hour x 8 hours/day

  = \$296/day.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 239.4 weeks = 1,197 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post-construction documents = \$50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alternative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system = 234,850 ft^2
  - Team hours to complete inspections = 80 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = $112/hour ($56/hour/team member)
  - Radiation surveys of surface soil = $47,000/event ($1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system (including berm) = 234,850 ft^2
  - Area requiring repair (10% of total area) = 23,485 ft^2 = 2,609 yd^2
  - Oversight (cap material 32 yd^3/hour) = 7 days (8 hours/day @ $56/hour)
  - Oversight (planting 1,000 yd^2/day) = 3 days (8 hours/day @ $56/hour).

Monitoring: Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.5.6 Representative Site 216-B-57 Trench (Cost Tables D-95 through D-98)

This site work was estimated to take 28.4 weeks (6.8 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and construction temporary facilities, performing the site survey, and performing decontamination setup.
- Excavate/dispose: 86 days (17.2 weeks)
- Restore/Cap: 41days (8.2 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

The total construction duration = 142 days = 28.4 weeks = 6.8 months.

Site Description: The following information can be found in Table D-103 or on the table presented under general assumptions.

- Area of contaminant mass = 200 ft x 14 ft = 2,800 ft^2
- Depth of overburden soil = 15 ft bgs
- Total depth of excavation = 45 ft bgs
- Area of disturbance = 335 ft x 149 ft = 49,915 ft^2.

The following volumes have been calculated using the site information. This information and quantities used to generate this information is also provided in Table D-104.

- Total excavation volume (based on 1.5H:1V side slopes) = 43,929 yd^3
- Depth of contaminated soil (45ft -15ft) = 30 ft
- Volume of contaminated soil (2,800ft^2 x 30ft) / 27 = 3,111 yd^3
- Volume of overburden soil (based on 1.5H:1V side slopes) = 40,818 yd^3
- Volume of material needed for blend (3,111 yd^3 x 5) = 15,556 yd^3
- Volume of Pit 30 material needed for blend = 0 yd^3
- Volume of material to ERDF (3,111 yd^3 + 15,556 yd^3) = 18,667 yd^3
- Overburden available for backfill = 25,262 yd^3
- Total backfill volume required = 43,929 yd^3
- Cap material: Compacted Silt loam (from Pit 30) = 2,861 yd^3
  Silt loam & Pea Gravel = 3,007 yd^3
  Pea Gravel (10% of mix) = 301 yd^3
  Silt loam (from Pit 30) = 2,707 yd^3
- Total fill soil needed = 38,061 yd^3
- Using 25,262 yd^3 overburden, Pit 30 fill soil needed = 12,799 yd^3.

Fluor Hanford Oversight: As indicated in the general assumptions, Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization).

- Duration of construction oversight = 142 days
- Construction oversight rate = $215/hour or $1,720/day.

During decontamination activities, Fluor Hanford will provide four RCTs to scan materials and equipment leaving the site.

- RCTs (4 at decon pad) = $56/hour x 8 hours/day x 4 RCTs
  = $1,792/day.

During all excavation activities on site Fluor Hanford will provide one RCT per excavator to scan the soil coming from the excavation to determine if the soil is considered overburden or contaminated.

- RCT (1 per on site excavator) = $56/hour x 8 hours/day

= \$448/day.

Fluor Hanford Sampling: Soil samples and air samples will be collected throughout the duration of construction. The frequency of each type of sample is described below.

Soil Sampling: Soil samples will be collected during the excavation of overburden soil and contaminated soil. The rate at which these samples will be collected equals six samples per site within the overburden soil, and one sample for every 845 yd^3 of excavated contaminated soil (bulked by 15%). These samples will be analyzed in an on-site laboratory. Quality control samples will be sent to an off-site laboratory at a rate of 1 for every 20 samples collected (5% of samples collected) or a minimum of one per site. Labor to collect soil samples includes one sample technician (half time) and one RCT (full time).

- Number of overburden samples = 6 samples
- Cost per sample (on-site lab) = \$1,100 / sample
- Cost per sample (off-site lab) = \$5,000 / sample
- Volume of contaminated soil + 15% = 3,111 yd^3 + 15%
- Number of contaminated soil samples = 3,578 yd^3 /845 yd^3
  = 5 samples
- Cost per sample (on-site lab) = \$5,000 / sample
- Cost per sample (off-site lab) = \$5,000 / sample
- Labor (sample tech) = (\$56/hour) x (8 hours/day) x 1/2
  = \$224/day
- Labor (RCT) = (\$56/hour) x (8 hours/day)
  = \$448/day
- Labor (total) = \$672/day
- Days of sampling = 86 days.

Air Sampling: Air samples will be collected during excavation activities, placement of first layer of backfill material, and dynamic compaction. The rate at which air samples will be collected equals one air sample per day in which the above referenced activities are taking place. Each sample collected will cost 1,000 to analyze plus labor to collect the samples and \$500 per sample in sampling equipment. Labor to collect air samples includes one sample technician (full time) and one RCT (full time).

- Number of days for excavation = 86 days
- Number of days to backfill first layer = 2 days
- Number of days for dynamic compaction = 2 days
- Number of air samples collected = 90 samples
- Labor (one sample tech and one RCT) = (\$56/hour) x (8 hours/day) x 2
  = \$896/day.

Fluor Hanford Transportation and Disposal: As mentioned in the general assumptions for Alternative 3, the cost for transportation and disposal of contaminated material at the ERDF is $1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

- Volume of contaminated soil = 3,111 yd^3
- Volume of soil to ERDF = 18,667 (see Site Description)
- Number of containers = 18,667 yd^3 x 1 container/11yd^3
  = 1,697 containers.

Mobilization/Demobilization: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operation costs of a generator (site utilities on cost table) during the construction period. Field office support consists of trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- Site
  - One hydraulic excavator and one operator
  - One bulldozer and one operator
  - One front-end loader and one operator
  - One water truck and one driver
  - One office trailer
  - One storage trailer
  - Four laborers.
- Pit 30
  - One hydraulic excavator and one operator
  - One front-end loader and one operator
  - Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

- Mobilization and demobilization = (1 mob + 1 demob) x 8 hrs/day x $37/hr
  = $592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

- Area of construction survey = Area of disturbance + 20%
  = 49,915 ft^2 / 43,560 ft^2/acre x 1.2

= 1.38 acres

- Cost to perform survey = $1,748/acre.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

- Length of temporary fence = 2 x (width + length) + 20%
  = 2 x (335 ft + 149 ft) x 1.2
  = 1,162 ft.

A haul road is assumed to be installed from the main road to the site. The haul road will consist of 6 inches of 1.5 inch gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft
- Width of haul road = 24 ft
- Gravel = [(24ft x 1,500ft) + 10%] = 39,600 ft^2 = 4,400 yd^2
- Cost when place at 6-in = $7.36/$yd^2$.

Decontamination: A decontamination pad will be construction to clean trucks leaving the site and equipment before demobilization. The decontamination pad constructed for Alternative 5 is the same pad discussed in Alternative 3. Refer to Alternative 3 for decontamination pad descriptions.

The rate of decontamination water usage is assumed to be 1,000 gallon/month. The time that the decontamination pad is in use (during excavation of contaminated soils) equals 43 days.

- Decontamination water = (1,000 gal/month)(1month/21days)(43 days)
  = 2,050 gal.

The decontamination pad will be staffed for the duration of contaminated soil excavation. It is assumed that the decontamination crew will consist of four laborers.

Duration of Contaminated soil excavation = 43 days
Labor rates (4 laborers) = $37/hour/laborer x 4 laborers
= $148/hour x 8 hours/day
= $1,184/day.

Excavation: The overburden excavation will be performed using one hydraulic excavator and one front-end loader. Overburden soil will be excavated by removing non-contaminated soil and placing it on the ground next to the excavation. A front-end loader will be used to move the soil to a nearby stock pile. Due to screening requirements (radiation screening of excavated soil), the excavation of overburden soil is expected to proceed at a rate of 120 yd^3/hour or 960 yd^3/day. It is assumed that the overburden stockpile can be placed close enough to the excavation to allow the production rate of the front-end loader to meet or exceed that of the excavator. Labor for overburden excavation consists of two operators (one for the excavator and one for the front-end loader) and one RCT to screen the excavated soil.

- Volume of overburden soil = 40,818 yd^3

- Days to excavate overburden soil = 40,818 yd^3 / 960 yd^3/day
  = 43 days
- Labor (2 operators) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

Contaminated soil will be excavated using one hydraulic excavator and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator can excavate the contaminated material and load it directly into the disposal containers mounted on the trucks. Due to blending requirements (5 parts clean to 1 part contaminated), the limited number of containers that can be taken to the ERDF on a daily basis (40 containers), and the limited volume of soil per container (11 yd^3/container), the excavation of contaminated soil is expected to proceed at a rate of 73 yd^3/day (based on 440 yd^3/day and 5:1 blending ratio). The excavator will be used to bring overburden soil back to the excavation for blending purposes. It is assumed that the front-end loader can meet or exceed the excavation production rate. Labor for contaminated soil excavation consists of two operators (one for the excavator and one for the front-end loader), one RCT with the excavator to screen the excavated soil, four laborers to perform decontamination activities, and four RCTs to screen decontaminated containers and trucks.

- Volume of contaminated soil = 3,111 yd^3
- Days to excavate contaminated soil = 3,111 yd^3 / 73yd^3/day
  = 43 days
- Labor (4 laborers & 2 operators) = \$37/hr x 8hrs/day/person
  = \$296/day/person.

During all excavation activities, it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

- Days required for excavation = 43 days + 43 days = 86 days
- Labor (one driver) = \$37/hour x 8 hours/day
  = \$296/day.

Site Restoration: Site restoration will consist of backfilling the excavation to within 40 inches of final grade with fill soil [consists of clean overburden soil previously excavated if available and/or fill materials obtained from the local borrow pit (Pit 30)]. Once ten feet of fill soil is placed into the excavation using a front-end loader and a bulldozer, the material will be dynamically compacted. Following dynamic compaction, fill soil will be placed to the desired depth (final grade minus 40 inches) using a front-end loader, a bulldozer, and vibratory roller for compaction. Following the placement of the fill soil, cap soils will be placed to final grade. Cap soils consist of 20 inches of compacted silt loam (obtained from Pit 30) and 20 inches of a silt loam pea gravel mixture (silt loam obtained from Pit 30 and pea gravel purchased). The compacted silt loam layer will be placed using a front-end loader, a bulldozer, and a vibratory roller. The silt loam pea gravel layer will be placed with a front-end loader and bulldozer (no compaction required).

Based on the information provided under Site Description, backfill volumes are as follows:

- Total backfill volume = 43,929 yd^3
- Required volume of compacted silt loam (Pit 30) = 2,861 yd^3
- Required volume of silt loam (Pit 30) = 2,707 yd^3
- Required volume of pea gravel = 301 yd^3
- Volume of fill soil needed = 38,061 yd^3
- Available Overburden material = 25,262 yd^3
- Required fill soil from Pit 30 = 12,799 yd^3
- Fill soil needed to achieve first 10 foot lift = 2,393 yd^3.

Dynamic Compaction: To avoid contact with the contaminated soil left in place, ten feet of fill soil will be placed on top of the remaining contaminated soil. This material will then be dynamically compacted using a crane with a large weight. To achieve compaction, the crane will drop the weight onto the backfill material. The assumed production rate is 5,000 ft^2/day. Labor for dynamic compaction includes one operator and one oiler.

- Area requiring dynamic compaction = 10,120 ft^2
- Compaction rate = 5,000 ft^2/day
- Days to perform dynamic compaction = 2 days
- Labor (one operator and one oiler) = \$37/hr x 8 hr/day/person
  = \$296/day/person.

Overburden Material: It is assumed that the overburden soil can be backfilled at a rate equal to 185 yd^3/hour. Operating the equipment for 8 hours each day, the production rate equals 1,480 yd^3/day. Labor for backfilling overburden material includes operators for each of the two pieces of equipment being used. If there is enough volume of overburden soil to place in the excavation following dynamic compaction, that soil will be placed at the same production rate using a front-end loader, a bulldozer, and a vibratory roller.

- Volume needed to place 10 feet = 2,393 yd^3
- Days to place first 10 feet = 2,393 yd^3 / 1,480 yd^3/day
  = 2 days
- Labor (2 operators) = \$37/hr x 8 hrs/day/person
  = \$296/day/person
- Remaining overburden = 22,869 yd^3
- Days to place remaining overburden = 22,869 yd^3 / 1,480 yd^3/day
  = 16 days
- Labor (3 operators) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

Pit 30 Fill Soil: Because Pit 30 fill soil needs to be trucked to the site, it is assumed that the fill soil from Pit 30 can be backfilled at a rate equal to 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator, and one front-end loader at Pit 30, and one front-end loader, one bulldozer, and one vibratory roller on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. Labor for backfilling Pit 30 fill soil includes operators for each of the five pieces of equipment (three on site and two at Pit 30), and five drivers for the trucks. If fill soil is being placed within the first 10 feet of the excavation, the production rate is the same but there will be no vibratory roller to provide compaction.

- Remaining Pit 30 fill soil = 12,799 yd^3
- Days to place remaining fill soil = 12,799 yd^3 / 1,280 yd^3/day = 10 days
- Labor (5 operators and 5 drivers) = \$37/hr x 8 hrs/day/person = \$296/day/person.

Compacted Silt Loam: Compacted silt loam can be obtained from Pit 30 and must be trucked to the site. Therefore, it is assumed that the compacted silt loam from Pit 30 can be backfilled at a rate of 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator, and one front-end loader at Pit 30, and one front-end loader, one bulldozer, and one vibratory roller on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. Labor for backfilling Pit 30 silt loam includes operators for each of the five pieces of equipment (three on site and two at Pit 30), and five drivers for the trucks.

- Compacted silt loam (Pit 30) = 2,861 yd^3
- Days to place compacted silt loam = (2,861 yd^3) / (1,280 yd^3/day) = 2.5 days
- Labor (5 operators and 5 drivers) = \$37/hr x 8 hrs/day/person = \$296/day/person.

Silt Loam and Pea Gravel: The silt loam for this layer can be obtained from Pit 30. Like the fill soil, Pit 30 silt loam needs to be trucked to the site, it is assumed that the silt loam from Pit 30 can be backfilled at a rate equal to 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator and one front-end loader at Pit 30, and one front-end loader and one bulldozer on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. The pea gravel for this layer must be purchased off-site and will need to be delivered to the site. It is assumed that the pea gravel can be delivered to the site, blended with the silt loam, and placed in the excavation at a rate of 160 yd^3/hour. Labor for backfilling silt loam and pea gravel includes operators for each of the four pieces of equipment (two on site and two at Pit 30), and five drivers for the trucks.

- Silt loam (Pit 30) = 2,707 yd^3
- Pea gravel (purchased) = 301 yd^3
- Total volume to backfill = 3,007 yd^3
- Days to place compacted silt loam = 3,007 yd^3 / 1,280 yd^3/day = 2.5 days
- Pit 30 labor (2 op. and 5 drivers) = \$37/hr x 8 hrs/day/person

= \$296/day/person

- On site labor (2 operators) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

Revegetation: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following;

- Area to be revegetated = 49,915 ft^2 = 5,546 yd^2
- Revegetation (includes lime, fertilizer, and seed) = \$1.63/yd^2
- Production rate = 1,000 yd^2/day = 6 days.

During all restoration activities (backfilling, compaction, and revegetation), it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

- Days required for restoration = 41 days
- Labor (one driver) = \$37/hour x 8 hours/day
  = \$296/day.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 28.4 weeks = 142 days
- Contractor support rate = \$237/hour = \$1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post-construction documents = \$50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alternative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system = 49,915 ft^2
  - Team hours to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = \$112/hour (\$56/hour/team member)
  - Radiation surveys of surface soil = \$10,000/event (\$1,000 for every 5,000 ft^2).

- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system = 49,915 ft^2
  - Area requiring repair (10% of total area) = 4,992 ft^2 = 555 yd^2
  - Oversight (cap material 32 yd^3/hour) = 2 day (8 hours/day @ $56/hour)
  - Oversight (planting 1,000 yd^2/day) = 1 day (8 hours/day @ $56/hour).

Monitoring. Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D3.5.7 Representative Site 216-B-58 Trench (Cost Tables D-103 through D-102)

This site work was estimated to take 7.2 weeks (1.7 months) based on the following breakdown. Time required for preparing pre- and post-construction submittals is in addition to the times estimated here.

- Mobilize: 10 days (2 weeks), includes mobilizing equipment and personnel, installing and construction temporary facilities, performing the site survey, and performing decontamination setup.
- Excavate/dispose: 12 days (2.4 weeks)
- Restore/Cap: 9 days (1.8 weeks)
- Demobilize: 5 days (1 week), includes demobilizing facilities, equipment, and personnel, performing the as-built site survey, and performing final site cleanup.

The total construction duration = 36 days = 7.2 weeks = 1.7 months.

Site Description: The following information can be found in Table D-103 or on the table presented under general assumptions.

- Area of contaminant mass = 200 ft x 10 ft = 2,000 ft^2
- Depth of overburden soil = 10 ft bgs
- Total depth of excavation = 17 ft bgs
- Area of disturbance = 251 ft x 61 ft = 15,311 ft^2.

The following volumes have been calculated using the site information. This information and quantities used to generate this information is also provided in Table D-104.

- Total excavation volume (based on 1.5H:1V side slopes) = 5,450 yd^3
- Depth of contaminated soil (17ft -10ft) = 7 ft

- Volume of contaminated soil ($2,000 ft^2 \times 7 ft$) / 27 = 518 yd^3
- Volume of overburden soil (based on 1.5H:1V side slopes) = 4,931 yd^3
- Volume of material needed for blend (518 yd^3 x 5) = 2,590 yd^3
- Volume of Pit 30 material needed for blend = 0 yd^3
- Volume of material to ERDF (518 yd^3 + 2,590 yd^3) = 3,108 yd^3
- Overburden available for backfill = 2,341 yd^3
- Total backfill volume required = 5,450 yd^3
- Cap material: *Compacted Silt loam (from Pit 30)* = *805* yd^3
  - Silt loam & Pea Gravel = 898 yd^3
  - Pea Gravel (10% of mix) = 90 yd^3
  - Silt loam (from Pit 30) = 808 yd^3
- Total fill soil needed = 3,747 yd^3
- Using 2,341 yd^3 overburden, Pit 30 fill soil needed = 1,406 yd^3.

Fluor Hanford Oversight: As indicated in the general assumptions, Fluor Hanford will provide oversight for the duration of the construction activities (mobilization through demobilization).

- Duration of construction oversight = 36 days
- Construction oversight rate = \$215/hour or \$1,720/day.

During decontamination activities Fluor Hanford will provide four RCTs to scan materials and equipment leaving the site.

- RCTs (4 at decon pad) = \$56/hour x 8 hours/day x 4 RCTs
  = \$1,792/day.

During all excavation activities on site, Fluor Hanford will provide one RCT per excavator to scan the soil coming from the excavation to determine if the soil is considered overburden or contaminated.

- RCT (1 per on site excavator) = \$56/hour x 8 hours/day
  = \$448/day.

Fluor Hanford Sampling: Soil samples and air samples will be collected throughout the duration of construction. The frequency of each type of sample is described below.

<u>Soil Sampling</u>: Soil samples will be collected during the excavation of overburden soil and contaminated soil. The rate at which these samples will be collected equals six samples per site within the overburden soil, and one sample for every 845 yd^3 of excavated contaminated soil (bulked by 15%). These samples will be analyzed in an on-site laboratory. Quality control *samples will be sent to an off-site laboratory at a rate of 1 for every 20 samples collected (5% of* samples collected) or a minimum of one per site. Labor to collect soil samples includes one sample technician (half time) and one RCT (full time).

- Number of overburden samples = 6 samples

- Cost per sample (on-site lab) = $1,100 / sample
- Cost per sample (off-site lab) = $5,000 / sample
- Volume of contaminated soil + 15% = 518 yd^3 + 15%
- Number of contaminated soil samples = 596 yd^3 /845 yd^3 = 1 sample
- Cost per sample (on-site lab) = $5,000 / sample
- Cost per sample (off-site lab) = $5,000 / sample
- Labor (sample tech) = ($56/hour) x (8 hours/day) x 1/2 = $224/day
- Labor (RCT) = ($56/hour) x (8 hours/day) = $448/day
- Labor (total) = $672/day
- Days of sampling = 12 days.

Air Sampling: Air samples will be collected during excavation activities, placement of first layer of backfill material, and dynamic compaction. The rate at which air samples will be collected equals one air sample per day in which the above referenced activities are taking place. Each sample collected will cost 1,000 to analyze plus labor to collect the samples and $500 per sample in sampling equipment. Labor to collect air samples includes one sample technician (full time) and one RCT (full time).

- Number of days for excavation = 12 days
- Number of days to backfill first layer = 1.5 days
- Number of days for dynamic compaction = 2 days
- Number of air samples collected = 16 samples
- Labor (one sample tech and one RCT) = ($56/hour) x (8 hours/day) x 2 = $896/day.

Fluor Hanford Transportation and Disposal: As mentioned in the general assumptions for Alternative 3, the cost for transportation and disposal of contaminated material at the ERDF is $1,100 per container. This cost includes labor cost to install the liners, material cost for the liners, transportation to the ERDF, and ERDF storage costs. ERDF storage cost is obtained from DOE/EM-0387 "Profiles of Environmental Restoration CERCLA Disposal Facilities", July 1999. The number of containers for disposal is calculated as follows:

- Volume of contaminated soil = 518 yd^3
- Volume of soil to ERDF = 3,018 (see Site Description)
- Number of containers = 3,018 yd^3 x 1 container/11yd^3 = 275 containers.

Mobilization/Demobilization: During the implementation of the RA, an office trailer and storage trailer are assumed to be rented as part of the office trailer and storage trailer cost. Other costs under field support are field office support and the mobilization, demobilization, monthly rental, and operation costs of a generator (site utilities on cost table) during the construction period. Field office support consists of trailer amenities (a computer, a printer/copier/scanner, paper, etc.).

Mobilization and demobilization of the following pieces of equipment and personnel will be included in the cost:

- Site
  - One hydraulic excavator and one operator
  - One bulldozer and one operator
  - One front-end loader and one operator
  - One water truck and one driver
  - One office trailer
  - One storage trailer
  - Four laborers.
- Pit 30
  - One hydraulic excavator and one operator
  - One front-end loader and one operator
  - Five dump trucks and five drivers.

Mobilization and demobilization for personnel has been assumed. The cost is calculated as follows:

- Mobilization and demobilization = (1 mob + 1 demob) x 8 hrs/day x \$37/hr
  = \$592/person.

It is assumed that a topographical construction survey will be performed before disturbing the site. The cost for the construction survey is based on the following:

- Area of construction survey = Area of disturbance + 20%
  = (15,311 ft^2) / (43,560 ft^2/acre) x 1.2
  = 0.42 acres
- Cost to perform survey = \$1,748/acre.

Temporary blaze orange fence will be placed around the site for protection from the excavation area. The cost of the temporary fence is based on the following:

- Length of temporary fence = 2 x (width + length) + 20%
  = 2 x (251 ft + 61 ft) x 1.2
  = 750 ft.

A haul road is assumed to be installed from the main road to the site. The haul road will consist of 6 inches of 1.5 inch gravel. The cost of the haul road is based on the following:

- Length of haul road = 1,500 ft

- Width of haul road = 24 ft
- Gravel = [(24ft x 1,500ft) + 10%] = 39,600 ft^2 = 4,400 yd^2
- Cost when place at 6" = \$7.36/yd^2.

Decontamination: A decontamination pad will be constructed to clean trucks leaving the site and equipment before demobilization. The decontamination pad constructed for Alternative 5 is the same pad discussed in Alternative 3. Refer to Alternative 3 for decontamination pad descriptions.

The rate of decontamination water usage is assumed to be 1,000 gallon/month. The time that the decontamination pad is in use (during excavation of contaminated soils) equals 12 days.

- Decontamination water = (1,000 gal/month)(1month/21days)(12 days)
  = 600 gal.

The decontamination pad will be staffed for the duration of contaminated soil excavation. It is assumed that the decontamination crew will consist of four laborers.

- Duration of Contaminated soil excavation = 12 days
- Labor rates (4 laborers) = \$37/hour/laborer x 4 laborers
  = \$148/hour x 8 hours/day
  = \$1,184/day.

Excavation: The overburden excavation will be performed using one hydraulic excavator and one front-end loader. Overburden soil will be excavated by removing non-contaminated soil and placing it on the ground next to the excavation. A front-end loader will be used to move the soil to a nearby stock pile. Due to screening requirements (radiation screening of excavated soil), the excavation of overburden soil is expected to proceed at a rate of 120 yd^3/hour or 960 yd^3/day. It is assumed that the overburden stockpile can be placed close enough to the excavation to allow the production rate of the front-end loader to meet or exceed that of the excavator. Labor for overburden excavation consists of two operators (one for the excavator and one for the front-end loader) and one RCT to screen the excavated soil.

- Volume of overburden soil = 4,931 yd^3
- Days to excavate overburden soil = 4,931 yd^3 / 960 yd^3/day
  = 5 days
- Labor (2 operators) = \$37/hr x 8 hrs/day/person
  = \$296/day/person.

Contaminated soil will be excavated using one hydraulic excavator and one front-end loader. Trucks are expected to have access to the excavation area such that the hydraulic excavator can excavate the contaminated material and load it directly into the disposal containers mounted on the trucks. Due to blending requirements (5 parts clean to 1 part contaminated), the limited number of containers that can be taken to the ERDF on a daily basis (40 containers), and the limited volume of soil per container (11 yd^3/container), the excavation of contaminated soil is expected to proceed at a rate of 73 yd^3/day (based on 440 yd^3/day and 5:1 blending ratio). The excavator will be used to bring overburden soil back to the excavation for blending purposes. It is assumed that the front-end loader can meet or exceed the excavation production rate. Labor for contaminated soil excavation consists of two operators (one for the excavator and one for the front-end loader), one RCT with the excavator to screen the excavated soil, four laborers to perform decontamination activities, and four RCTs to screen decontaminated containers and trucks.

- Volume of contaminated soil = 518 yd^3
- Days to excavate contaminated soil = 518 yd^3 / 73yd^3/day
  = 7 days
- Labor (4 laborers & 2 operators) = \$37/hr x 8hrs/day/person
  = \$296/day/person

During all excavation activities, it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

- Days required for excavation = 5 days + 7 days = 12 days
- Labor (one driver) = \$37/hour x 8 hours/day
  = \$296/day.

Site Restoration: Site restoration will consist of backfilling the excavation to within 40 inches of final grade with fill soil [consists of clean overburden soil previously excavated if available and/or fill materials obtained from the local borrow pit (Pit 30)]. Once ten feet of fill soil is placed into the excavation using a front-end loader and a bulldozer, the material will be dynamically compacted. Following dynamic compaction, fill soil will be placed to the desired depth (final grade minus 40 inches) using a front-end loader, a bulldozer, and vibratory roller for compaction. Following the placement of the fill soil, cap soils will be placed to final grade. Cap soils consist of 20 inches of compacted silt loam (obtained from Pit 30) and 20 inches of a silt loam pea gravel mixture (silt loam obtained from Pit 30 and pea gravel purchased). The compacted silt loam layer will be placed using a front-end loader, a bulldozer, and a vibratory roller. The silt loam pea gravel layer will be placed with a front-end loader and bulldozer (no compaction required).

Based on the information provided under Site Description, backfill volumes are as follows:

- Total backfill volume = 5,450 yd^3
- Required volume of compacted silt loam (Pit 30) = 805 yd^3
- Required volume of silt loam (Pit 30) = 808 yd^3
- Required volume of pea gravel = 90 yd^3
- Volume of fill soil needed = 3,747 yd^3
- Available Overburden material = 2,341 yd^3
- Required fill soil from Pit 30 = 1,406 yd^3
- Fill soil needed to achieve first 10 foot lift = 2,074 yd^3.

Dynamic Compaction: To avoid contact with the contaminated soil left in place, ten feet of fill soil will be placed on top of the remaining contaminated soil. This material will then be dynamically compacted using a crane with a large weight. To achieve compaction, the crane will drop the weight onto the backfill material. The assumed production rate is 5,000 ft^2/day. Labor for dynamic compaction includes one operator and one oiler.

- Area requiring dynamic compaction = 9,200 ft^2
- Compaction rate = 5,000 ft^2/day
- Days to perform dynamic compaction = 2 days
- Labor (one operator and one oiler) = \$37/hr x 8 hr/day/person = \$296/day/person.

<u>Overburden Material</u>: It is assumed that the overburden soil can be backfilled at a rate equal to 185 yd^3/hour. Operating the equipment for 8 hours each day, the production rate equals 1,480 yd^3/day. Labor for backfilling overburden material includes operators for each of the two pieces of equipment being used. If there is enough volume of overburden soil to place in the excavation following dynamic compaction, that soil will be placed at the same production rate using a front-end loader, a bulldozer, and a vibratory roller.

- Volume needed to place 10 feet = 2,074 yd^3
- Days to place first 10 feet = 2,074 yd^3 / 1,480 yd^3/day = 1.5 days
- Labor (2 operators) = \$37/hr x 8 hrs/day/person = \$296/day/person
- Remaining overburden = 267 yd^3
- Days to place remaining overburden = 267 yd^3 / 1,480 yd^3/day = 0.5 days
- Labor (3 operators) = \$37/hr x 8 hrs/day/person = \$296/day/person.

<u>Pit 30 Fill Soil</u>: Because Pit 30 fill soil needs to be trucked to the site, it is assumed that the fill soil from Pit 30 can be backfilled at a rate equal to 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator, and one front-end loader at Pit 30, and one front-end loader, one bulldozer, and one vibratory roller on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. Labor for backfilling Pit 30 fill soil includes operators for each of the five pieces of equipment (three on site and two at Pit 30), and five drivers for the trucks. If fill soil is being placed within the first 10 feet of the excavation, the production rate is the same but there will be no vibratory roller to provide compaction.

- Remaining Pit 30 fill soil = 1,406 yd^3
- Days to place remaining fill soil = 1,406 yd^3 / 1,280 yd^3/day = 1 day
- Labor (5 operators and 5 drivers) = \$37/hr x 8 hrs/day/person = \$296/day/person.

Compacted Silt Loam: Compacted silt loam can be obtained from Pit 30 and must be trucked to the site. Therefore, it is assumed that the compacted silt loam from Pit 30 can be backfilled at a rate of 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator, and one front-end loader at Pit 30, and one front-end loader, one bulldozer, and one vibratory roller on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. Labor for backfilling Pit 30 silt loam includes operators for each of the five pieces of equipment (three on site and two at Pit 30), and five drivers for the trucks.

• Compacted silt loam (Pit 30)	= 805 yd^3
• Days to place compacted silt loam	= 805 yd^3 / 1,280 yd^3/day
	= 1 day
• Labor (5 operators and 5 drivers)	= \$37/hr x 8 hrs/day/person
	= \$296/day/person.

Silt Loam and Pea Gravel: The silt loam for this layer can be obtained from Pit 30. Like the fill soil, Pit 30 silt loam needs to be trucked to the site, it is assumed that the silt loam from Pit 30 can be backfilled at a rate equal to 160 yd^3/hour. This production rate is based on using five trucks hauling 16 yd^3 each and making two trips every hour, one excavator and one front-end loader at Pit 30, and one front-end loader and one bulldozer on site. Operating the equipment for 8 hours each day, the production rate equals 1,280 yd^3/day. The pea gravel for this layer must be purchased off-site and will need to be delivered to the site. It is assumed that the pea gravel can be delivered to the site, blended with the silt loam, and placed in the excavation at a rate of 160 yd^3/hour. Labor for backfilling silt loam and pea gravel includes operators for each of the four pieces of equipment (two on site and two at Pit 30), and five drivers for the trucks.

• Silt loam (Pit 30)	= 808 yd^3
• Pea gravel (purchased)	= 90 yd^3
• Total volume to backfill	= 898 yd^3
• Days to place compacted silt loam	= 898 yd^3 / 1,280 yd^3/day
	= 1 days
• Pit 30 labor (2 op. and 5 drivers)	= \$37/hr x 8 hrs/day/person
	= \$296/day/person
• On site labor (2 operators)	= \$37/hr x 8 hrs/day/person
	= \$296/day/person.

Revegetation: Following the installation of the cap the silt loam with pea gravel will be revegetated. Revegetation costs are based on the following;

• Area to be revegetated	= 15,311 ft^2 = 1,701 yd^2
• Revegetation (includes lime, fertilizer, and seed)	= \$1.63/yd^2
• Production rate	= 1,000 yd^2/day = 2 days.

During all restoration activities (backfilling, compaction, and revegetation), it is required to have a water truck in operation. The costs associated with the water truck include the truck and one driver.

- Days required for restoration = 9 days
- Labor (one driver) = $37/hour x 8 hours/day = $296/day.

Miscellaneous: Miscellaneous costs for this cost estimate consist of support personnel and preparing post-construction documents. During construction activities (mobilization through demobilization), the contractor will have support personnel on site. Miscellaneous costs are calculated as follows:

- Duration of contractor support = 7.2 weeks = 36 days
- Contractor support rate = $237/hour = $1,896/day (see general assumptions)
- Time to prepare post-construction documents = 160 hours (assumption)
- Labor rate for post-construction documents = $50/hour (assumption).

Surveillance and Cap Maintenance: The costs associated with surveillance and cap maintenance are operation and maintenance costs and are incurred annually. The surveillance and cap maintenance is expected to be equal to the site inspection/surveillance and existing cover maintenance cost items under Alternative 2. Refer to the Alternative 2 assumptions for these cost items. The surveillance and cap maintenance costs are calculated as follows:

- Surveillance/inspections
  - Area of cap system = 15,311 ft^2
  - Team hours to complete inspections = 16 hours (16 hours for every 50,000 ft^2)
  - Hourly rate for team (2 people/team) = $112/hour ($56/hour/team member)
  - Radiation surveys of surface soil = $3,000/event ($1,000 for every 5,000 ft^2).
- Cap maintenance (area of cap + riprap apron area)
  - Area of cap system = 15,311 ft^2
  - Area requiring repair (10% of total area) = 1,531 ft^2 = 170 yd^2
  - Oversight (cap material 32 yd^3/hour) = 1 day (8 hours/day @ $56/hour)
  - Oversight (planting 1,000 yd^2/day) = 1 day (8 hours/day @ $56/hour).

Monitoring. Monitoring includes collecting groundwater samples from down-gradient wells to evaluate the performance of the cap system. As indicated in the general assumptions, these monitoring costs are institutional costs and are not included in this cost estimate.

D4.0 REFERENCES

Comprehensive Environmental Response, Compensation and Liability Act of 1980, 42 USC 9601, et seq.

EPA/540/G-89/004, 1988, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA, Interim Final,* Office of Solid Waste and Emergency Response, U.S. Environmental Protection Agency, Washington, D.C.

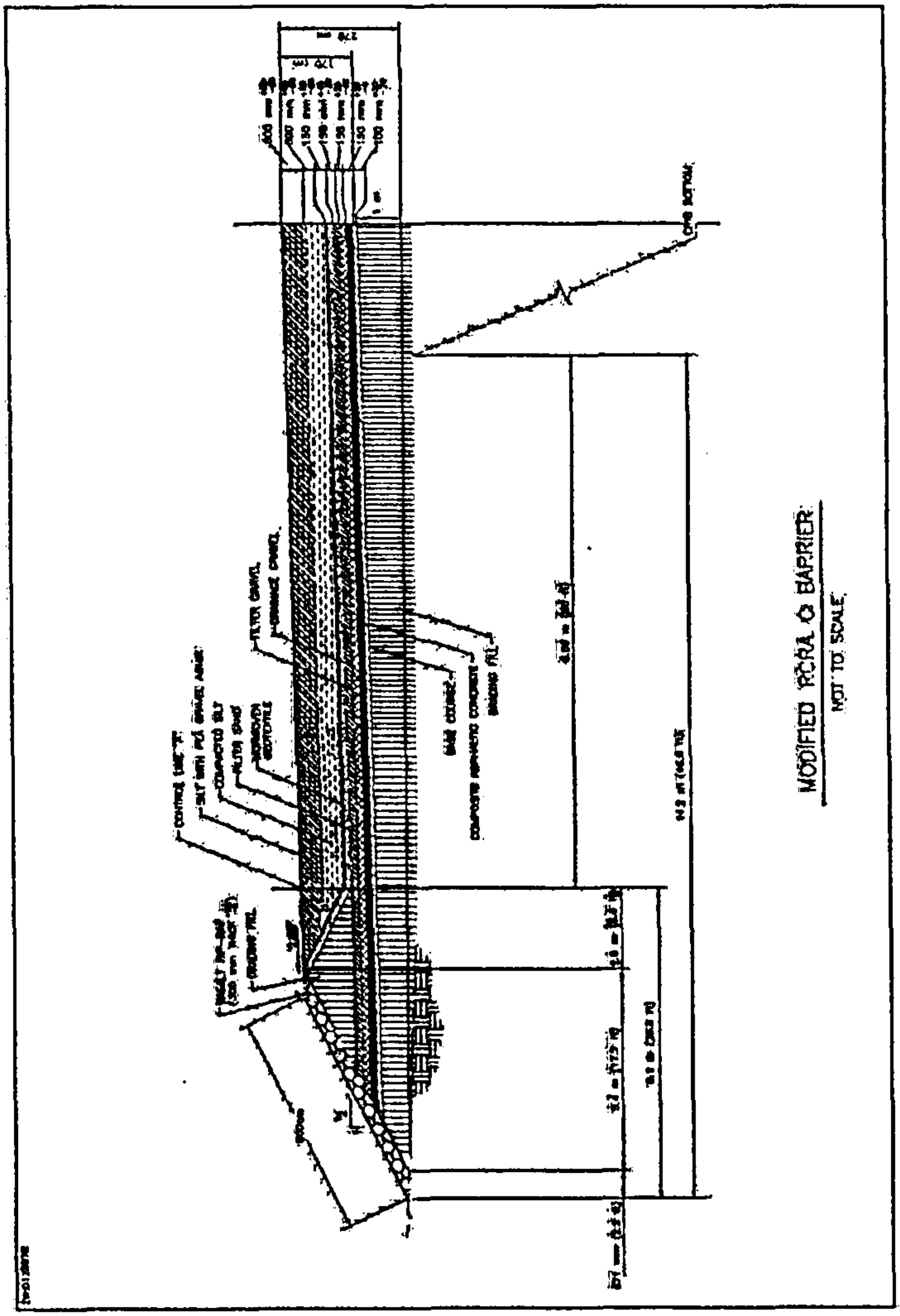
Means, R. S., 2002a, *ECHOS Environmental Remediation Cost Data – Unit Price,* 8th Annual Edition, Robert S. Means Company, Kingston, Massachusetts.

Means, R. S., 2002b, *Site Work and Landscape Cost Data,* 21st Annual Edition, Robert S. Means Company, Kingston, Massachusetts.

OMB Circular No. A-94, 1992, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs,* Office of Management and Budget, Washington, D.C.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

Figure D-1. Modified *Resource Conservation and Recovery Act of 1976* Subtitle C Barrier.



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Alternative 2, Maintain Existing Soil Cover and/or Cap, Institutional Controls, and Monitored Natural Attenuation, costs are presented for the representative waste sites in Tables D-1 through D-32.

Table D-1. (Alternative 2), 216-T-26 Crib Representative Site, Capital Cost 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
FLUOR HANFORD COST											
IMPLEMENT INSTITUTIONAL CONTROLS											
Prepare Deed Restrictions	200	hour			56.00		$0	$0	$11,200	$0	$11,200
Fluor Hanford Field Costs							$0	$0	$11,200	$0	$11,200
G&A on Labor Cost @	15%								$1,680		$1,680
G&A on Material Cost @	15%							$0			$0
G&A on Equipment Cost @	15%									$0	$0
Fluor Hanford Total Cost							$0	$0	$12,880	$0	$12,880
Contingency on Total Field Costs @	20%										$2,576
TOTAL COST											$15,456

G&A = General and administrative.

Table D-2. (Alternative 2), 216-T-26 Crib Representative Site, Periodic Cost
200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State.

Item	Item Cost ($)			Notes
	Annual	Per 5 Years	Per 30 Years	
Site inspection	$1,792			Cost is based on 16 hours @ $112/hour for every 50,000 ft^2. (Site = 900 ft^2).
Radiation survey of surface soil	$1,000			Cost is based on $1,000 for every 5,000 ft^2. Site = 900 ft^2.
Existing cover maintenance	$4,248			Cost includes the purchase of soil to repair ruts and holes over 10% of the site area. Refer to Table D-4.
Vadose zone monitoring		$3,750	$7,130	Monitoring occurs once every 5 years at a cost of $75/linear ft of borehole. Borehole replacement occurs once every 30 years. Refer to Table D-4.
Reporting	$10,000			Select laboratory, prepare sampling plan, document sampling event and results.
Site review		$20,000		Prepare site condition report.

TOTAL	$17,040	$23,750	$7,130

Table D-3. (Alternative 2), 216-T-26 Crib Representative Site, Present Worth Analysis 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%	Present Worth
0	$15,456		$15,456	1.0000	$15,456
1		$17,040	$17,040	0.9690	$16,512
2		$17,040	$17,040	0.9389	$15,999
3		$17,040	$17,040	0.9098	$15,503
4		$17,040	$17,040	0.8816	$15,022
5		$40,790	$40,790	0.8543	$34,847
6		$17,040	$17,040	0.8278	$14,106
7		$17,040	$17,040	0.8021	$13,668
8		$17,040	$17,040	0.7773	$13,245
9		$17,040	$17,040	0.7532	$12,834
10		$40,790	$40,790	0.7298	$29,768
11		$17,040	$17,040	0.7072	$12,051
12		$17,040	$17,040	0.6852	$11,676
13		$17,040	$17,040	0.6640	$11,314
14		$17,040	$17,040	0.6434	$10,963
15		$40,790	$40,790	0.6235	$25,432
16		$17,040	$17,040	0.6041	$10,294
17		$17,040	$17,040	0.5854	$9,975
18		$17,040	$17,040	0.5672	$9,665
19		$17,040	$17,040	0.5496	$9,365
20		$40,790	$40,790	0.5326	$21,725
21		$17,040	$17,040	0.5161	$8,794
22		$17,040	$17,040	0.5001	$8,522
23		$17,040	$17,040	0.4846	$8,257
24		$17,040	$17,040	0.4696	$8,002
25		$40,790	$40,790	0.4550	$18,559
26		$17,040	$17,040	0.4409	$7,513
27		$17,040	$17,040	0.4272	$7,279
28		$17,040	$17,040	0.4140	$7,054
29		$17,040	$17,040	0.4011	$6,835
30		$47,919	$47,919	0.3887	$18,626
31		$17,040	$17,040	0.3766	$6,417
32		$17,040	$17,040	0.3650	$6,220
33		$17,040	$17,040	0.3536	$6,025
34		$17,040	$17,040	0.3427	$5,840
35		$40,790	$40,790	0.3321	$13,546
36		$17,040	$17,040	0.3218	$5,483
37		$17,040	$17,040	0.3118	$5,313
38		$17,040	$17,040	0.3021	$5,148
39		$17,040	$17,040	0.2927	$4,988
40		$40,790	$40,790	0.2837	$11,572

Table D-3. (Alternative 2), 216-T-26 Crib Representative Site, Present Worth Analysis 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
41		$17,040	$17,040	0.2749	$4,684
42		$17,040	$17,040	0.2664	$4,539
43		$17,040	$17,040	0.2581	$4,398
44		$17,040	$17,040	0.2501	$4,262
45		$40,790	$40,790	0.2423	$9,883
46		$17,040	$17,040	0.2348	$4,001
47		$17,040	$17,040	0.2275	$3,877
48		$17,040	$17,040	0.2205	$3,757
49		$17,040	$17,040	0.2136	$3,640
50		$40,790	$40,790	0.2070	$8,443
51		$17,040	$17,040	0.2006	$3,418
52		$17,040	$17,040	0.1944	$3,313
53		$17,040	$17,040	0.1884	$3,210
54		$17,040	$17,040	0.1825	$3,110
55		$40,790	$40,790	0.1769	$7,216
56		$17,040	$17,040	0.1714	$2,921
57		$17,040	$17,040	0.1661	$2,830
58		$17,040	$17,040	0.1609	$2,742
59		$17,040	$17,040	0.1559	$2,656
60		$47,919	$47,919	0.1511	$7,241
61		$17,040	$17,040	0.1464	$2,495
62		$17,040	$17,040	0.1419	$2,418
63		$17,040	$17,040	0.1375	$2,343
64		$17,040	$17,040	0.1332	$2,270
65		$40,790	$40,790	0.1291	$5,266
66		$17,040	$17,040	0.1251	$2,132
67		$17,040	$17,040	0.1212	$2,065
68		$17,040	$17,040	0.1174	$2,000
69		$17,040	$17,040	0.1138	$1,939
70		$40,790	$40,790	0.1103	$4,499
71		$17,040	$17,040	0.1068	$1,820
72		$17,040	$17,040	0.1035	$1,764
73		$17,040	$17,040	0.1003	$1,709
74		$17,040	$17,040	0.0972	$1,656
75		$40,790	$40,790	0.0942	$3,842
76		$17,040	$17,040	0.0913	$1,556
77		$17,040	$17,040	0.0884	$1,506
78		$17,040	$17,040	0.0857	$1,460
79		$17,040	$17,040	0.0830	$1,414
80		$40,790	$40,790	0.0805	$3,284
81		$17,040	$17,040	0.0780	$1,329
82		$17,040	$17,040	0.0756	$1,288

Table D-3. (Alternative 2), 216-T-26 Crib Representative Site, Present Worth Analysis 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
83		$17,040	$17,040	0.0732	$1,247
84		$17,040	$17,040	0.0709	$1,208
85		$40,790	$40,790	0.0687	$2,802
86		$17,040	$17,040	0.0666	$1,135
87		$17,040	$17,040	0.0645	$1,099
88		$17,040	$17,040	0.0625	$1,065
89		$17,040	$17,040	0.0606	$1,033
90		$47,919	$47,919	0.0587	$2,813
91		$17,040	$17,040	0.0569	$970
92		$17,040	$17,040	0.0551	$939
93		$17,040	$17,040	0.0534	$910
94		$17,040	$17,040	0.0518	$883
95		$40,790	$40,790	0.0502	$2,048
96		$17,040	$17,040	0.0486	$828
97		$17,040	$17,040	0.0471	$803
98		$17,040	$17,040	0.0456	$777
99		$17,040	$17,040	0.0442	$753
100		$40,790	$40,790	0.0429	$1,750
101		$17,040	$17,040	0.0415	$707
102		$17,040	$17,040	0.0402	$685
103		$17,040	$17,040	0.0390	$665
104		$17,040	$17,040	0.0378	$644
105		$40,790	$40,790	0.0366	$1,493
106		$17,040	$17,040	0.0355	$605
107		$17,040	$17,040	0.0344	$586
108		$17,040	$17,040	0.0333	$567
109		$17,040	$17,040	0.0323	$550
110		$40,790	$40,790	0.0313	$1,277
111		$17,040	$17,040	0.0303	$516
112		$17,040	$17,040	0.0294	$501
113		$17,040	$17,040	0.0285	$486
114		$17,040	$17,040	0.0276	$470
115		$40,790	$40,790	0.0267	$1,089
116		$17,040	$17,040	0.0259	$441
117		$17,040	$17,040	0.0251	$428
118		$17,040	$17,040	0.0243	$414
119		$17,040	$17,040	0.0236	$402
120		$47,919	$47,919	0.0228	$1,093
121		$17,040	$17,040	0.0221	$377
122		$17,040	$17,040	0.0214	$365
123		$17,040	$17,040	0.0208	$354
124		$17,040	$17,040	0.0201	$342

Table D-3. (Alternative 2), 216-T-26 Crib Representative Site, Present Worth Analysis 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
125		$40,790	$40,790	0.0195	$795
126		$17,040	$17,040	0.0189	$322
127		$17,040	$17,040	0.0183	$312
128		$17,040	$17,040	0.0177	$302
129		$17,040	$17,040	0.0172	$293
130		$40,790	$40,790	0.0167	$681
131		$17,040	$17,040	0.0161	$274
132		$17,040	$17,040	0.0156	$266
133		$17,040	$17,040	0.0152	$259
134		$17,040	$17,040	0.0147	$250
135		$40,790	$40,790	0.0142	$579
136		$17,040	$17,040	0.0138	$235
137		$17,040	$17,040	0.0134	$228
138		$17,040	$17,040	0.0129	$220
139		$17,040	$17,040	0.0125	$213
140		$40,790	$40,790	0.0122	$498
141		$17,040	$17,040	0.0118	$201
142		$17,040	$17,040	0.0114	$194
143		$17,040	$17,040	0.0111	$189
144		$17,040	$17,040	0.0107	$182
145		$40,790	$40,790	0.0104	$424
146		$17,040	$17,040	0.0101	$172
147		$17,040	$17,040	0.0098	$167
148		$17,040	$17,040	0.0094	$160
149		$17,040	$17,040	0.0092	$157
150		$40,790	$40,790	0.0089	$363
				TOTAL PRESENT WORTH	$685,665

1. Discount rate column is a calculated annual multiplier when discount rate = $(1-e)^n$ where e = 3.2% and n = year (1 - 150).

Table D-4. (Alternative 2), 216-T-26 Crib Representative Site, Calculation Sheet 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Purchase, deliver, and place topsoil											
Purchase pea gravel (purchase and delivery)	0.7	cy		$55.67			$0	$39	$0	$0	$39
Silt loam, from Pit 30 excavate/load (6.3 cy)	1	day			$296.00	$1,190.17	$0	$0	$296	$1,190	$1,486
Silt loam hauling, 1 truck	1	day			$296.00	$398.55	$0	$0	$296	$399	$695
Equipment mob/demob (front-end loader)	3	ea			$100.00	$352.00	$0	$0	$300	$1,056	$1,356
Place, grade, and compact backfill	7	csyy		$14.00	$10.00	$5.68	$0	$98	$70	$40	$208
Fine grading and seeding, incl. lime, fert, and seed	10	hrs		$0.26	$1.19	$0.18	$0	$3	$12	$2	$16
Oversight (1 days x 8 hrs/day)	8				$56.00		$0	$0	$448	$0	$448
Subtotal Direct Costs							$0	$140	$1,422	$2,686	$4,248

Item	Quantity	Unit	Unit Cost ($)				Extended Cost ($)				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Drill vadose zone borehole (cost occurs every 30 years)											
Mobilize/demobilize drill rig	1	ls			$625.00	$1,875	$0	$0	$625	$1,875	$2,500
Borings for vadose zone borehole (50 ft)	50	lf			$8.77	$36.23	$0	$0	$439	$1,811	$2,250
Decontaminate drill rig	1	ls	1,000.00				$1,000	$0	$0	$0	$1,000
Collect/containerize IDW	1	ea	50.00				$50	$0	$0	$0	$50
Characterize IDW	1	ea	700.00				$700	$0	$0	$0	$700
Transport and dispose of IDW off site	1	drum	150.00				$150	$0	$0	$0	$150
Oversight (includes sampling, labor, and equipment)	8	hour			56.00		$0	$0	$448	$0	$448
PPE (1 p * 1 day)	1	day		31.67			$0	$32	$0	$0	$32
Subtotal Direct Costs							1,512	32	1,384	3,686	7,130

IDW = Investigation derived waste.
PPE = Personal protective equipment.

Table D-5. (Alternative 2), 216-B-46 Crib Representative Site, Capital Cost 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	Subtotal
FLUOR HANFORD COST											
IMPLEMENT INSTITUTIONAL CONTROLS											
Prepare Institutional Controls	200	hour			$56.00		$0	$0	$11,200	$0	$11,200
Fluor Hanford Field Cost							$0	$0	$11,200	$0	$11,200
Fluor Hanford G&A on Labor Cost @	15%						$0	$0	$1,680	$0	$1,680
Fluor Hanford G&A on Material Cost @	15%						$0	$0	$0	$0	$0
Fluor Hanford G&A on Equipment Cost @	15%						$0	$0	$0	$0	$0
Fluor Hanford Total Cost							$0	$0	$12,880	$0	$12,880
Contingency on Total Field Costs @	20%										$2,576
TOTAL COST											$15,456

G&A = General and administrative.

Table D-6. (Alternative 2), 216-B-46 Crib Representative Site, Periodic Cost
200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State.

Item	Item Cost			Notes
	Annual	Per 5 Years	Per 30 Years	
Site inspection	$3,584			Cost is based on 16 hours @ $112/hour for every 50,000 ft^2. Site = 61,152 ft^2.
Radiation survey of surface soil	$13,000			Cost is based on $1,000 for every 5,000 ft^2. Site = 61,152 ft^2.
Existing cover maintenance	$24,118			Cost includes the purchase of soil to repair ruts and holes over 10% of the site area. Refer to Table D-8.
Vadose zone monitoring		$3,750	$7,130	Monitoring occurs once every 5 years at a cost of $75/linear ft of borehole. Bore hole replacement occurs once every 30 years. Refer to Table D-8.
Reporting	$10,000			Select laboratory, prepare sampling plan, document sampling event and results.
Site review		$20,000		Prepare site condition report.

TOTAL	$50,702	$23,750	$7,130

Table D-7. (Alternative 2), 216-B-46 Crib Representative Site, Present Worth Analysis 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
0	$15,456		$15,456	1.0000	$15,456
1		$50,702	$50,702	0.9690	$49,131
2		$50,702	$50,702	0.9389	$47,604
3		$50,702	$50,702	0.9098	$46,129
4		$50,702	$50,702	0.8816	$44,699
5		$74,452	$74,452	0.8543	$63,605
6		$50,702	$50,702	0.8278	$41,971
7		$50,702	$50,702	0.8021	$40,668
8		$50,702	$50,702	0.7773	$39,411
9		$50,702	$50,702	0.7532	$38,189
10		$74,452	$74,452	0.7298	$54,335
11		$50,702	$50,702	0.7072	$35,857
12		$50,702	$50,702	0.6852	$34,741
13		$50,702	$50,702	0.6640	$33,666
14		$50,702	$50,702	0.6434	$32,622
15		$74,452	$74,452	0.6235	$46,421
16		$50,702	$50,702	0.6041	$30,629
17		$50,702	$50,702	0.5854	$29,681
18		$50,702	$50,702	0.5672	$28,758
19		$50,702	$50,702	0.5496	$27,866
20		$74,452	$74,452	0.5326	$39,653
21		$50,702	$50,702	0.5161	$26,168
22		$50,702	$50,702	0.5001	$25,356
23		$50,702	$50,702	0.4846	$24,570
24		$50,702	$50,702	0.4696	$23,810
25		$74,452	$74,452	0.4550	$33,876
26		$50,702	$50,702	0.4409	$22,355
27		$50,702	$50,702	0.4272	$21,660
28		$50,702	$50,702	0.4140	$20,991
29		$50,702	$50,702	0.4011	$20,337
30		$81,582	$81,582	0.3887	$31,711
31		$50,702	$50,702	0.3766	$19,095
32		$50,702	$50,702	0.3650	$18,506
33		$50,702	$50,702	0.3536	$17,928
34		$50,702	$50,702	0.3427	$17,376
35		$74,452	$74,452	0.3321	$24,726
36		$50,702	$50,702	0.3218	$16,316
37		$50,702	$50,702	0.3118	$15,809
38		$50,702	$50,702	0.3021	$15,317
39		$50,702	$50,702	0.2927	$14,841
40		$74,452	$74,452	0.2837	$21,122

Table D-7. (Alternative 2), 216-B-46 Crib Representative Site, Present Worth Analysis 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
41		$50,702	$50,702	0.2749	$13,938
42		$50,702	$50,702	0.2664	$13,507
43		$50,702	$50,702	0.2581	$13,086
44		$50,702	$50,702	0.2501	$12,681
45		$74,452	$74,452	0.2423	$18,040
46		$50,702	$50,702	0.2348	$11,905
47		$50,702	$50,702	0.2275	$11,535
48		$50,702	$50,702	0.2205	$11,180
49		$50,702	$50,702	0.2136	$10,830
50		$74,452	$74,452	0.2070	$15,412
51		$50,702	$50,702	0.2006	$10,171
52		$50,702	$50,702	0.1944	$9,857
53		$50,702	$50,702	0.1884	$9,552
54		$50,702	$50,702	0.1825	$9,253
55		$74,452	$74,452	0.1769	$13,171
56		$50,702	$50,702	0.1714	$8,690
57		$50,702	$50,702	0.1661	$8,422
58		$50,702	$50,702	0.1609	$8,158
59		$50,702	$50,702	0.1559	$7,905
60		$81,582	$81,582	0.1511	$12,327
61		$50,702	$50,702	0.1464	$7,423
62		$50,702	$50,702	0.1419	$7,195
63		$50,702	$50,702	0.1375	$6,972
64		$50,702	$50,702	0.1332	$6,754
65		$74,452	$74,452	0.1291	$9,612
66		$50,702	$50,702	0.1251	$6,343
67		$50,702	$50,702	0.1212	$6,145
68		$50,702	$50,702	0.1174	$5,952
69		$50,702	$50,702	0.1138	$5,770
70		$74,452	$74,452	0.1103	$8,212
71		$50,702	$50,702	0.1068	$5,415
72		$50,702	$50,702	0.1035	$5,248
73		$50,702	$50,702	0.1003	$5,085
74		$50,702	$50,702	0.0972	$4,928
75		$74,452	$74,452	0.0942	$7,013
76		$50,702	$50,702	0.0913	$4,629
77		$50,702	$50,702	0.0884	$4,482
78		$50,702	$50,702	0.0857	$4,345
79		$50,702	$50,702	0.0830	$4,208
80		$74,452	$74,452	0.0805	$5,993
81		$50,702	$50,702	0.0780	$3,955
82		$50,702	$50,702	0.0756	$3,833
83		$50,702	$50,702	0.0732	$3,711

Table D-7. (Alternative 2), 216-B-46 Crib Representative Site, Present Worth Analysis 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
84		$50,702	$50,702	0.0709	$3,595
85		$74,452	$74,452	0.0687	$5,115
86		$50,702	$50,702	0.0666	$3,377
87		$50,702	$50,702	0.0645	$3,270
88		$50,702	$50,702	0.0625	$3,169
89		$50,702	$50,702	0.0606	$3,073
90		$81,582	$81,582	0.0587	$4,789
91		$50,702	$50,702	0.0569	$2,885
92		$50,702	$50,702	0.0551	$2,794
93		$50,702	$50,702	0.0534	$2,708
94		$50,702	$50,702	0.0518	$2,626
95		$74,452	$74,452	0.0502	$3,738
96		$50,702	$50,702	0.0486	$2,464
97		$50,702	$50,702	0.0471	$2,388
98		$50,702	$50,702	0.0456	$2,312
99		$50,702	$50,702	0.0442	$2,241
100		$74,452	$74,452	0.0429	$3,194
101		$50,702	$50,702	0.0415	$2,104
102		$50,702	$50,702	0.0402	$2,038
103		$50,702	$50,702	0.0390	$1,977
104		$50,702	$50,702	0.0378	$1,917
105		$74,452	$74,452	0.0366	$2,725
106		$50,702	$50,702	0.0355	$1,800
107		$50,702	$50,702	0.0344	$1,744
108		$50,702	$50,702	0.0333	$1,688
109		$50,702	$50,702	0.0323	$1,638
110		$74,452	$74,452	0.0313	$2,330
111		$50,702	$50,702	0.0303	$1,536
112		$50,702	$50,702	0.0294	$1,491
113		$50,702	$50,702	0.0285	$1,445
114		$50,702	$50,702	0.0276	$1,399
115		$74,452	$74,452	0.0267	$1,988
116		$50,702	$50,702	0.0259	$1,313
117		$50,702	$50,702	0.0251	$1,273
118		$50,702	$50,702	0.0243	$1,232
119		$50,702	$50,702	0.0236	$1,197
120		$81,582	$81,582	0.0228	$1,860
121		$50,702	$50,702	0.0221	$1,121
122		$50,702	$50,702	0.0214	$1,085
123		$50,702	$50,702	0.0208	$1,055
124		$50,702	$50,702	0.0201	$1,019
125		$74,452	$74,452	0.0195	$1,452
126		$50,702	$50,702	0.0189	$958

Table D-7. (Alternative 2), 216-B-46 Crib Representative Site, Present Worth Analysis 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
127		$50,702	$50,702	0.0183	$928
128		$50,702	$50,702	0.0177	$897
129		$50,702	$50,702	0.0172	$872
130		$74,452	$74,452	0.0167	$1,243
131		$50,702	$50,702	0.0161	$816
132		$50,702	$50,702	0.0156	$791
133		$50,702	$50,702	0.0152	$771
134		$50,702	$50,702	0.0147	$745
135		$74,452	$74,452	0.0142	$1,057
136		$50,702	$50,702	0.0138	$700
137		$50,702	$50,702	0.0134	$679
138		$50,702	$50,702	0.0129	$654
139		$50,702	$50,702	0.0125	$634
140		$74,452	$74,452	0.0122	$908
141		$50,702	$50,702	0.0118	$598
142		$50,702	$50,702	0.0114	$578
143		$50,702	$50,702	0.0111	$563
144		$50,702	$50,702	0.0107	$543
145		$74,452	$74,452	0.0104	$774
146		$50,702	$50,702	0.0101	$512
147		$50,702	$50,702	0.0098	$497
148		$50,702	$50,702	0.0094	$477
149		$50,702	$50,702	0.0092	$466
150		$74,452	$74,452	0.0089	$663
				TOTAL PRESENT WORTH	$1,728,295

1 Discount rate column is a calculated annual multiplier when discount rate = $(1-e)^n$ where e = 3.2% and n = year (1 - 150).

Table D-8. (Alternative 2), 216-B-46 Crib Representative Site, Calculation Sheet 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Purchase, delivery, and place topsoil											
Purchase pea gravel (purchase and delivery)	45.0	cy		$55.67			$0	$2,505	$0	$0	$2,505
Silt loam, from Pit 30 excavate/load (408 cy)	2	day			$296.00	$1,190.17	$0	$0	$592	$2,380	$2,972
Silt loam hauling, 1 truck	2	day			$296.00	$398.55	$0	$0	$592	$797	$1,389
Equipment mob/demob (front-end loader)	3	ea			$100.00	$352.00	$0	$0	$300	$1,056	$1,356
Place, grade, and compact backfill	453	cy		$14.00	$10.00	$5.68	$0	$6,342	$4,530	$2,573	$13,445
Fine grading and seeding, incl. lime, fert, and seed	679	sy		$0.26	$1.19	$0.18	$0	$177	$808	$122	$1,107
Oversight (3 days x 8 hrs/day)	24	hrs			$56.00		$0	$0	$1,344	$0	$1,344
Subtotal Direct Costs							$0	$9,024	$8,166	$6,929	$24,118

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Drill vadose zone borehole (cost occurs every 30 years)											
Mobilize/demobilize drill rig	1	ls			$625.00	$1,875.00	$0	$0	$625	$1,875	$2,500
Borings for vadose zone borehole (50 ft)	50	lf			$8.77	$36.23	$0	$0	$439	$1,811	$2,250
Decontamination of drill rig	1	ls	1,000.00				$1,000	$0	$0	$0	$1,000
Collect/containerize IDW	1	ea	50.00				$50	$0	$0	$0	$50
Characterize IDW	1	ea	700.00				$700	$0	$0	$0	$700
Transport/dispose of IDW off-Site	1	drum	150.00				$150	$0	$0	$0	$150
Oversight (includes sampling, labor, and equipment)	8	hrs			$56.00		$0	$0	$448	$0	$448
PPE (1 p * 1 day)	1	day		31.67			$0	$32	$0	$0	$32
Subtotal Direct Costs							$1,900	$32	$1,512	$3,686	$7130

IDW = Investigation derived waste
PPE = Personnel protective equipment

Table D-9. (Alternative 2), 216-B-5 Reverse Well Representative Site, Capital Cost 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (2 pages).

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
FLUOR HANFORD COST											
IMPLEMENT INSTITUTIONAL CONTROLS											
Prepare Institutional Controls	200	hr			$56.00		$0	$0	$11,200	$0	$11,200
OVERSIGHT											
Construction Oversight	10	days			$1,720.00		$0	$0	$17,200	$0	$17,200
RCT Decontamination Crew (4 RCTs)	1	days			$1,792.00		$0	$0	$1,792	$0	$1,792
Disposal of Rolloff Boxes to ERDF	1	ea	$1,100.00				$1,100	$0	$0	$0	$1,100
Fluor Hanford Field Cost							$1,100	$0	$30,192	$0	$31,292
Fluor Hanford G & A on Labor Cost @	15%								$4,529		$4,529
Fluor Hanford G & A on Material Cost @	15%							$0			$165
Fluor Hanford G & A on Equipment Cost @	15%									$0	$0
Fluor Hanford Total Cost							$1,100	$0	$34,721	$0	$35,821
CONSTRUCTION CONTRACTOR COST											
MOBILIZATION/DEMOBILIZATION AND FIELD SUPPORT											
Mobilize/Demobilize Drill Rig	1	ls			$625.00	$1,875.00	$0	$0	$625	$1,875	$2,500
Install Temporary Fence (Blaze Orange)	192	lf		$1.63	$1.16		$0	$313	$223	$0	$536
Haul Road - Gravel, 6" thick	4,400	sy		$6.50	$0.33	$0.53	$0	$28,600	$1,452	$2,332	$32,384
Construct Decontamination Pad (See Table D-12)	1	ea		$836.86		$1,060.56	$0	$837	$0	$1,061	$1,897
DECONTAMINATION											
Water for Decon Process (1,000 gal/month)	50	gal		$0.20			$0	$10	$0	$0	$10
ABANDONMENT											
Hydraulic Backhoe	4	day			$296.00	$260.60	$0	$0	$1,184	$1,042	$2,226
Abandon Well	302	lf	$55.95				$16,897	$0	$0	$0	$16,897
SITE RESTORATION											
Hydraulic Backhoe	1	day			$296.00	$260.60	$0	$0	$296	$261	$557
Fine Grading and Seeding (Lime, Fert, and Seed Incl.)	4,402	sy		$0.26	$1.19	$0.18	$0	$1,145	$5,238	$792	$7,175
MISCELLANEOUS											
Support Personnel	10	day			$1,896.00		$0	$0	$18,960	$0	$18,960
Labor (4 laborers @ $37/hour)	10	day			$1,184.00		$0	$0	$11,840	$0	$11,840
Post Construction Documents	80	hr			$50.00		$0	$0	$4,000	$0	$4,000

Table D-9. (Alternative 2), 216-B-5 Reverse Well Representative Site, Capital Cost 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (2 pages).

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Construction Contractor Field Cost							$16,897	$30,904	$43,818	$7,363	$98,982
Direct Markup on Labor @	25%								$10,955		$10,955
Direct Markup on Materials @	10%							$3,090			$3,090
Direct Markup on Subcontracts @	10%						$1,690				$1,690
Construction Contractor G&A @	26.5%						$4,478	$8,190	$11,612	$1,951	$26,230
Construction Contractor Subtotal							$23,064	$42,184	$66,384	$9,314	$140,947
Fluor Hanford G&A on Construction Contractor Cost @	15%						$3,460	$6,328	$9,958	$1,397	$21,142
Construction Contractor Total Cost							$26,524	$48,512	$76,342	$10,711	$162,089
Fluor Hanford Total Cost (From Above)							$1,100	$0	$34,721	$0	$35,821
Project Subtotal							$27,624	$48,512	$111,063	$10,711	$197,910
Contingency on Total Field Cost @	20%										$39,582
TOTAL COST											$237,492

ERDF = Environmental Restoration Disposal Facility.
G&A = General and administrative.
RCT = Radiation control technician.

Table D-10. (Alternative 2), 216-B-5 Reverse Well Representative Site, Periodic Cost
200-TW-2 Tank Waste Group, Hanford Site, Washington State.

Item	Item Cost			Notes
	Annual	Per 5 Years	Per 30 Years	
Site inspection	$1,792			Cost is based on 16 hours. @ $112/hour for every 50,000 ft². Site = 1,600 ft².
Radiation survey of surface soil	$1,000			Cost is based on $1,000 for every 5,000 ft². Site = 1,600 ft².
Existing cover maintenance	$4,437			Cost includes the purchase of soil to repair ruts and holes over 10% of the site area. Refer to Tab;e D=12/
Vadose zone monitoring		$3,750	$7,130	Monitoring occurs once every 5 years at a cost of $75/linear ft of borehole. Borehole replacement occurs once every 30 years. Refer to Table D-12.
Reporting	$10,000			Select laboratory, prepare sampling plan, document sampling event and results.
Site review		$20,000		Prepare site condition report.

TOTAL	$17,229	$23,750	$7,130

Table D-11. (Alternative 2), 216-B-5 Reverse Well Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth ($)
0	$237,492		$237,492	1.0000	$237,492
1		$17,229	$17,229	0.9690	$16,695
2		$17,229	$17,229	0.9389	$16,176
3		$17,229	$17,229	0.9098	$15,675
4		$17,229	$17,229	0.8816	$15,189
5		$40,979	$40,979	0.8543	$35,008
6		$17,229	$17,229	0.8278	$14,262
7		$17,229	$17,229	0.8021	$13,819
8		$17,229	$17,229	0.7773	$13,392
9		$17,229	$17,229	0.7532	$12,977
10		$40,979	$40,979	0.7298	$29,906
11		$17,229	$17,229	0.7072	$12,184
12		$17,229	$17,229	0.6852	$11,805
13		$17,229	$17,229	0.6640	$11,440
14		$17,229	$17,229	0.6434	$11,085
15		$40,979	$40,979	0.6235	$25,550
16		$17,229	$17,229	0.6041	$10,408
17		$17,229	$17,229	0.5854	$10,086
18		$17,229	$17,229	0.5672	$9,772
19		$17,229	$17,229	0.5496	$9,469
20		$40,979	$40,979	0.5326	$21,825
21		$17,229	$17,229	0.5161	$8,892
22		$17,229	$17,229	0.5001	$8,616
23		$17,229	$17,229	0.4846	$8,349
24		$17,229	$17,229	0.4696	$8,091
25		$40,979	$40,979	0.4550	$18,645
26		$17,229	$17,229	0.4409	$7,596
27		$17,229	$17,229	0.4272	$7,360
28		$17,229	$17,229	0.4140	$7,133
29		$17,229	$17,229	0.4011	$6,911
30		$48,109	$48,109	0.3887	$18,700
31		$17,229	$17,229	0.3766	$6,488
32		$17,229	$17,229	0.3650	$6,289
33		$17,229	$17,229	0.3536	$6,092
34		$17,229	$17,229	0.3427	$5,904
35		$40,979	$40,979	0.3321	$13,609
36		$17,229	$17,229	0.3218	$5,544
37		$17,229	$17,229	0.3118	$5,372
38		$17,229	$17,229	0.3021	$5,205
39		$17,229	$17,229	0.2927	$5,043

Table D-11. (Alternative 2), 216-B-5 Reverse Well Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth ($)
40		$40,979	$40,979	0.2837	$11,626
41		$17,229	$17,229	0.2749	$4,736
42		$17,229	$17,229	0.2664	$4,590
43		$17,229	$17,229	0.2581	$4,447
44		$17,229	$17,229	0.2501	$4,309
45		$40,979	$40,979	0.2423	$9,929
46		$17,229	$17,229	0.2348	$4,045
47		$17,229	$17,229	0.2275	$3,920
48		$17,229	$17,229	0.2205	$3,799
49		$17,229	$17,229	0.2136	$3,680
50		$40,979	$40,979	0.2070	$8,483
51		$17,229	$17,229	0.2006	$3,456
52		$17,229	$17,229	0.1944	$3,349
53		$17,229	$17,229	0.1884	$3,246
54		$17,229	$17,229	0.1825	$3,144
55		$40,979	$40,979	0.1769	$7,249
56		$17,229	$17,229	0.1714	$2,953
57		$17,229	$17,229	0.1661	$2,862
58		$17,229	$17,229	0.1609	$2,772
59		$17,229	$17,229	0.1559	$2,686
60		$48,109	$48,109	0.1511	$7,269
61		$17,229	$17,229	0.1464	$2,522
62		$17,229	$17,229	0.1419	$2,445
63		$17,229	$17,229	0.1375	$2,369
64		$17,229	$17,229	0.1332	$2,295
65		$40,979	$40,979	0.1291	$5,290
66		$17,229	$17,229	0.1251	$2,155
67		$17,229	$17,229	0.1212	$2,088
68		$17,229	$17,229	0.1174	$2,023
69		$17,229	$17,229	0.1138	$1,961
70		$40,979	$40,979	0.1103	$4,520
71		$17,229	$17,229	0.1068	$1,840
72		$17,229	$17,229	0.1035	$1,783
73		$17,229	$17,229	0.1003	$1,728
74		$17,229	$17,229	0.0972	$1,675
75		$40,979	$40,979	0.0942	$3,860
76		$17,229	$17,229	0.0913	$1,573
77		$17,229	$17,229	0.0884	$1,523
78		$17,229	$17,229	0.0857	$1,477
79		$17,229	$17,229	0.0830	$1,430
80		$40,979	$40,979	0.0805	$3,299
81		$17,229	$17,229	0.0780	$1,344

Table D-11. (Alternative 2), 216-B-5 Reverse Well Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth ($)
82		$17,229	$17,229	0.0756	$1,303
83		$17,229	$17,229	0.0732	$1,261
84		$17,229	$17,229	0.0709	$1,222
85		$40,979	$40,979	0.0687	$2,815
86		$17,229	$17,229	0.0666	$1,147
87		$17,229	$17,229	0.0645	$1,111
88		$17,229	$17,229	0.0625	$1,077
89		$17,229	$17,229	0.0606	$1,044
90		$48,109	$48,109	0.0587	$2,824
91		$17,229	$17,229	0.0569	$980
92		$17,229	$17,229	0.0551	$949
93		$17,229	$17,229	0.0534	$920
94		$17,229	$17,229	0.0518	$892
95		$40,979	$40,979	0.0502	$2,057
96		$17,229	$17,229	0.0486	$837
97		$17,229	$17,229	0.0471	$811
98		$17,229	$17,229	0.0456	$786
99		$17,229	$17,229	0.0442	$762
100		$40,979	$40,979	0.0429	$1,758
101		$17,229	$17,229	0.0415	$715
102		$17,229	$17,229	0.0402	$693
103		$17,229	$17,229	0.0390	$672
104		$17,229	$17,229	0.0378	$651
105		$40,979	$40,979	0.0366	$1,500
106		$17,229	$17,229	0.0355	$612
107		$17,229	$17,229	0.0344	$593
108		$17,229	$17,229	0.0333	$574
109		$17,229	$17,229	0.0323	$556
110		$40,979	$40,979	0.0313	$1,283
111		$17,229	$17,229	0.0303	$522
112		$17,229	$17,229	0.0294	$507
113		$17,229	$17,229	0.0285	$491
114		$17,229	$17,229	0.0276	$476
115		$40,979	$40,979	0.0267	$1,094
116		$17,229	$17,229	0.0259	$446
117		$17,229	$17,229	0.0251	$432
118		$17,229	$17,229	0.0243	$419
119		$17,229	$17,229	0.0236	$407
120		$48,109	$48,109	0.0228	$1,097
121		$17,229	$17,229	0.0221	$381
122		$17,229	$17,229	0.0214	$369
123		$17,229	$17,229	0.0208	$358

Table D-11. (Alternative 2), 216-B-5 Reverse Well Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth ($)
124		$17,229	$17,229	0.0201	$346
125		$40,979	$40,979	0.0195	$799
126		$17,229	$17,229	0.0189	$326
127		$17,229	$17,229	0.0183	$315
128		$17,229	$17,229	0.0177	$305
129		$17,229	$17,229	0.0172	$296
130		$40,979	$40,979	0.0167	$684
131		$17,229	$17,229	0.0161	$277
132		$17,229	$17,229	0.0156	$269
133		$17,229	$17,229	0.0152	$262
134		$17,229	$17,229	0.0147	$253
135		$40,979	$40,979	0.0142	$582
136		$17,229	$17,229	0.0138	$238
137		$17,229	$17,229	0.0134	$231
138		$17,229	$17,229	0.0129	$222
139		$17,229	$17,229	0.0125	$215
140		$40,979	$40,979	0.0122	$500
141		$17,229	$17,229	0.0118	$203
142		$17,229	$17,229	0.0114	$196
143		$17,229	$17,229	0.0111	$191
144		$17,229	$17,229	0.0107	$184
145		$40,979	$40,979	0.0104	$426
146		$17,229	$17,229	0.0101	$174
147		$17,229	$17,229	0.0098	$169
148		$17,229	$17,229	0.0094	$162
149		$17,229	$17,229	0.0092	$159
150		$40,979	$40,979	0.0089	$365
				TOTAL PRESENT WORTH	$913,564

1. Discount rate column is a calculated annual multiplier when discount rate = $(1-e)^n$ where e = 3.2% and n = year (1 - 150).

Table D-12. (Alternative 2), 216-B-5 Reverse Well Representative Site, Calculation Sheet 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (2 Pages).

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Purchase, deliver, and place topsoil											
Purchase Pea Gravel (purchase and delivery)	1.2	cy		$55.67			$0	$67	$0	$0	$67
Silt Loam, from Pit 30 excavate/load (10.8 cy)	1	day			$296.00	$1,190.17	$0	$0	$296	$1,190	$1,486
Silt Loam Hauling, 1 Truck	1	day			$296.00	$398.55	$0	$0	$296	$399	$695
Equipment Mob/Demob (Front end loader)	3	ea			$100.00	$352.00	$0	$0	$300	$1,056	$1,356
Place, grade, and compact backfill	12	cy		$14.00	$10.00	$5.68	$0	$168	$120	$68	$356
Fine Grading and seeding, incl. lime, fert, and seed	18	sy		$0.26	$1.19	$0.18	$0	$5	$21	$3	$29
Oversight (1 day x 8 hrs/day)	8	hrs			$56.00		$0	$0	$448	$0	$448
Subtotal Direct Costs							$0	$239	$1,481	$2,716	$4,437

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Drill vadose zone borehole (cost occurs every 30 years)											
Mobilize/demobilize drill rig	1	ls			$625.00	$1,875.00	$0	$0	$625	$1,875	$2,500
Borings for vadose zone borehole (50 ft)	50	lf			$8.77	$36.23	$0	$0	$439	$1,811	$2,250
Decontamination of drill rig	1	ls	1,000.00				$1,000	$0	$0	0	$1,000
Collect/containerize IDW	1	ea	50.00				$50	$0	$0	0	$50
Characterize IDW	1	ea	700.00				$700	$0	$0	0	$700
Transport/dispose of IDW off site	1	drum	150.00				$150	$0	$0	0	$150
Oversight (includes sampling, labor, and equipment)	8	hour			$56.00		$0	$0	$448	0	$448
PPE (1 p * 1 day)	1	day		31.67			$0	$32	0	0	$32
Subtotal Direct Costs							$1,900	32	$1,512	$3,686	$7,130

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Decontamination Pad Construction											
Timber grates	0.402	mbf		$577.00			$0	$232	$0	$0	$232
Install 60 mil LLDPE	1,188	sf		$0.44		$0.26	$0	$523	$0	$309	$832
3" SCH 80 PVC pipe	5	lf		$1.63			$0	$8	$0	$0	$8
Sump pump (2 for 1 months)	2	mo				$375.00	$0	$0	$0	$750	$750
Sump construction (1)	1	ls		$74.04		$1.68	$0	$74	$0	$2	$76
Subtotal Direct Costs							$0	$837	$0	$1,061	$1,897

Table D-12 (Alternative 2), 216-B-5 Reverse Well Representative Site, Calculation Sheet
200-TW-2 Tank Waste Group, Hanford Site, Washington State, (2 Pages).

Note:
1 The decontamination pad cost for Alternative 2 is less expensive than the decontamination pad for Alternative 3 because the Alternative 4 decontamination pad usage is expected to be only 1 day, where for Alternative 3 decontamination pad is expected to be used day after day for long periods of time.
2 Costs of labor to construct and use the decontamination pad provided under Miscellaneous (labor) on Table D-9.
IDW = Investigation derived waste.
PPE = Personnel protective equipment.

Table D-13. (Alternative 2), 216-B-7A&B Crib Representative Site, Capital Cost 200-TW-2 Tank Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
FLUOR HANFORD COST											
IMPLEMENT INSTITUTIONAL CONTROLS											
Institutional Controls	200	hr			$56.00		$0	$0	$11,200	$0	$11,200
Fluor Hanford Field Costs							$0	$0	$11,200	$0	$11,200
Fluor HanfordG & A on Labor Cost @	15%								$1,680		$1,680
Fluor HanfordG & A on Material Cost @	15%										$0
Fluor HanfordG & A on Equipment Cost @	15%									$0	$0
Fluor Hanford Total Cost									$12,880	$0	$12,880
Contingency on Total Field Cost @	20%										$2,576
TOTAL COST											$15,456

G&A = General and administrative.

Table D-14. (Alternative 2), 216-B-7A&B Crib Representative Site, Periodic Cost 200-TW-2 Tank Waste Group, Hanford Site, Washington State.

Item	Item Cost ($)			Notes
	Annual	Per 5 Years	Per 30 Years	
Site inspection	$1,792			Cost is based on 16 hours @ $112/hour for every 50,000 ft^2. Site = 672 ft^2.
Radiation survey of surface soil	$1,000			Cost is based on $1,000 for every 5,000 ft^2. Site = 672 ft^2.
Existing cover maintenance	$4,174			Cost includes the purchass of soil to repair ruts and holes over 10% of the site area. Refer to Table D-16.
Vadose zone monitoring		$3,750	$7,130	Monitoring occurs once every 5 years at a cost of $75/linear ft of borehole. Borehole replacement occurs once every 30 years. Refer to Table D-16.
Reporting	$10,000			Select laboratory, prepare sampling plan, document sampling event and results.
Site Review		$20,000		Prepare site condition report.

TOTAL	$16,966	$23,750	$7,130

Table D-15. (Alternative 2), 216-B-7A&B Crib Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
0	$15,456		$15,456	1.0000	$15,456
1		$16,966	$16,966	0.9690	$16,440
2		$16,966	$16,966	0.9389	$15,929
3		$16,966	$16,966	0.9098	$15,436
4		$16,966	$16,966	0.8816	$14,957
5		$40,716	$40,716	0.8543	$34,784
6		$16,966	$16,966	0.8278	$14,044
7		$16,966	$16,966	0.8021	$13,608
8		$16,966	$16,966	0.7773	$13,188
9		$16,966	$16,966	0.7532	$12,779
10		$40,716	$40,716	0.7298	$29,715
11		$16,966	$16,966	0.7072	$11,998
12		$16,966	$16,966	0.6852	$11,625
13		$16,966	$16,966	0.6640	$11,265
14		$16,966	$16,966	0.6434	$10,916
15		$40,716	$40,716	0.6235	$25,386
16		$16,966	$16,966	0.6041	$10,249
17		$16,966	$16,966	0.5854	$9,932
18		$16,966	$16,966	0.5672	$9,623
19		$16,966	$16,966	0.5496	$9,325
20		$40,716	$40,716	0.5326	$21,685
21		$16,966	$16,966	0.5161	$8,756
22		$16,966	$16,966	0.5001	$8,485
23		$16,966	$16,966	0.4846	$8,222
24		$16,966	$16,966	0.4696	$7,967
25		$40,716	$40,716	0.4550	$18,526
26		$16,966	$16,966	0.4409	$7,480
27		$16,966	$16,966	0.4272	$7,248
28		$16,966	$16,966	0.4140	$7,024
29		$16,966	$16,966	0.4011	$6,805
30		$47,846	$47,846	0.3887	$18,598
31		$16,966	$16,966	0.3766	$6,389
32		$16,966	$16,966	0.3650	$6,193
33		$16,966	$16,966	0.3536	$5,999
34		$16,966	$16,966	0.3427	$5,814
35		$40,716	$40,716	0.3321	$13,522
36		$16,966	$16,966	0.3218	$5,460
37		$16,966	$16,966	0.3118	$5,290
38		$16,966	$16,966	0.3021	$5,125
39		$16,966	$16,966	0.2927	$4,966

Table D-15. (Alternative 2), 216-B-7A&B Crib Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
40		$40,716	$40,716	0.2837	$11,551
41		$16,966	$16,966	0.2749	$4,664
42		$16,966	$16,966	0.2664	$4,520
43		$16,966	$16,966	0.2581	$4,379
44		$16,966	$16,966	0.2501	$4,243
45		$40,716	$40,716	0.2423	$9,865
46		$16,966	$16,966	0.2348	$3,984
47		$16,966	$16,966	0.2275	$3,860
48		$16,966	$16,966	0.2205	$3,741
49		$16,966	$16,966	0.2136	$3,624
50		$40,716	$40,716	0.2070	$8,428
51		$16,966	$16,966	0.2006	$3,403
52		$16,966	$16,966	0.1944	$3,298
53		$16,966	$16,966	0.1884	$3,196
54		$16,966	$16,966	0.1825	$3,096
55		$40,716	$40,716	0.1769	$7,203
56		$16,966	$16,966	0.1714	$2,908
57		$16,966	$16,966	0.1661	$2,818
58		$16,966	$16,966	0.1609	$2,730
59		$16,966	$16,966	0.1559	$2,645
60		$47,846	$47,846	0.1511	$7,229
61		$16,966	$16,966	0.1464	$2,484
62		$16,966	$16,966	0.1419	$2,407
63		$16,966	$16,966	0.1375	$2,333
64		$16,966	$16,966	0.1332	$2,260
65		$40,716	$40,716	0.1291	$5,256
66		$16,966	$16,966	0.1251	$2,122
67		$16,966	$16,966	0.1212	$2,056
68		$16,966	$16,966	0.1174	$1,992
69		$16,966	$16,966	0.1138	$1,931
70		$40,716	$40,716	0.1103	$4,491
71		$16,966	$16,966	0.1068	$1,812
72		$16,966	$16,966	0.1035	$1,756
73		$16,966	$16,966	0.1003	$1,702
74		$16,966	$16,966	0.0972	$1,649
75		$40,716	$40,716	0.0942	$3,835
76		$16,966	$16,966	0.0913	$1,549
77		$16,966	$16,966	0.0884	$1,500
78		$16,966	$16,966	0.0857	$1,454
79		$16,966	$16,966	0.0830	$1,408
80		$40,716	$40,716	0.0805	$3,278

Table D-15. (Alternative 2), 216-B-7A&B Crib Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
81		$16,966	$16,966	0.0780	$1,323
82		$16,966	$16,966	0.0756	$1,283
83		$16,966	$16,966	0.0732	$1,242
84		$16,966	$16,966	0.0709	$1,203
85		$40,716	$40,716	0.0687	$2,797
86		$16,966	$16,966	0.0666	$1,130
87		$16,966	$16,966	0.0645	$1,094
88		$16,966	$16,966	0.0625	$1,060
89		$16,966	$16,966	0.0606	$1,028
90		$47,846	$47,846	0.0587	$2,809
91		$16,966	$16,966	0.0569	$965
92		$16,966	$16,966	0.0551	$935
93		$16,966	$16,966	0.0534	$906
94		$16,966	$16,966	0.0518	$879
95		$40,716	$40,716	0.0502	$2,044
96		$16,966	$16,966	0.0486	$825
97		$16,966	$16,966	0.0471	$799
98		$16,966	$16,966	0.0456	$774
99		$16,966	$16,966	0.0442	$750
100		$40,716	$40,716	0.0429	$1,747
101		$16,966	$16,966	0.0415	$704
102		$16,966	$16,966	0.0402	$682
103		$16,966	$16,966	0.0390	$662
104		$16,966	$16,966	0.0378	$641
105		$40,716	$40,716	0.0366	$1,490
106		$16,966	$16,966	0.0355	$602
107		$16,966	$16,966	0.0344	$584
108		$16,966	$16,966	0.0333	$565
109		$16,966	$16,966	0.0323	$548
110		$40,716	$40,716	0.0313	$1,274
111		$16,966	$16,966	0.0303	$514
112		$16,966	$16,966	0.0294	$499
113		$16,966	$16,966	0.0285	$484
114		$16,966	$16,966	0.0276	$468
115		$40,716	$40,716	0.0267	$1,087
116		$16,966	$16,966	0.0259	$439
117		$16,966	$16,966	0.0251	$426
118		$16,966	$16,966	0.0243	$412
119		$16,966	$16,966	0.0236	$400
120		$47,846	$47,846	0.0228	$1,091
121		$16,966	$16,966	0.0221	$375

Table D-15. (Alternative 2), 216-B-7A&B Crib Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
122		$16,966	$16,966	0.0214	$363
123		$16,966	$16,966	0.0208	$353
124		$16,966	$16,966	0.0201	$341
125		$40,716	$40,716	0.0195	$794
126		$16,966	$16,966	0.0189	$321
127		$16,966	$16,966	0.0183	$310
128		$16,966	$16,966	0.0177	$300
129		$16,966	$16,966	0.0172	$292
130		$40,716	$40,716	0.0167	$680
131		$16,966	$16,966	0.0161	$273
132		$16,966	$16,966	0.0156	$265
133		$16,966	$16,966	0.0152	$258
134		$16,966	$16,966	0.0147	$249
135		$40,716	$40,716	0.0142	$578
136		$16,966	$16,966	0.0138	$234
137		$16,966	$16,966	0.0134	$227
138		$16,966	$16,966	0.0129	$219
139		$16,966	$16,966	0.0125	$212
140		$40,716	$40,716	0.0122	$497
141		$16,966	$16,966	0.0118	$200
142		$16,966	$16,966	0.0114	$193
143		$16,966	$16,966	0.0111	$188
144		$16,966	$16,966	0.0107	$182
145		$40,716	$40,716	0.0104	$423
146		$16,966	$16,966	0.0101	$171
147		$16,966	$16,966	0.0098	$166
148		$16,966	$16,966	0.0094	$159
149		$16,966	$16,966	0.0092	$156
150		$40,716	$40,716	0.0089	$362
				TOTAL PRESENT WORTH	$683,381

1 Discount rate column is a calculated annual multiplier when discount rate = $(1-e)^n$ where e = 3.2% and n = year (1 - 150).

Table D-16. (Alternative 2), 216-B-7A&B Crib Representative Site, Calculation Sheet 200-TW-2 Tank Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Purchase, deliver, and place topsoil											
Purchase pea gravel (purchase and delivery)	0.5	cy		$55.67			$0	$28	$0	$0	$28
Silt loam, from Pit 30 excavate/load (4.5 cy)	1	day			$296.00	$1,190.17	$0	$0	$296	$1,190	$1,486
Silt loam hauling, 1 truck	1	day			$296.00	$398.55	$0	$0	$296	$399	$695
Equipment mob/demob (front-end loader)	3	ea			$100.00	$352.00	$0	$0	$300	$1,056	$1,356
Place, grade, and compact backfill	5	cy		$14.00	$10.00	$5.68	$0	$70	$50	$28	$148
Fine grading and seeding, incl. lime, fert. and seed	8	sy		$0.26	$1.19	$0.18	$0	$2	$10	$1	$13
Oversight (1 day x 8 hrs/day)	8	hrs			$56.00		$0	$0	$448	$0	$448
Subtotal Direct Costs							$0	$100	$1,400	$2,675	$4,174

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Drill vadose zone borehole (cost occurs every 30 years)											
Mobilize/demobilize drill rig	1	ls			$625.00	$1,875.00	$0	$0	$625	$1,875	$2,500
Borings for vadose zone borehole (50 ft)	50	lf			$8.77	$36.23	$0	$0	$439	$1,811	$2,250
Decontamination of drill rig	1	ls	$1,000.00				$1,000	$0	$0	$0	$1,000
Collect/containerize IDW	1	ea	$50.00				$50	$0	$0	$0	$50
Characterize IDW	1	ea	$700.00				$700	$0	$0	$0	$700
Transport/dispose IDW offsite	1	drums	$150.00				$150	$0	$0	$0	$150
Oversight (includes sampling, labor, and equipment)	8	hrs			$56.00		$0	$0	$448	$0	$448
PPE (1 p * 1 day)	1	day		$31.67			$0	$32	$0	$0	$32
Subtotal Direct Costs							$1,900	$32	$1,512	$3,686	$7,130

Table D-17. (Alternative 2), 216-B-38 Trench Representative Site, Capital Cost 200-TW-2 Scavenged Tank Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost: Subcontract	Unit Cost: Material	Unit Cost: Labor	Unit Cost: Equipment	Extended Cost: Subcontract	Extended Cost: Material	Extended Cost: Labor	Extended Cost: Equipment	Subtotal
FLUOR HANFORD COST											
IMPLEMENT INSTITUTIONAL CONTROLS											
Prepare Deed Restrictions	200	hr			$56.00		$0	$0	$11,200	$0	$11,200
Fluor Hanford Field Costs							$0	$0	$11,200	$0	$11,200
Fluor Hanford G & A on Labor Cost @	15%								$1,680		$1,680
Fluor Hanford G & A on Material Cost @	15%							$0			$0
Fluor Hanford G & A on Equipment Cost @	15%									$0	$0
Fluor Hanford Total Cost							$0	$0	$12,880	$0	$12,880
Contingency on Total Field Costs	20%										$2,576
TOTAL COST											$15,456

G&A = General and administrative.

Table D-18. (Alternative 2), 216-B-38 Trench Representative Site, Periodic Cost 200-TW-2 Tank Waste Group, Hanford Site, Washington State.

Item	Item Cost			Notes
	Annually	per 5 Years	per 30 Years	
Site inspection	$7,168			Cost is based on 16 hours @ $112/hr for every 50,000 feet². Site = 165,850 ft².
Radiation survey of surface soil	$33,000			Cost is based on $1,000 for every 5,000 ft². Site = 165,850 ft².
Existing cover Maintenance	$64,782			Cost includes the purchas of soil to repair ruts and holes over 10% of the site area. Refer to Table D-20.
Vadose zone monitoring		$3,750	$7,130	Monitoring occurs once every 5 years at a cost of $75/lf of borehole. Bore hole replacement occurs once every 30 years. Refer to Table D-20.
Reporting	$10,000			Obtain lab, prepare sampling plan, document sampling event and results.
Site reviews		$20,000		Prepare site condition report.

TOTALS	**$114,950**	**$23,750**	**$7,130**

Table D-19. (Alternative 2), 216-B-38 Trench Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
0	$15,456		$15,456	1.0000	$15,456
1		$114,950	$114,950	0.9690	$111,387
2		$114,950	$114,950	0.9389	$107,927
3		$114,950	$114,950	0.9098	$104,582
4		$114,950	$114,950	0.8816	$101,340
5		$138,700	$138,700	0.8543	$118,492
6		$114,950	$114,950	0.8278	$95,156
7		$114,950	$114,950	0.8021	$92,202
8		$114,950	$114,950	0.7773	$89,351
9		$114,950	$114,950	0.7532	$86,581
10		$138,700	$138,700	0.7298	$101,223
11		$114,950	$114,950	0.7072	$81,293
12		$114,950	$114,950	0.6852	$78,764
13		$114,950	$114,950	0.6640	$76,327
14		$114,950	$114,950	0.6434	$73,959
15		$138,700	$138,700	0.6235	$86,480
16		$114,950	$114,950	0.6041	$69,441
17		$114,950	$114,950	0.5854	$67,292
18		$114,950	$114,950	0.5672	$65,200
19		$114,950	$114,950	0.5496	$63,177
20		$138,700	$138,700	0.5326	$73,872
21		$114,950	$114,950	0.5161	$59,326
22		$114,950	$114,950	0.5001	$57,487
23		$114,950	$114,950	0.4846	$55,705
24		$114,950	$114,950	0.4696	$53,981
25		$138,700	$138,700	0.4550	$63,109
26		$114,950	$114,950	0.4409	$50,682
27		$114,950	$114,950	0.4272	$49,107
28		$114,950	$114,950	0.4140	$47,589
29		$114,950	$114,950	0.4011	$46,107
30		$145,830	$145,830	0.3887	$56,684
31		$114,950	$114,950	0.3766	$43,290
32		$114,950	$114,950	0.3650	$41,957
33		$114,950	$114,950	0.3536	$40,646
34		$114,950	$114,950	0.3427	$39,393
35		$138,700	$138,700	0.3321	$46,062
36		$114,950	$114,950	0.3218	$36,991
37		$114,950	$114,950	0.3118	$35,841
38		$114,950	$114,950	0.3021	$34,726
39		$114,950	$114,950	0.2927	$33,646
40		$138,700	$138,700	0.2837	$39,349

Table D-19. (Alternative 2), 216-B-38 Trench Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
41		$114,950	$114,950	0.2749	$31,600
42		$114,950	$114,950	0.2664	$30,623
43		$114,950	$114,950	0.2581	$29,669
44		$114,950	$114,950	0.2501	$28,749
45		$138,700	$138,700	0.2423	$33,607
46		$114,950	$114,950	0.2348	$26,990
47		$114,950	$114,950	0.2275	$26,151
48		$114,950	$114,950	0.2205	$25,347
49		$114,950	$114,950	0.2136	$24,553
50		$138,700	$138,700	0.2070	$28,711
51		$114,950	$114,950	0.2006	$23,059
52		$114,950	$114,950	0.1944	$22,346
53		$114,950	$114,950	0.1884	$21,657
54		$114,950	$114,950	0.1825	$20,978
55		$138,700	$138,700	0.1769	$24,536
56		$114,950	$114,950	0.1714	$19,702
57		$114,950	$114,950	0.1661	$19,093
58		$114,950	$114,950	0.1609	$18,496
59		$114,950	$114,950	0.1559	$17,921
60		$145,830	$145,830	0.1511	$22,035
61		$114,950	$114,950	0.1464	$16,829
62		$114,950	$114,950	0.1419	$16,311
63		$114,950	$114,950	0.1375	$15,806
64		$114,950	$114,950	0.1332	$15,311
65		$138,700	$138,700	0.1291	$17,906
66		$114,950	$114,950	0.1251	$14,380
67		$114,950	$114,950	0.1212	$13,932
68		$114,950	$114,950	0.1174	$13,495
69		$114,950	$114,950	0.1138	$13,081
70		$138,700	$138,700	0.1103	$15,299
71		$114,950	$114,950	0.1068	$12,277
72		$114,950	$114,950	0.1035	$11,897
73		$114,950	$114,950	0.1003	$11,530
74		$114,950	$114,950	0.0972	$11,173
75		$138,700	$138,700	0.0942	$13,066
76		$114,950	$114,950	0.0913	$10,495
77		$114,950	$114,950	0.0884	$10,162
78		$114,950	$114,950	0.0857	$9,851
79		$114,950	$114,950	0.0830	$9,541
80		$138,700	$138,700	0.0805	$11,165
81		$114,950	$114,950	0.0780	$8,966
82		$114,950	$114,950	0.0756	$8,690

Table D-19. (Alternative 2), 216-B-38 Trench Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
83		$114,950	$114,950	0.0732	$8,414
84		$114,950	$114,950	0.0709	$8,150
85		$138,700	$138,700	0.0687	$9,529
86		$114,950	$114,950	0.0666	$7,656
87		$114,950	$114,950	0.0645	$7,414
88		$114,950	$114,950	0.0625	$7,184
89		$114,950	$114,950	0.0606	$6,966
90		$145,830	$145,830	0.0587	$8,560
91		$114,950	$114,950	0.0569	$6,541
92		$114,950	$114,950	0.0551	$6,334
93		$114,950	$114,950	0.0534	$6,138
94		$114,950	$114,950	0.0518	$5,954
95		$138,700	$138,700	0.0502	$6,963
96		$114,950	$114,950	0.0486	$5,587
97		$114,950	$114,950	0.0471	$5,414
98		$114,950	$114,950	0.0456	$5,242
99		$114,950	$114,950	0.0442	$5,081
100		$138,700	$138,700	0.0429	$5,950
101		$114,950	$114,950	0.0415	$4,770
102		$114,950	$114,950	0.0402	$4,621
103		$114,950	$114,950	0.0390	$4,483
104		$114,950	$114,950	0.0378	$4,345
105		$138,700	$138,700	0.0366	$5,076
106		$114,950	$114,950	0.0355	$4,081
107		$114,950	$114,950	0.0344	$3,954
108		$114,950	$114,950	0.0333	$3,828
109		$114,950	$114,950	0.0323	$3,713
110		$138,700	$138,700	0.0313	$4,341
111		$114,950	$114,950	0.0303	$3,483
112		$114,950	$114,950	0.0294	$3,380
113		$114,950	$114,950	0.0285	$3,276
114		$114,950	$114,950	0.0276	$3,173
115		$138,700	$138,700	0.0267	$3,703
116		$114,950	$114,950	0.0259	$2,977
117		$114,950	$114,950	0.0251	$2,885
118		$114,950	$114,950	0.0243	$2,793
119		$114,950	$114,950	0.0236	$2,713
120		$145,830	$145,830	0.0228	$3,325
121		$114,950	$114,950	0.0221	$2,540
122		$114,950	$114,950	0.0214	$2,460
123		$114,950	$114,950	0.0208	$2,391
124		$114,950	$114,950	0.0201	$2,311

Table D-19. (Alternative 2), 216-B-38 Trench Representative Site, Present Worth Analysis 200-TW-2 Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
125		$138,700	$138,700	0.0195	$2,705
126		$114,950	$114,950	0.0189	$2,173
127		$114,950	$114,950	0.0183	$2,104
128		$114,950	$114,950	0.0177	$2,035
129		$114,950	$114,950	0.0172	$1,977
130		$138,700	$138,700	0.0167	$2,316
131		$114,950	$114,950	0.0161	$1,851
132		$114,950	$114,950	0.0156	$1,793
133		$114,950	$114,950	0.0152	$1,747
134		$114,950	$114,950	0.0147	$1,690
135		$138,700	$138,700	0.0142	$1,970
136		$114,950	$114,950	0.0138	$1,586
137		$114,950	$114,950	0.0134	$1,540
138		$114,950	$114,950	0.0129	$1,483
139		$114,950	$114,950	0.0125	$1,437
140		$138,700	$138,700	0.0122	$1,692
141		$114,950	$114,950	0.0118	$1,356
142		$114,950	$114,950	0.0114	$1,310
143		$114,950	$114,950	0.0111	$1,276
144		$114,950	$114,950	0.0107	$1,230
145		$138,700	$138,700	0.0104	$1,442
146		$114,950	$114,950	0.0101	$1,161
147		$114,950	$114,950	0.0098	$1,127
148		$114,950	$114,950	0.0094	$1,081
149		$114,950	$114,950	0.0092	$1,058
150		$138,700	$138,700	0.0089	$1,234
				TOTAL PRESENT WORTH	$3,718,238

1. Discount rate column is a calculated annual multiplier when discount rate = $(1-e)^n$ where e = 3.2% and n = year (1 - 150).

Table D-20. (Alternative 2), 216-B-38 Trench Representative Site, Calculation Sheet 200-TW-2 Tank Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Purchase, deliver, and place topsoil											
Purchase pea gravel (purchase and delivery)	123.0	cy		$55.67			$0	$6,847	$0	$0	$6,847
Silt loam, from Pit 30 excavate/load (1,107 cy)	5	day			$296.00	$1,190.17	$0	$0	$1,480	$5,951	$7,431
Silt loam hauling, 2 trucks (5 days each)	10	day			$296.00	$398.55	$0	$0	$2,960	$3,986	$6,946
Equipment mob/demob (front-end loader)	4	ea			$100.00	$352.00	$0	$0	$400	$1,408	$1,808
Place, grade, and compact backfill	1,230	cy		$14.00	$10.00	$5.68	$0	$17,220	$12,300	$6,986	$36,508
Fine grading and seeding, incl. lime, fert, and seed	1,843	sy		$0.26	$1.19	$0.18	$0	$479	$2,193	$332	$3,004
Oversight (5 days x 8 hrs/day)	40	hrs			$56.00		$0	$0	$2,240	$0	$2,240
Subtotal Direct Costs							$0	$24,547	$21,573	$18,663	$64,782

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Drill vadose zone borehole (cost occurs every 30 years)											
Mobilize/demobilize drill rig	1	ls			$625.00	$1,875.00	$0	$0	$625	$1,875	$2,500
Borings for vadose zone borehole (50 ft)	50	lf			$8.77	$36.23	$0	$0	$439	$1,811	$2,250
Decontamination of drill rig	1	ls	$1,000.00				$1,000	$0	$0	$0	$1,000
Collect/containerize IDW	1	ea	$50.00				$50	$0	$0	$0	$50
Characterize IDW	1	ea	$700.00				$700	$0	$0	$0	$700
Transport/dispose IDW offsite	1	drum	$150.00				$150	$0	$0	$0	$150
Oversight (includes sampling, labor, and equipment)	8	hrs			$56.00		$0	$0	$448	$0	$448
PPE (1 p * 1 day)	1	day		$31.67			$0	$32	$0	$0	$32
Subtotal Direct Costs							$1,900	$32	$1,512	$3,686	$7,130

IDW = Investigation derived waste.
PPE = Personal protective equipment.

Table D-21. (Alternative 2), 216-B-57 Crib Representative Site, Capital Cost 200-PW-5 Fission Product Rich ProcessWaste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
FLUOR HANFORD COST											
IMPLEMENT INSTITUTIONAL CONTROLS											
Prepare Deed Restrictions	200	hr			$56.00		$0	$0	$11,200	$0	$11,200
Fluor Hanford Field Costs							$0	$0	$11,200	$0	$11,200
Fluor Hanford G & A on Labor Cost @	15%						$0	$0	$1,680	$0	$1,680
Fluor Hanford G & A on Material Cost @	15%						$0	$0	$0	$0	$0
Fluor Hanford G & A on Equipment Cost @	15%						$0	$0	$0	$0	$0
Fluor Hanford Total Cost							$0	$0	$12,880	$0	$12,880
Contingency on Total Field Costs @	20%										$2,576
TOTAL COST											$15,456

G&A = General and administrative.

Table D-22. (Alternative 2), 216-B-57 Crib Representative Site, Periodic Cost 200-PW-5 Fission Product Rich Process Waste Group, Hanford Site, Washington State.

Item	Item Cost			Notes
	Annually	per 5 Years	per 30 Years	
Site inspection	$1,792			Cost is based on 16 hours @ $112/hr for every 50,000 feet^2. Site = 3,000 ft^2.
Radiation survey of surface soil	$1,000			Cost is based on $1,000 for every 5,000 ft^2. Site = 3,000 ft^2.
Existing cover maintenance	$4,776			Cost includes the purchase of soil to repair ruts and holes over 10% of the site area. Refer to Table D-24.
Vadose zone monitoring		$3,750	$7,130	Monitoring occurs once every 5 years at a cost of $75/lf of borehole. Borehole replacement occurs once every 30 years. Refer to Table D-24.
Reporting	$10,000			Obtain lab, prepare sampling plan, document sampling event and results.
Site reviews		$20,000		Prepare site condition report.

TOTALS	$17,568	$23,750	$7,130

Table D-23. (Alternative 2), 216-B-57 Crib Representative Site, Present Worth Analysis 200-PW-5 Fission Product Rich Process Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%	Present Worth
0	$15,456		$15,456	1.0000	$15,456
1		$17,568	$17,568	0.9690	$17,024
2		$17,568	$17,568	0.9389	$16,495
3		$17,568	$17,568	0.9098	$15,984
4		$17,568	$17,568	0.8816	$15,488
5		$41,318	$41,318	0.8543	$35,298
6		$17,568	$17,568	0.8278	$14,543
7		$17,568	$17,568	0.8021	$14,092
8		$17,568	$17,568	0.7773	$13,656
9		$17,568	$17,568	0.7532	$13,233
10		$41,318	$41,318	0.7298	$30,154
11		$17,568	$17,568	0.7072	$12,424
12		$17,568	$17,568	0.6852	$12,038
13		$17,568	$17,568	0.6640	$11,665
14		$17,568	$17,568	0.6434	$11,304
15		$41,318	$41,318	0.6235	$25,762
16		$17,568	$17,568	0.6041	$10,613
17		$17,568	$17,568	0.5854	$10,285
18		$17,568	$17,568	0.5672	$9,965
19		$17,568	$17,568	0.5496	$9,656
20		$41,318	$41,318	0.5326	$22,006
21		$17,568	$17,568	0.5161	$9,067
22		$17,568	$17,568	0.5001	$8,786
23		$17,568	$17,568	0.4846	$8,514
24		$17,568	$17,568	0.4696	$8,250
25		$41,318	$41,318	0.4550	$18,800
26		$17,568	$17,568	0.4409	$7,746
27		$17,568	$17,568	0.4272	$7,505
28		$17,568	$17,568	0.4140	$7,273
29		$17,568	$17,568	0.4011	$7,047
30		$48,448	$48,448	0.3887	$18,832
31		$17,568	$17,568	0.3766	$6,616
32		$17,568	$17,568	0.3650	$6,412
33		$17,568	$17,568	0.3536	$6,212
34		$17,568	$17,568	0.3427	$6,021
35		$41,318	$41,318	0.3321	$13,722
36		$17,568	$17,568	0.3218	$5,654
37		$17,568	$17,568	0.3118	$5,478
38		$17,568	$17,568	0.3021	$5,307
39		$17,568	$17,568	0.2927	$5,142
40		$41,318	$41,318	0.2837	$11,722

Table D-23. (Alternative 2), 216-B-57 Crib Representative Site, Present Worth Analysis 200-PW-5 Fission Product Rich Process Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%	Present Worth
41		$17,568	$17,568	0.2749	$4,830
42		$17,568	$17,568	0.2664	$4,680
43		$17,568	$17,568	0.2581	$4,534
44		$17,568	$17,568	0.2501	$4,394
45		$41,318	$41,318	0.2423	$10,011
46		$17,568	$17,568	0.2348	$4,125
47		$17,568	$17,568	0.2275	$3,997
48		$17,568	$17,568	0.2205	$3,874
49		$17,568	$17,568	0.2136	$3,753
50		$41,318	$41,318	0.2070	$8,553
51		$17,568	$17,568	0.2006	$3,524
52		$17,568	$17,568	0.1944	$3,415
53		$17,568	$17,568	0.1884	$3,310
54		$17,568	$17,568	0.1825	$3,206
55		$41,318	$41,318	0.1769	$7,309
56		$17,568	$17,568	0.1714	$3,011
57		$17,568	$17,568	0.1661	$2,918
58		$17,568	$17,568	0.1609	$2,827
59		$17,568	$17,568	0.1559	$2,739
60		$48,448	$48,448	0.1511	$7,321
61		$17,568	$17,568	0.1464	$2,572
62		$17,568	$17,568	0.1419	$2,493
63		$17,568	$17,568	0.1375	$2,416
64		$17,568	$17,568	0.1332	$2,340
65		$41,318	$41,318	0.1291	$5,334
66		$17,568	$17,568	0.1251	$2,198
67		$17,568	$17,568	0.1212	$2,129
68		$17,568	$17,568	0.1174	$2,063
69		$17,568	$17,568	0.1138	$1,999
70		$41,318	$41,318	0.1103	$4,557
71		$17,568	$17,568	0.1068	$1,876
72		$17,568	$17,568	0.1035	$1,818
73		$17,568	$17,568	0.1003	$1,762
74		$17,568	$17,568	0.0972	$1,708
75		$41,318	$41,318	0.0942	$3,892
76		$17,568	$17,568	0.0913	$1,604
77		$17,568	$17,568	0.0884	$1,553
78		$17,568	$17,568	0.0857	$1,506
79		$17,568	$17,568	0.0830	$1,458
80		$41,318	$41,318	0.0805	$3,326
81		$17,568	$17,568	0.0780	$1,370
82		$17,568	$17,568	0.0756	$1,328
83		$17,568	$17,568	0.0732	$1,286

Table D-23. (Alternative 2), 216-B-57 Crib Representative Site, Present Worth Analysis 200-PW-5 Fission Product Rich Process Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%	Present Worth
84		$17,568	$17,568	0.0709	$1,246
85		$41,318	$41,318	0.0687	$2,839
86		$17,568	$17,568	0.0666	$1,170
87		$17,568	$17,568	0.0645	$1,133
88		$17,568	$17,568	0.0625	$1,098
89		$17,568	$17,568	0.0606	$1,065
90		$48,448	$48,448	0.0587	$2,844
91		$17,568	$17,568	0.0569	$1,000
92		$17,568	$17,568	0.0551	$968
93		$17,568	$17,568	0.0534	$938
94		$17,568	$17,568	0.0518	$910
95		$41,318	$41,318	0.0502	$2,074
96		$17,568	$17,568	0.0486	$854
97		$17,568	$17,568	0.0471	$827
98		$17,568	$17,568	0.0456	$801
99		$17,568	$17,568	0.0442	$777
100		$41,318	$41,318	0.0429	$1,773
101		$17,568	$17,568	0.0415	$729
102		$17,568	$17,568	0.0402	$706
103		$17,568	$17,568	0.0390	$685
104		$17,568	$17,568	0.0378	$664
105		$41,318	$41,318	0.0366	$1,512
106		$17,568	$17,568	0.0355	$624
107		$17,568	$17,568	0.0344	$604
108		$17,568	$17,568	0.0333	$585
109		$17,568	$17,568	0.0323	$567
110		$41,318	$41,318	0.0313	$1,293
111		$17,568	$17,568	0.0303	$532
112		$17,568	$17,568	0.0294	$517
113		$17,568	$17,568	0.0285	$501
114		$17,568	$17,568	0.0276	$485
115		$41,318	$41,318	0.0267	$1,103
116		$17,568	$17,568	0.0259	$455
117		$17,568	$17,568	0.0251	$441
118		$17,568	$17,568	0.0243	$427
119		$17,568	$17,568	0.0236	$415
120		$48,448	$48,448	0.0228	$1,105
121		$17,568	$17,568	0.0221	$388
122		$17,568	$17,568	0.0214	$376
123		$17,568	$17,568	0.0208	$365
124		$17,568	$17,568	0.0201	$353
125		$41,318	$41,318	0.0195	$806
126		$17,568	$17,568	0.0189	$332

Table D-23. (Alternative 2), 216-B-57 Crib Representative Site, Present Worth Analysis 200-PW-5 Fission Product Rich Process Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%	Present Worth
127		$17,568	$17,568	0.0183	$322
128		$17,568	$17,568	0.0177	$311
129		$17,568	$17,568	0.0172	$302
130		$41,318	$41,318	0.0167	$690
131		$17,568	$17,568	0.0161	$283
132		$17,568	$17,568	0.0156	$274
133		$17,568	$17,568	0.0152	$267
134		$17,568	$17,568	0.0147	$258
135		$41,318	$41,318	0.0142	$587
136		$17,568	$17,568	0.0138	$242
137		$17,568	$17,568	0.0134	$235
138		$17,568	$17,568	0.0129	$227
139		$17,568	$17,568	0.0125	$220
140		$41,318	$41,318	0.0122	$504
141		$17,568	$17,568	0.0118	$207
142		$17,568	$17,568	0.0114	$200
143		$17,568	$17,568	0.0111	$195
144		$17,568	$17,568	0.0107	$188
145		$41,318	$41,318	0.0104	$430
146		$17,568	$17,568	0.0101	$177
147		$17,568	$17,568	0.0098	$172
148		$17,568	$17,568	0.0094	$165
149		$17,568	$17,568	0.0092	$162
150		$41,318	$41,318	0.0089	$368
				TOTAL PRESENT WORTH	$702,841

1. Discount rate column is a calculated annual multiplier when discount rate = $(1-e)^n$ where e = 3.2% and n = year (1 - 150).

Table D-24. (Alternative 2), 216-B-57 Crib Representative Site, Calculation Sheet 200-PW-2 Fission Product Rich Process Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Purchase, deliver, and place topsoil											
Purchase pea gravel (purchase and delivery)	2.2	cy		$55.67			$0	$122	$0	$0	$122
Silt loam, from Pit 30 excavate/load (19.8 cy)	1	day			$296.00	$1,190.17	$0	$0	$296	$1,190	$1,486
Silt loam hauling, 1 truck	1	day			$296.00	$398.55	$0	$0	$296	$399	$695
Equipment mob/demob (front-end loader)	3	ea			$100.00	$352.00	$0	$0	$300	$1,056	$1,356
Place, grade, and compact backfill	22	cy		$14.00	$10.00	$5.68	$0	$308	$220	$125	$653
Fine grading and seeding, incl. lime, fert, and seed	10	sy		$0.26	$1.19	$0.18	$0	$3	$12	$2	$16
Oversight (1 day x 8 hrs/day)	8	hrs			$56.00		$0	$0	$448	$0	$448
Subtotal Direct Costs							$0	$433	$1,572	$2,771	$4,776

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Drill vadose zone borehole (cost occurs every 30 years)											
Mobilize/demobilize drill rig	1	ls			$625.00	$1,875.00	$0	$0	$625	$1,875	$2,500
Borings for vadose zone borehole (50 ft)	50	lf			$8.77	$36.23	$0	$0	$439	$1,811	$2,250
Decontamination of drill rig	1	ls	$1,000.00				$1,000	$0	$0	$0	$1,000
Collect/containerize IDW	1	ea	$50.00				$50	$0	$0	$0	$50
Characterize IDW	1	ea	$700.00				$700	$0	$0	$0	$700
Transport/dispose IDW offsite	1	drum	$150.00				$150	$0	$0	$0	$150
Oversight (includes sampling, labor, and equipment)	8	hrs			$56.00		$0	$0	$448	$0	$448
PPE (1 p * 1 day)	1	day		$31.67			$0	$32	$0	$0	$32
Subtotal Direct Costs							$1,900	$32	$1,512	$3,686	$7,130

Table D-25. (Alternative 2), 241-B-361 Settling Tank, Capital Cost 200-TW-2 Tank Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
FLUOR HANFORD COST											
IMPLEMENT INSTITUTIONAL CONTROLS											
Prepare Institutional Controls	200	hr			$56.00		$0	$0	$11,200	$0	$11,200
Fluor Hanford Field Costs							$0	$0	$11,200	$0	$11,200
Fluor Hanford G & A on Labor Cost @	15%								$1,680		$1,680
Fluor Hanford G & A on Material Cost @	15%							$0			$0
Fluor Hanford G & A on Subcontract Cost @	15%									$0	$0
Fluor Hanford Total Cost							$0	$0	$12,880	$0	$12,880
Contingency on Total Field Costs	20%										$2,576
TOTAL COST MINUS SLUDGE REMOVAL											$15,456
Sludge Removal											$6,000,000
TOTAL COST											$6,015,456

G&A = General and administrative.

Table D-26. (Alternative 2), 241-B-361 Settling Tank, Periodic Cost 200-TW-2 Tank Waste Group, Hanford Site, Washington State.

Item	Item Cost			Notes
	Annually	per 5 Years	per 30 Years	
Site inspection	$1,792			Cost is based on 16 hours @ $112/hr for every 50,000 ft^2. Site = 314 sf.
Radiation survey of surface soil	$1,000			Cost is based on $1,000 for every 5,000 ft^2. (Site = 314 ft^2.
Existing cover maintenance	$4,097			Cost includes the purchase of soil to repair ruts and holes over 10% of the site area. Refer to Table D-28.
Vadose zone monitoring		$3,750	$7,130	Monitoring occurs once every 5 years at a cost of $75/lf of borehole. Borehole replacement occurs once every 30 years. Refer to Table D-28.
Reporting	$10,000			Obtain lab, prepare sampling plan, document sampling event and results.
Site reviews		$20,000		Prepare site condition report.
TOTALS	$16,889	$23,750	$7,130	

Table D-27. (Alternative 2), 241-B-361 Settling Tank, Present Worth Analysis 200-TW-2 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
0	$6,015,456		$6,015,456	1.0000	$6,015,456
1		$16,889	$16,889	0.9690	$16,365
2		$16,889	$16,889	0.9389	$15,857
3		$16,889	$16,889	0.9098	$15,366
4		$16,889	$16,889	0.8816	$14,889
5		$40,639	$40,639	0.8543	$34,718
6		$16,889	$16,889	0.8278	$13,981
7		$16,889	$16,889	0.8021	$13,547
8		$16,889	$16,889	0.7773	$13,128
9		$16,889	$16,889	0.7532	$12,721
10		$40,639	$40,639	0.7298	$29,658
11		$16,889	$16,889	0.7072	$11,944
12		$16,889	$16,889	0.6852	$11,572
13		$16,889	$16,889	0.6640	$11,214
14		$16,889	$16,889	0.6434	$10,866
15		$40,639	$40,639	0.6235	$25,338
16		$16,889	$16,889	0.6041	$10,203
17		$16,889	$16,889	0.5854	$9,887
18		$16,889	$16,889	0.5672	$9,579
19		$16,889	$16,889	0.5496	$9,282
20		$40,639	$40,639	0.5326	$21,644
21		$16,889	$16,889	0.5161	$8,716
22		$16,889	$16,889	0.5001	$8,446
23		$16,889	$16,889	0.4846	$8,184
24		$16,889	$16,889	0.4696	$7,931
25		$40,639	$40,639	0.4550	$18,491
26		$16,889	$16,889	0.4409	$7,446
27		$16,889	$16,889	0.4272	$7,215
28		$16,889	$16,889	0.4140	$6,992
29		$16,889	$16,889	0.4011	$6,774
30		$47,769	$47,769	0.3887	$18,568
31		$16,889	$16,889	0.3766	$6,360
32		$16,889	$16,889	0.3650	$6,164
33		$16,889	$16,889	0.3536	$5,972
34		$16,889	$16,889	0.3427	$5,788
35		$40,639	$40,639	0.3321	$13,496
36		$16,889	$16,889	0.3218	$5,435
37		$16,889	$16,889	0.3118	$5,266
38		$16,889	$16,889	0.3021	$5,102
39		$16,889	$16,889	0.2927	$4,943
40		$40,639	$40,639	0.2837	$11,529

Table D-27. (Alternative 2), 241-B-361 Settling Tank, Present Worth Analysis 200-TW-2 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
41		$16,889	$16,889	0.2749	$4,643
42		$16,889	$16,889	0.2664	$4,499
43		$16,889	$16,889	0.2581	$4,359
44		$16,889	$16,889	0.2501	$4,224
45		$40,639	$40,639	0.2423	$9,847
46		$16,889	$16,889	0.2348	$3,966
47		$16,889	$16,889	0.2275	$3,842
48		$16,889	$16,889	0.2205	$3,724
49		$16,889	$16,889	0.2136	$3,607
50		$40,639	$40,639	0.2070	$8,412
51		$16,889	$16,889	0.2006	$3,388
52		$16,889	$16,889	0.1944	$3,283
53		$16,889	$16,889	0.1884	$3,182
54		$16,889	$16,889	0.1825	$3,082
55		$40,639	$40,639	0.1769	$7,189
56		$16,889	$16,889	0.1714	$2,895
57		$16,889	$16,889	0.1661	$2,805
58		$16,889	$16,889	0.1609	$2,717
59		$16,889	$16,889	0.1559	$2,633
60		$47,769	$47,769	0.1511	$7,218
61		$16,889	$16,889	0.1464	$2,473
62		$16,889	$16,889	0.1419	$2,397
63		$16,889	$16,889	0.1375	$2,322
64		$16,889	$16,889	0.1332	$2,250
65		$40,639	$40,639	0.1291	$5,246
66		$16,889	$16,889	0.1251	$2,113
67		$16,889	$16,889	0.1212	$2,047
68		$16,889	$16,889	0.1174	$1,983
69		$16,889	$16,889	0.1138	$1,922
70		$40,639	$40,639	0.1103	$4,482
71		$16,889	$16,889	0.1068	$1,804
72		$16,889	$16,889	0.1035	$1,748
73		$16,889	$16,889	0.1003	$1,694
74		$16,889	$16,889	0.0972	$1,642
75		$40,639	$40,639	0.0942	$3,828
76		$16,889	$16,889	0.0913	$1,542
77		$16,889	$16,889	0.0884	$1,493
78		$16,889	$16,889	0.0857	$1,447
79		$16,889	$16,889	0.0830	$1,402
80		$40,639	$40,639	0.0805	$3,271
81		$16,889	$16,889	0.0780	$1,317
82		$16,889	$16,889	0.0756	$1,277
83		$16,889	$16,889	0.0732	$1,236

Table D-27. (Alternative 2), 241-B-361 Settling Tank, Present Worth Analysis 200-TW-2 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
84		$16,889	$16,889	0.0709	$1,197
85		$40,639	$40,639	0.0687	$2,792
86		$16,889	$16,889	0.0666	$1,125
87		$16,889	$16,889	0.0645	$1,089
88		$16,889	$16,889	0.0625	$1,056
89		$16,889	$16,889	0.0606	$1,023
90		$47,769	$47,769	0.0587	$2,804
91		$16,889	$16,889	0.0569	$961
92		$16,889	$16,889	0.0551	$931
93		$16,889	$16,889	0.0534	$902
94		$16,889	$16,889	0.0518	$875
95		$40,639	$40,639	0.0502	$2,040
96		$16,889	$16,889	0.0486	$821
97		$16,889	$16,889	0.0471	$795
98		$16,889	$16,889	0.0456	$770
99		$16,889	$16,889	0.0442	$746
100		$40,639	$40,639	0.0429	$1,743
101		$16,889	$16,889	0.0415	$701
102		$16,889	$16,889	0.0402	$679
103		$16,889	$16,889	0.0390	$659
104		$16,889	$16,889	0.0378	$638
105		$40,639	$40,639	0.0366	$1,487
106		$16,889	$16,889	0.0355	$600
107		$16,889	$16,889	0.0344	$581
108		$16,889	$16,889	0.0333	$562
109		$16,889	$16,889	0.0323	$546
110		$40,639	$40,639	0.0313	$1,272
111		$16,889	$16,889	0.0303	$512
112		$16,889	$16,889	0.0294	$497
113		$16,889	$16,889	0.0285	$481
114		$16,889	$16,889	0.0276	$466
115		$40,639	$40,639	0.0267	$1,085
116		$16,889	$16,889	0.0259	$437
117		$16,889	$16,889	0.0251	$424
118		$16,889	$16,889	0.0243	$410
119		$16,889	$16,889	0.0236	$399
120		$47,769	$47,769	0.0228	$1,089
121		$16,889	$16,889	0.0221	$373
122		$16,889	$16,889	0.0214	$361
123		$16,889	$16,889	0.0208	$351
124		$16,889	$16,889	0.0201	$339
125		$40,639	$40,639	0.0195	$792
126		$16,889	$16,889	0.0189	$319

Table D-27. (Alternative 2), 241-B-361 Settling Tank, Present Worth Analysis 200-TW-2 Scavenged Tank Waste Group, Hanford Site, Washington State, (4 pages).

Year	Capital Cost	Annual Cost	Total Year Cost	Annual Discount Rate at 3.2%[1]	Present Worth
127		$16,889	$16,889	0.0183	$309
128		$16,889	$16,889	0.0177	$299
129		$16,889	$16,889	0.0172	$290
130		$40,639	$40,639	0.0167	$679
131		$16,889	$16,889	0.0161	$272
132		$16,889	$16,889	0.0156	$263
133		$16,889	$16,889	0.0152	$257
134		$16,889	$16,889	0.0147	$248
135		$40,639	$40,639	0.0142	$577
136		$16,889	$16,889	0.0138	$233
137		$16,889	$16,889	0.0134	$226
138		$16,889	$16,889	0.0129	$218
139		$16,889	$16,889	0.0125	$211
140		$40,639	$40,639	0.0122	$496
141		$16,889	$16,889	0.0118	$199
142		$16,889	$16,889	0.0114	$193
143		$16,889	$16,889	0.0111	$187
144		$16,889	$16,889	0.0107	$181
145		$40,639	$40,639	0.0104	$423
146		$16,889	$16,889	0.0101	$171
147		$16,889	$16,889	0.0098	$166
148		$16,889	$16,889	0.0094	$159
149		$16,889	$16,889	0.0092	$155
150		$40,639	$40,639	0.0089	$362
				TOTAL PRESENT WORTH	$6,680,995

1. Discount rate column is a calculated annual multiplier when discount rate = $(1-e)^n$ where e = 3.2% and n = year (1 - 150).

Table D-28. (Alternative 2), 241-B-361 Settling Tank, Calculation Sheet 200-TW-2 Tank Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Purchase, deliver, and place topsoil											
Purchase pea gravel (purchase and delivery)	0.3	cy		$55.67			$0	$17	$0	$0	$117
Silt loam, from Pit 30 excavate/load (2.7.8 cy)	1	day			$296.00	$1,190.17	$0	$0	$296	$1,190	$1,486
Silt loam hauling, 1 truck	1	day			$296.00	$398.55	$0	$0	$296	$399	$695
Equipment mob/demob (front-end loader)	3	ea			$100.00	$352.00	$0	$0	$300	$1,056	$1,356
Place, grade, and compact backfill	3	cy		$14.00	$10.00	$5.68	$0	$42	$30	$17	$89
Fine grading and seeding, incl. lime, fert, and seed	4	sy		$0.26	$1.19	$0.18	$0	$1	$5	$1	$7
Oversight (1 day x 8 hrs/day)	8	hrs			$56.00		$0	$0	$448	$0	$448
Subtotal Direct Costs							**$0**	**$60**	**$1,375**	**$2,662**	**$4,097**

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
Drill vadose zone borehole (cost occurs every 30 years)											
Mobilize/demobilize drill rig	1	ls			$625.00	$1,875.00	$0	$0	$625	$1,875	$2,500
Borings for vadose zone borehole (50 ft)	50	lf			$8.77	$36.23	$0	$0	$439	$1,811	$2,250
Decontamination of drill rig	1	ls	$1,000.00				$1,000	$0	$0	$0	$1,000
Collect/containerize IDW	1	ea	$50.00				$50	$0	$0	$0	$50
Characterize IDW	1	ea	$700.00				$700	$0	$0	$0	$700
Transport/dispose IDW offsite	1	drum	$150.00				$150	$0	$0	$0	$150
Oversight (includes sampling, labor, and equipment)	8	hrs			$56.00		$0	$0	$448	$0	$448
PPE (1 p * 1 day)	1	day		$31.67			$0	$32	$0	$0	$32
Subtotal Direct Costs							**$1,900**	**$32**	**$1,512**	**$3,686**	**$7,130**

IDW = Investigation derived waste.
PPE = Personnel protective equipment.

Table D-29. (Alternative 2), 216-B-58 Trench Representative Site, Capital Costs 200-TW-1 Scavenged Tank Waste Group, Hanford Site, Washington State.

Item	Quantity	Unit	Unit Cost				Extended Cost				Subtotal
			Subcontract	Material	Labor	Equipment	Subcontract	Material	Labor	Equipment	
FLUOR HANFORD COST											
IMPLEMENT INSTITUTIONAL CONTROLS											
Prepare Institutional Controls	200	hr			$56.00		$0	$0	$11,200	$0	$11,200
Fluor Hanford Field Cost							$0	$0	$11,200	$0	$11,200
Fluor Hanford G & A on Labor Cost @	15%								$1,680		$1,680
Fluor Hanford G & A on Material Cost @	15%							$0			$0
Fluor Hanford G & A on Equipment Cost @	15%									$0	$0
Fluor Hanford Total Cost							$0	$0	$12,880	$0	$12,880
Contingency on Total Field Cost @	20%										$2,576
TOTAL COST											**$15,456**

G&A = General and administrative.