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Rev. 0

Verification Package for the 300-FF-1 Operable Unit Ash Pits

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Prepared for the U.S. Department of Energy
Office of Environmental Restoration

Bechtel Hanford, Inc.
Richland, Washington

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Author: R. A. Carlson

Approval: C. R. Johnson, 300-FF-1 Task Lead

Charlie Johnson — Signature

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Author
R. A. Carlson

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this verification package is to demonstrate attainment of the remedial action objectives for the ash pits located in the 300-FF-1 Operable Unit (OU). An evaluation of data collected from six test pits excavated in the ash pits is presented in this package. Analysis of data includes field screening and fixed laboratory results. Figure 1 illustrates the configuration of the 300-FF-1 OU and the location of the ash pits within the OU.

1.2 REMEDIATION AUTHORITY

Remediation of the 300-FF-1 OU waste sites is authorized in the 300-FF-1 and 300-FF-5 OUs Record of Decision (ROD) (EPA et al. 1996). Remedial action objectives for this site are also presented in the ROD (which was signed in July 1996) and are discussed in Sections 2.0 and 3.0. Methods for demonstration of attainment of remedial action objectives are presented in the *300-FF-1 Remedial Design Report/Remedial Action Work Plan* (DOE-RL 1977).

2.0 SITE DESCRIPTION

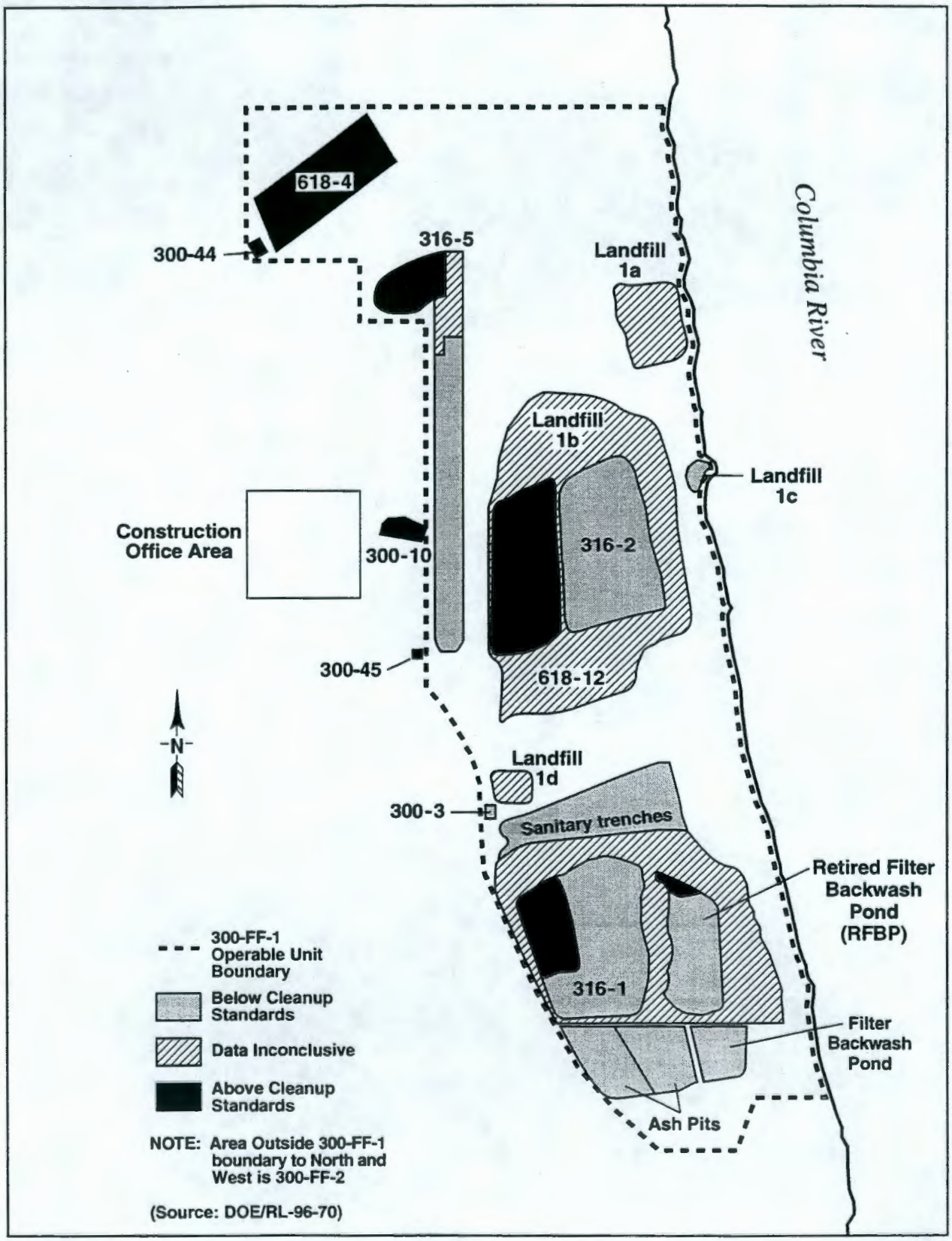
2.1 SITE HISTORY/DESCRIPTION

The 300 Area coal-fired power house generated coal ash starting about 1944. The coal fly ash was suspended in a water slurry and sluiced to the South Process Pond (SPP) until 1951. At that time, the SPP area was reduced by creating a dike near the southern end of the pond. The area south of the new dike was slated for the ash pits; therefore, the ash pits were originally part of the SPP. The original configuration of the ash pits was one long pit and around 1960, the long pit was constructed into two ash pits that represent the current configuration. The pits are approximately 4.6 to 6.1 m (15 to 20 ft) deep and 7,400 m^2 (80,000 ft^2) in area and received about 56,000,000 L/yr (15,000,000 gal/yr) of fly ash slurry during operations. When the ash dried, it was removed from the ash pits and placed near the Columbia River bank, between the North and South Process Ponds and in a number of other locations.

The 300-FF-1 OU contaminants of concern identified in the *300-FF-1 Sampling and Analysis Plan* (SAP)[1] (DOE-RL 1997) are uranium-234, uranium-235, uranium-238, cobalt-60, arsenic, benzo(a)pyrene, chrysene, polychlorinated biphenyls, and thallium. Contaminants encountered during remediation activities are provided in Section 3.0.

[1] The 300-FF-1 SAP is included as Appendix C of the *300-FF-1 Remedial Design Report/Remedial Action Work Plan* (DOE-RL 1997).

Figure 1. 300-FF-1 Operable Unit



E9712007.2

2.2 REMEDIAL ACTION DESCRIPTION

During the 300-FF-1 Phase I remedial investigation (RI), samples of ash from the ash pits were obtained to determine if further investigations would be required at this assumed to be nonhazardous source facility. The RI data indicated metals concentrations in the ash were below cleanup standards. However, the ash pits were constructed in an area that at one time was operationally part of the SSP. The RI did not collect samples from soils below the ash pit sediments that could contain contaminants from the SPP. Therefore, the 300-FF-1 ROD required remedial action at the ash pits to verify no contaminants below the ash pits remained from the previous SPP operations.

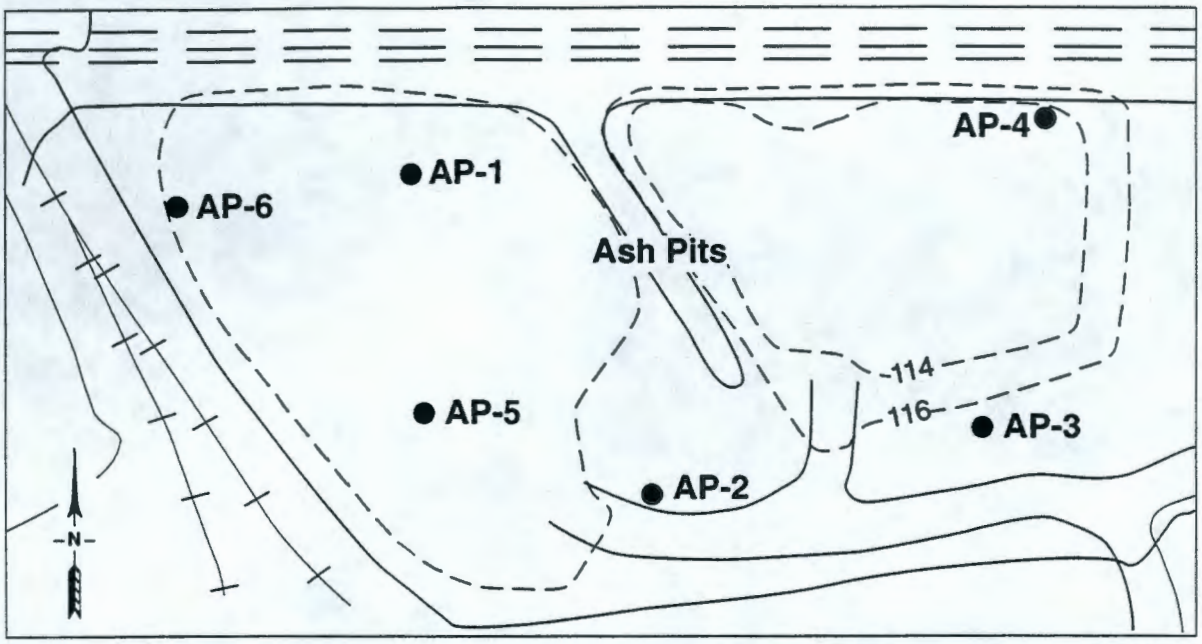
It was determined during the 300-FF-1 SAP data quality objectives (DOE-RL 1997) process that six sample locations be randomly identified in the area of the ash pits. The samples would be taken below the ash pit sediments at a depth approximately 4.6 m (15 ft) below surface grade to verify soils potentially containing contaminants associated with the early operation of the SPP are below the cleanup standards. The ash pits would be considered remediated with no further action required if the data confirms that contaminant levels in the sediments below the ash pits are below the cleanup standards. Six randomly located test pits were excavated on August 13 and 14, 1997, in the ash pits per the coordinates identified in the 300-FF-1 SAP (DOE-RL 1997) and as listed in Table 1. A plan view of the ash pits and test pit locations are depicted in Figure 2. Each test pit was excavated to a depth of 4.6 m (15 ft) below the existing ash pit surface elevation at each test pit location. Field screening was performed on approximate 0.3 m (1 ft) vertical intervals per the requirements of the SAP. Field screening results did not identify any contaminants of concern above the 300-FF-1 ROD cleanup levels, so offsite laboratory verification samples were taken at the bottom of each test pit. The sampler estimated the depth of excavation in the test pits and also documented geologic descriptions of the test pit soils with depth. This information was used to ascertain that the sample being taken was below the ash sediments. The test pits were then backfilled. Results of the field screening and laboratory analysis are discussed further in Sections 3.0 and 4.0.

Table 1. Test Pit Locations.

Test Pit Numbers	Easting (meters)	Northing (meters)	Depth[a] (meters)
AP-1	594,359	115,947	4.6
AP-2	594,250	115,973	4.6
AP-3	594,281	115,978	4.6
AP-4	594,366	115,989	4.6
AP-5	594,284	115,946	4.6
AP-6	594,315	115,936	4.6

[a]Depth of verification samples taken at 4.6 m (15 ft) below each test pits surface elevation.

Figure 2. Ash Pits Plan View and Test Pit Locations.



AP-1 = Ash Pit Test Numbers Scale: 1cm = 10m E9710038.2

3.0 REMEDIAL ACTION OBJECTIVES AND CRITERIA

3.1 REMEDIAL ACTION GOALS

Remedial action goals (RAG) for this site are derived from the RDR/RAWP (DOE-RL 1997). Site-specific cleanup standards are listed in Table 2.

Table 2. Ash Pit Cleanup Standards

Contaminant[a]	MTCA Method C	Surface and Groundwater	Dose Exposure
Arsenic	219 mg/kg	[b]	N/A
Benzo(a)Pyrene	18 mg/kg	[b]	N/A
Chrysene	18 mg/kg	[b]	N/A
Polychlorinated Biphenyls	17 mg/kg	[b]	N/A
Thallium	245 mg/kg	[b]	N/A
Radionuclides[a]	N/A	[b]	15 mrem/yr

[a] 15 mrem/yr equates to 350 pCi/g for uranium in the 300-FF-1 OU industrial scenario.
[b] No additional evaluation of metal and semivolatile organic constituents are required as a qualitative evaluation of the processes that affect transport of contaminants through the OU was performed and documented in the RDR/RAWP (DOE-RL 1997). The qualitative analysis of physicochemical properties of 300-FF-1 OU soils and contaminants show future migration potential of contaminants to be extremely slow and at low concentrations. This coupled with toxicity characteristic leachate procedures results presented strong conclusive physical evidence of slow leaching potential.
[c] This is demonstrated by comparing the uranium results of the verification sampling effort to uranium concentrations modeled under an industrial scenario using the Residual Radioactivity (RESRAD) computer code.
N/A = not applicable

The RAGs for this site include the following:

1. Meeting MTCA Method C standards for metals and semivolatile organics.

2. Meeting 15 mrem/year dose standard above background from uranium. This is demonstrated by comparing the uranium results of the verification sampling effort to uranium concentrations modeled under an industrial scenario using the RESRAD computer code. (The RESRAD modeling used only uranium in developing the radiation cleanup standard because cobalt-60 is of concern only in the SPP and also has a short half-life [5.26 years]. Cobalt-60 concentrations in the SPP averaged about 3.8 pCi/g in 1995, which will decay naturally to a level of insignificant dose contribution by the time cleanup of the OU is completed. No other radionuclides contribute significantly to the total dose.) The cobalt-60 discussion is pertinent to the ash pits verification sampling because the ash pits were constructed over an area that was part of the SPP.

3. Meeting soil cleanup goals that are protective of groundwater and surface water. This is demonstrated by meeting 1 and 2 above and by (a) modeling the uranium results of the verification sampling using the RESRAD computer code and (b) verifying that the new results are equal to or lower than the concentration and time plots from the original analysis.

3.2 SUMMARY STATISTICS

Analysis of the data was performed consistent with the methods in the SAP (DOE-RL 1997). Statistics to demonstrate achievement of the three RAOs were calculated as follows:

1. For metals and semivolatile organics: (a) the 95% upper confidence limit (UCL) for each contaminant was calculated on either the arithmetic or geometric mean, as applicable from six soil samples taken in the bottom of the ash pit test pits, and the results were compared to the MTCA Method C standards (see Table 2); (b) no single sample concentration was greater than two times the MTCA Method C cleanup standards; and (c) less than 10% of the sample concentrations exceed the MTCA Method C cleanup standards.

2. For uranium exposure, the 95% UCL was calculated on the arithmetic or geometric mean, as applicable from the six soil samples taken in the bottom of the ash pit test pits. These results were compared to the RESRAD model results for the 300-FF-1 OU industrial scenario. The RESRAD model parameters used for the industrial scenario are documented in Appendix B of DOE-RL 1997.

3. For groundwater and river protection, the 95% UCL for uranium was calculated on the arithmetic mean from the six soil samples taken in the bottom of the ash pit test pits. These results were input into the RESRAD model in conjunction with the appropriate parameters for the industrial scenario listed in Appendix B of DOE-RL 1997.

Table 3 shows the contaminants of concern residual 95% UCL concentrations calculated on the arithmetic mean or geometric mean, as applicable.

Table 3. Contaminants of Concern Residual Contamination.

Contaminant	95% UCL on the Mean
Cobalt-60	0.03 pCi/g
Total uranium	1.61 pCi/g
Arsenic	8.81 mg/kg
Benzo(a)pyrene	N/A[a]
Chrysene	N/A[a]
Polychlorinated biphenyls	0.25 mg/kg
Thallium	5.25 mg/kg

[a] All verification samples were non-detect; therefore, no UCL calculation is required.

N/A = not applicable

3.3 ATTAINMENT OF RADIONUCLIDE SOIL CLEANUP STANDARDS

For uranium exposure verification, the 95% UCL uranium concentration in the soil shown in Table 2 was compared to 350 pCi/g uranium that is the dose equivalent of 15 mrem/yr above background. The 350 pCi/g uranium concentration is based on the 300-FF-1 industrial scenario model results using the RESRAD computer code and is the uranium concentration that is equivalent to a dose of 15 mrem/year maximum above background identified as the RAG. The 95% UCL cobalt-60 concentration in soil is well below the 1995 SPP average concentration of 3.8 pCi/g and has already decayed to an insignificant dose contribution. The results of the statistical analysis clearly indicate that the RAG has been met.

3.4 ATTAINMENT OF MODEL TOXICS CONTROL ACT CLEANUP STANDARDS

Table 4 presents the results of site verification based on *Washington Administrative Code* (WAC) 173-340-745, "Model Toxics Control Act – Cleanup," (MTCA) Method C cleanup standards. The RAGs for MTCA Method C cleanup standards have all been met.

Table 4. Analytical Results.[a]

Contaminant	Cleanup Criteria (mg/kg)	95% UCL (mg/kg)[b]		Max. Detected (mg/kg)[c]		Total Number of Samples	Number Exceeding Criteria	% Samples Exceeding Criteria[d]	
Arsenic	219	8.81	✓	8.20	✓	6	0	0	✓
Benzo(a)pyrene	18	N/A[e]	✓	N/A[e]	✓	6	0	0	✓
Chrysene	18	N/A[e]	✓	N/A[e]	✓	6	0	0	✓
Polychlorinated Biphenyls	17	0.25	✓	0.26	✓	6	0	0	✓
Thallium	245	5.25	✓	5.20	✓	6	0	0	✓

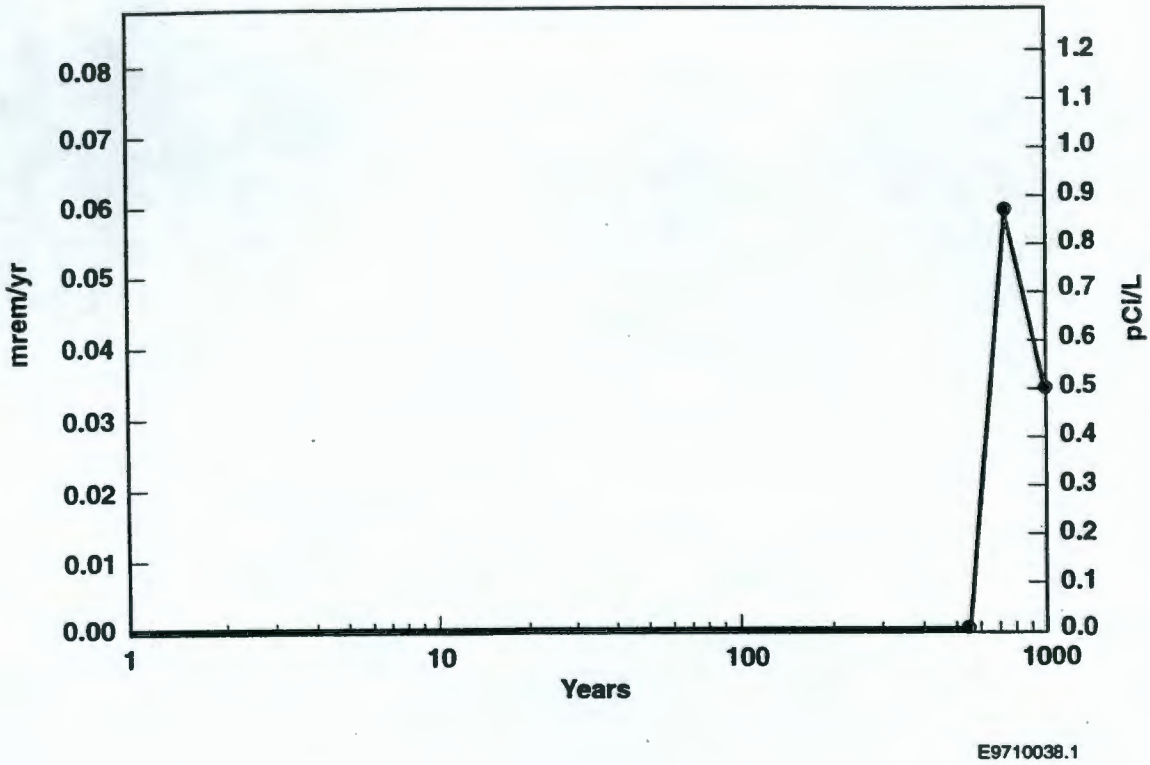
[a] ✓indicates MTCA Method C (WAC 173-340-740[7e]) criteria has been met.
[b] Criteria are comparison to the cleanup criteria.
[c] Criteria are single detection can exceed two times the cleanup criteria.
[d] Criteria are no more than 10% of the samples can exceed the cleanup criteria.
[e] All samples were nondetections.
N/A = not applicable

3.5 ATTAINMENT OF GROUNDWATER AND SURFACE WATER REMEDIAL ACTION GOALS

For groundwater protection, uranium concentrations in the soil were calculated using the RESRAD model for comparison with the RAGs presented in Section 2.0 of the RDR/RAWP (DOE-RL 1997). RESRAD parameters used for groundwater protection verification are the same as those included in Appendix B of the RDR/RAWP (DOE-RL 1997) with the exception of the area of contamination modeled. The ash pit verification modeling was performed using the existing area of the ash pits. Upon completion of OU remediation, the RESRAD model will be run again using (1) the 95% UCL for uranium results from the liquid waste sites and (2) the 95% UCL for uranium results from the burial ground and landfills using the areas as modeled in Appendix B of the RDR/RAWP (DOE-RL 1997). There is not expected to be any significant difference in model results using individual waste site areas versus the area of all liquid wastes sites.

The RESRAD model predicts no concentration of total uranium in groundwater from the ash pits waste site for the first 550 years and up to a maximum of just under 0.9 pCi/L in the groundwater in about 750 years and rapidly begins declining through the 1,000 years modeled. Figure 3 shows the RESRAD model results for uranium in groundwater. The results clearly show that the RAGs have been met.

Figure 3. Dose to the Industrial Worker and Groundwater Concentrations Versus Time for the 300-FF-1 Operable Unit Ash Pits.



4.0 SAMPLING AND ANALYTICAL RESULTS

4.1 SUMMARY OF FIELD SCREENING AND LABORATORY ANALYSIS

No remedial action excavation activities were performed in the ash pits. However, six test pits were excavated at randomly selected locations in the ash pits. In-process, field screening was performed on the soils excavated from the test pits on approximate 0.3 m (1 ft) intervals to the bottom of the test pits per the requirements of the 300-FF-1 SAP (DOE-RL 1997). In-process screening consisted of surveying the soils for radiological contamination using a large area probe. No contamination above the 350 pCi/g uranium cleanup standard was found during the in-process screening effort. The specification for use of the radiological survey instrumentation is documented in BHI 1997.

Upon completion of excavation of each test pit, three samples were collected from one location at the bottom of the excavation as follows: (1) a field screening sample for metals and volatile organic compounds, (2) a total radiological activities sample for shipment, and (3) the verification sample for offsite analysis. Results from samples 1 and 2 described above were

reviewed for contaminant identification and concentrations prior to authorization to ship the verification sample. In all cases, the verification samples were able to be shipped for contaminant of concern analysis based on the field screening and total activities results.

All sampling and tool decontamination was performed in accordance with requirements in BHI-EE-01, *Environmental Investigations Procedures*. All samples were handled using Bechtel Hanford, Inc. chain-of-custody control procedures. Soil samples were collected and analyzed according to the approved SAP (DOE-RL 1997).

Field quality assurance/quality control (QA/QC) measures were used to assess sampling precision. QC samples were taken per the requirements of Table C-9 of the SAP (DOE-RL 1997). The QC samples taken for the ash pits also covered the Clean Soil Stockpile area. These included one equipment blank sample, one field duplicate sample, one field split sample, and one field blank sample. Level A data validation was performed on this set of data.

4.2 DATA EVALUATION

Data evaluation was performed in several steps as follows:

1. Test pit locations were staked using a global positioning system to the randomly selected coordinates defined in the SAP (DOE-RL 1997). A detailed map was generated plotting the coordinates after being staked (Figure 2). Detailed records of field screening and laboratory sample locations and sample numbers are documented in the field logbooks.

2. The analytical data was compiled and reviewed as it was received to determine levels of contamination within the ash pits. Depending on contamination levels, additional analyses could be requested. The analytical results from duplicate and split samples were also evaluated to determine the overall analytical precision.

3. Analytical results from blank samples were reviewed to determine if detections were due to sources other than the sampling locations. For common laboratory glassware cleaning contaminants (e.g., methylene chloride, acetone, toluene, 2-butanone, and phthalate esters), the U.S. Environmental Protection Agency's "10-times rule" was used. Detected concentrations of common laboratory contaminants had to be greater than 10 times the corresponding blank value to be considered valid. Other contaminants had to be greater than five times the sample blank value to be considered valid.

4.3 DATA VALIDATION

After sampling was completed, all of the fixed-base laboratory data from one sample delivery group was validated to Level A, per BHI-EE-01, Procedure 2.5.

Under the level A validation procedure, the following were reviewed:

- Sample holding times evaluation
- Deliverable requested versus reported analysis.

5.0 STATEMENT OF PROTECTIVENESS

As has been demonstrated in this verification package, the RAGs for direct exposure (15 mrem/year), MTCA Method C cleanup standards, groundwater and surface water protection (protection of the Columbia River) have all been achieved. Soils below the ash pits potentially contributing to direct exposure were sampled, analyzed, and found to be below cleanup standards. Soils below the ash pits contributing to the potential degradation of groundwater and the Columbia River have all been sampled, analyzed, and uranium modeled to show that no remaining constituents pose an unacceptable threat to groundwater or the Columbia River. Thus, the soils below the ash pits have been remediated and no longer pose an unacceptable threat to human health or the environment.

For clarity, the following information is included regarding verification sampling at the ash pits. The ash pits verification sampling effort was not focused on the ash pits, but rather, on the soils underlying the ash pits. The ash pit sediments were sampled during the 300-FF-1 OU Phase 1 remedial investigation and found to be nonhazardous; the sediments were further documented to be below the cleanup standards in the ROD (EPA et al. 1996). The ROD requirement to perform verification sampling at the ash pits was mandated to verify that contaminants above cleanup standards did not exist in the soils below the ash pits resulting from previous SPP operations. The ROD requirement was met as documented in this verification package.

6.0 REFERENCES

BHI-EE-01, *BHI Environmental Investigations Procedures*, Vol. 1, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1997, *Survey Method for Radiological Surveys of 300-FF-1 Operable Unit Soil and Materials*, BHI-01010, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 1997, *300-FF-1 Remedial Design Report/Remedial Action Work Plan*, DOE/RL-96-70, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, Ecology, and DOE, 1996, *Record of Decision for the 300-FF-5 and 300-FF-1 Operable Units*, U.S. Environmental Protection Agency, Washington State Department of Ecology and U.S. Department of Energy, Region 10, Richland, Washington.

WAC 173-340-740 (e), "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, as amended.

APPENDIX A

SUMMARY OF THE ASH PITS SAMPLING AND ANALYTICAL DATA

ASH PIT VERIFICATION SAMPLE SUMMARY STATISTICS										
Sample Location	Sample Number		Arsenic		Thallium		Cobalt-60	Uranium	PCB's	
			Data (mg/kg)	Ln (Data) (mg/kg)	Data (mg/kg)	Ln (Data) (mg/kg)	Data (pCi/g)	Data (pCi/g)	Data (mg/kg)	Ln (Data) (mg/kg)
Ash Pit 4	B0L704		1.5	0.41	2.00	0.69	0.03	1.06	0.25	-1.41
Ash Pit 1	B0L705		1.0	-0.05	1.20	0.18	0.01	1.61	0.25	-1.41
Ash Pit 6	B0L706		2.0	0.69	1.40	0.34	0.02	1.38	0.25	-1.41
Ash Pit 5	B0L707		8.2	2.10	5.20	1.65	0.03	1.53	0.25	-1.38
Ash Pit 2	B0L708		2.0	0.69	1.00	0.00	0.04	1.52	0.26	-1.34
Ash Pit 3	B0L709		2.4	0.88	0.90	-0.11	0.02	1.56	0.24	-1.44
sum			17.05	4.72	11.70	2.76	0.14	8.66	1.49	-8.37
count			6.00	6.00	6.00	6.00	6.00	6.00	6.00	6.00
arith mean			2.84	0.79	1.95	0.46	0.02	1.44	0.25	-1.40
stnd. Dev			2.67	0.72	1.64	0.65	0.01	0.20	0.01	0.03
variance			7.14	0.52	2.69	0.42	0.00	0.24	0.00	0.00
coef of var			0.94	0.92	0.84	1.41	0.32	0.14	0.03	-0.02
geo. Mean			N/A	2.20	N/A	1.58	N/A	N/A	N/A	0.25
st.dev. Gm			N/A	2.06	N/A	1.91	N/A	N/A	N/A	1.03
95% UCL			N/A	8.81	N/A	5.25	0.03	1.61	N/A	0.25

ASH PIT VERIFICATION SAMPLE RESULTS FOR URANIUM AND PCB's

Summation o Isotopic Uranium Data and Data Qualifiers

Sample	B0L704		B0L705		B0L706		B0707		B0L708		B0L709	
	(pCi/g)	Qualifier	(pCi/g)	Qualifier	(pCi/g)	Qualifier	(pCi/g)	Qualifier	(pCi/g)	Qualifier	(pCi/g)	Qualifier
U-234	0.57	N/A	0.84	N/A	0.61	N/A	0.72	N/A	0.68	N/A	0.75	N/A
U-235	0.04	N/A	0.00	N/A	0.04	U	0.03	N/A	0.02	U	0.04	N/A
U-238	0.45	N/A	0.77	N/A	0.73	N/A	0.78	N/A	0.82	N/A	0.77	N/A
Total U	1.06		1.61		1.38		1.53		1.52		1.56	

Summation of Polychlorinated Biphenyls (PCB's) and Data Qualifiers

Arochlor Type	B0L704		B0L705		B0L706		B0707		B0L708		B0L709	
	(ug/kg)	Qualifier	(ug/kg)	Qualifier	(ug/kg)	Qualifier	(ug/kg)	Qualifier	(ug/kg)	Qualifier	(ug/kg)	Qualifier
1016	35	U	35	U	35	U	36	U	35	U	34	U
1221	35	U	35	U	35	U	36	U	35	U	34	U
1232	35	U	35	U	35	U	36	U	35	U	34	U
1242	35	U	35	U	35	U	36	U	35	U	34	U
1248	35	U	35	U	35	U	36	U	52	N/A	34	U
1254	35	U	35	U	35	U	36	U	35	U	34	U
1260	35	U	35	U	35	U	36	U	35	U	34	U
Total PCB	245		245		245		252		262		238	

Data Qualifier's U The analyte was (or compound) was not detected. The associated value is the sample quantitation limit.

ASH PIT VERIFICATION DATA SUMMARY TABLE

Sample Location	Sample Number	Arsenic		Thallium		PCB's		Benzo(a)pyrene		Chrysene	
		Data (mg/kg)	Qualifiers	Data (mg/kg)	Qualifiers	Data (mg/kg)	Qualifiers	Data (mg/kg)	Qualifiers	Data (mg/kg)	Qualifiers
Ash Pit 4	B0L704	1.5	B	2.00	B	0.25	U	0.34	U	0.34	U
Ash Pit 1	B0L705	1.0	B	1.20	B	0.25	U	0.35	U	0.35	U
Ash Pit 6	B0L706	2.0	B	1.40	B	0.25	U	0.35	U	0.35	U
Ash Pit 5	B0L707	8.2	B	5.20	B	0.25	U	0.35	U	0.35	U
Ash Pit 2	B0L708	2.0	B	1.00	B	0.26	U	0.35	U	0.35	U
Ash Pit 3	B0L709	2.4	B	0.90	B	0.24	N/A	0.34	U	0.34	U

Note: For PCB's, the values reported are the summation of the 7 individual arochlor's analyzed. The U qualifier indicates all 7 arochlors were not detected for that sample.

Sample Location	Sample Number	Uranium		Cobalt-60	
		Data (pCi/g)	Qualifiers	Data (pCi/g)	Qualifiers
Ash Pit 4	B0L704	1.06	N/A	0.03	U
Ash Pit 1	B0L705	1.61	N/A	0.01	U
Ash Pit 6	B0L706	1.38	N/A	0.02	U
Ash Pit 5	B0L707	1.53	N/A	0.03	N/A
Ash Pit 2	B0L708	1.52	N/A	0.04	U
Ash Pit 3	B0L709	1.56	N/A	0.02	U

Qualifier Definitions

B (Organics) The compound was detected in the associated blank.
B (Metals) The analyte was detected above the IDL (instrument detection limit) but below the CRDL (contract required detection limit.)
U The analyte (or compound) was not detected. The associated value is the sample quantitation limit.

ASH PIT VERIFICATION SAMPLES CONTAMINANT DISTRIBUTION DETERMINATION

W test for normality (arsenic)		ranked values	calc. d	a1 to a3 from tableA1.	Calc. W
		0.95	3.5721	0.6431	4.662475
mean	2.84	1.5	1.7956	0.2806	0.25254
r	3	2	0.7056	0.0875	0
		2	0.7056	sum	4.915015
		2.4	0.1936	square	24.15737
		8.2	28.7296	1/d	0.02801
		d=	35.7021	W	0.676637

from table A-2 for W 0.05 and n=6, is .788 Since W=.677 is less than .788,
the raw data is not normally distributed.

W test for normality (thallium)		ranked values	calc. d	a1 to a3 from tableA1.	Calc. W
		0.9	1.1025	0.6431	2.76533
mean	1.95	1	0.9025	0.2806	0.2806
r	3	1.2	0.5625	0.0875	0.0175
		1.4	0.3025	sum	3.06343
		2	0.0025	square	9.384603
		5.2	10.5625	1/d	0.074432
		d=	13.435	W	0.698519

from table A-2 for W 0.05 and n=6, is .788 Since W=.699 is less than .788,
the raw data is not normally distributed.

W test for normality (Uranium)		ranked values	calc. d	a1 to a3 from tableA1.	Calc. W
		1.06	0.1444	0.6431	0.353705
mean	1.44	1.35	0.0081	0.2806	0.058926
r	3	1.52	0.0064	0.0875	0.000875
		1.53	0.0081	sum	0.413506
		1.56	0.0144	square	0.170987
		1.61	0.0289	1/d	4.755112
		d=	0.2103	W	0.813063

from table A-2 for W 0.05 and n=6, is .788 Since W=.813 is greater than .788,
the raw data is normally distributed.

Note: Tests for normality were not performed on 1) Benzo(a)Pyrene and Chrysene because all samples were non-detects and 2) Cobalt-60 and PCB's because 5 of 6 samples for each were non-detect and the single sample concentration identified was near the sample quantitation limit.

Reference: Washington State Department of Ecology Toxics Cleanup Program, Statistical Guidance for Ecology Site Managers, August 1992.

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