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Rev. 0

300-FF-1 Waste Site 300-44 Verification Package

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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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Charlie Johnson — 12/11/97

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1.0 INTRODUCTION

1.1 PURPOSE

The purpose of this verification package is to document achievement of the remedial action objectives for waste site 300-44, which is located in the 300-FF-1 Operable Unit (OU).

1.2 SITE HISTORY AND DESCRIPTION

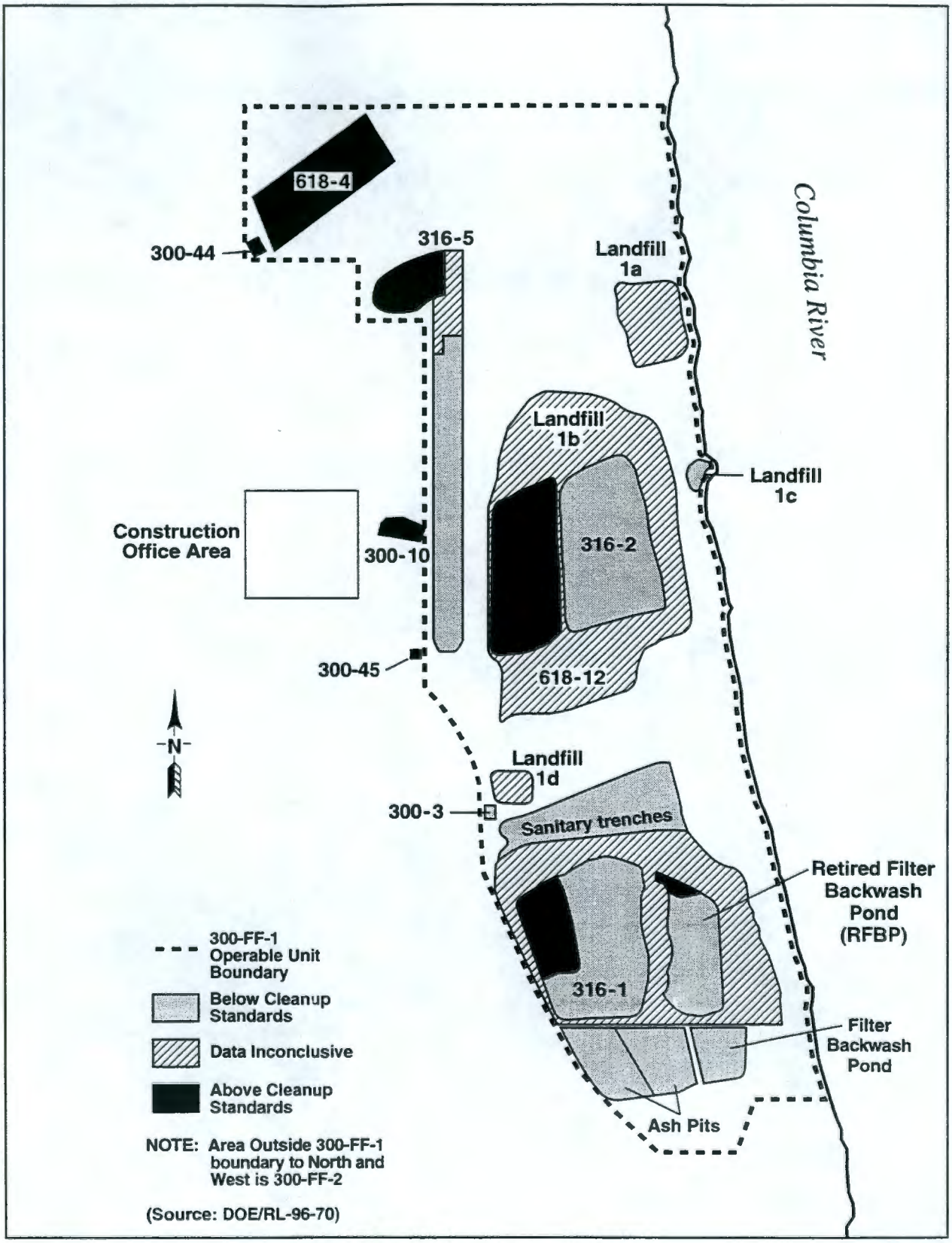
The 300-FF-1 OU includes liquid waste disposal sites, landfills, a burial ground, surface radiation areas, and miscellaneous debris (Figure 1). During the 300-FF-1 Phase I remedial investigation, surface radiation surveys were performed to determine areas within the OU that required action. Waste site 300-44 was located west of the 618-4 Burial Ground at the north end of the 300-FF-1 OU and was posted as an Underground Radioactive Materials Area. The site consisted primarily of contaminated soil and was approximately 159 m^2 (1,711 ft^2) as designed in area.

2.0 REMEDIATION OF WASTE SITE 300-44

2.1 REMEDIATION AUTHORITY

Remediation of the 300-FF-1 OU waste sites is authorized in the 300-FF-1 and 300-FF-5 OU Record of Decision (EPA et al. 1996). Contaminants of concern (COCs) for the 300-FF-1 OU, as identified in the *300-FF-1 Remedial Design Report/Remedial Action Work Plan* (RDR/RAWP) (DOE-RL 1997), are uranium-234, uranium-235, uranium-238, cobalt-60, arsenic, thallium, benzo(a)pyrene, chrysene, and polychlorinated biphenyl (PCB) compounds. Remedial action objectives presented in the Record of Decision (EPA et al. 1996) are discussed in Sections 2.0 and 3.0. The methods used to demonstrate achievement of remedial action objectives are documented in the RDR/RAWP (DOE-RL 1997).

Figure 1. 300-FF-1 Operable Unit



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2.2 REMEDIATION GOALS

Remedial action goals for the 300-FF-1 OU waste sites are listed as follows:

- Remove contaminated soil to achieve the *Washington Administrative Code* (WAC) 173-340-740, "Model Toxics Control Act—Cleanup," (MTCA) Method C cleanup standards for the chemical COCs (metals, semivolatile organics, and PCBs). The cleanup standards include criteria specifying that no single sample results can exceed twice the cleanup level, and that not more than 10% of all results can exceed the cleanup level.

- Remove contaminated soil to achieve a 15 mrem/year dose standard above background for the radiological COCs (uranium and cobalt-60). The uranium concentration that is equivalent to a dose of 15 mrem/year maximum above background is 350 pCi/g. This is demonstrated by comparison of the uranium results from the verification samples to the uranium concentrations modeled under an industrial scenario using the Residual Radioactivity (RESRAD) computer code. The RESRAD model used only uranium to develop the radiation cleanup standard because cobalt-60 is of concern only in the 300-FF-1 South Process Pond and it has a short half-life (5.26 years). No other radionuclides contribute significantly to the total dose.

- Remove contaminated soil to achieve protection of groundwater and surface water. This is demonstrated by meeting the MTCA Method C and dose standard criteria, and by showing that RESRAD models of the uranium results from the verification samples are equal to or lower than the concentration and time plots from the original analysis. The RESRAD parameters used for groundwater protection verification are included in Appendix B of the RDR/RAWP (DOE-RL 1997).

Site-specific cleanup standards for the 300-FF-1 COCs are listed in Table 1.

Table 1. Waste Site 300-44 Cleanup Standards.

Constituent	MTCA Method C	Surface and Groundwater	Dose Exposure
Arsenic	219 mg/kg	[a]	N/A
Benzo(a)pyrene	18 mg/kg	[a]	N/A
Chrysene	18 mg/kg	[a]	N/A
PCBs	17 mg/kg	[a]	N/A
Thallium	245 mg/kg	[a]	N/A
Radionuclides	N/A	[b]	15 mrem/yr[c]

[a] 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 as 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 procedure results, presented conclusive physical evidence of slow leaching potential.
[b] This is demonstrated by comparison of the uranium results from the verification samples to uranium concentrations modeled under an industrial scenario using the RESRAD computer code.
[c] The 15 mrem/yr equates to 350 pCi/g for uranium in the 300-FF-1 OU industrial scenario.
PCBs = polychlorinated biphenyls
N/A = not applicable

2.3 REMEDIATION PROCESS

A layer of overburden ranging in depth from 0.3 to 0.9 m (1 to 3 ft) was removed prior to the excavation of waste site 300-44. The overburden was placed in a stockpile adjacent to the waste site on the east side. When excavation of the waste site was complete, two samples were collected from the stockpile (as discussed in Section 3.0) to confirm that the overburden in the stockpile was acceptable to use as backfill material.

Waste site 300-44 was initially excavated to a depth of 0.3 m (1 ft) below grade based on the 300-FF-1 OU remedial design. The "Confirm as Clean" procedure found in the RDR/RAWP (DOE-RL 1997) was then implemented to remove 0.3 m (1 ft) lifts as necessary to complete the excavation. After completion of the first lift, a radiological survey of the remaining soil was performed. Based on the survey results, it was determined that additional excavation of waste site 300-44 was not required. Contaminated soil removed from waste site 300-44 was transported to the Environmental Restoration Disposal Facility for disposal. Verification samples were then collected as discussed in Section 3.0. Results from the final surface radiation survey are included in the appendix of this document.

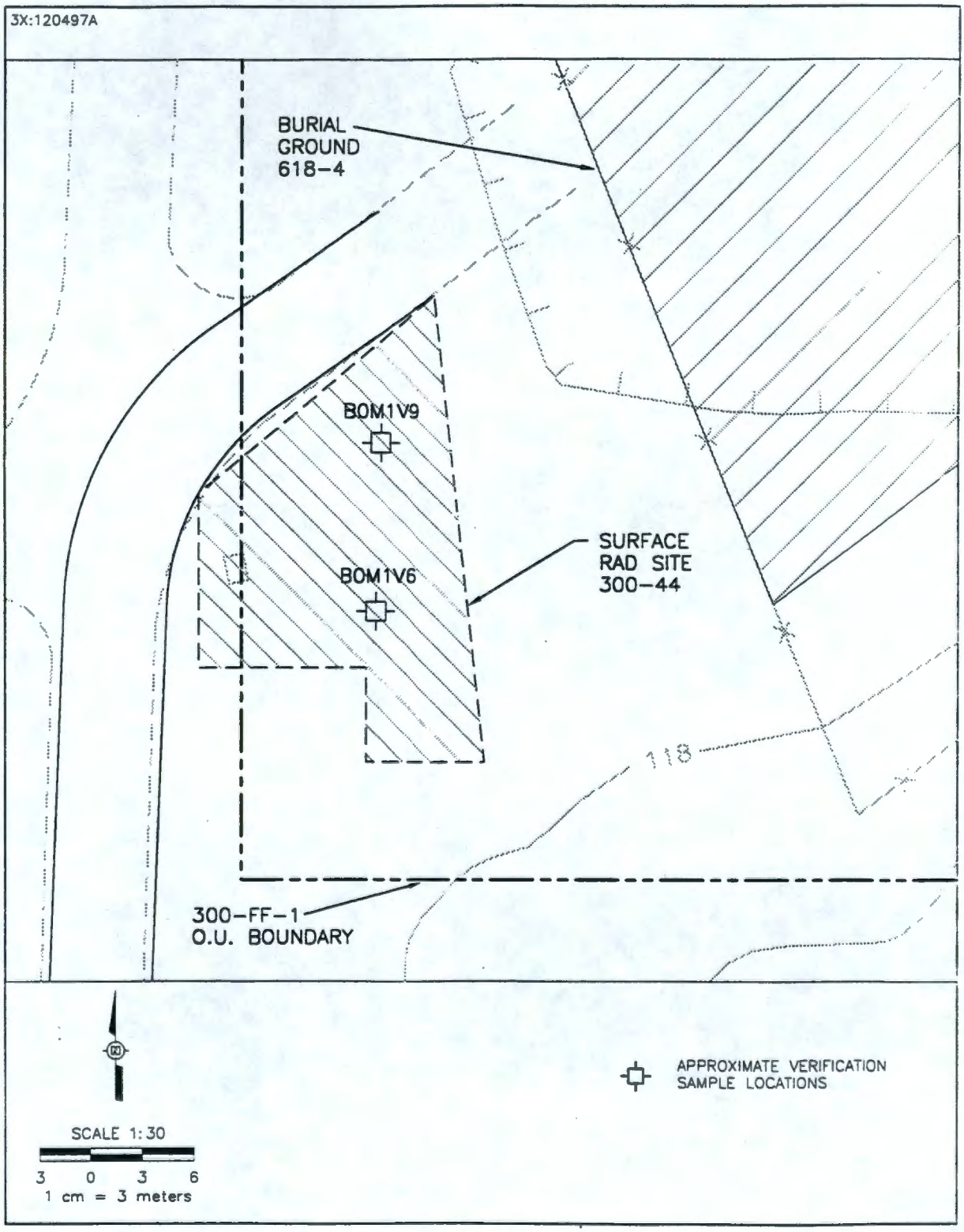
3.0 VERIFICATION SAMPING AND ANALYSIS

3.1 SAMPLE COLLECTION

In accordance with the RDR/RAWP (DOE-RL 1997), separate verification sampling is not needed to confirm cleanup of the small surface radiation area west of the 618-4 Burial Ground. The stakeholders made this agreement for closeout of waste site 300-44 based on its small size and proximity to the 618-4 Burial Ground. At the discretion of the project manager, two random samples were collected in addition to the RDR/RAWP (DOE-RL 1997) closeout requirements and analyzed to verify that the COC concentrations in the remaining soil were within the cleanup standards. If the sample data confirmed that contaminant levels in the remaining soil were below the cleanup standards, then remediation of waste site 300-44 would be considered complete with no further action required. The two verification samples (B0M1V6 and B0M1V9) were collected from random locations on September 25, 1997. A plan view of waste site 300-44 and the verification sample locations are depicted in Figure 2.

The decision to collect two samples from the overburden stockpile was documented on *300 NPL Agreement/Change Control Form* (control number 114). On November 18, 1997, two samples (B0M6B3 and B0M6B6) were collected from random locations in the overburden stockpile adjacent to the east side of the waste site. If the sample data confirmed that constituent levels in the overburden stockpile were below the cleanup standards, then the overburden stockpile would be considered acceptable for use as backfill material.

Figure 2. Waste Site 300-44 Verification Sample Locations.



The verification samples and stockpile samples were collected in accordance with the RDR/RAWP (DOE-RL 1997) and applicable procedures from BHI-EE-01, *Environmental Investigations Procedures*. The samples were collected under Sample Authorization Form B97-160 and documented in field logbook number EL1395.

3.2 SAMPLE RESULTS

The verification samples and stockpile samples were delivered under chain-of-custody to Quanterra and analyzed for the 300-FF-1 COCs in accordance with the RDR/RAWP (DOE-RL 1997). Table 2 presents a summary of the verification sample results and the applicable cleanup standards specified in Section 2.0.

Table 2. Verification Sample Results Summary.

Constituent	Cleanup Criteria	Units	B0M1V6	B0M1V9	% Samples Exceeding Criteria[d]		# Samples > 2X Criteria[d]	
Arsenic	219	mg/kg	16.9	15.5	0	✓	0	✓
Thallium	245	mg/kg	3.2 U	3.2 U	0	✓	0	✓
Benzo(a)pyrene	18	mg/kg	0.33 U	0.33 U	0	✓	0	✓
Chrysene	18	mg/kg	0.33 U	0.33 U	0	✓	0	✓
PCBs[a]	17	mg/kg	0.23 U	0.23 U	0	✓	0	✓
Uranium[b]	350	pCi/g	0.51	0.61	0	✓	0	✓
Cobalt-60[c]	[c]	pCi/g	0.051 U	0.051 U	0	✓	0	✓

NOTE: A "U" qualifier indicates that the constituent was not detected. The associated value is the quantitation limit/minimum detectable activity for the sample.

[a] Reported result calculated as a sum of Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260.

[b] Reported result calculated as a sum of uranium-234, uranium-235, and uranium-238 concentrations.

[c] The RESRAD model used only uranium in development of the radiation cleanup standard because cobalt-60 is of concern only in the 300-FF-1 South Process Pond and also has a short half-life (5.26 years). No other radionuclides contribute significantly to the total dose.

[d] A "✓" indicates that associated criteria were met.

PCBs = polychlorinated biphenyls

A summary of sample results from the overburden stockpile and the applicable cleanup standards that are specified in Section 2.0 is presented in Table 3.

Table 3. Stockpile Sample Results Summary.

Constituent	Cleanup Criteria	Units	B0M6B3	B0M6B6	% Samples Exceeding Criteria[d]		# Samples > 2X Criteria[d]	
Arsenic	219	mg/kg	9.1	6.0	0	✓	0	✓
Thallium	245	mg/kg	3.4 U	3.4 U	0	✓	0	✓
Benzo(a)pyrene	18	mg/kg	0.35 U	0.35 U	0	✓	0	✓
Chrysene	18	mg/kg	0.35 U	0.35 U	0	✓	0	✓
PCBs[a]	17	mg/kg	0.23 U	0.23 U	0	✓	0	✓
Uranium[b]	350	pCi/g	0.69	0.56	0	✓	0	✓
Cobalt-60[c]	[c]	pCi/g	0.19 U	0.19 U	0	✓	0	✓

NOTE: A "U" qualifier indicates that the constituent was not detected. The associated value is the quantitation limit/minimum detectable activity for the sample.
[a] Reported result calculated as a sum of Aroclors 1016, 1221, 1232, 1242, 1248, 1254, and 1260.
[b] Reported result calculated as a sum of uranium-234, uranium-235, and uranium-238 concentrations.
[c] The RESRAD model used only uranium in development of the radiation cleanup standard because cobalt-60 is of concern only in the 300-FF-1 South Process Pond and also has a short half-life (5.26 years). No other radionuclides contribute significantly to the total dose.
[d] A "✓" indicates that associated criteria were met.
PCBs = polychlorinated biphenyls

3.3 DATA VALIDATION

Verification samples were collected only as a best management practice in support of waste site 300-44 remediation activities. Verification and stockpile sample results were reviewed to ensure that all requested data was received and verify compliance with analytical holding times consistent with BHI-EE-01, Procedure 2.5, "Data Validation," Level A.

3.4 DATA EVALUATION

Due to the number of verification samples that were collected, a 95% upper confidence level on the arithmetic mean was not calculated to perform a statistical evaluation of the verification and stockpile sample results. The verification samples were collected as a best management practice in support of waste site 300-44 remediation activities. Results were evaluated against the established 300-FF-1 OU cleanup criteria as follows:

- **Metals, Semivolatile Organics, and PCBs:** Results for all of the constituents were one to two orders of magnitude below the established cleanup level. Accordingly, no single sample concentration was greater than two times the MTCA Method C cleanup standards, and less than 10% of the sample concentrations exceed the MTCA Method C cleanup

standards. Results for arsenic were within the range of concentrations documented in the *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes* (DOE-RL 1994). Based on these results, the remedial action goals for MTCA Method C cleanup standards have all been met.

- **Uranium Exposure:** Summed results for the reported uranium isotopes were two orders of magnitude below the 350 pCi/g cleanup criteria established by the RESRAD model for the 300-FF-1 OU industrial scenario. The 350 pCi/g cleanup level for uranium is equivalent to the remedial action goal for a dose that does not exceed 15 mrem/yr above background. The uranium results were also consistent with Hanford Site background levels documented in the *Hanford Site Background: Part 2, Soil Background for Radionuclides* (DOE-RL 1996). Based on these results, the remedial action goal for radionuclides in soil has been met. The RESRAD model parameters used for the industrial scenario are documented in Appendix B of the RDR/RAWP (DOE-RL 1997).

- **Groundwater and Columbia River Protection:** The MTCA Method C cleanup standards were achieved. The RESRAD modeling was not performed on results for the two verification samples, as they were not required for this waste site. The average uranium concentration is 0.56 pCi/g. Based on comparison of RESRAD modeling for the 300-FF-1 OU ash pits verification package (95% upper confidence level of 1.61 pCi/g for residual uranium), the dose to the industrial worker from consumption of area groundwater would peak approximately 550 years into the future at 0.02 mrem/year as a result of residual uranium at waste site 300-44. These results clearly indicate that the remedial action goals have been met for groundwater and Columbia River protection. Results for the waste site 300-44 will be included in the overall RESRAD modeling for the 618-4 Burial Ground at the conclusion of 300-FF-1 OU remediation activities.

4.0 STATEMENT OF PROTECTIVENESS

As demonstrated in this verification package, the remediation goals for direct exposure (15 mrem/year), MTCA Method C cleanup standards, and groundwater and surface water (protection of the Columbia River) have all been achieved. Contaminated soil was removed from the site and disposed of at the Environmental Restoration Disposal Facility. Remaining soil within waste site 300-44 was sampled, analyzed, and found to be below cleanup standards. Waste site 300-44 is remediated and no longer poses an unacceptable threat to human health or the environment. Overburden removed from the waste site prior to excavation was also sampled, analyzed, and found to be below the cleanup standards, confirming its acceptability for use as backfill material.

5.0 REFERENCES

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

BHI, 1997, *300 NPL Agreement/Change Control Form*, Control Number 114, dated November 18, 1997.

DOE-RL, 1994, *Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes*, DOE/RL-92-24, Rev. 2, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 1996, *Hanford Site Background: Part 2, Soil Background for Radionuclides*, DOE/RL-96-12, Rev. 0, U.S. Department of Energy, Richland Operations Office, 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-1 and 300-FF-5 Operable Units*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and the U.S. Department of Energy, Region 10, Richland, Washington.

WAC 173-340-740, "Model Toxics Control Act—Cleanup," *Washington Administrative Code*, as amended.

APPENDIX

WASTE SITE 300-44 RADIOLOGICAL SURVEY RESULTS

APPENDIX

WASTE SITE 300-44 RADIOLOGICAL SURVEY RESULTS

The following is provided to support information documented in the survey results included in this Appendix.

- The Radiological Survey Record (RSR) contains two main sections: one section is a map of the area surveyed and the other is a list of contamination/dose rate levels found.

- The Environmental Restoration Contractor RadCon program is set up so that survey locations are denoted on the map portion of the RSR. Fixed readings are denoted by the "#" symbol and smear locations are denoted by a number inside a circle.

- If no contamination is found above the levels contained in the Technical Assessment referenced on the RSR for the area surveyed, then no information is written in the list area of the RSR. If levels above the Technical Assessment levels are found, they are recorded in the list section of the RSR with any applicable correction factors.

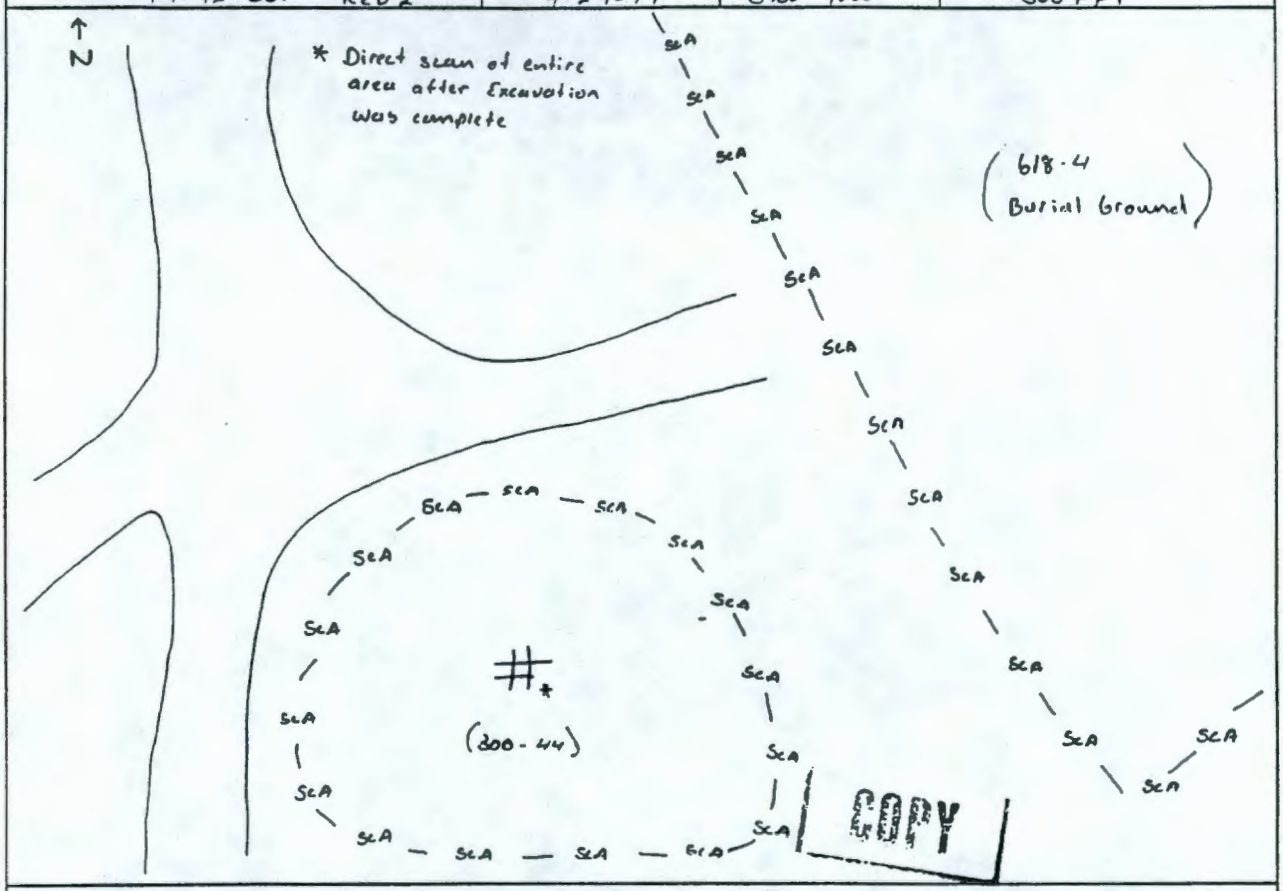
- Dose rate information is recorded on the map and also in the list section to show how the corrected dose rates were obtained.

300-44

ERC RADIOLOGICAL SURVEY RECORD

Type of Survey (check one only)	Survey #
☐ Release ☐ Routine ☒ Work Progress ☐ Shipment	RSR - FF 1/2-97- 0618

RWP # / Rev. #	Date	Time	Location
FF 1/2-001 Rev 2	9-24-97	0230-1200	300 FF1



Unless noted, contamination levels are below the levels listed in Project Technical Assessment #: TA-96-17

-C- Contamination Area	-H- High Contamination Area	-B- Radiological Buffer Area	-AR- Airborne Radioactivity Area	-RM- Radioactive Materials Area	-R- Radiation Area	-HR- High Radiation Area	-VHR- Very High Radiation Area

○ Technical Smear	# Direct	M Large Area Wipe	Contact γ 30 cm	Contact β 30 cm	General Area Dose Rate ■ Uncorrected Meter Reading (mR/hr)	△ Micro Rem (µR/hr)	N Neutrons (mRem/hr)	(AS) Air Sample Location	-SCA- Soil Contamination Area

Instruments

Model	Serial #	Source ✓ (Initial)	Cal Due Date	Model	Serial #	Source ✓ (Initial)	Cal Due Date
6M	0445	[illegible]	5-15-98	6M	0963	[illegible]	3-31-98
P-11	0662	[illegible]	6-4-98	P-11	0001	[illegible]	9-4-98

RCT Name/Signature/Date:	RCT Supervisor Name/Signature/Date:
Tufford JM / [illegible] / 9-24-97 KDLAWING / [illegible] 9-24-97	D.L. HIII [illegible] 9/26/97

RSR completed in accordance with BHI-SH-04, Procedure 3.1.

Contamination Measurement Information

Circled values in Removable β-γ denotes mrad/hr β

Unless otherwise noted, use the following Correction Factors:
Source smaller than probe size: PAM = 7 P-11 probe = 10
Source larger than probe size: PAM = 14 P-11 probe = 50

List other Correction Factors, instruments, and source documents:

No.	Description of Item or Location	Removable (dpm/100 cm²)				Total (dpm/100 cm²)			
		α	α C-F	β-γ	β-γ C-F	α	α C-F	β-γ	β-γ C-F

N
A

Corrected Dose Rate Calculations

Show all work. CF = 1 unless noted.

Location	Contact Readings		30 cm Readings	
	β (mrad/hr) (WD-WC) X CF = DR	γ (mR/hr) WC X CF = DR	β (mrad/hr) (WD-WC) X CF = DR	γ (mR/hr) WC X CF = DR

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