Date Submitted: 9/3/08 Originator: J. M. Capron Phone: 372-9227	**WASTE SITE RECLASSIFICATION FORM** Operable Unit(s): 300-FF-2 Waste Site Code: 331 LSLDF Type of Reclassification Action: Closed Out ☐ Interim Closed Out ☐ No Action ☒ RCRA Postclosure ☐ Rejected ☐ Consolidated ☐	Control Number: 2008-020

This form documents agreement among parties listed authorizing classification of the subject unit as Closed Out, Interim Closed Out, No Action, RCRA Postclosure, Rejected, or Consolidated. This form also authorizes backfill of the waste management unit, if appropriate, for Closed Out and Interim Closed Out units. Final removal from the NPL of No Action and Closed Out waste management units will occur at a future date.

Description of current waste site condition:

The 331 Life Sciences Laboratory Drain Field (LSLDF) septic system waste site consists of a diversion chamber, two (dual-chambered) septic tanks, a distribution box, and a drain field. This septic system was designed to receive sanitary wastewater, from animal studies conducted in the 331-A and 331-B Buildings, for discharge into the soil column. However, field observations and testing suggest the 331 LSLDF septic system did not receive any discharges. Sampling and evaluation of this waste site have been performed in accordance with remedial action objectives (RAOs) and goals established by the *Interim Action Record of Decision for the 300-FF-2 Operable Unit, Hanford Site, Benton County, Washington* (300-FF-2 ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington. The selected action involved (1) evaluating the site using available process information, (2) evaluating the site through sampling to determine that the RAOs have been achieved, and (3) proposing the site for reclassification to No Action.

Basis for reclassification:

In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 331 LSLDF waste site to No Action. The current site conditions achieve the industrial land use RAOs and the corresponding remedial action goals established in the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* and the 300-FF-2 ROD. This site does not have a deep zone or other condition that would warrant an institutional control in accordance with the 300-FF-2 ROD under the industrial land use scenario. The basis for reclassification to No Action is described in detail in the *Remaining Sites Verification Package for the 331 Life Sciences Laboratory Drain Field Septic System* (attached).

Waste Site Controls:
Engineered Controls: Yes ☐ No ☒ Institutional Controls: Yes ☐ No ☒ O&M requirements: Yes ☐ No ☒
If any of the Waste Site Controls are checked Yes specify control requirements including reference to the Record of Decision, TSD Closure Letter, or other relevant documents.

M. S. French DOE Federal Project Director (printed)	[signature] Signature	10/2/08 Date
N/A Ecology Project Manager (printed)	Signature	Date
A. L. Boyd EPA Project Manager (printed)	[signature] Signature	10/16/08 Date

REMAINING SITES VERIFICATION PACKAGE FOR THE 331 LIFE SCIENCES LABORATORY DRAIN FIELD SEPTIC SYSTEM

Attachment to Waste Site Reclassification Form 2008-020

October 2008

REMAINING SITES VERIFICATION PACKAGE FOR THE 331 LIFE SCIENCES LABORATORY DRAIN FIELD SEPTIC SYSTEM

EXECUTIVE SUMMARY

The 331 Life Sciences Laboratory Drain Field (LSLDF) Septic System waste site consists of a diversion chamber, two (dual-chambered) septic tanks, a distribution box, and a drain field originally connected to the 331 complex. The 331 LSLDF septic system was operational from 1970 to 1974, at which time the sanitary sewer connections from the 331 complex were rerouted to the 300 Area Sanitary Sewer. The 331 LSLDF septic system was fully isolated and abandoned in place. This septic system was designed to receive sanitary wastewater associated with animal studies from the 331-A and 331-B Buildings for discharge into the soil column. However, field observations and testing suggest the 331 LSLDF septic system did not receive any discharges. It is probable that all of the animal study discharges were routed to the 331 Life Sciences Laboratory Trenches 1 and 2 (331 LSLT1 and 331 LSLT2), the 331 LSLT1 Animal Waste Pit, the 300 Area Sanitary Sewer, or transported to the 100 Area.

The animal studies conducted in the 331 complex involved the use of radioisotopes. According to the Waste Information Data System, between 25 and 2,500 µCi of plutonium-238 could have been discharged to the 331 LSLDF in January 1975. However, January 1975 is after the identified operational lifetime of the 331 LSLDF septic system. The 331 LSLDF septic system is reported to have been isolated and abandoned in 1974 and would not have been able to receive discharges from the 331 complex in 1975. Other documentation indicates the contamination in question was discharged to the 300 Area process sewer (DOE-RL 1992).

The two dual-chambered 331 LSLDF septic tanks were sampled on April 18, 2006. Clear liquids were found in both of the septic tanks. An evaluation of the liquid samples, based on both field methods and fixed laboratory analyses, concluded that the septic tanks were either never used or previously pumped and rinsed. The residual water within the septic tanks appeared to be rainwater.

The *Work Instruction for Confirmatory Sampling of the 331 Life Sciences Laboratory Drain Field (LSLDF)* was developed to determine if contamination was present in the drain field (WCH 2006). Confirmatory sampling of the drain field and of the soil around the distribution box was performed in April 2007. Similar to the septic tanks, all of the drain field laterals were found to be unexpectedly clean, and almost new in appearance. Sediments within the laterals were only sparingly available, and the little that could be collected from each lateral was combined to achieve a sufficient sample size for fixed laboratory analysis.

Confirmatory sampling shows that the 331 LSLDF waste site meets the applicable industrial land use scenario under the *Interim Action Record of Decision for the 300-FF-2 Operable Unit, Hanford Site, Benton County, Washington* (300-FF-2 ROD) (EPA 2001). Field radiological surveys were performed to evaluate the potential presence of the radioisotopes resulting from the

animal studies. No elevated radiological activity was detected in the field or in the samples analyzed at the laboratories. No contaminants of potential concern (COPCs) were detected at concentrations exceeding the direct exposure remedial action goals (RAGs) for the industrial land use scenario. Concentrations of 19 COPCs, including inorganic and organic constituents, exceeded soil RAG values for groundwater and/or river protection. However, none of these COPCs is predicted to reach groundwater based on soil-partioning coefficient values and/or insufficient total contaminant mass.

Confirmatory sampling results were also compared to the unrestricted (residential) land use RAGs, which determined that in addition to the previously mentioned 19 COPCs exceeding soil RAGs for groundwater and/or river protection aroclor-1254 and dieldren concentrations exceed the unrestricted direct exposure RAGs. However, the overall volume of material within the 331 LSLDF containing these constituents was determined to be minimal. Aroclor-1254 is likely the result of oils or mastics used to seal various components of the septic system during construction of the 331 LSLDF septic system. Therefore, it may be appropriate to consider the 331 LSLDF waste site for residential (unrestricted) land use; this should be considered as part of the final remedial investigation/feasibility study and land use determinations for the 300 Area.

In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 331 LSLDF waste site to No Action based on attainment of industrial land use RAOs and the corresponding RAGS established in the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (DOE-RL 2004b) and the *Interim Action Record of Decision for the 300-FF-2 Operable Unit, Hanford Site, Benton County, Washington* (300-FF-2 ROD) (EPA 2001) (Table ES-1). The site does not have a deep zone or other conditions that would warrant the imposition of institutional controls for this land use scenario, in accordance with the 300-FF-2 ROD.

Soil cleanup levels were established in the 300-FF-2 ROD (EPA 2001) based, in part, on a limited ecological risk assessment. Although not required by the 300-FF-2 ROD, a comparison against ecological risk screening levels has been made for the 331 LSLDF site contaminants of concern and other constituents. Screening levels were exceeded for the constituents; antimony, arsenic, boron, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, selenium, silver, vanadium, zinc, aroclor-1254, and dieldren. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of these constituents does not pose a risk to ecological receptors because there is only a small amount of material containing aroclor-1254 and dieldren directly associated with the septic system pipeline, concentrations of manganese, vanadium, and chromium are below site background levels, and the concentrations of boron and molybdenum are consistent with those seen elsewhere at the Hanford Site (no established background value is available for boron and molybdenum). Antimony, arsenic, and selenium are within the range of Hanford Site background levels. Exceedances for cadmium, copper, lead, mercury, silver, and zinc will be evaluated in the context of additional lines of evidence as part of the baseline risk assessment. A more complete quantitative ecological risk assessment will be presented in the baseline risk assessment for the river corridor portion of the Hanford Site and will be used to support the final closeout decision for this site.

Table ES-1. Summary of Remedial Action Goals for the 331 LSLDF Waste Site – Industrial Land Use. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure Radionuclides	Attain 15 mrem/yr dose rate above background over 1,000 years.	No radionuclide COCs or COPCs were detected above background values.	Yes
Direct Exposure Nonradionuclides	Attain individual COC RAGs.	All individual COC/COPC concentrations are below the industrial land use direct exposure criteria.	Yes
Risk Requirements Nonradionuclides	Attain a hazard quotient of <1 for all individual noncarcinogens.	All individual hazard quotients are <1.	Yes
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	The cumulative hazard quotient (0.350) is <1.	
	Attain an excess cancer risk of $<1 \times 10^{-5}$ for individual carcinogens.	The excess cancer risk values for individual carcinogens are $<1 \times 10^{-5}$.	
	Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	The total excess cancer risk value (1.1×10^{-6}) is $<1 \times 10^{-5}$.	
Groundwater/River Protection – Radionuclides	Attain single COPC groundwater and river protection RAGs.	No radionuclide COCs or COPCs were detected above background values.	Yes
	Attain national primary drinking water regulations:[a] 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.		
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide from DOE Order 5400.5.[b]		
	Meet total uranium standard of 21.2 pCi/L.[c]		

Table ES-1. Summary of Remedial Action Goals for the 331 LSLDF Waste Site – Industrial Land Use. (2 Pages)

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Residual concentrations of antimony, barium, cadmium, total chromium, copper, lead, mercury, selenium, silver, zinc, bis(2-ethylhexyl)phthalate, aldrin, gamma-BHC, 4,4'-DDE, dieldrin, endosulfan I, endrin, heptachlor epoxide, and aroclor-1254 are above the soil RAGs for groundwater and/or river protection. However, the overall volume of contaminated material is insufficient for these contaminants to saturate the vadose zone soil column and migrate to groundwater (and subsequently the Columbia River). Furthermore, RESRAD modeling predicts the barium, cadmium, total chromium, copper, lead, mercury, selenium, silver, zinc, bis(2-ethylhexyl)phthalate, aldrin, dieldrin gamma-BHC, 4,4'-DDE, endosulfan I, endrin, heptachlor epoxide, and aroclor-1254 will not reach groundwater (and, therefore, the Columbia River) within 1,000 years due to the K_d values of these consitiuents.[d]	Yes

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] *Radiation Protection of the Public and Environment* (DOE Order 5400.5).
[c] Based on the isotopic distribution of uranium in the 100 Areas, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater* (BHI 2001).
[d] Based on the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005), these constituents are not predicted to migrate more than 2 m (7 ft) vertically in 1,000 years (based on the lowest soil-partitioning coefficient distribution [mercury] of 30 mL/g). The vadose zone underlying the contamination is approximately 7 m (23 ft) thick.

COC = contaminant of concern
COPC = contaminant of potential concern
MCL = maximum contaminant level
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose assessment model)

REMAINING SITES VERIFICATION PACKAGE FOR THE 331 LIFE SCIENCES LABORATORY DRAIN FIELD SEPTIC SYSTEM

STATEMENT OF PROTECTIVENESS

The 331 Life Sciences Laboratory Drain Field (LSLDF) Septic System waste site sample results demonstrate that the site achieves the remedial action objectives (RAOs) established in the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (RDR/RAWP) (DOE-RL 2004b) and the *Interim Action Record of Decision for the 300-FF-2 Operable Unit* (300-FF-2 ROD) (EPA 2001). The contaminant concentrations meet RAOs for the industrial land use scenario. This site does not have a deep zone; therefore, in accordance with the 300-FF-2 ROD, no institutional controls are required.

A comparison against ecological risk screening levels has been made for the 331 LSLDF site contaminants of concern and other constituents. Screening levels were exceeded for the constituents; antimony, arsenic, boron, cadmium, chromium, copper, lead, manganese, mercury, molybdenum, selenium, silver, vanadium, zinc, aroclor-1254, and dieldren. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of these constituents does not pose a risk to ecological receptors because there is only a small amount of material containing aroclor-1254 and dieldren directly associated with the septic system pipeline, concentrations of manganese, vanadium and chromium are below site background levels, and the concentrations of boron and molybdenum are consistent with those seen elsewhere at the Hanford Site (no established background value is available for boron and molybdenum). Antimony, arsenic, and selenium are within the range of Hanford Site background levels. Exceedances for cadmium, copper, lead, mercury, silver, and zinc will be evaluated in the context of additional lines of evidence as part of the baseline risk assessment. A more complete quantitative ecological risk assessment will be presented in the baseline risk assessment for the river corridor portion of the Hanford Site and will be used to support the final closeout decision for this site.

GENERAL SITE INFORMATION AND BACKGROUND

The 331 LSLDF waste site (Figure 1) is a septic system consisting of a diversion chamber, two (dual-chambered) septic tanks, a distribution box, and a drain field connected to the 331 complex (Figure 2). The 331 LSLDF septic system was operational from 1970 to 1974, at which time the sanitary sewer connections were rerouted to the 300 Area Sanitary Sewer. The 331 LSLDF septic system was fully isolated and abandoned in place in 1974 (DOE-RL 1992).

Figure 1. 331 Life Sciences Laboratory Site Map.

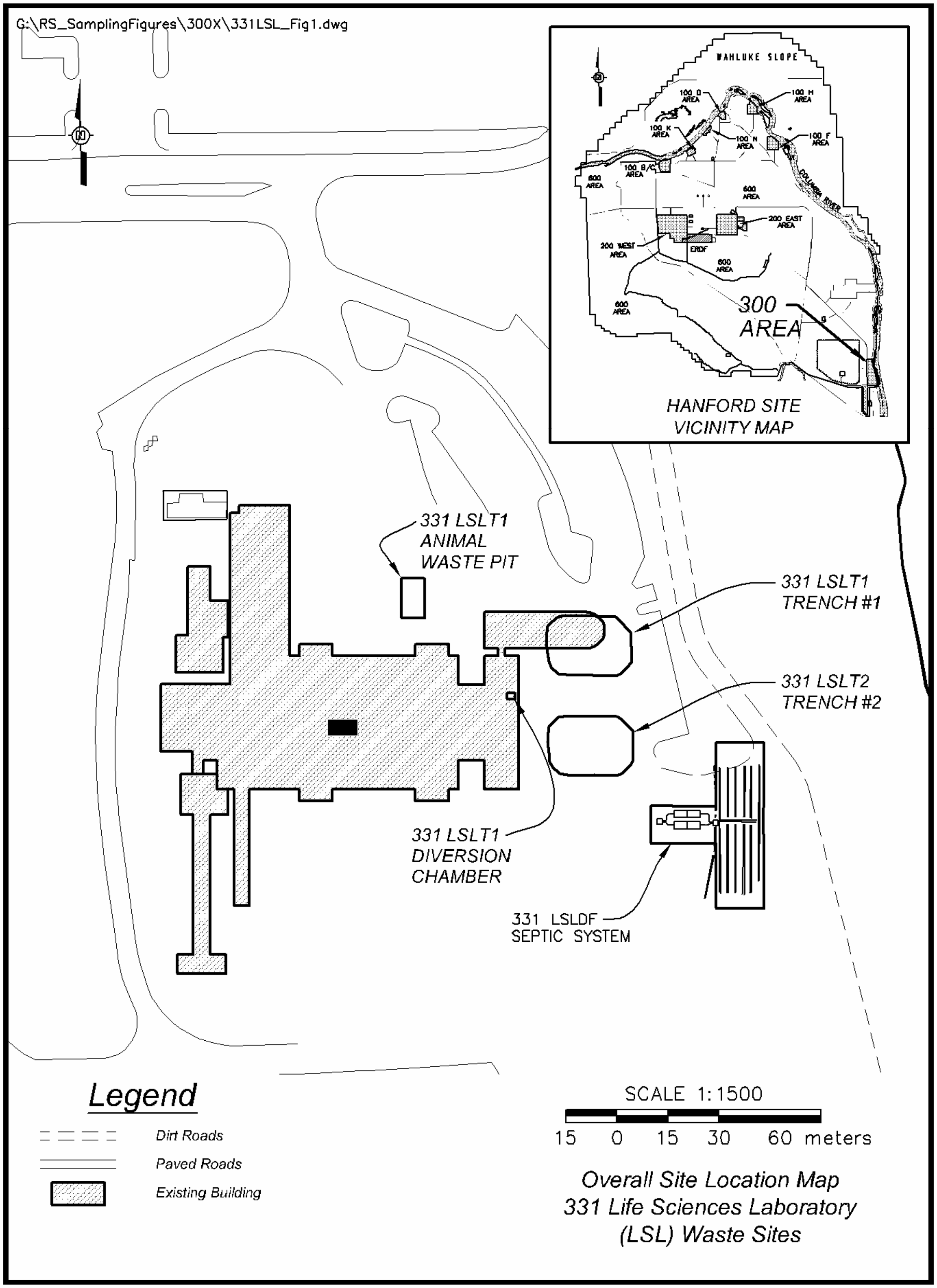
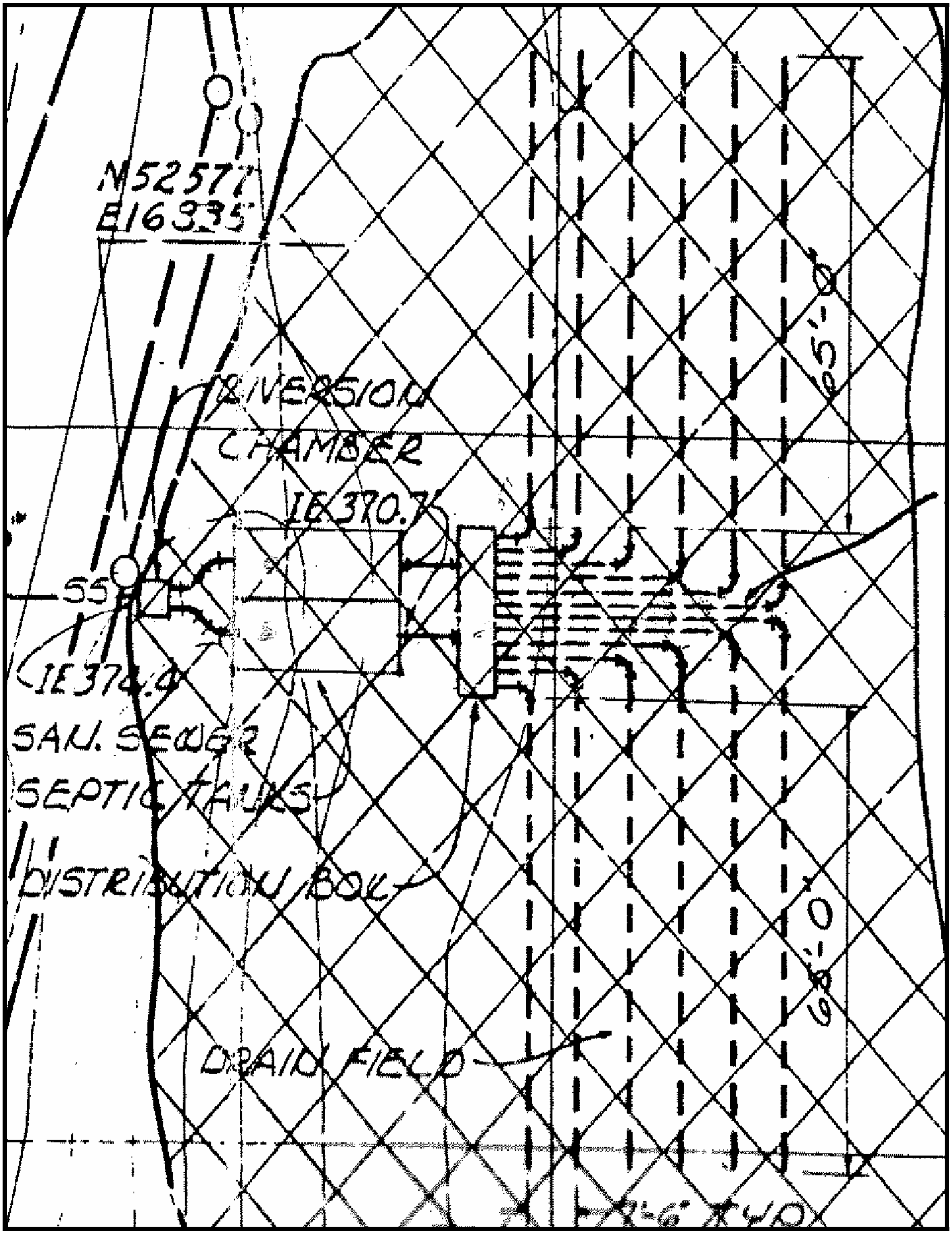


Figure 2. 331 Drain Field Details (WHC 1996).



This septic system was designed to receive sanitary wastewater associated with animal studies from the 331-A and 331-B Buildings for discharge into the soil column. However, field observations and testing suggest this system did not receive any discharges. It is probable that all of the animal study discharges were routed to the 331 Life Sciences Laboratory Trenches 1 and 2 (331 LSLT1 and 331 LSLT2), the 331 LSLT1 Animal Waste Pit, the 300 Area Sanitary Sewer, or transported to the 100 Area (DOE-RL 1992).

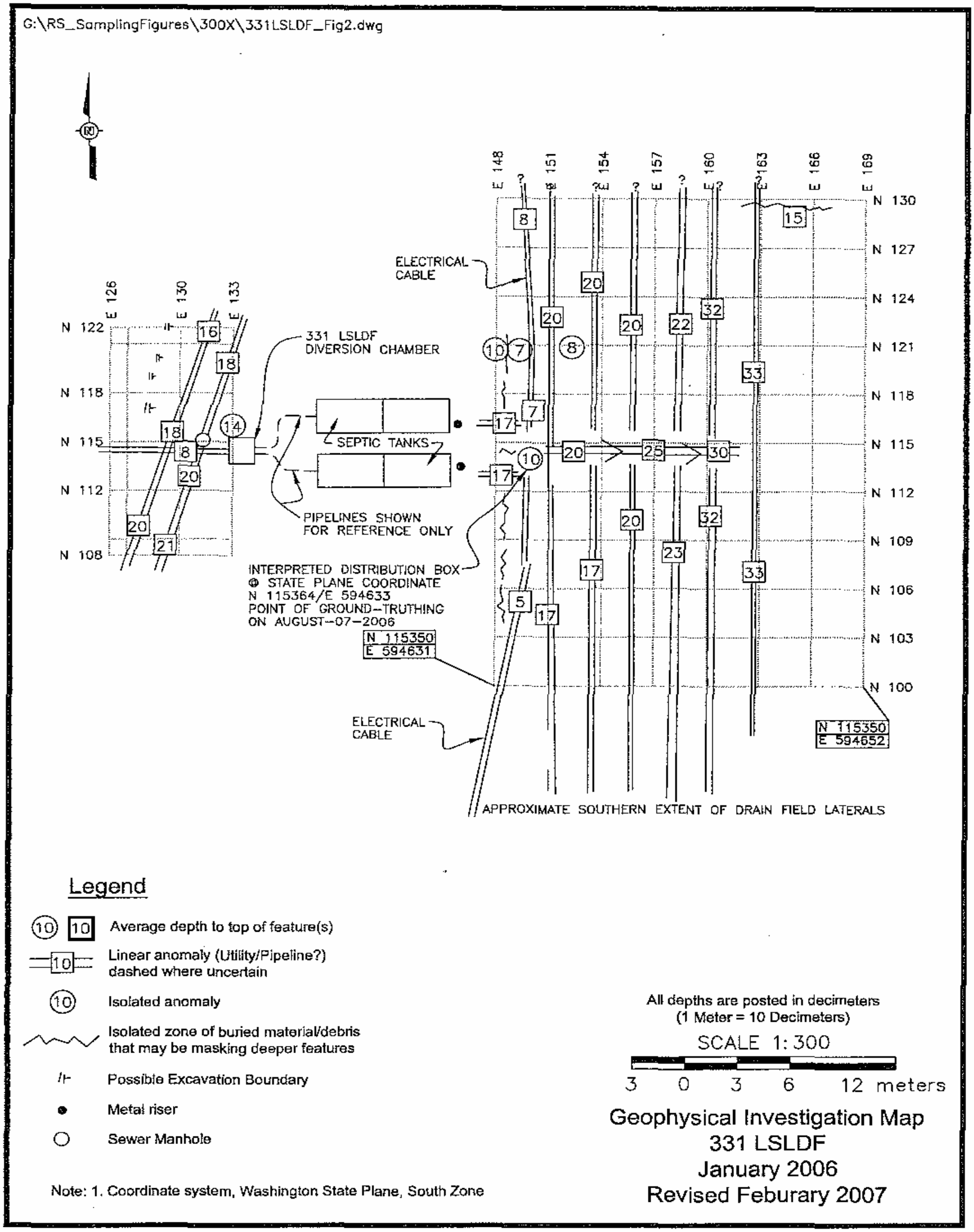
The animal studies involved the use of radioisotopes, and the animal waste was segregated on the basis of radiological activity. Solid animal waste exceeding 200 pCi/g specific activity was transported to the 100-F Area trenches (DOE-RL 1992). Other solid animal waste (less than 200 pCi/g specific activity) was allowed to flush into the 331 waste system(s). According to the Waste Information Data System, between 25 and 2,500 µCi of plutonium-238 could have been flushed to the 331 LSLDF in January 1975. However, January 1975 is after the identified operational lifetime of the 331 LSLDF septic system when the waste site is reported to have been isolated and should not have been able to receive discharges from the 331 complex. Other documentation indicates that this contamination was discharged to the 300 Area process sewer (DOE-RL 1992).

SEPTIC TANK SAMPLING ACTIVITIES

An initial site visit was conducted in January 2006. Concrete structures were the only above-ground features associated with the septic system. These structures are the upper portions of the diversion chamber and septic tanks and their access ports. The area was otherwise relatively flat. A geophysical survey was performed at the 331 LSLDF site in January 2006 to locate and map subsurface features (Mitchell and Wiegman 2006) (Figure 3). The geophysical survey was performed using ground-penetrating radar. The survey identified several linear/utility features, all but one of which could be correlated to the septic system components, including the drain field laterals, inlet pipe, and interconnecting pipes associated with the diversion chamber and distribution box. A north-south-running linear feature on the western edge of the drain field crossing over the distribution box was later determined to be an energized electrical line unrelated to the 331 LSLDF waste site (Mitchell 2007).

The two dual-chambered 331 LSLDF septic tanks were sampled on April 18, 2006, for the purposes of evaluating waste disposition options for the tank contents and to support development of sampling strategies for the drain field. Clear liquids were found in both of the septic tanks. Liquid samples collected from each of the two westernmost cells of the tanks were analyzed for radionuclides, metals, mercury, anions, polychlorinated biphenyls (PCBs), semivolatile organic compounds, and volatile organic compounds (VOCs). Field pH measurements of the liquid collected from each tank ranged from 7 to 7.5. Based on the clarity of the liquids and the results of field and laboratory analyses of the samples collected, it was concluded that the septic tanks were either never used or had been previously pumped and rinsed. The residual water found within the septic tanks appears to be rainwater. Analytical data from the septic tanks are presented in Appendix A. Field sampling activities are further described in the sampler’s logbook (WCH 2008a).

Figure 3. Geophysical Interpretation Map.



Because the results from the 331 LSLDF septic tanks samples were insufficient to determine that the waste site did not require remediation, the *Work Instruction for Confirmatory Sampling of the 331 Life Sciences Laboratory Drain Field (LSLDF)* (WCH 2006) was developed.

CONFIRMATORY SAMPLING ACTIVITIES

Confirmatory sampling of the drain field and the soil around the distribution box was performed between April 14, 2007 and April 24, 2007 (WCH 2008a).

Similar to the septic tanks, the drain field laterals were observed to be unexpectedly clean, almost new in appearance. During sampling activities, field instruments were used to search for indications of the radioisotopes expected to be present from the animal studies. No elevated radiological activity was detected in the field or in the samples analyzed at the offsite laboratories. However, the sample results do indicate elevated concentrations of 17 nonradionuclide contaminants. Laboratory data from samples collected during the confirmatory sampling event are presented in Appendix A.

The following sections describe the contaminants of potential concern (COPCs), sample design, sampling activities, and sample results.

Contaminants of Potential Concern

The COPCs for the 331 LSLDF site were identified based on existing historical information for the site. The COPC list provided in the 300-FF-2 ROD (EPA 2001) includes americium-241, curium-244, neptunium-237, plutonium-238, plutonium-239, uranium-232, uranium-233, cadmium, chromium, lead, and total uranium. Historical information for the Hanford Site shows that there are no likely sources of the uranium-232 isotope; therefore, uranium-232 was eliminated as a COPC. Based on further evaluation of wastes potentially discharged to the septic system, pesticides, PCBs, mercury, inorganic anions (including nitrate and nitrite), semivolatile organic compounds, and gamma-emitting radionuclides were added as COPCs.

Because an inductively coupled plasma (ICP) analysis was planned for cadmium, chromium, and lead, the expanded list of ICP metals was also added to the analytical list in the analytical results data package. These additional COPCs include arsenic, antimony, barium, beryllium, boron, cobalt, copper, manganese, molybdenum, nickel, selenium, silver, vanadium, and zinc.

Contingencies were provided for adding contaminants to the COPC list if anomalies were discovered during confirmatory sampling. No suspected asbestos-containing material or petroleum-stained soil was observed during sampling; therefore, asbestos and total petroleum hydrocarbon analyses were not requested. Field screening for VOCs was performed and none were detected during sampling; therefore, laboratory analysis for VOCs was not requested.

Confirmatory Sample Design

Historical data, process knowledge, site visit observations, and other available information were used to develop the site-specific sample design (WCH 2006). The objective of the sample design was to determine the presence or absence of any environmental contamination and to determine the nature and estimate the extent of any contamination found. The sample design included focused samples to be collected at locations where contamination was most likely to be found (Figure 4). These samples included two samples from a test pit at the distribution box, one from within the distribution box, and one from beneath the pipes exiting the distribution box. Additionally, two trenches excavated within the drain field to access residual sediments and underlying soils allowed for composite samples to be collected from inside and below each of the six laterals from each trench.

Field Sampling

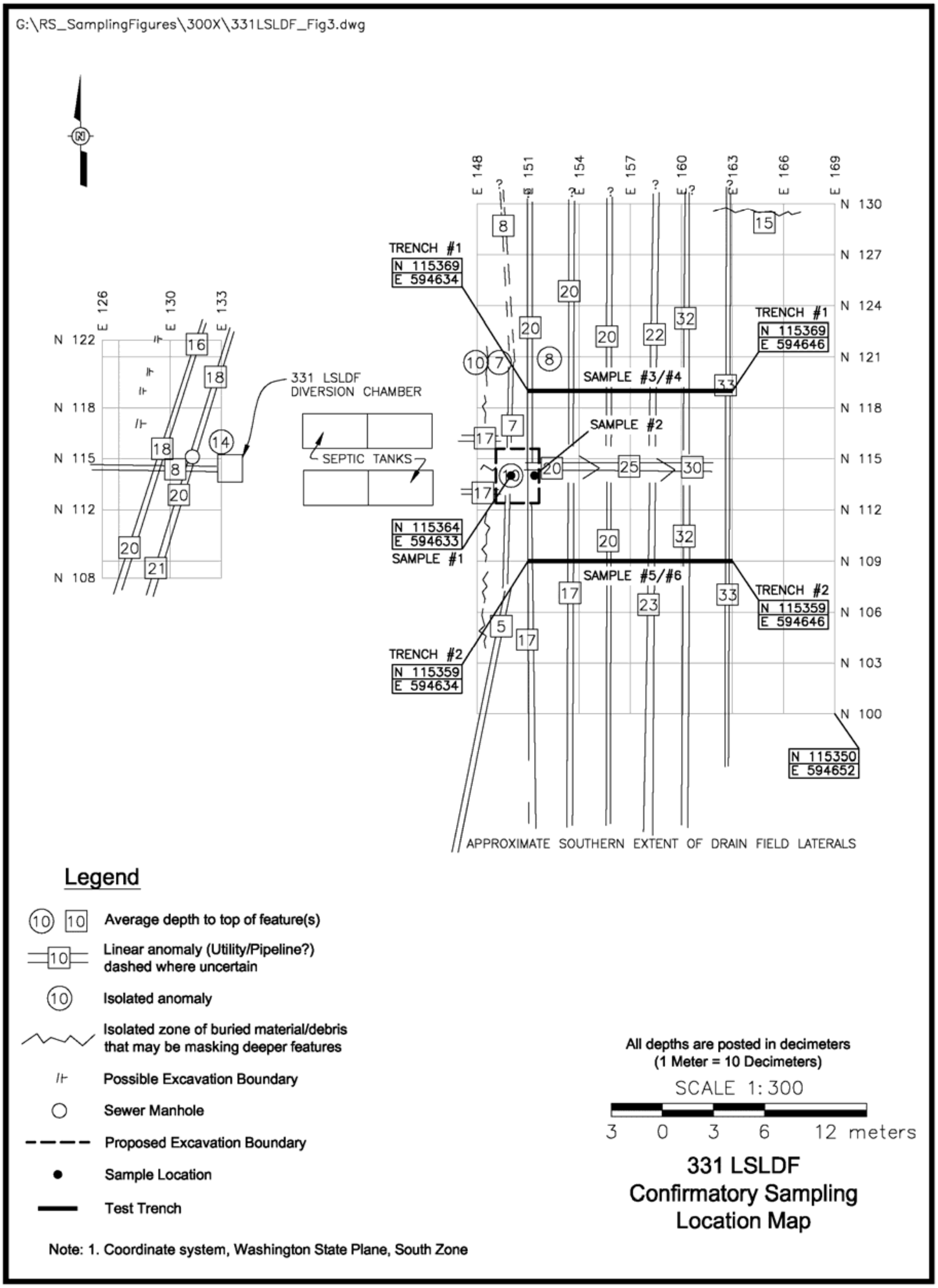
Confirmatory sampling activities began by excavating the northern trench (Appendix B, Photograph B-1). The vitrified clay pipe of the drain field laterals was excavated nearly intact, with multiple sections of pipe still connected to each other (Appendix B, Photograph B-2).

The four westernmost laterals in the northern trench contained no recoverable sediment (Appendix B, Photograph B-3). The fifth and sixth laterals contained small amounts of residual sediment. The observed sediment was collected. However, the resulting volume was insufficient to perform all of the laboratory analyses indicated in the work instruction. The sediment sample (J134W1) collected from the northern trench consisted of 90% of material collected from the sixth lateral and 10% of material from the fifth lateral. A soil sample (J134W2) consisting of material from below the laterals within the northern trench was collected. Additionally, a deeper soil sample (J134V6) and a duplicate (J134V7) were collected from within the northern trench. These samples are native material collected approximately 0.24 m (0.8 ft) below the laterals. A sample (J134W5) of the clay tile from the fifth lateral was also collected.

Excavation and sampling of the southern trench proceeded with similar results. No recoverable sediment was found within the five westernmost laterals. Small amounts of sediment were recovered and sampled (J134W3) from the sixth lateral only. A sample (J134V8) of native soil below the laterals within the southern trench was collected without difficulty. Additionally, a sample (J134W4) of the drainage rock from beneath the sixth lateral was collected (Appendix B, Photograph B-1).

Sampling within the distribution box proved to be problematic using the equipment available. Sampling the distribution box would have required breaking it open, which posed the risk of spilling liquid and/or solids that may have been inside. In a discussion with the U. S. Environmental Protection Agency Hanford Office Project Manager it was decided that to prevent a possible spill no sample needed to be collected from within the distribution box.

Figure 4. 331 LSLDF Confirmatory Sample Locations.



The samples collected from just upstream of the distribution box, in the septic tanks, from pipes downstream of the distribution box, and within the drain field were determined to be sufficient to determine the current contamination levels at the 331 LSLDF septic system. Excavation of the eastern side of the distribution box found 12 individual pipelines exiting it (Appendix B, Photograph B-5), as was indicated on the engineering drawings (Figure 2). No sediment was observed within these pipelines. A soil sample (J134V9) was collected from below the pipelines exiting the eastern side of the distribution box.

A summary of samples collected during confirmatory sampling at the 331 LSLDF waste site is presented in Table 1.

Table 1. Sample Summary for Confirmatory Sampling at the 331 LSLDF Waste Site. (2 Pages)

Sample Location		Sample Media	Sample Number	Coordinate Locations [a]	Depth (bgs)	Sample Analysis
Northern test trench	90% lateral 6 10% lateral 5	Sediment within laterals	J134W1	N 155369 E 594634 to N 115369 E 594646	3.3 m (10.8 ft)	PCB, SVOA, pesticides, ICP metals, mercury, nitrate, nitrite, GEA, gross alpha,[b] gross beta,[c] americium-241, curium-244, neptunium-237, isotopic plutonium, isotopic uranium
	Directly below laterals	Soil	J134W2		2.7 m (9 ft)	PCB, SVOA, pesticides, ICP metals, mercury, nitrate, nitrite, GEA, gross alpha,[b] gross beta,[c] americium-241, curium-244, neptunium-237, isotopic plutonium, isotopic uranium
	Native	Soil	J134V6		3.0 m (9.8 ft)	PCB, SVOA, pesticides, ICP metals, mercury, nitrate, nitrite, GEA, gross alpha,[b] gross beta,[c] americium-241, curium-244, neptunium-237, isotopic plutonium, isotopic uranium, TPH
	Duplicate of J134V6	Soil	J134V7		3.0 m (9.8 ft)	PCB, SVOA, pesticides, ICP metals, mercury, nitrate, nitrite, GEA, gross alpha,[b] gross beta,[c] americium-241, curium-244, neptunium-237, isotopic plutonium, isotopic uranium, TPH
	Lateral 5	Clay tile	J134W5		3.0 m (9.8 ft)	GEA, gross alpha,[b] gross beta,[c] americium-241, curium-244, neptunium-237, isotopic plutonium, isotopic uranium

Table 1. Sample Summary for Confirmatory Sampling at the 331 LSLDF Waste Site. (2 Pages)

Sample Location		Sample Media	Sample Number	Coordinate Locations [a]	Depth (bgs)	Sample Analysis
Southern test trench	Lateral 6	Sediment within lateral	J134W3	N 115359 E 594634 to N 115359 E 594646	3.3 m (10.8 ft)	PCB, SVOA, pesticides, ICP metals, mercury, nitrate, nitrite, GEA, gross alpha,[b] gross beta,[c] americium-241, curium-244, neptunium-237, isotopic plutonium, isotopic uranium
	Native	Soil	J134V8		3.0 m (9.8 ft)	PCB, SVOA, pesticides, ICP metals, mercury, nitrate, nitrite, GEA, gross alpha,[b] gross beta,[c] americium-241, curium-244, neptunium-237, isotopic plutonium, isotopic uranium, TPH
	Under lateral 6	Gravel	J134W4		3.3 m (10.8 ft)	GEA, gross alpha,[b] gross beta,[c] americium-241, curium-244, neptunium-237, isotopic plutonium, isotopic uranium
	Below pipelines exiting the eastern edge	Soil	J134V9		1.0 m (3.3 ft)	PCB, SVOA, pesticides, ICP metals, mercury, nitrate, nitrite, GEA, gross alpha,[b] gross beta,[c] americium-241, curium-244, neptunium-237, isotopic plutonium, isotopic uranium, TPH
Equipment blank	NA	Silica sand	J134W0	NA	NA	Inorganic anions, ICP metals and mercury, SVOA, VOA, pesticides, PCBs, GEA, gross alpha,[b] gross beta,[c] americium-241, curium-244, neptunium-237, isotopic plutonium, isotopic uranium, TPH

[a] Washington State Plane (meters).
[b] Gross alpha activity was not detected above background; therefore, further alpha-specific analysis was not needed.
[c] Gross beta activity was not detected above background; therefore, strontium analysis was not performed.

bgs = below ground surface
GEA = gamma energy analysis
ICP = inductively coupled plasma
NA = not applicable
PCB = polychlorinated biphenyl
SVOA = semivolatile organic analysis
TPH = total petroleum hydrocarbons
VOA = volatile organic analysis

Confirmatory Sample Results

Similar to the septic tanks, all of the drain field laterals were found to be clean, almost new in appearance. Sediments within the laterals were only sparingly available, and the little that could be collected (from the fifth and sixth laterals in the northern trench and the sixth lateral in the southern trench) had to be combined to achieve a sufficient sample size for fixed laboratory analysis. Field radiological surveys were performed to evaluate the presence of radioisotopes from the animal studies. No radiological activity was detected in the field or in the samples analyzed at the laboratories. The sample results do indicate detections for 29 COPCs. Data for the detected COPCs compared to the industrial and residential land use RAGs are presented in Table 2 (soil RAGs for groundwater and river protection are the same for both land use scenarios). The complete data set is presented in Appendix A.

Data Evaluation

Confirmatory samples were analyzed using analytical methods approved by the EPA (DOE-RL 2004a). All test pits and test trenches were excavated and sampled as specified in the 331 LSLDF work instruction (WCH 2006) and documented in the field logbook (WCH 2008a), with the exception of one sample that was not collected from within the distribution box. The overall amount of contaminated material within the 331 LSLDF was determined to be minimal because sediments were only present within some of the laterals and then only in small quantities. A diagram of the waste site showing the sampling locations with detections above the groundwater and river protection RAGs as well as detections above the residential land use scenario RAGs is presented as Figure 5.

Industrial Land Use Scenario

All contaminant concentrations are below direct exposure RAGs for industrial land use. The contaminants barium, cadmium, total-chromium, copper, lead, mercury, selenium, silver, zinc, bis(2-ethylhexyl)phthalate, aldrin, gamma-BHC, 4,4'-DDE, dieldrin, endosulfan I, endrin, heptachlor epoxide, and aroclor-1254 exceed soil RAGs for groundwater and/or river protection, but have relatively high soil-partitioning coefficients (K_d values), which limit the mobility of these constituents in the subsurface (BHI 2005). There is more than 7 m (23 ft) of soil between the contamination and groundwater. Considering the distance to groundwater and the high K_d values for these constituents, the detections of barium, cadmium, total-chromium, copper, lead, mercury, selenium, silver, zinc, bis(2-ethylhexyl)phthalate, aldrin, dieldrin, gamma-BHC, 4,4'-DDE, endosulfan I, endrin, heptachlor epoxide, and aroclor-1254 remain protective of groundwater and the Columbia River (BHI 2005). The maximum detected antimony, gamma-BHC, and endosulfan I concentrations are also above the groundwater and/or river protection soil RAGs. However, the total mass of these contaminants within the sparse sediment in the laterals would be insufficient to saturate the vadose zone soil column and migrate completely to groundwater (and subsequently the Columbia River). It is therefore concluded that residual concentrations of antimony, gamma-BHC, and endosulfan I at the 331 LSLDF site also satisfy the RAOs to protect groundwater and the Columbia River.

Table 2. Comparison of Maximum Soil Values to Action Levels at the 331 LSLDF Waste Site (2 pages)

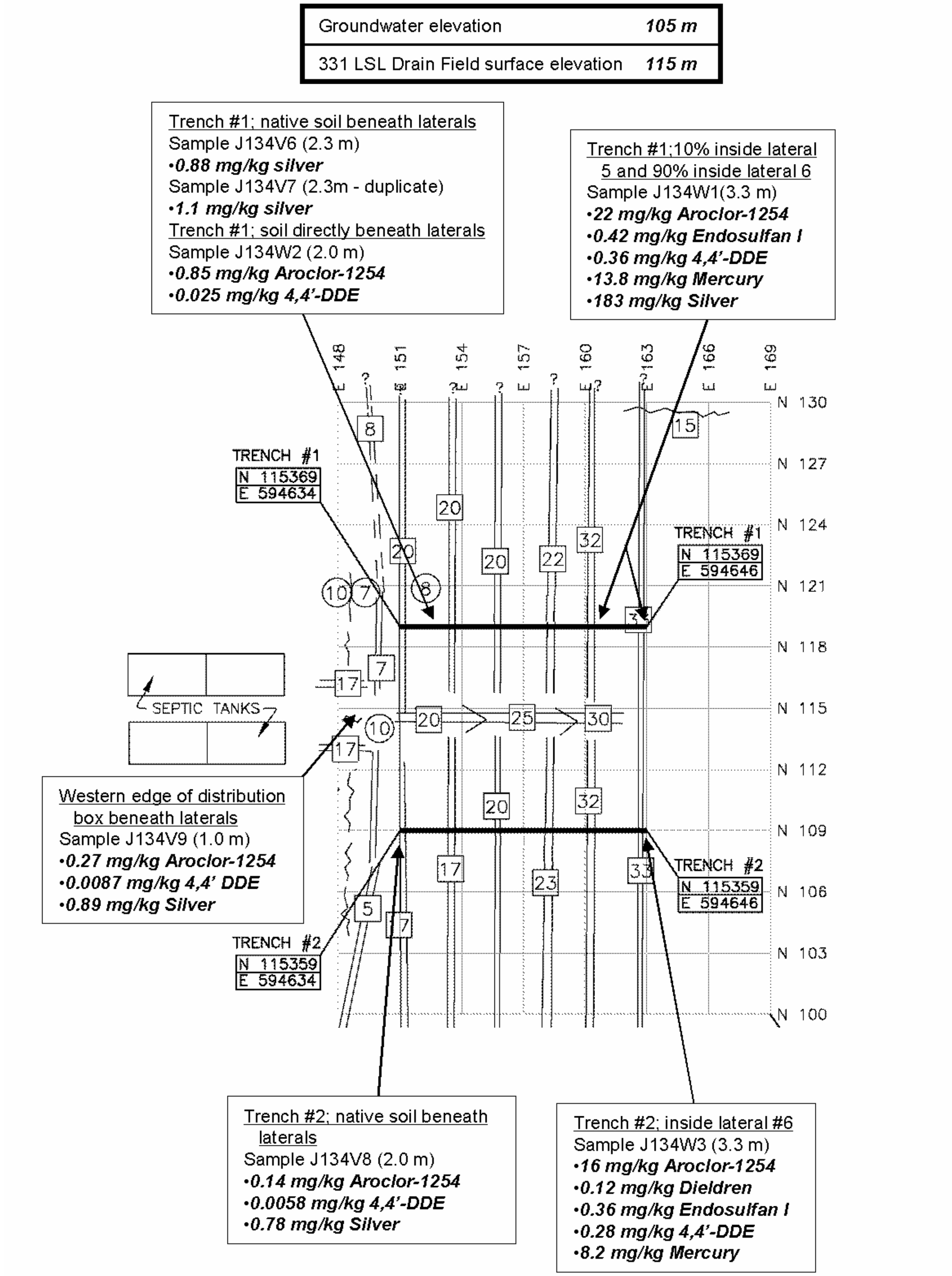
Contaminants of Potential Concern	Kd (mL/g)	Maximum Value (mg/kg)	Remedial Action Goals[a] (mg/kg)				Does the Maximum Result Exceed RAGs?	Does the Maximum Result pass RESRAD modeling?
			Industrial Direct Exposure	Residential Direct Exposure	Protective of Ground Water	Protective of the River		
Metals								
Antimony	1.4	6.4	1,400	32	5 [b]	5 [b]	Yes	Yes[c]
Barium	25	425	4,900	1,600	200[d]	400[d]	Yes	Yes[e]
Boron	3	1.7	700,000[d]	16,000[d]	320[d]	NA	No	
Cadmium	30	6.7	139	13.9	0.81[b]	0.81 [b]	Yes	Yes[e]
Chromium, total	200	29.9	5,250,000[d]	120,000[d]	18.5 [b]	18.5 [b]	Yes	Yes[c]
Copper	22	232	130,000	2,960	59.2	22.0 [b]	Yes	Yes[c]
Lead	30	56.1	1,000	353	10.2 [b]	10.2 [b]	Yes	Yes[c]
Mercury	30	13.8	1,050	24	0.33 [b]	0.33 [b]	Yes	Yes[c]
Molybdenum	20	5.5	17,500[d]	400[d]	8[d]	NA	No	
Selenium	150	1.8	17,500[d]	400[d]	5[d]	1[d]	Yes	Yes[c]
Silver	90	183	17,500[d]	400[d]	8[d]	0.73 [b]	Yes	Yes[c]
Zinc	30	452	1.05E+06[d]	24,000[d]	480[d]	67.8 [b]	Yes	Yes[e]
Semivolatiles								
Bis(2-ethylhexyl) phthalate	110	58.0	9,380[d]	71.4[d]	0.6[d]	0.36[d]	Yes	Yes[e]
Butylbenzylphthalate	13.8	17.0	700,000[d]	16,000[d]	320[d]	250[d]	No	
Di-n-butylphthalate	1.57	2.5	350,000[d]	8,000[d]	160[d]	540[d]	No	
Isophorone	0.0468	0.068	138,000[d]	1,050[d]	9.21[d]	1.68[d]	No	
Pesticides								
Aldrin	48.7	0.0092	7.72[d]	0.0588[d]	0.00165 [f]	0.00165[f]	Yes	Yes[c]
BHC, alpha	1.76	0.00039	20.8[d]	0.159[d]	0.00165[f]	0.00165[f]	No	
BHC, delta	3.38	0.0073	NA	NA	NA	NA	No	
BHC, gamma (Lindane)	1.35	0.0044	101[d]	0.769[d]	0.00673[f]	0.0038[f]	Yes	Yes[c]
DDE, 4,4'-	86.4	0.36	386[d]	2.94[d]	0.0257[d]	0.005[f]	Yes	Yes[c]
Dieldrin	25.6	0.12	8.2[d]	0.0625[d]	0.003[f]	0.003[f]	Yes	Yes[g]
Endosulfan (I, II, sulfate)	2.04	0.438	21,000[d]	480[d]	9.6[d]	0.0112[d]	Yes	Yes[c]
Endrin (and ketone, aldehyde)	10.8	0.24	1,050[d]	24[d]	0.2[d]	0.039[d]	Yes	Yes[c]
Heptachlor epoxide	83.2	0.0047	14.4[d]	0.11[d]	0.002[f]	0.002[f]	Yes	Yes[c]
Methoxychlor	80	0.0033	17,500[d]	400[d]	4[d]	1.67[d]	No	

Table 2. Comparison of Maximum Soil Values to Action Levels at the 331 LSLDF Waste Site (2 pages)

Contaminants of Potential Concern	Kd (mL/g)	Maximum Value (mg/kg)	Remedial Action Goals (mg/kg)				Does the Maximum Result Exceed RAGs?	Does the Maximum Result pass RESRAD modeling?
			Industrial Direct Exposure	Residential Direct Exposure	Protective of Ground-water	Protective of the River		
Polychlorinated Biphenyls								
Aroclor-1254	75.6	22.0	65.6[d]	0.5[d]	0.017[f]	0.017[f]	Yes	Yes[g]
Volatiles								
Acetone	0.0006	0.6	3.15E−06[d]	72,000[d]	720[d]	NA	No	
Methylene chloride	0.01	0.11	17,500[d]	133[d]	0.5[d]	0.94[d]	No	

[a] Remedial action goals are established in the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (DOE-RL 2004a) unless otherwise indicated.
[b] Where cleanup levels are less than background, cleanup levels default to background per WAC 173-340-700[4][d] (Ecology 1996).
[c] The total mass of contaminant is insufficient to saturate the vadose zone soil column and migrate completely to groundwater (and subsequently the Columbia River). Therefore, residual concentrations satisfy the RAOs to protect human health, natural resources, groundwater, and the Columbia River.
[d] Calculated using the appropriate formulas from Ecology 1996, WAC 173-340-740, with toxicity values updated through April, 2008, from the EPA Integrated Risk Information System (IRIS) at http://www.epa.gov/iris or from the Risk Assessment Information System (RAIS) database of the Oak Ridge National Laboratory (ORNL) on the Internet at http://risk.lsd.ornl.gov. Parameters have been checked against Ecology's CLARC Database on the internet at https://www.ecy.wa.gov.
[e] Based on *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a), residual concentrations are not predicted to migrate more than 3 m (10 ft) vertically in 1000 years based on the lowest distribution coefficient (Kd) of the contaminants that this calculation is applied to (copper, 22 mL/g) the vadose zone underlying the contamination is approximately 7 m (23 ft) thick. Therefore, residual concentrations of these contaminants are predicted to be protective of groundwater and the river.
[f] Where cleanup levels are less than RDLs, cleanup levels default to RDLs per WAC 173-340-707(2), (WAC 173-340).
[g] A site specific risk assessment (Appendix C) was prepared showing that residual concentrations meet the remedial action objectives (WCH 2008b, WCH 2008c).

Figure 5. 331 LSLDF Confirmatory Sampling Results



Assessment of the risk requirements for the 331 LSLDF waste site is determined by calculation of the hazard quotient and excess carcinogenic risk values for nonradionuclides under the industrial land use scenario (WCH 2008d). These calculations are located in Appendix C. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1 x 10^{-5}, and a cumulative excess carcinogenic risk of less than 1 x 10^{-5}. These risk values were conservatively calculated for the waste site using the highest values obtained from any one sample. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. The calculations indicated that all individual hazard quotients for noncarcinogenic constituents are less than 1.0. The cumulative hazard quotient for the 331 LSLDF waste site is 0.350. All individual carcinogenic risk values are less than 1 x 10^{-6}. The cumulative carcinogenic risk value is 1.1 x 10^{-6}. Therefore, nonradionuclide risk requirements are met.

Residential Land Use Scenario

While not required for the land use scenario identified for the 331 LSLDF in the interim 300-FF-2 ROD, an evaluation of attainment of RAOs for unrestricted (residential) land use was also performed. Groundwater and river protection RAOs and corresponding RAGs are the same for this scenario as for industrial land use, such that the determination of protectiveness described previously remains applicable.

In consideration of residential direct exposure, the maximum detected concentrations of aroclor-1254 (22 mg/kg) and dieldren (0.12 mg/kg) at the 331 LSLDF are above the RAGs of 0.5 mg/kg and 0.0625 mg/kg, respectively. The aroclor-1254 result was obtained from a sediment sample (J134W1) collected from within the fifth and sixth laterals in the northern half of the 331 LSLDF. The dieldren result was obtained from a sediment sample (J134W3) collected from within the sixth lateral in the southern half of the 331 LSLDF. Sediments within the laterals were only sparingly available, and the little that could be collected from the fifth and sixth laterals in the northern half of the 331 LSLDF had to be combined to achieve a sufficient sample size. A site-specific risk assessment for the 331 LSLDF was prepared. This assessment shows that residual aroclor-1254 and dieldren at the 331 LSLDF waste site do not pose a significant risk to ecological or human receptors. The residual aroclor-1254 is likely the result of oils or mastics used to seal various components of the septic system during construction of the 331 LSLDF septic system.

Assessment of the risk requirements for the 331 LSLDF waste site is determined by calculation of the hazard quotient and excess carcinogenic risk values for nonradionuclides under the unrestricted (residential) land use scenario (WCH 2008b, WCH 2008c). These calculations are located in Appendix C. The requirements include an individual hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than 1 x 10^{-6}, and a cumulative excess carcinogenic risk of less than 1 x 10^{-5}. These risk values were conservatively calculated for the waste site using the highest values obtained from any one sample. Risk values were not calculated for constituents that were not detected or were detected at concentrations below Hanford Site or Washington State background values. The calculations indicated that all individual hazard quotients for noncarcinogenic constituents are less than 1.0.

The cumulative hazard quotient for the 331 LSLDF waste site is 8.6 x 10^{-2}. All individual cumulative carcinogenic risk values are less than 1 x 10^{-6}. The cumulative carcinogenic risk value is 3.7 x 10^{-6}. Therefore, nonradionuclide risk requirements are met.

Summary

The RAOs established in the *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (DOE-RL 2004b) consist of 5 RAOs, presented here in an abbreviated form:

- RAO #1 Prevent or reduce risk to human health, ecological receptors, and natural resources associated with exposure to wastes or soil contaminated above applicable or relevant and appropriate requirements or risk-based criteria.
- RAO #2 Prevent migration of contaminants through the soil column to groundwater and the Columbia River such that concentrations reaching groundwater and the river do not exceed maximum contaminant levels.
- RAO #3 Prevent or reduce occupational health risks to workers performing remedial action.
- RAO #4 Minimize the general disruption of cultural resources and wildlife habitat, and prevent adverse impacts to cultural resources and threatened or endangered species.
- RAO #5 Ensure that appropriate institutional controls and monitoring requirements are in place to protect future users at a remediated site.

The risk to human health, ecological receptors, and natural resources presented by the small localized quantity of residual contamination in the soil at the 331 LSLDF site is minimal. Protection of groundwater and the Columbia River is achieved based on insufficient contaminant mass to migrate to groundwater (and thus the river). The occupational risk to workers is achieved based on all measured contaminant concentrations being below industrial direct exposure soil RAG values. The potential adverse impacts to wildlife habitat along the riverbank associated with remedial action at the 331 LSLDF site outweighs the risks presented by the small quantity of residual contamination at the waste site. Institutional controls are not required because the site does not have a deep zone or other conditions that would warrant them for the industrial land use scenario.

In accordance with this evaluation, the confirmatory sampling results support a reclassification of the 331 LSLDF waste site to No Action for an industrial land use scenario. The current site conditions achieve the RAOs and the corresponding RAGs established in the RDR/RAWP (DOE-RL 2004b) and the 300-FF-2 ROD (EPA 2001). A site-specific risk assessment found that the contamination may also be protective of human health and the environment for an unrestricted (residential) land use scenario. This should be considered, as appropriate, in the final remedial investigation/feasibility study and land use determinations for the 300 Area

DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the confirmatory sampling approach and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications. The DQA for the 331 LSLDF waste site established that the data are of the right type, quality, and quantity to support site decisions within specified error tolerances. All analytical data were found to be acceptable for decision-making purposes. The evaluation verified that the sample design was sufficient for the purpose of site closeout verification. The detailed DQA is presented in Appendix D.

SUMMARY FOR INTERIM CLOSURE

The 331 LSLDF waste site has been evaluated in accordance with the 300-FF-2 ROD (EPA 2001) and the *300 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2004a). Focused sampling to determine the current state of the 331 LSLDF waste site was performed. The analytical data were shown to meet the cleanup objectives for industrial direct exposure, groundwater protection, and river protection. Accordingly, a reclassification to No Action is supported for the 331 LSLDF waste site. This site does not have a deep zone or any conditions that would warrant institutional controls for industrial land use.

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APPENDIX A

331 LIFE SCIENCES LABORATORY SEPTIC TANK INFORMATIONAL DATA SUMMARY TABLES

AND

331 LIFE SCIENCES LABORATORY DRAIN FIELD CONFIRMATORY DATA SUMMARY TABLES

Table A-1. Septic Tank Sampling Data Results. (6 Pages)

Sample Area	HEIS Number	Sample Date	Americium-241 (GEA)			Americium-241			Cesium-137			Cobalt-60			Curium-242		
			pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA
Septic Tank #2	J11XP2	04/18/06	98	U	98	0	U	1	17	U	17	16	U	16	0	U	1.1
Septic Tank #3	J11XP3	04/18/06	230	U	230	0	U	0.99	31	U	31	28	U	28	0	U	1

Sample Area	HEIS Number	Sample Date	Curium-243/244			Europium-152			Europium-154			Europium-155			Gross Alpha		
			pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA
Septic Tank #1	J11XP2	04/18/06	0.137	U	1	43	U	43	53	U	53	53	U	53	-1.95	U	7.3
Septic Tank #2	J11XP3	04/18/06	0.129	U	0.99	84	U	84	93	U	93	100	U	100	-0.705	U	4.3

Sample Area	HEIS Number	Sample Date	Gross Beta			Neptunium-237			Plutonium-238			Plutonium-239/240			Potassium-40		
			pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA
Septic Tank #1	J11XP2	04/18/06	69.4		4.1	0.272	U	0.81	0	U	0.81	0.105	U	0.81	410	U	410
Septic Tank #2	J11XP3	04/18/06	39.9		2.8	0	U	0.68	0	U	0.88	0	U	0.88	870	U	870

Sample Area	HEIS Number	Sample Date	Strontium (total)			Radium-226			Radium-228			Thorium-228			Thorium-232		
			pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA
Septic Tank #1	J11XP2	04/18/06	-0.069	U	1	28	U	28	77	U	77	25	U	25	77	U	77
Septic Tank #2	J11XP3	04/18/06	0.168	U	0.88	69	U	69	140	U	140	47	U	47	140	U	140

Sample Area	HEIS Number	Sample Date	Uranium-233/234			Uranium-235 (GEA)			Uranium-235			Uranium-238 (GEA)			Uranium-238		
			pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA	pCi/L	Q	MDA
Septic Tank #1	J11XP2	04/18/06	0.949		0.36	72	U	72	0.172	U	0.44	1.14		0.36	0.245		0.23
Septic Tank #2	J11XP3	04/18/06	0.555		0.39	120	U	120	0.122	U	0.47	0.505		0.39	0.379		0.21

C = blank contamination
D = diluted
GEA = gamma energy analysis
HEIS = Hanford Environmental Information System
J = estimate
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
TPH = total petroleum hydrocarbon
U= undetected

Table A-1. 331 Septic Tank Sampling Data Results. (6 Pages)

Sample Area	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium		
			ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
Septic Tank #2	J11XP2	04/18/06	251		28.8	14.8		4.4	8.3		6.1	33	C	0.2
Septic Tank #1	J11XP3	04/18/06	51.8		28.8	24.3		434	6.1	U	6.1	46.4	C	0.2

Sample Area	HEIS Number	Sample Date	Boron			Cadmium			Calcium			Chromium		
			ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
Septic Tank #2	J11XP2	04/18/06	48.7	C	7.2	0.7	U	0.7	42700	C	16.4	7.3		1.3
Septic Tank #1	J11XP3	04/18/06	39.7	C	2.4	0.7	U	0.7	65000	C	16.4	1.3	U	1.3

Sample Area	HEIS Number	Sample Date	Copper			Iron			Lead			Magnesium		
			ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
Septic Tank #2	J11XP2	04/18/06	25.3		1.2	514		34.9	5		3.1	676		9.7
Septic Tank #1	J11XP3	04/18/06	12.2		1.2	40		34.9	3.1	U	3.1	920		9.7

Sample Area	HEIS Number	Sample Date	Mercury			Molybdenum			Nickel			Postassium		
			ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
Septic Tank #2	J11XP2	04/18/06	0.1	U	0.1	3.9		2.9	4.9		2.4	68100		68.1
Septic Tank #1	J11XP3	04/18/06	0.1	U	0.1	3.8		2.9	3.8		2.4	41800		22.7

Sample Area	HEIS Number	Sample Date	Silicon			Silver			Sodium			Vanadium		
			ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
Septic Tank #2	J11XP2	04/18/06	16700		22.7	1.1		0.7	189000		22.8	74.3		0.9
Septic Tank #1	J11XP3	04/18/06	9130		22.7	0.76		0.7	80300		7.6	9		0.9

Sample Area	HEIS Number	Sample Date	Bromide			Chloride			Flouride			Nitrate		
			ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
Septic Tank #2	J11XP2	04/18/06	250	U	250	2300		250	250	U	250	82300	D	2500
Septic Tank #1	J11XP3	04/18/06	250	U	250	1700		250	250	U	250	4080		250

Sample Area	HEIS Number	Sample Date	Nitrogen in Nitrite and Nitrate			Phosphate			Sulfate		
			ug/L	Q	PQL	ug/L	Q	PQL	ug/L	Q	PQL
Septic Tank #2	J11XP2	04/18/06	17400	D	400	5800		250	48300	D	2500
Septic Tank #1	J11XP3	04/18/06	840		20	1500		250	105000	D	5000

Table A-1. 331 Septic Tank Sampling Data Results. (6 Pages)

Sample Area	HEIS Number	Sample Date	Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242		
			µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL
Septic Tank #2	J11XP2	04/18/06	0.41	U	0.41	0.41	U	0.41	0.41	U	0.41	0.41	U	0.41
Septic Tank #1	J11XP3	04/18/06	0.40	U	0.40	0.40	U	0.40	0.40	U	0.40	0.40	U	0.40

Sample Area	HEIS Number	Sample Date	Aroclor-1248			Aroclor-1254			Aroclor-1260		
			µg/L	Q	PQL	µg/L	Q	PQL	µg/L	Q	PQL
Septic Tank #2	J11XP2	04/18/06	0.41	U	0.41	0.41	U	0.41	35	U	35
Septic Tank #1	J11XP3	04/18/06	0.40	U	0.40	0.40	U	0.40	35	U	35

Table A-1. 331 Septic Tank Sampling Data Results. (6 Pages)

Constituent	J11XP2 Sample Date 4/18/06 Septic Tank #2			J11XP3 Sample Date 4/18/06 Septic Tank #1		
	µg/L	Q	PQL	µg/L	Q	PQL
1,2,4-Trichlorobenzene	10	U	10	10	U	10
1,2-Dichlorobenzene	10	U	10	10	U	10
1,3-Dichlorobenzene	10	U	10	10	U	10
1,4-Dichlorobenzene	10	U	10	10	U	10
2,4,5-Trichlorophenol	26	U	26	25	U	25
2,4,6-Trichlorophenol	10	U	10	10	U	10
2,4-Dichlorophenol	10	U	10	10	U	10
2,4-Dimethylphenol	10	U	10	10	U	10
2,4-Dinitrophenol	26	U	26	25	U	25
2,4-Dinitrotoluene	10	U	10	10	U	10
2,6-Dinitrotoluene	10	U	10	10	U	10
2-Chloronaphthalene	10	U	10	10	U	10
2-Chlorophenol	10	U	10	10	U	10
2-Methylnaphthalene	10	U	10	10	U	10
2-Methylphenol (cresol, o-)	10	U	10	10	U	10
2-Nitroaniline	26	U	26	25	U	25
2-Nitrophenol	10	U	10	10	U	10
3+4 Methylphenol (cresol, m+p)	10	U	10	10	U	10
3,3'-Dichlorobenzidine	10	U	10	10	U	10
3-Nitroaniline	26	U	26	25	U	25
4,6-Dinitro-2-methylphenol	26	U	26	25	U	25
4-Bromophenylphenyl ether	10	U	10	10	U	10
4-Chloro-3-methylphenol	10	U	10	10	U	10
4-Chloroaniline	10	U	10	10	U	10
4-Chlorophenylphenyl ether	10	U	10	10	U	10
4-Nitroaniline	26	U	26	25	U	25
4-Nitrophenol	26	U	26	25	U	25
Acenaphthene	10	U	10	10	U	10
Acenaphthylene	10	U	10	10	U	10
Anthracene	10	U	10	10	U	10
Benzo(a)anthracene	10	U	10	10	U	10
Benzo(a)pyrene	10	U	10	10	U	10
Benzo(b)fluoranthene	10	U	10	10	U	10
Benzo(ghi)perylene	10	U	10	10	U	10
Benzo(k)fluoranthene	10	U	10	10	U	10

Table A-1. 331 Septic Tank Sampling Data Results. (6 Pages)

Constituent	J11XP2 Sample Date 4/18/06 Septic Tank #2			J11XP3 Sample Date 4/18/06 Septic Tank #1		
	µg/L	Q	PQL	µg/L	Q	PQL
Bis(2-chloro-1-methylethyl)ether	10	U	10	10	U	10
Bis(2-Chloroethoxy)methane	10	U	10	10	U	10
Bis(2-chloroethyl) ether	10	U	10	10	U	10
Bis(2-ethylhexyl) phthalate	6	JB	10	57	B	10
Butylbenzylphthalate	10	U	10	10	U	10
Carbazole	10	U	10	10	U	10
Chrysene	10	U	10	10	U	10
Di-n-butylphthalate	2	J	10	10	U	10
Di-n-octylphthalate	10	U	10	10	U	10
Dibenz[a,h]anthracene	10	U	10	10	U	10
Dibenzofuran	10	U	10	10	U	10
Diethylphthalate	10	U	10	10	U	10
Dimethyl phthalate	10	U	10	10	U	10
Fluoranthene	10	U	10	10	U	10
Fluorene	10	U	10	10	U	10
Hexachlorobenzene	10	U	10	10	U	10
Hexachlorobutadiene	10	U	10	10	U	10
Hexachlorocyclopentadiene	10	U	10	10	U	10
Hexachloroethane	10	U	10	10	U	10
Indeno(1,2,3-cd)pyrene	10	U	10	10	U	10
Isophorone	10	U	10	10	U	10
N-Nitroso-di-n-dipropylamine	10	U	10	10	U	10
N-Nitrosodiphenylamine	10	U	10	10	U	10
Naphthalene	10	U	10	10	U	10
Nitrobenzene	10	U	10	10	U	10
Pentachlorophenol	26	U	26	25	U	25
Phenanthrene	10	U	10	10	U	10
Phenol	10	U	10	10	U	10
Pyrene	10	U	10	10	U	10

Table A-1. 331 Septic Tank Sampling Data Results. (6 Pages)

Constituent	J11XP2 Sample Date 4/18/06 Septic Tank #2			J11XP3 Sample Date 4/18/06 Septic Tank #1		
	µg/L	Q	PQL	µg/L	Q	PQL
1,1,1-Trichloroethane	5	U	5	5	U	5
1,1,2,2-Tetrachloroethane	5	U	5	5	U	5
1,1,2-Trichloroethane	5	U	5	5	U	5
1,1-Dichloroethane	5	U	5	5	U	5
1,1-Dichloroethene	5	U	5	5	U	5
1,2-Dichloroethane	5	U	5	5	U	5
1,2-Dichloroethene(Total)	5	U	5	5	U	5
1,2-Dichloropropane	5	U	5	5	U	5
2-Butanone	10	U	10	10	U	10
2-Hexanone	10	U	10	10	U	10
4-Methyl-2-Pentanone	10	U	10	10	U	10
Acetone	5	J	10	10	U	10
Benzene	5	U	5	5	U	5
Bromodichloromethane	5	U	5	5	U	5
Bromoform	5	U	5	5	U	5
Bromomethane	10	U	10	10	U	10
Carbon disulfide	5	U	5	5	U	5
Carbon tetrachloride	5	U	5	5	U	5
Chlorobenzene	5	U	5	5	U	5
Chloroethane	10	U	10	10	U	10
Chloroform	5	U	5	5	U	5
Chloromethane	10	U	10	10	U	10
cis-1,2-Dichloroethylene	5	U	5	5	U	5
cis-1,3-Dichloropropene	5	U	5	5	U	5
Dibromochloromethane	5	U	5	5	U	5
Ethylbenzene	5	U	5	5	U	5
Methylenechloride	5	B	5	5	B	5
Styrene	5	U	5	5	U	5
Tetrachloroethene	5	U	5	5	U	5
Toluene	5	U	5	5	U	5
trans-1,2-Dichloroethylene	5	U	5	5	U	5
trans-1,3-Dichloropropene	5	U	5	5	U	5
Trichloroethene	5	U	5	5	U	5
Vinyl chloride	10	U	10	10	U	10
Xylenes (total)	5	U	5	5	U	5

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

Sample Location	Sample Number	Sample Date	Americium-241			Americium-241 GEA			Cesium-137			Cobalt-60		
			pCi/g	Q	MDA	pCi/g	QUAL	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Trench #1 native soil	J134V6	April 18, 2007	-0.0058	U	0.09	0.33	U	0.33	0.097	U	0.097	0.12	U	0.12
Duplicate of J134V6	J134V7	April 18, 2007	0.0734	U	0.28	0.33	U	0.33	0.1	U	0.1	0.12	U	0.12
Trench #2 native soil	J134V8	April 19, 2007	0.0224	U	0.091	0.091	U	0.091	0.11	U	0.11	0.1	U	0.1
Western edge of distribution box below laterals	J134V9	April 19, 2007	-0.0163	U	0.088	0.085	U	0.085	0.096	U	0.096	0.1	U	0.1
Equipment blank	J134W0	April 18, 2007	0.172	U	0.22	0.082	U	0.082	0.024	U	0.024	0.025	U	0.025
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	April 18, 2007	0.0868	U	0.33	0.36	U	0.36	0.38	U	0.38	0.18	U	0.18
Trench #1 soil under laterals	J134W2	April 18, 2007	-0.0516	U	0.39	0.21	U	0.21	0.057	U	0.057	0.058	U	0.058
Trench #2 sediment inside lateral 6 (100%)	J134W3	April 19, 2007	0.144	U	0.27	0.6	U	0.6	0.3	U	0.3	0.3	U	0.3
Trench #2 rock under lateral 6	J134W4	April 19, 2007	-0.0358	U	0.27	0.048	U	0.048	0.058	U	0.058	0.059	U	0.059
Trench #1 Clay tile under lateral 5	J134W5	April 18, 2007	0.0555	U	0.27	0.11	U	0.11	0.12	U	0.12	0.12	U	0.12

Sample Location	Sample Number	Sample Date	Curium-242			Curium-243/244			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Trench #1 native soil	J134V6	April 18, 2007	0.0255	U	0.061	-0.0059	U	0.084	0.26	U	0.26	0.38	U	0.38
Duplicate of J134V6	J134V7	April 18, 2007	-0.0401	U	0.31	-0.0736	U	0.53	0.25	U	0.25	0.37	U	0.37
Trench #2 native soil	J134V8	April 19, 2007	0.0061	U	0.1	-0.0281	U	0.19	0.28	U	0.28	0.31	U	0.31
Western edge of distribution box below laterals	J134V9	April 19, 2007	0.0235	U	0.079	0.0109	U	0.15	0.28	U	0.28	0.31	U	0.31
Equipment blank	J134W0	April 18, 2007	0	U	0.24	-0.0287	U	0.22	0.057	U	0.057	0.083	U	0.083
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	April 18, 2007	0	U	0.36	0.0435	U	0.33	0.46	U	0.46	0.55	U	0.55
Trench #1 soil under laterals	J134W2	April 18, 2007	-0.0561	U	0.43	0.103	U	0.64	0.13	U	0.13	0.21	U	0.21
Trench #2 sediment inside lateral 6 (100%)	J134W3	April 19, 2007	-0.0389	U	0.3	-0.0719	U	0.55	0.78	U	0.78	0.94	U	0.94
Trench #2 rock under lateral 6	J134W4	April 19, 2007	-0.0388	U	0.3	0	U	0.44	0.15	U	0.15	0.17	U	0.17
Trench #1 Clay tile under lateral 5	J134W5	April 18, 2007	-0.0604	U	0.29	0.0556	U	0.45	0.31	U	0.31	0.37	U	0.37

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

Sample Location	Sample Number	Sample Date	Europium-155			Gross alpha			Gross beta			Neptunium-237		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Trench #1 native soil	J134V6	April 18, 2007	0.26	U	0.26	6.02	U	8.2	8.06		5.5	0	U	0.084
Duplicate of J134V6	J134V7	April 18, 2007	0.26	U	0.26	14.5		7.6	13.9		5.8	0	U	0.084
Trench #2 native soil	J134V8	April 19, 2007	0.21	U	0.21	8.78		6	14.4		5.4	0.0282	U	0.084
Western edge of distribution box below laterals	J134V9	April 19, 2007	0.19	U	0.19	4.84	U	6.7	12.5		5.6	0	U	0.082
Equipment blank	J134W0	April 18, 2007	0.054	U	0.054	1.26	U	3.2	8.09		5.4	0	U	0.15
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	April 18, 2007	0.39	U	0.39	8.32		3.7	3.08	U	5.7	0	U	0.12
Trench #1 soil under laterals	J134W2	April 18, 2007	0.13	U	0.13	10.3		5.5	13.5		5.3	0.0797	U	0.12
Trench #2 sediment inside lateral 6 (100%)	J134W3	April 19, 2007	0.64	U	0.64	7.35		4.1	8.8		6.1	0	U	0.12
Trench #2 rock under lateral 6	J134W4	April 19, 2007	0.12	U	0.12	13.3		6.7	21		5.5	0	U	0.11
Trench #1 Clay tile under lateral 5	J134W5	April 18, 2007	0.23	U	0.23	4.78	U	4.8	8.39		5.6	0	U	0.11

Sample Location	Sample Number	Sample Date	Nickel-63			Plutonium-238			Plutonium-239/240			Potassium-40		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Trench #1 native soil	J134V6	April 18, 2007	-1.48	U	11	0	U	0.28	0	U	0.28	8.89		1
Duplicate of J134V6	J134V7	April 18, 2007	0.285	U	4.1	0	U	0.38	0	U	0.3	10.8		1
Trench #2 native soil	J134V8	April 19, 2007	-2	U	5.4	0	U	0.28	0	U	0.28	11.3		1
Western edge of distribution box below laterals	J134V9	April 19, 2007	-1.64	U	6.1	0.0378	U	0.35	0	U	0.29	8.98		0.88
Equipment blank	J134W0	April 18, 2007	-1.36	U	3.2	-0.0303	U	0.28	0	UX	0.23	4.67		0.26
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	April 18, 2007	-0.374	U	6.4	-0.032	U	0.24	0.128	U	0.24	0	UX	4.5
Trench #1 soil under laterals	J134W2	April 18, 2007	-2.75	U	12	-0.0118	U	0.079	0	U	0.045	12.6		0.79
Trench #2 sediment inside lateral 6 (100%)	J134W3	April 19, 2007	-2.09	U	3.7	0.0216	U	0.066	0.113		0.041	0.0467	U	7.5
Trench #2 rock under lateral 6	J134W4	April 19, 2007	-0.0532	U	4.6	-0.0458	U	0.35	0	U	0.35	11.5		0.63
Trench #1 Clay tile under lateral 5	J134W5	April 18, 2007	-0.463	U	8	0.033	U	0.084	0.12		0.046	8.48		1.2

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

Sample Location	Sample Number	Sample Date	Radium-226			Radium-228			Technetium-99			Thorium-228 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Trench #1 native soil	J134V6	April 18, 2007	0.263		0.19	0.601		0.41	0.26	U	1.8	0.596		0.15
Duplicate of J134V6	J134V7	April 18, 2007	0.55	U	0.55	0.84	U	0.84	-0.0349	U	2	0.476		0.15
Trench #2 native soil	J134V8	April 19, 2007	0.499		0.19	0.792		0.44	0.319	U	1.3	0.699		0.19
Western edge of distribution box below laterals	J134V9	April 19, 2007	0.302		0.19	0.822		0.38	0.0982	U	0.56	0.611		0.2
Equipment blank	J134W0	April 18, 2007	0.137		0.044	0.268		0.099	-0.0318	U	0.52	0.174		0.029
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	April 18, 2007	1.2	U	1.2	2.5	U	2.5	-0.0342	U	1.1	1.2	U	1.2
Trench #1 soil under laterals	J134W2	April 18, 2007	0.469		0.11	0.756		0.25	0.261	U	0.98	0.636		0.061
Trench #2 sediment inside lateral 6 (100%)	J134W3	April 19, 2007	0.65	U	0.65	2.5	U	2.5	0.0268	U	0.55	1.2	U	1.2
Trench #2 rock under lateral 6	J134W4	April 19, 2007	0.485		0.12	0.658		0.24	-0.0074	U	0.58	0.62		0.086
Trench #1 Clay tile under lateral 5	J134W5	April 18, 2007	1.09		0.24	1.04		0.46	0.168	U	0.6	1.11		0.16

Sample Location	Sample Number	Sample Date	Thorium-232 GEA			Total beta radiostrontium			Uranium-233/234			Uranium-235		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
9.5	J134V6	April 18, 2007	0.601		0.41	0.0481	U	0.33	0.432		0.21	0	U	0.25
Duplicate of J134V6	J134V7	April 18, 2007	0.84	U	0.84	0.14	U	0.38	0.439		0.17	0.0796	U	0.2
Trench #2 native soil	J134V8	April 19, 2007	0.792		0.44	0.0929	U	0.3	0.49		0.14	0	U	0.17
Western edge of distribution box below laterals	J134V9	April 19, 2007	0.822		0.38	-0.0478	U	0.3	0.404		0.14	0	U	0.17
Equipment blank	J134W0	April 18, 2007	0.268		0.099	-0.0138	U	0.19	0.283		0.18	0	U	0.22
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	April 18, 2007	2.5	U	2.5	-0.0174	U	0.15	0.858		0.18	0.0281	U	0.21
Trench #1 soil under laterals	J134W2	April 18, 2007	0.756		0.25	-0.0621	U	0.19	0.54		0.15	0.0467	U	0.18
Trench #2 sediment inside lateral 6 (100%)	J134W3	April 19, 2007	2.5	U	2.5	-0.0482	U	0.14	0.862		0.18	0	U	0.22
Trench #2 rock under lateral 6	J134W4	April 19, 2007	0.658		0.24	-0.0379	U	0.13	0.662		0.17	0.0267	U	0.2
Trench #1 Clay tile under lateral 5	J134W5	April 18, 2007	1.04		0.46	0.0699	U	0.19	0.429		0.14	0.0216	U	0.17

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

sample location	Sample Number	Sample Date	Uranium-235 GEA			Uranium-238			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Trench #1 native soil	J134V6	April 18, 2007	0.37	U	0.37	0.458		0.21	13	U	13
Duplicate of J134V6	J134V7	April 18, 2007	0.4	U	0.4	0.417		0.17	14	U	14
Trench #2 native soil	J134V8	April 19, 2007	0.44	U	0.44	0.471		0.14	11	U	11
Western edge of distribution box below laterals	J134V9	April 19, 2007	0.38	U	0.38	0.386		0.14	11	U	11
Equipment blank	J134W0	April 18, 2007	0.09	U	0.09	0.283		0.18	2.9	U	2.9
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	April 18, 2007	0.69	U	0.69	0.418		0.18	21	U	21
Trench #1 soil under laterals	J134W2	April 18, 2007	0.2	U	0.2	0.386		0.15	6.7	U	6.7
Trench #2 sediment inside lateral 6 (100%)	J134W3	April 19, 2007	1.1	U	1.1	0.862		0.18	35	U	35
Trench #2 rock under lateral 6	J134W4	April 19, 2007	0.24	U	0.24	0.486		0.17	6.5	U	6.5
Trench #1 Clay tile under lateral 5	J134W5	April 18, 2007	0.43	U	0.43	0.465		0.14	13	U	13

Table A-2. Confirmatory Sampling at the 331 Life Sciences Laboratory Drain Field (LSLDF). (14 Pages)

sample location	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Trench #1 native soil	J134V6	4/18/2007	4510		1.8	0.33	U	0.33	2		0.42	67.9	C	0.02	0.39		0.02
Duplicate of J134V6	J134V7	4/18/2007	4880		1.8	0.32	U	0.32	1.7		0.41	63.5	C	0.02	0.37		0.02
Trench #2 native soil	J134V8	4/19/2007	5940		1.8	0.33	U	0.33	2.1		0.42	78.6	C	0.02	0.41		0.02
Western edge of distribution box below laterals	J134V9	4/19/2007	3840		1.8	0.33	U	0.33	1.4		0.42	49.6	C	0.02	0.33		0.02
Equipment blank	J134W0	4/18/2007	39.1		1.7	0.3	U	0.3	0.38	U	0.38	0.97	C	0.02	0.02		0.02
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	4/18/2007	4240		1.4	6.4		0.3	16.5		0.39	425	C	0.02	0.28		0.01
Trench #1 soil under laterals	J134W2	4/18/2007	6900		1.5	0.36		0.32	2.4		0.41	77.4	C	0.02	0.57		0.01
Trench #2 sediment inside lateral 6 (100%)	J134W3	4/19/2007	5190		1.4	3.9		0.31	12.3		0.4	306	C	0.02	0.35		0.01
Trench #2 rock under lateral 6	J134W4	4/19/2007															
Trench #1 Clay tile under lateral 5	J134W5	4/18/2007															

sample location	HEIS Number	Sample Date	Boron			Bromide			Cadmium			Calcium			Chloride		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Trench #1 native soil	J134V6	4/18/2007	0.59		0.39	2.5	U	2.5	0.1	C	0.03	3470	C	1.9	2.5	U	2.5
Duplicate of J134V6	J134V7	4/18/2007	0.67		0.38	2.6	U	2.6	0.07	C	0.03	3630	C	1.8	2.6	U	2.6
Trench #2 native soil	J134V8	4/19/2007	1.4		0.39	2.3	U	2.3	0.14	C	0.03	4490	C	1.9	38.8		2.3
Western edge of distribution box below laterals	J134V9	4/19/2007	1.2		0.39	2.6	U	2.6	0.08	C	0.03	3600	C	1.9	2.6	U	2.6
Equipment blank	J134W0	4/18/2007	0.35	U	0.35	3.01	U	3	0.04	C	0.03	18.5	C	1.7	3.01	U	3
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	4/18/2007	1.6		0.36				6.7		0.03	10700	C	0.71			
Trench #1 soil under laterals	J134W2	4/18/2007	1.7		0.38				0.13		0.03	3470	C	0.75			
Trench #2 sediment inside lateral 6 (100%)	J134W3	4/19/2007	1.2		0.37				1.5		0.03	4820	C	0.74			
Trench #2 rock under lateral 6	J134W4	4/19/2007															
Trench #1 Clay tile under lateral 5	J134W5	4/18/2007															

sample location	HEIS Number	Sample Date	Chromium			Cobalt			Copper			Fluoride			Iron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Trench #1 native soil	J134V6	4/18/2007	5.4	C	0.08	6.8		0.09	14.4		0.27	2.5	U	2.5	18400	C	0.39
Duplicate of J134V6	J134V7	4/18/2007	6.4	C	0.08	7.6		0.09	14.8		0.26	2.6	U	2.6	19700	C	0.38
Trench #2 native soil	J134V8	4/19/2007	7.8	C	0.08	8.6		0.09	15.4		0.26	2.3	U	2.3	22000	C	0.39
Western edge of distribution box below laterals	J134V9	4/19/2007	4.7	C	0.08	6.9		0.09	12.4		0.26	2.6	U	2.6	17300	C	0.39
Equipment blank	J134W0	4/18/2007	0.19	C	0.07	0.08	U	0.08	0.32		0.24	3.01	U	3	99.8	C	0.35
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	4/18/2007	29.9		0.08	1.8		0.09	232		0.11				11000		2.8
Trench #1 soil under laterals	J134W2	4/18/2007	10.3		0.08	7.8		0.09	13.4		0.12				21300		3
Trench #2 sediment inside lateral 6 (100%)	J134W3	4/19/2007	21.7		0.08	4		0.09	128		12				14400		2.9
Trench #2 rock under lateral 6	J134W4	4/19/2007															
Trench #1 Clay tile under lateral 5	J134W5	4/18/2007															

Table A-2. Confirmatory Sampling at the 331 Life Sciences Laboratory Drain Field (LSLDF). (14 Pages)

sample location	HEIS Number	Sample Date	Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Trench #1 native soil	J134V6	4/18/2007	9	C	0.29	3160		3.5	215	C	0.02	0.08		0.02	0.53	C	0.13
Duplicate of J134V6	J134V7	4/18/2007	4.5	C	0.38	3450		3.4	248	C	0.02	0.09		0.02	0.59	C	0.13
Trench #2 native soil	J134V8	4/19/2007	4.1	C	0.28	4250		3.5	349	C	0.02	0.05		0.02	0.22	C	0.13
Western edge of distribution box below laterals	J134V9	4/19/2007	3.7	C	0.29	2990		3.5	238	C	0.02	0.11		0.02	0.33	C	0.13
Equipment blank	J134W0	4/18/2007	0.37	C	0.26	4.5		3.2	2.5	C	0.02	0.02	U	0.02	0.12	U	0.12
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	4/18/2007	56.1		0.27	1030	C	0.69	50.3		0.02	13.8		0.18	5.5		0.12
Trench #1 soil under laterals	J134W2	4/18/2007	4.8		0.28	4120	C	0.73	310		0.02	0.05		0.01	0.3		0.13
Trench #2 sediment inside lateral 6 (100%)	J134W3	4/19/2007	31.8		0.27	1890	C	0.72	134		0.02	8.2		0.16	3.5		0.13
Trench #2 rock under lateral 6	J134W4	4/19/2007															
Trench #1 Clay tile under lateral 5	J134W5	4/18/2007															

sample location	HEIS Number	Sample Date	Nickel			Nitrate			Nitrite			Nitrogen in Nitrite and Nitrate			Phosphate		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Trench #1 native soil	J134V6	4/18/2007	7.9		0.19	41.7		2.52	2.52	U	2.52	9.5		0.1	7		2.5
Duplicate of J134V6	J134V7	4/18/2007	7.6		0.19	38.8		2.61	2.61	U	2.61	9		0.1	6.7		2.6
Trench #2 native soil	J134V8	4/19/2007	10		0.19	33.4		2.29	2.29	U	2.29	7.8		0.09	5.5		2.3
Western edge of distribution box below laterals	J134V9	4/19/2007	6.9		0.19	8.7		2.6	2.6	U	2.6	2.3		0.1	4.4		2.6
Equipment blank	J134W0	4/18/2007	0.18	U	0.18	3.01	U	3	3.01	U	3	0.121	U	0.12	3.01	U	3
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	4/18/2007	7.2		0.18												
Trench #1 soil under laterals	J134W2	4/18/2007	9.5		0.19												
Trench #2 sediment inside lateral 6 (100%)	J134W3	4/19/2007	7.1		0.19												
Trench #2 rock under lateral 6	J134W4	4/19/2007															
Trench #1 Clay tile under lateral 5	J134W5	4/18/2007															

sample location	HEIS Number	Sample Date	Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Trench #1 native soil	J134V6	4/18/2007	789		56.5	0.38	U	0.38	474	C	0.62	0.88		0.09	121	C	3
Duplicate of J134V6	J134V7	4/18/2007	824		55.8	0.37	U	0.37	444	C	0.62	1.1		0.09	108	C	3
Trench #2 native soil	J134V8	4/19/2007	1190		56.2	0.38	U	0.38	1300	C	0.62	0.78		0.09	149	C	3
Western edge of distribution box below laterals	J134V9	4/19/2007	592		56.4	0.38	U	0.38	479	C	0.62	0.89		0.06	104	C	3
Equipment blank	J134W0	4/18/2007	51.2		51.2	0.34	U	0.34	36.1	C	0.56	0.08		0.08	6.8	C	2.8
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	4/18/2007	374		4.6	1.8		0.35	255	C	0.4	183		0.09	94.6	C	0.42
Trench #1 soil under laterals	J134W2	4/18/2007	1570		4.9	0.37	U	0.37	552	C	0.42	0.8		0.09	132	C	0.44
Trench #2 sediment inside lateral 6 (100%)	J134W3	4/19/2007	760		4.8	0.82		0.36	877	C	0.41	103		0.09	128	C	0.43
Trench #2 rock under lateral 6	J134W4	4/19/2007															
Trench #1 Clay tile under lateral 5	J134W5	4/18/2007															

Table A-2. Confirmatory Sampling at the 331 Life Sciences Laboratory Drain Field (LSLDF). (14 Pages)

sample location	HEIS Number	Sample Date	Sulfate			TPH			Uranium			Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Trench #1 native soil	J134V6	4/18/2007	33.2		2.5	142	U	142	0.815		0.013	49.6		0.1	56.5	C	0.03
Duplicate of J134V6	J134V7	4/18/2007	35.7		2.6	141	U	141	2.3		0.013	53.1		0.1	63.2	C	0.03
Trench #2 native soil	J134V8	4/19/2007	26.2		2.3	141	U	141	0.881		0.013	51.5		0.1	57.7	C	0.03
Western edge of distribution box below laterals	J134V9	4/19/2007	14.5		2.6	141	U	141	0.827		0.013	45.2		0.1	48.6	C	0.03
Equipment blank	J134W0	4/18/2007	3.01	U	3	133	U	133	0.614		0.013	0.09	U	0.09	0.87	C	0.03
Trench #1 sediment inside laterals 5 (90%) and 6 (10%)	J134W1	4/18/2007							1.4		0.013	16		0.1	452		0.03
Trench #1 soil under laterals	J134W2	4/18/2007							1		0.013	50.7		0.1	137		0.03
Trench #2 sediment inside lateral 6 (100%)	J134W3	4/19/2007							1.41		0.013	29.8		0.1	133		0.03
Trench #2 rock under lateral 6	J134W4	4/19/2007							1.64		0.013						
Trench #1 Clay tile under lateral 5	J134W5	4/18/2007							1.21		0.013						

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

Constituent	J134V8 Trench #2 native soil			J134V9 Western edge of distribution box below laterals			J134W0 Equipment blank		
	April 19, 2007			April 19, 2007			April 18, 2007		
	ug/kg	Q	PQL		Q	PQL	ug/kg	Q	PQL
Aroclor-1016	14	U	14	140	UD	140	13	U	13
Aroclor-1221	14	U	14	140	UD	140	13	U	13
Aroclor-1232	14	U	14	140	UD	140	13	U	13
Aroclor-1242	14	U	14	140	UD	140	13	U	13
Aroclor-1248	14	U	14	140	UD	140	13	U	13
Aroclor-1254	140		14	270	D	140	13	U	13
Aroclor-1260	14	U	14	140	UD	140	13	U	13

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

331 LSLDF Constituent	J134W1 Trench #1 sediment inside laterals 5 (90%) and 6 (10%)			J134W2 Trench #1 soil under laterals			J134W3 Trench #2 sediment inside lateral 6 (100%)		
	April 18, 2007			April 18, 2007			April 19, 2007		
	ug/kg	Q	PQL		Q	PQL	ug/kg	Q	PQL
Aroclor-1016	40000	UD	40000	1300	UD	1300	13000	UD	13000
Aroclor-1221	40000	UD	40000	1300	UD	1300	13000	UD	13000
Aroclor-1232	40000	UD	40000	1300	UD	1300	13000	UD	13000
Aroclor-1242	40000	UD	40000	1300	UD	1300	13000	UD	13000
Aroclor-1248	40000	UD	40000	1300	UD	1300	13000	UD	13000
Aroclor-1254	22000	JD	40000	850	JD	1300	16000	UD	16000
Aroclor-1260	40000	UD	40000	1300	UD	1300	13000	UD	13000

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

Constituent	J134V8			J134V9			J134W0		
	Trench #2 native soil			Western edge of distribution box			Equipment blank		
	April 19, 2007			April 19, 2007			April 18, 2007		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aldrin	0.56	JD	1.4	1.4	UD	1.4	1.3	UD	1.3
Alpha-BHC	1.4	UD	1.4	0.39	JDX	1.4	1.3	UD	1.3
alpha-Chlordane	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
beta-1,2,3,4,5,6-Hexachlorocyclohexane	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
Delta-BHC	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
Dichlorodiphenyldichloroethane	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
Dichlorodiphenyldichloroethylene	5.8	D	1.4	8.7	D	1.4	1.3	UD	1.3
Dichlorodiphenyltrichloroethane	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
Dieldrin	3	DX	1.4	1.4	UD	1.4	1.3	UD	1.3
Endosulfan I	1.9	D	1.4	0.99	JD	1.4	1.3	UD	1.3
Endosulfan II	3.1	DX	1.4	1.4	UD	1.4	1.3	UD	1.3
Endosulfan sulfate	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
Endrin	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
Endrin aldehyde	2.1	DX	1.4	2.9	DX	1.4	1.3	UD	1.3
Endrin ketone	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
Gamma-BHC (Lindane)	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
gamma-Chlordane	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
Heptachlor	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
Heptachlor epoxide	1.4	UD	1.4	1.4	UD	1.4	1.3	UD	1.3
Methoxychlor	1.4	UD	1.4	3.3	DX	3.3	1.3	UD	1.3
Toxaphene	14	UD	14	14	UD	14	13	UD	13

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

Constituent	J134W1			J134W2			J134W3		
	Trench #1 sediment inside laterals			Trench #1 soil under laterals			Trench #2 sediment inside lateral 6 (100%)		
	April 18, 2007			April 18, 2007			April 19, 2007		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Aldrin	9.2	JX	4	1.3	UD	1.3	4.9	DX	1.3
Alpha-BHC	4	UD	4	1.3	UD	1.3	1.3	UD	1.3
alpha-Chlordane	4	UD	4	1.3	UD	1.3	1.3	UD	1.3
beta-1,2,3,4,5,6-Hexachlorocyclohexane	4	UD	4	1.3	UD	1.3	1.3	UD	1.3
Delta-BHC	7.3	JX	4	1.3	UD	1.3	5.4	D	1.3
Dichlorodiphenyldichloroethane	4	UD	4	1.3	UD	1.3	1.3	UD	1.3
Dichlorodiphenyldichloroethylene	360	D	4	25	D	1.3	280	D	1.3
Dichlorodiphenyltrichloroethane	4	UD	4	1.3	UD	1.3	1.3	UD	1.3
Dieldrin	4	UD	4	13	DX	1.3	120	DX	1.3
Endosulfan I	420	D	4	1.3	UD	1.3	360	D	1.3
Endosulfan II	18	DX	4	1.3	UD	1.3	1.3	UD	1.3
Endosulfan sulfate	4	UD	4	1.3	UD	1.3	1.3	UD	1.3
Endrin	4	UD	4	1.3	UD	1.3	1.3	UD	1.3
Endrin aldehyde	130	DX	4	7.4	DX	1.3	100	DX	1.3
Endrin ketone	110	D	4	1.3	UD	1.3	37	DX	1.3
Gamma-BHC (Lindane)	4.4	JX	4	1.3	UD	1.3	1.3	UD	1.3
gamma-Chlordane	4	UD	4	1.3	UD	1.3	1.3	UD	1.3
Heptachlor	4	UD	4	1.3	UD	1.3	1.3	UD	1.3
Heptachlor epoxide	4.7	JX	4	1.3	UD	1.3	1.3	UD	1.3
Methoxychlor	4	UD	4	1.3	UD	1.3	1.3	UD	1.3
Toxaphene	13	UD	13	13	UD	13	13	UD	13

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

331 LSLDF Constituent	J134V8			J134V9			J134W0		
	Trench #2 native soil			Western edge of distribution box			Equipment blank		
	April 19, 2007			April 19, 2007			April 18, 2007		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	350	U	350	350	U	350	330	U	330
1,2-Dichlorobenzene	350	U	350	350	U	350	330	U	330
1,3-Dichlorobenzene	350	U	350	350	U	350	330	U	330
1,4-Dichlorobenzene	350	U	350	350	U	350	330	U	330
2,4,5-Trichlorophenol	880	U	880	880	U	880	830	U	830
2,4,6-Trichlorophenol	350	U	350	350	U	350	330	U	330
2,4-Dichlorophenol	350	U	350	350	U	350	330	U	330
2,4-Dimethylphenol	350	U	350	350	U	350	330	U	330
2,4-Dinitrophenol	880	U	880	880	U	880	830	U	830
2,4-Dinitrotoluene	350	U	350	350	U	350	330	U	330
2,6-Dinitrotoluene	350	U	350	350	U	350	330	U	330
2-Chloronaphthalene	350	U	350	350	U	350	330	U	330
2-Chlorophenol	350	U	350	350	U	350	330	U	330
2-Methylnaphthalene	350	U	350	350	U	350	330	U	330
2-Methylphenol (cresol, o-)	350	U	350	350	U	350	330	U	330
2-Nitroaniline	880	U	880	880	U	880	830	U	830
2-Nitrophenol	350	U	350	350	U	350	330	U	330
3+4 Methylphenol (cresol, m+p)	350	U	350	350	U	350	330	U	330
3,3'-Dichlorobenzidine	350	U	350	350	U	350	330	U	330
3-Nitroaniline	880	U	880	880	U	880	830	U	830
4,6-Dinitro-2-methylphenol	880	U	880	880	U	880	830	U	830
4-Bromophenylphenyl ether	350	U	350	350	U	350	330	U	330
4-Chloro-3-methylphenol	350	U	350	350	U	350	330	U	330
4-Chloroaniline	350	U	350	350	U	350	330	U	330
4-Chlorophenylphenyl ether	350	U	350	350	U	350	330	U	330
4-Nitroaniline	880	U	880	880	U	880	830	U	830
4-Nitrophenol	880	U	880	880	U	880	830	U	830
Acenaphthene	350	U	350	350	U	350	330	U	330
Acenaphthylene	350	U	350	350	U	350	330	U	330
Anthracene	350	U	350	350	U	350	330	U	330
Benzo(a)anthracene	350	U	350	350	U	350	330	U	330
Benzo(a)pyrene	350	U	350	350	U	350	330	U	330
Benzo(b)fluoranthene	350	U	350	350	U	350	330	U	330
Benzo(ghi)perylene	350	U	350	350	U	350	330	U	330
Benzo(k)fluoranthene	350	U	350	350	U	350	330	U	330

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

331 LSLDF Constituent	J134V8			J134V9			J134W0		
	Trench #2 native soil			Western edge of distribution box			Equipment blank		
	April 19, 2007			April 19, 2007			April 18, 2007		
	ug/kg	Q	PQL		Q	PQL	ug/kg	Q	PQL
Bis(2-chloro-1-methylethyl)ether	350	U	350	350	U	350	330	U	330
Bis(2-Chloroethoxy)methane	350	U	350	350	U	350	330	U	330
Bis(2-chloroethyl) ether	350	U	350	350	U	350	330	U	330
Bis(2-ethylhexyl) phthalate	290	JB	350	130	JB	350	55	JB	330
Butylbenzylphthalate	88	J	350	34	J	350	330	U	330
Carbazole	350	U	350	350	U	350	330	U	330
Chrysene	350	U	350	350	U	350	330	U	330
Di-n-butylphthalate	45	JB	350	37	JB	350	38	JB	330
Di-n-octylphthalate	350	U	350	350	U	350	330	U	330
Dibenz[a,h]anthracene	350	U	350	350	U	350	330	U	330
Dibenzofuran	350	U	350	350	U	350	330	U	330
Diethylphthalate	350	U	350	350	U	350	330	U	330
Dimethyl phthalate	350	U	350	350	U	350	330	U	330
Fluoranthene	350	U	350	350	U	350	330	U	330
Fluorene	350	U	350	350	U	350	330	U	330
Hexachlorobenzene	350	U	350	350	U	350	330	U	330
Hexachlorobutadiene	350	U	350	350	U	350	330	U	330
Hexachlorocyclopentadiene	350	U	350	350	U	350	330	U	330
Hexachloroethane	350	U	350	350	U	350	330	U	330
Indeno(1,2,3-cd)pyrene	350	U	350	350	U	350	330	U	330
Isophorone	350	U	350	350	U	350	68	J	330
N-Nitroso-di-n-dipropylamine	350	U	350	350	U	350	330	U	330
N-Nitrosodiphenylamine	350	U	350	350	U	350	330	U	330
Naphthalene	350	U	350	350	U	350	330	U	330
Nitrobenzene	350	U	350	350	U	350	330	U	330
Pentachlorophenol	880	U	880	880	U	880	830	U	830
Phenanthrene	350	U	350	350	U	350	330	U	330
Phenol	350	U	350	350	U	350	330	U	330
Pyrene	350	U	350	350	U	350	330	U	330

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

331 LSLDF Constituent	J134W1			J134W2			J134W3		
	Trench #1 sediment inside laterals			Trench #1 soil under laterals			Trench #2 sediment inside lateral 6 (100%)		
	April 18, 2007			April 18, 2007			April 19, 2007		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,2,4-Trichlorobenzene	3300	UD	3300	330	U	330	3300	UD	3300
1,2-Dichlorobenzene	3300	UD	3300	330	U	330	3300	UD	3300
1,3-Dichlorobenzene	3300	UD	3300	330	U	330	3300	UD	3300
1,4-Dichlorobenzene	3300	UD	3300	330	U	330	3300	UD	3300
2,4,5-Trichlorophenol	8300	UD	8300	830	U	830	8300	UD	8300
2,4,6-Trichlorophenol	3300	UD	3300	330	U	330	3300	UD	3300
2,4-Dichlorophenol	3300	UD	3300	330	U	330	3300	UD	3300
2,4-Dimethylphenol	3300	UD	3300	330	U	330	3300	UD	3300
2,4-Dinitrophenol	8300	UD	8300	830	U	830	8300	UD	8300
2,4-Dinitrotoluene	3300	UD	3300	330	U	330	3300	UD	3300
2,6-Dinitrotoluene	3300	UD	3300	330	U	330	3300	UD	3300
2-Chloronaphthalene	3300	UD	3300	330	U	330	3300	UD	3300
2-Chlorophenol	3300	UD	3300	330	U	330	3300	UD	3300
2-Methylnaphthalene	3300	UD	3300	330	U	330	3300	UD	3300
2-Methylphenol (cresol, o-)	3300	UD	3300	330	U	330	3300	UD	3300
2-Nitroaniline	8300	UD	8300	830	U	830	8300	UD	8300
2-Nitrophenol	3300	UD	3300	330	U	330	3300	UD	3300
3+4 Methylphenol (cresol, m+p)	3300	UD	3300	330	U	330	3300	UD	3300
3,3'-Dichlorobenzidine	3300	UD	3300	330	U	330	3300	UD	3300
3-Nitroaniline	8300	UD	8300	830	U	830	8300	UD	8300
4,6-Dinitro-2-methylphenol	8300	UD	8300	830	U	830	8300	UD	8300
4-Bromophenylphenyl ether	3300	UD	3300	330	U	330	3300	UD	3300
4-Chloro-3-methylphenol	3300	UD	3300	330	U	330	3300	UD	3300
4-Chloroaniline	3300	UD	3300	330	U	330	3300	UD	3300
4-Chlorophenylphenyl ether	3300	UD	3300	330	U	330	3300	UD	3300
4-Nitroaniline	8300	UD	8300	830	U	830	8300	UD	8300
4-Nitrophenol	8300	UD	8300	830	U	830	8300	UD	8300
Acenaphthene	3300	UD	3300	330	U	330	3300	UD	3300
Acenaphthylene	3300	UD	3300	330	U	330	3300	UD	3300
Anthracene	3300	UD	3300	330	U	330	3300	UD	3300
Benzo(a)anthracene	3300	UD	3300	330	U	330	3300	UD	3300
Benzo(a)pyrene	3300	UD	3300	330	U	330	3300	UD	3300
Benzo(b)fluoranthene	3300	UD	3300	330	U	330	3300	UD	3300
Benzo(ghi)perylene	3300	UD	3300	330	U	330	3300	UD	3300
Benzo(k)fluoranthene	3300	UD	3300	330	U	330	3300	UD	3300

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

331 LSLDF Constituent	J134W1			J134W2			J134W3		
	Trench #1 sediment inside laterals			Trench #1 soil under laterals			Trench #2 sediment inside lateral 6 (100%)		
	April 18, 2007			April 18, 2007			April 19, 2007		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
Bis(2-chloro-1-methylethyl)ether	3300	UD	3300	330	U	330	3300	UD	3300
Bis(2-Chloroethoxy)methane	3300	UD	3300	330	U	330	3300	UD	3300
Bis(2-chloroethyl) ether	3300	UD	3300	330	U	330	3300	UD	3300
Bis(2-ethylhexyl) phthalate	58000	BD	3300	910	B	330	54000	BD	3300
Butylbenzylphthalate	16000	D	3300	340		340	17000	D	3300
Carbazole	3300	UD	3300	330	U	340	3300	UD	3300
Chrysene	3300	UD	3300	330	U	330	3300	UD	3300
Di-n-butylphthalate	2300	JBD	3300	98	JB	330	2500	JBD	3300
Di-n-octylphthalate	3300	UD	3300	330	U	330	3300	UD	3300
Dibenz[a,h]anthracene	3300	UD	3300	330	U	330	3300	UD	3300
Dibenzofuran	3300	UD	3300	330	U	330	3300	UD	3300
Diethylphthalate	3300	UD	3300	330	U	330	3300	UD	3300
Dimethyl phthalate	3300	UD	3300	330	U	330	3300	UD	3300
Fluoranthene	3300	UD	3300	330	U	330	3300	UD	3300
Fluorene	3300	UD	3300	330	U	330	3300	UD	3300
Hexachlorobenzene	3300	UD	3300	330	U	330	3300	UD	3300
Hexachlorobutadiene	3300	UD	3300	330	U	330	3300	UD	3300
Hexachlorocyclopentadiene	3300	UD	3300	330	U	330	3300	UD	3300
Hexachloroethane	3300	UD	3300	330	U	330	3300	UD	3300
Indeno(1,2,3-cd)pyrene	3300	UD	3300	330	U	330	3300	UD	3300
Isophorone	3300	UD	3300	330	U	330	3300	UD	3300
N-Nitroso-di-n-dipropylamine	3300	UD	3300	330	U	330	3300	UD	3300
N-Nitrosodiphenylamine	3300	UD	3300	330	U	330	3300	UD	3300
Naphthalene	3300	UD	3300	330	U	330	3300	UD	3300
Nitrobenzene	3300	UD	3300	330	U	330	3300	UD	3300
Pentachlorophenol	8300	UD	8300	830	U	830	8300	UD	8300
Phenanthrene	3300	UD	3300	330	U	330	3300	UD	3300
Phenol	3300	UD	3300	330	U	330	3300	UD	3300
Pyrene	3300	UD	3300	330	U	330	3300	UD	3300

Table A-2. 331 Drain Field Confirmatory Sampling Data Results. (14 Pages)

331 LSLDF Constituent	J134V8			J134V9			J134W0		
	Trench #2 native soil			Western edge of distribution box			Equipment blank		
	April 19, 2007			April 19, 2007			April 18, 2007		
	ug/kg	Q	PQL	ug/kg	Q	PQL	ug/kg	Q	PQL
1,1,1-Trichloroethane	5	U	5	5	U	5	5	U	5
1,1,2,2-Tetrachloroethane	5	U	5	5	U	5	5	U	5
1,1,2-Trichloroethane	5	U	5	5	U	5	5	U	5
1,1-Dichloroethane	5	U	5	5	U	5	5	U	5
1,1-Dichloroethene	5	U	5	5	U	5	5	U	5
1,2-Dichloroethane	5	U	5	5	U	5	5	U	5
1,2-Dichloroethene(Total)	5	U	5	5	U	5	5	U	5
1,2-Dichloropropane	5	U	5	5	U	5	5	U	5
2-Butanone	10	U	10	10	U	10	10	U	10
2-Hexanone	10	U	10	10	U	10	10	U	10
4-Methyl-2-Pentanone	10	U	10	10	U	10	10	U	10
Acetone	590	BD	10	170	B	10	150	B	10
Benzene	5	U	5	5	U	5	5	U	5
Bromodichloromethane	5	U	5	5	U	5	5	U	5
Bromoform	5	U	5	5	U	5	5	U	5
Bromomethane	10	U	10	10	U	10	10	U	10
Carbon disulfide	5	U	5	5	U	5	5	U	5
Carbon tetrachloride	5	U	5	5	U	5	5	U	5
Chlorobenzene	5	U	5	5	U	5	5	U	5
Chloroethane	10	U	10	10	U	10	10	U	10
Chloroform	5	U	5	5	U	5	5	U	5
Chloromethane	10	U	10	10	U	10	10	U	10
cis-1,2-Dichloroethylene	5	U	5	5	U	5	5	U	5
cis-1,3-Dichloropropene	5	U	5	5	U	5	5	U	5
Dibromochloromethane	5	U	5	5	U	5	5	U	5
Ethylbenzene	5	U	5	5	U	5	5	U	5
m-Xylene	5	U	5	5	U	5			
Methylenechloride	10	B	5	11	B	5	6	B	5
o-Xylene				5	U	5			
Styrene	5	U	5	5	U	5	5	U	5
Tetrachloroethene	5	U	5	5	U	5	5	U	5
Toluene	5	U	5	5	U	5	5	U	5
trans-1,2-Dichloroethylene	5	U	5	5	U	5	5	U	5
trans-1,3-Dichloropropene	5	U	5	5	U	5	5	U	5
Trichloroethene	5	U	5	5	U	5	5	U	5
Vinyl chloride	10	U	10	10	U	10	10	U	10
Xylenes (total)	5	U	5	5	U	5	5	U	5

APPENDIX B

CONFIRMATORY SAMPLING PHOTOGRAPHS

Photograph B-1. Drainage Rock Associated with Laterals at the 331 LSLDF.

Photograph B-2. Vitrified Clay Pipe from the Northern Half of the 331 LSLDF.

Photograph B-3. Clean Interior of Vitrified Clay Pipe Laterals in the 331 LSLDF.

Photograph B-4. The Distribution Box at the 331 LSLDF.

Photograph B-5. Piping from the Distribution Box at the Head of the 331 LSLDF.

APPENDIX C

CALCULATION BRIEFS

APPENDIX C

CALCULATION BRIEFS

The calculations in this appendix are kept in the active Washington Closure Hanford project files and are available upon request. When the project is completed, the file will be stored in a U.S. Department of Energy, Richland Operations Office repository. These calculations have been prepared in accordance with ENG-1, *Engineering Services*, ENG-1-4.5, "Project Calculation," Washington Closure Hanford, Richland, Washington. The following calculations are provided in this appendix:

<u>DISCLAIMER FOR CALCULATIONS</u>

The calculations provided in this appendix have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

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CALCULATION COVER SHEET

Project Title: Field Remediation **Job No. 14655**

Area: 300 Area

Discipline: Environmental *Calculation No: 0300X-CA-V0092

Subject: 331 LSLDF Human Health Risk Assessment Calculation Brief

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover – 1 pg Summary – 7 pg Total – 8 pages	S. W. Clark (Rev. 0 signed)	H. M. Sulloway (Rev. 0 signed)	N/A	J. D. Ludowise (Rev. 0 signed)	Approved 03-07-2008
1	Cover – 1 pg Summary – 7 pg Total – 8 pages	S. W. Clark	H. M. Sulloway	N/A	J. D. Ludowise	4-22-08

SUMMARY OF REVISION

1	Revision 1 was necessary to add the pesticide dieldrin to the site-specific human health risk assessment for the 331 LSLDF septic system waste site. For convenience the entire calculation brief was replaced.

WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark	Date:	4/21/08	Calc. No.:	0300X-CA-V0092	Rev.:	1
Project:	300 Area Field Remediation	Job No:	14655	Checked:	H. M. Sulloway	Date:	4/21/08
Subject:	331 LSLDF Human Health Risk Assessment Calculation Brief					Sheet No. 1 of 7	

PURPOSE:

Calculate the incremental cancer risk from residual concentrations of the polychlorinated biphenyl (PCB) Aroclor-1254 and the pesticide dieldrin at the 331 Life Sciences Laboratory Drain Field Septic System (LSLDF) site.

GIVEN/REFERENCES:

1) Maximum residual concentrations of Aroclor-1254 and dieldrin from the *Remaining Sites Verification Package for the 331 Life Sciences Laboratory Drain Field Septic System* (RSVP), Attachment to Waste Site Reclassification Form 2008-020, reported in Table 1, below.
2) *Remedial Design Report/Remedial Action Work Plan for the 300 Area* (RDR/RAWP), DOE/RL-2001-47, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
3) Equations for calculating contaminant intake from Appendix D of *Hanford Site Risk Assessment Methodology* (HSRAM), DOE/RL-91-45, Rev. 3, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) Use of area factors and occupancy factors to account for small waste site size and actual period of occupancy in the rural-residential scenario is discussed in the *User's Manual for RESRAD Version 6*, ANL/EAD-4, Environmental Assessment Division, Argonne National Laboratory, Argonne, Illinois.
5) Aroclor-1254 and dieldrin soil-water distribution coefficients (Kd values) of 75.6 mL/g and 25.6 mL/g from Calc. No. 0100X-CA-V0046, *100 Area Radionuclide and Nonradionuclide Lookup Values for the 1995 Interim Action ROD,* Bechtel Hanford, Inc., Richland, Washington.

SOLUTION:

1) Table 1 shows the maximum concentrations of Aroclor-1254 and dieldrin reported at the 331 LSLDF in the RSVP.

Table 1. Cleanup Verification Data Set [a]

Contaminant	Maximum Concentration (mg/kg)
Aroclor-1254	22.0
Dieldrin	0.12

[a] Soil concentration values are from the *Remaining Sites Verification Package for the 331 Life Sciences Laboratory Drain Field Septic System*, Attachment to Waste Site Reclassification Form 2008-020, Table 2.

2) Table 2 shows the risk assessment input parameters shared with RESRAD for calculation of area factors and occupancy factors.

Table 2. Risk Assessment Input Parameters Shared with RESRAD

Parameter	Units	Value	Citation
Area of surface debris waste site	m^2	15.2	Site specific
Exposure duration	years	30	100 Area RDR/RAWP
Fraction of time spent indoors	unitless	0.6	100 Area RDR/RAWP
Fraction of time spent outdoors (on site)	unitless	0.2	100 Area RDR/RAWP
Soil ingestion rate	g/yr	73	100 Area RDR/RAWP
Inhalation rate	m^3/yr	7,300	100 Area RDR/RAWP
Mass dust loading for inhalation	g/m^3	0.0001	100 Area RDR/RAWP
Wind speed	m/s	3.4	100 Area RDR/RAWP

3) Table 3 shows the contaminant-specific risk assessment input parameters for the inhalation and soil ingestion pathways. Aroclor-1254 and dieldrin have high distribution coefficients (Kd values of 75.6 and 25.6 mL/g) per Calc. No. 0100X-CA-V0046 and are not predicted to move through the vadose zone in water-dependent pathways within 1,000 years. Only the inhalation and soil ingestion pathways will be affected by Aroclor-1254 and dieldrin. There are no noncarcinogenic reference doses for soil ingestion or inhalation (RfDo or RfDi) for Aroclor-1254 or dieldrin so there is no hazard quotient calculation.

Table 3. Contaminant-Specific Risk Assessment Input Parameters

Contaminant	Pathway: Inhalation (Fugitive Dust)		Pathway: Soil Ingestion	
	RfDi [a] (mg/kg-d)	CSFi [b] (kg-d/mg)	RfDo [a] (mg/kg-d)	CSFo [b] (kg-d/mg)
Aroclor-1254	N/A	2.0	N/A	2.0
Dieldrin	N/A	16.1	N/A	16

[a] RfDi or RfDo = Noncarcinogenic Reference Dose for dust inhalation or soil ingestion. Refers to chemical-specific toxicity values used to evaluate noncarcinogenic effects resulting from exposures to chemicals. Obtained from the EPA IRIS (Integrated Risk Information System) database.
[b] CSFi or CSFo = Cancer Slope Factor for dust inhalation or soil ingestion. Refers to chemical-specific Cancer Slope Factors used to calculate carcinogenic risk Obtained from the EPA IRIS (Integrated Risk Information System) database.
N/A = Not Available

METHODOLOGY:

1) Incremental Cancer Risk:

The incremental cancer risk is calculated from the following general formula:

$$ICR = (\text{Daily Intake})\ CSF$$

Where CSF = the cancer slope factor with units of kg - day/mg. As applicable, the EPA provides separate values of the cancer slope factor for the inhalation and oral ingestion pathways (CSFi and CSFo, respectively).

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Subject:	331 LSLDF Human Health Risk Assessment Calculation Brief					Sheet No. 3 of 7	

2) Daily Intake for the Soil Ingestion Pathway:

Daily Intake for the soil ingestion pathway is calculated from the following formula from HSRAM Equation D-23, including the area factor and occupancy factor from the *User's Manual for RESRAD Version 6*:

$$DIS = \frac{C \times SI \times ED \times AFS \times OFS}{BW \times AL \times 365(d/yr)}$$

Where: C is contaminant concentration, (site-specific concentration, mg/kg)

SI is Soil Ingestion Rate, (73 g/yr)

AFS is an area factor for soil ingestion: AFS = A/1000 for A < 1000 m^2

AFS = 1 for A > 1000 m^2

A is the area of the contaminated zone, m^3

OFS is the occupancy factor for soils: OFS = (IT) + (OT)

IT is the Indoor Time Factor (0.6)

OT is the Outdoor Time Factor (0.2)

OFS = 0.6 + 0.2 = 0.8

ED is exposure duration (30 yr)

BW is body weight (70 kg)

AL is average lifetime (70 yr)

3) Daily Intake for the Inhalation Pathway:

Daily Intake for the inhalation pathway is calculated using the following formula from HSRAM Equation D-30, including the area factor and occupancy factor from the *User's Manual for RESRAD Version 6*:

$$DII = \frac{C \times IR \times ML \times ED \times AFI \times OFI}{BW \times AL \times 365(d/yr)}$$

Where: C is contaminant concentration, (site-specific concentration, mg/kg)

IR is Inhalation Rate, (7,300 m^3/yr

ML is Mass Loading, (0.0001 g/m^3)

ED is exposure duration (30 yr)

AFI is the site specific area factor for dust inhalation calculated from formula B.4 of the *User's Manual for RESRAD Version 6*:

$$AFI = \frac{a}{1 + b\left(\sqrt{A}\right)^c}$$

In this equation, A is the area of the contaminated zone, m^2, and a, b, and c are least squares regression coefficients dependent upon the average wind speed as

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark	Date:	4/21/08	Calc. No.:	0300X-CA-V0092	Rev.:	1
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Subject:	331 LSLDF Human Health Risk Assessment Calculation Brief					Sheet No. 4 of 7	

described in Table B.2 of the *User's Manual for RESRAD Version 6*. Calculation results are shown in the RESULTS section of this Calculation Summary.

OFI is the occupancy factor for inhalation: OFI = (IT x IDF) + (OT)

IT is the Indoor Time Factor (0.6)
IDF = Indoor dust filtration factor (0.4)
OT is the Outdoor Time Factor (0.2)
OFI = (0.6 x 0.4) + 0.2 = 0.44

BW is body weight (70 kg)
AL is average lifetime (70 yr)

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark *SWC*	Date:	*4/21/08*	Calc. No.:	0300X-CA-V0092	Rev.:	1
Project:	300 Area Field Remediation	Job No:	14655	Checked:	H. M. Sulloway *HMS*	Date:	*4/21/08*
Subject:	331 LSLDF Human Health Risk Assessment Calculation Brief					Sheet No.	5 of 7

RESULTS:

Calculations were performed using an Excel spreadsheet, incorporating the formulas shown in the METHODOLOGY section of this Calculation Summary.

1) Incremental Cancer Risk from the Soil Ingestion Pathway:

The following Excel spreadsheet incorporates the formulas for calculation of incremental cancer risk from PCBs in the soil ingestion pathway:

Table 3. Excel Calculation of Incremental Cancer Risk in the Soil Ingestion Pathway

	A	B	C	D	E	F	G	H
1	Area factor for soil ingestion pathway is calculated per the *User's Manual for RESRAD Version 6.0*, Formula F.3:							
2		Area, m^2	AFS = Area/1000 for Area < 1000 m^2					
3	331 LSLDF	15.2	0.0152					
4								
5	Soil Ingestion Intake = (C*SI*ED*AFS*OFS*UCF1)/(BW*AL*UCF2)							
6	<u>Variable</u>	<u>Aroclor-1254</u>	<u>Dieldrin</u>	<u>Description</u>				
7	C	22.0	0.12	mg/kg, Maximum concentration				
8	SI	73	73	g/yr, Soil Ingestion rate				
9	ED	30	30	years, Exposure Duration				
10	AFS	0.0152	0.0152	unitless area factor				
11	OFS	0.8	0.8	unitless occupancy factor				
12	UCF1	0.001	0.001	kg/gm, Units conversion factor				
13	BW	70	70	kg, Body weight				
14	AL	70	70	years, Average lifetime				
15	UCF2	365	365	days/year, Units conversion factor				
16	CFSo	2	16	kg - d / mg, Cancer slope factor				
17	Aroclor-1254 Ingestion Daily Intake = E22 = (B7*B8*B9*B10*B11*B12)/(B13*B14*B15)							
18	Aroclor-1254 Ingestion Incremental Cancer Risk = E23 = (E22*B16)							
19	Dieldrin Ingestion Daily Intake = F22 = (C7*C8*C9*C10*C11*C12)/(C13*C14*C15)							
20	Dieldrin Ingestion Incremental Cancer Risk = F23 = (F22*C16)							
21					<u>Aroclor-1254</u>	<u>Dieldrin</u>		
22	Calculated Ingestion Daily Intake =				3.28E-07	1.79E-09	mg / kg - day	
23	Ingestion Incremental Cancer Risk =				6.55E-07	2.86E-08		

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark SWC	Date:	4/21/08	Calc. No.:	0300X-CA-V0092	Rev.:	1
Project:	300 Area Field Remediation	Job No:	14655	Checked:	H. M. Sulloway HMS	Date:	4/21/08
Subject:	331 LSLDF Human Health Risk Assessment Calculation Brief					Sheet No. 6 of 7	

2) Incremental Cancer Risk from the Inhalation Pathway:

The following Excel spreadsheet incorporates the formulas for calculation of incremental cancer risk from PCBs in the inhalation pathway:

Table 4. Excel Calculation of Incremental Cancer Risk in the Inhalation Pathway

	A	B	C	D	E	F	G	H
1	Area factor for inhalation pathway is calculated per the *User's Manual for RESRAD Version 6.0*, Formula B.4, calculating least squares regression coefficients for a wind speed of 3.4 m/s per the *User's Manual for RESRAD Version 6.0*, Formula B.2:							
2	Coefficient a for 3.4 m/s Wind Speed = B7 = (B6-((A8-A7)/(A8-A6))*(B6-B8))							
3	Coefficient b for 3.4 m/s Wind Speed = C7 = (C6-((A7-A6)/(A8-A6))*(C6-C8))							
4	Coefficient c for 3.4 m/s Wind Speed = D7 = (D6-((A7-A6)/(A8-A6))*(D6-D8))							
5	Wind Speed, m/s	a	b	c				
6	2	1.6819	25.5076	-0.2278				
7	3.4	1.2029	28.3173	-0.2315				
8	5	0.7837	31.5283	-0.2358				
	Area Factor for Inhalation Pathway = AFI = (B7/(1 +C7(((SQRT(A10))^D7)))							
9		Area, m^2	AFI					
10	331 LSLDF	15.2	0.0555					
12	Inhalation Intake = (C*IR*ML*ED*AFI*OFI*UCF1)/(BW*AL*UCF2)							
13	Variable	Aroclor-1254	Dieldrin	Description				
14	C	22.0	0.12	mg/kg, Maximum concentration				
15	IR	7,300	7,300	m^3/yr, Inhalation rate				
16	ML	0.0001	0.0001	gm/m^3, Mass dust loading for inhalation				
17	ED	30	30	years, Exposure Duration				
18	AFI	0.0555	0.0555	unitless area factor				
19	OFI	0.44	0.44	unitless occupancy factor				
20	UCF1	0.001	0.001	kg/gm, Units conversion factor				
21	BW	70	70	kg, Body weight				
22	AL	70	70	years, Average lifetime				
23	UCF2	365	365	days/year, Units conversion factor				
24	CFSi	2	16.1	kg - d / mg, Cancer slope factor				
25	Aroclor-1254 Inhalation Daily Intake = E30 = (B14*B15*B16*B17*B18*B19*B20)/(B21*B22*B23)							
26	Aroclor-1254 Inhalation Incremental Cancer Risk = E31 = (E30*B24)							
27	Dieldrin Inhalation Daily Intake = F30 = (C14*C15*C16*C17*C18*C19*C20)/(C21*C22*C23)							
28	Dieldrin Inhalation Incremental Cancer Risk = F31 = (F30*C24)							
29					Aroclor-1254	Dieldrin		
30				Calculated Inhalation Daily Intake =	6.58E-09	3.59E-11	mg / kg - day	
31				Inhalation Incremental Cancer Risk =	1.32E-08	5.78E-10		

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark	Date:	4/21/08	Calc. No.:	0300X-CA-V0092	Rev.:	1
Project:	300 Area Field Remediation	Job No:	14655	Checked:	H. M. Sulloway	Date:	4/21/08
Subject:	331 LSLDF Human Health Risk Assessment Calculation Brief					Sheet No. 7 of 7	

CONCLUSIONS:

- The incremental cancer risk due to Aroclor-1254 in the soil ingestion pathway is 6.55E-07.
- The incremental cancer risk due to total Aroclor-1254 in the inhalation pathway is 1.32E-08.
- The total human health excess cancer risk due to Aroclor-1254 at the 331 LSLDF site is the sum of the incremental cancer risks from the soil ingestion and inhalation pathways: 6.68E-07.
- The incremental cancer risk due to dieldrin in the soil ingestion pathway is 2.86E-08.
- The incremental cancer risk due to total dieldrin in the inhalation pathway is 5.78E-10.
- The total human health excess cancer risk due to dieldrin at the 331 LSLDF site is the sum of the incremental cancer risks from the soil ingestion and inhalation pathways: 2.92E-08.
- The total human health excess cancer risk due to Aroclor-1254 and dieldrin at the 331 LSLDF site is the sum of the incremental cancer risks from the soil ingestion and inhalation pathways: 6.97E-07.

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CALCULATION COVER SHEET

Project Title: 300 Area Field Remediation **Job No. 14655**

Area: 300

Discipline: Environmental *Calculation No: 0300X-CA-V-0093

Subject: 331 LSLDF Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation [X] Preliminary [ ] Superseded [ ] Voided [ ]

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover - 1 pg Summary - 3 pg Total - 4 pages	M. W. Perrott (Rev. 0 signed)	L. D. Habel (Rev. 0 signed)	N/A	J. M. Capron (Rev. 0 signed)	Approved 03-31-2008
1	Cover - 1 pg Summary - 4 pg Total - 5 pages	[signature] M. W. Perrott	[signature] L. D. Habel	N/A	J. M. Capron	[signature] 4/23/08

SUMMARY OF REVISION

1	Revision 1 was necessary to add additional contaminants to the Hazard Quotient and Carcinogenic Risk calculations at the 331 LSLDF septic system waste site. For convenience the entire calculation brief was replaced.

WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford CALCULATION SHEET

Originator:	M. W. Perrott *[signature]*	Date:	4/22/08	Calc. No.:	0300X-CA-V0093	Rev.:	1
Project:	300 Area Field Remediation	Job No:	14655	Checked:	L.D. Habel *[initials]*	Date:	4/22/08
Subject:	331 LSLDF Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 4	

PURPOSE:

Provide documentation to support the calculation of the hazard quotient (HQ) and carcinogenic (excess cancer) risk values for the 331 LSLDF waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2004), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

1) DOE-RL, 2004, *Remedial Design Report/Remedial Action Work Plan for the 300 Area,* DOE/RL-2001-47, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.

3) WCH, 2008a, *331 LSLDF Human Health Risk Assessment Calculation Brief*, 0300X-CA-V0092, Rev. 1, Washington Closure Hanford, Richland, Washington.

4) WCH, 2008b, *Remaining Sites Verification Package for the 331 Life Sciences Laboratory Drain Field Septic System*, Attachment to Waste Site Reclassification Form 2008-020, April 2008, Washington Closure Hanford, Richland, Washington.

SOLUTION:

1) Calculate an HQ for each noncarcinogenic constituent detected above background and compare it to the individual HQ of <1.0 (DOE-RL 2004).

2) Sum the HQs and compare to the cumulative HQ criterion of <1.0.

3) Calculate an excess cancer risk value for each carcinogenic constituent detected above background and compare it to the individual excess cancer risk criterion of $<1 \times 10^{-6}$ (DOE-RL 2004).

4) Sum the excess cancer risk values and compare to the cumulative cancer risk criterion of $<1 \times 10^{-5}$.

Washington Closure Hanford		CALCULATION SHEET					
Originator:	M. W. Perrott	Date:	4/22/08	Calc. No.:	0300X-CA-V0093	Rev.:	1
Project:	300 Area Field Remediation	Job No:	14655	Checked:	L.D. Habel	Date:	4/22/08
Subject:	331 LSLDF Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 4	

METHODOLOGY:

HQ and carcinogenic risk calculations were conservatively calculated for the entire 331 LSLDF waste site using the maximum detected values obtained from confirmatory sampling. Of the nonradionuclide contaminants of potential concern (COPCs) 29 constituents required HQ and risk calculations because these COPCs were detected and either cannot be attributed to natural occurrence, had concentrations above background, or background concentrations were not available. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) A site specific area factor was determined in the *331 LSLDF Human Health Risk Assessment Calculation Brief* (WCH 2008a) to account for the small size of the 331 LSLDF waste site. This value was used to calculate the soil ingestion daily intake (Figure 1).

2) For example, the maximum result for methylene chloride (0.11 mg/kg), multiplied by the soil ingestion daily intake (1.49 E-08 day^{-1}) divided by the oral reference dose (RfD) (0.06 mg/kg day) gives the hazard quotient (HQ) (2.7 E-08). Comparing this value, and all other individual values, to the requirement of <1.0, this criterion is met.

3) After the HQ calculations are completed for the appropriate analytes, the cumulative HQ is obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The sum of the HQ values is 1.8 x 10^{-3} Comparing this value to the requirement of <1.0, this criterion is met.

4) To calculate the excess cancer risk, the maximum value is divided by the carcinogenic RAG value, then multiplied by 1 x 10^{-6}. For example, the maximum value for methylene chloride is 0.11 mg/kg; divided by 133 mg/kg, and multiplied as indicated, is 8.3 x 10^{-10}. Comparing this value to the requirement of <1 x 10^{-6}, this criterion is met.

5) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk is obtained by summing the individual values. The sum of the excess cancer risk values is 2.3 x 10^{-6}. Comparing this value to the requirement of <1 x 10^{-5}, this criterion is met.

RESULTS:

1) List individual noncarcinogens and corresponding HQs >1.0: None
2) List the cumulative noncarcinogenic HQ >1.0: None
3) List individual carcinogens and corresponding excess cancer risk >1 x 10^{-6}: None
4) List the cumulative excess cancer risk for carcinogens >1 x 10^{-5}: None.

Table 1 shows the results of the calculation.

Washington Closure Hanford CALCULATION SHEET

Originator:	M. W. Perrott	Date:	4/22/08	Calc. No.:	0300X-CA-V0093	Rev.:	1
Project:	300 Area Field Remediation	Job No:	14655	Checked:	L.D. Habel	Date:	4/22/08
Subject:	331 LSLDF Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 4	

Figure 1. Supporting Calculations for Determining Site-Specific Hazard Quotients for the 331 LSLDF Waste Site.

Calculation of the site-specific area factor for soil ingestion pathway using the formulas from the *331 LSLDF Human Health Risk Assessment Calculation Brief* (WHC 2008a).

331 LSLDF Calculation of Hazard Quotient
Hazard Quotient (HQ) = (Contaminant Ingestion Daily Intake)/(RfD)

Site-specific area factor for soil ingestion pathway (from WHC 2008a).

331 LSLDF Area = 1.52E+01 m^2

Site-specific area factor (AFS) = 1.52E-02 m^2

Soil Ingestion Intake Factor = (SI*ED*AFS*OFS*UCF1)/(BW*AL*UCF2)
Contaminant Ingestion Intake = (CONC)*(Soil Ingestion Rate)

Variable	Value	Description
SI	73	g/yr, Soil Ingestion rate
ED	30	years, Exposure Duration
AFS	1.52E-02	unitless, Site-specific area factor
OFS	0.8	unitless, Occupancy factor
UCF1	0.001	kg/gm, Units conversion factor
BW	70	kg, Body weight
AL	70	years, Average lifetime
UCF2	365	days/year, Units conversion factor
RfD	contaminant specific	(mg/kg-day) Oral reference dose

Soil Ingestion Daily Intake Factor = 1.49E-08 day^{-1}
Contaminant Ingestion Daily Intake = (Soil Ingestion Daily Intake Factor)*(Contaminant Concentration)
Hazard Quotient = (Contaminant Ingestion Daily Intake)/(RfD)

Washington Closure Hanford CALCULATION SHEET

Originator:	M. W. Perrott	Date:	4/22/08	Calc. No.:	0300X-CA-V0093	Rev.:	1
Project:	300 Area Field Remediation	Job No:	14655	Checked:	L.D. Habel	Date:	4/22/08
Subject:	331 LSLDF Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 4	

Table 1. Hazard Quotient and Excess Cancer Risk Results for the 331 LSLDF Waste Site.

Contaminants of Potential Concern	Maximum Value[a] (mg/kg)	Oral Reference Dose (RfD) (mg/kg-day)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Antimony	6.4	0.0004	2.4E-04	--	--
Barium	425	0.2	3.2E-05	--	--
Boron	1.7	0.2	1.3E-07	--	--
Cadmium	6.7	0.001	1.0E-04	13.9	4.8E-07
Chromium, total	29.9	1.5	3.0E-07		
Copper	232	0.037	9.3E-05	--	--
Lead[d]	56.1	--	--	--	--
Mercury	13.80	0.0003	6.9E-04	--	--
Molybdenum	5.5	0.005	1.6E-05	--	--
Selenium	1.8	0.005	5.4E-06	--	--
Silver	183	0.005	5.5E-04	--	--
Zinc	452	0.3	2.2E-05	--	--
Semivolatiles					
Bis(2-ethylhexyl) phthalate	58.0	0.02	4.3E-05	71.4	8.1E-07
Butylbenzylphthalate	17	0.2	1.3E-06	--	--
Di-n-butylphthalate	2.5	0.1	3.7E-07	--	--
Isophorone	0.068	0.2	5.1E-09	1,050	6.5E-11
Pesticides					
Aldrin	0.0092	0.00003	4.6E-06	0.0588	1.6E-07
BHC, alpha	0.00039		--	0.159	2.5E-09
BHC, delta	0.0073		--	--	--
BHC, gamma (Lindane)	0.0044	0.0003	2.2E-07	0.769	5.7E-09
DDE, 4,4'-	0.36		--	2.94	1.2E-07
Dieldrin	0.12	0.00005	3.6E-05	0.0625	2.9E-08[c]
Endosulfan (I, II, sulfate)	0.438	0.006	1.1E-06	--	--
Endrin (and ketone, aldehyde)	0.24	0.0003	1.2E-05	--	--
Heptachlor epoxide	0.0047	0.000013	5.4E-06	0.11	4.3E-08
Methoxychlor	0.0033	0.005	9.8E-09	--	--
Polychlorinated Biphenyls					
Aroclor-1254	22.0	--	--	0.5	6.7E-07[c]
Volatiles					
Acetone	0.59	0.9	9.8E-09	--	--
Methylene chloride	0.11	0.06	2.7E-08	133	8.3E-10
Totals					
Cumulative Hazard Quotient:			**1.8E-03**		
Cumulative Excess Cancer Risk:					**2.3E-06**

Notes:
RAG = remedial action goal
-- = not applicable or no value available
[a] = Table 2 (WCH 2008b).
[b] = Value obtained from *Washington Administrative Code* (WAC) 173-340-740(3), Method B, 1996, unless otherwise noted.
[c] = Value obtained from site-specific risk assessment (WCH 2008a)
[d] = Lead does not have a reference dose for calculation of a hazard quotient because toxic effects of lead are correlated with blood-lead levels rather than exposure levels or daily intake.

CONCLUSION:

This calculation demonstrates that the 331 LSLDF waste site meets the requirements for the hazard quotients and carcinogenic (excess cancer) risk as identified in the RDR/RAWP (DOE-RL 2004).

CALCULATION COVER SHEET

Project Title: Field Remediation **Job No. 14655**

Area: 300-Area

Discipline: Environmental *Calculation No: 0300X-CA-V0094 7 MWP 9/28/08

Subject: Industrial Land Use Scenario 331 LSLDF Hazard Quotient and Carcinogenic Risk Calculations

Computer Program: Excel Program No: 2003

The attached calculations have been generated to document compliance with established cleanup levels. These calculations should be used in conjunction with other relevant documents in the administrative record.

Committed Calculation ☒ Preliminary ☐ Superseded ☐ Voided ☐

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover – 1 pg Summary – 4 pg Total – 5 pages	M. W. Perrott	S. W. Clark	N/A	J. M. Capron	9/28/08

SUMMARY OF REVISION

WCH-DE-018 (05/08/2007) *Obtain Calc. No. from Document Control and Form from Intranet

Washington Closure Hanford CALCULATION SHEET

Originator:	M. W. Perrott	Date:	9/25/08	Calc. No.:	0300X-CA-V0097	Rev.:	0
Project:	300 Area Field Remediation	Job No:	14655	Checked:	S. W. Clark	Date:	9/25/08
Subject:	Industrial Land Use Scenario 331 LSLDF Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 1 of 4	

PURPOSE:

Provide documentation to support the calculation of the industrial land use scenario hazard quotient (HQ) and carcinogenic (excess cancer) risk values for the 331 LSLDF waste site. In accordance with the remedial action goals (RAGs) in the remedial design report/remedial action work plan (RDR/RAWP) (DOE-RL 2004), the following criteria must be met:

1) An HQ of <1.0 for all individual noncarcinogens
2) A cumulative HQ of <1.0 for noncarcinogens
3) An excess cancer risk of $<1 \times 10^{-5}$ for individual carcinogens
4) A cumulative excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.

GIVEN/REFERENCES:

1) DOE-RL, 2004, *Remedial Design Report/Remedial Action Work Plan for the 300 Area,* DOE/RL-2001-47, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

2) WAC 173-340, "Model Toxics Control Act – Cleanup," *Washington Administrative Code*, 1996.

3) WCH, 2008a, *331 LSLDF Human Health Risk Assessment Calculation Brief*, 0300X-CA-V0092, Rev. 1, Washington Closure Hanford, Richland, Washington.

4) WCH, 2008b, *Remaining Sites Verification Package for the 331 Life Sciences Laboratory Drain Field Septic System*, Attachment to Waste Site Reclassification Form 2008-020, April 2008, Washington Closure Hanford, Richland, Washington.

SOLUTION:

1) Calculate an HQ for each noncarcinogenic constituent detected above background and compare it to the individual HQ of <1.0 (DOE-RL 2004).

2) Sum the HQs and compare to the cumulative HQ criterion of <1.0.

3) Calculate an excess cancer risk value for each carcinogenic constituent detected above background and compare it to the individual excess cancer risk criterion of $<1 \times 10^{-5}$ (DOE-RL 2004).

4) Sum the excess cancer risk values and compare to the cumulative cancer risk criterion of $<1 \times 10^{-5}$.

Washington Closure Hanford CALCULATION SHEET

Originator:	M. W. Perrott *MWP*	Date:	9/25/08	Calc. No.:	0300X-CA-V0097	Rev.:	0
Project:	300 Area Field Remediation	Job No:	14655	Checked:	S. W. Clark *SWC*	Date:	9/25/08
Subject:	Industrial Land Use Scenario 331 LSLDF Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 2 of 4	

METHODOLOGY:

Industrial land use scenario HQ and carcinogenic risk calculations were conservatively calculated for the entire 331 LSLDF waste site using the maximum detected values obtained from confirmatory sampling. Of the nonradionuclide contaminants of potential concern (COPCs) 29 constituents required HQ and risk calculations because these COPCs were detected and either cannot be attributed to natural occurrence, had concentrations above background, or background concentrations were not available. All other site nonradionuclide COPCs were not detected or were quantified below background levels. An example of the HQ and risk calculations is presented below:

1) For example, the maximum result for methylene chloride (0.11 mg/kg), divided by the industrial land use scenario noncarcinogen RAG (2.1E+05 mg/kg) gives the hazard quotient (HQ) (5.2E-07). Comparing this value, and all other individual results, to the requirement of <1.0, this criterion is met.

2) After the HQ calculations are completed for the appropriate analytes, the cumulative HQ is obtained by summing the individual values. (To avoid errors due to intermediate rounding, the individual HQ values prior to rounding are used for this calculation.) The sum of the HQ values is 0.350 Comparing this value to the requirement of <1.0, this criterion is met.

3) To calculate the excess cancer risk, the maximum value is divided by the industrial land use scenario carcinogenic RAG value, then multiplied by 1×10^{-5}. For example, the maximum value for methylene chloride is 0.11 mg/kg; divided by 1.75E+04 mg/kg, and multiplied as indicated, is 6.3E-11. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

4) After these calculations are completed for the carcinogenic analytes, the cumulative excess cancer risk is obtained by summing the individual values. The sum of the excess cancer risk values is 1.1×10^{-6}. Comparing this value to the requirement of $<1 \times 10^{-5}$, this criterion is met.

RESULTS:

1) List individual noncarcinogens and corresponding HQs >1.0: None
2) List the cumulative noncarcinogenic HQ >1.0: None
3) List individual carcinogens and corresponding excess cancer risk $>1 \times 10^{-5}$: None
4) List the cumulative excess cancer risk for carcinogens $>1 \times 10^{-5}$: None.

Table 1 shows the results of the calculation.

Washington Closure Hanford CALCULATION SHEET

Originator:	M. W. Perrott	Date:	9/25/08	Calc. No.:	0300X-CA-V0097	Rev.:	0
Project:	300 Area Field Remediation	Job No:	14655	Checked:	S. W. Clark	Date:	9/25/08
Subject:	Industrial Land Use Scenario 331 LSLDF Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 3 of 4	

Table 1. Hazard Quotient and Excess Cancer Risk Results for the Industrial Land Use Scenario at the 331 LSLDF Waste Site.

Contaminants of Potential Concern	Maximum Value[a] (mg/kg)	Noncarcinogen RAG[b] (mg/kg)	Hazard Quotient	Carcinogen RAG[b] (mg/kg)	Carcinogen Risk
Metals					
Antimony	6.4	1400	4.6E-03		
Barium	425.0	700000	6.07E-04	4900[c]	8.67E-08
Boron	1.7	700000	2.4E-06		
Cadmium	6.7	3500	1.9E-03	139[c]	4.8E-07
Chromium, total	29.9	5250000	5.70E-06		
Copper	232	130000	1.78E-03	--	--
Lead[d]	56.1	--	--	--	--
Mercury	13.80	1050	0.0131	--	--
Molybdenum	5.5	17500	3.1E-04	--	--
Selenium	1.8	17500	1.0E-04	--	--
Silver	183	17500	0.0105	--	--
Zinc	452	1050000	4.30E-04	--	--
Semivolatiles					
Bis(2-ethylhexyl) phthalate	58.0	70000	8.29E-04	9380	6.18E-08
Butylbenzylphthalate	17	700000	2.4E-05	--	--
Di-n-butylphthalate	2.5	350000	7.1E-06	--	--
Isophorone	0.068	700000	9.7E-08	138000	4.9E-12
Pesticides					
Aldrin	0.0092	105	8.8E-05	7.7	1.2E-08
BHC, alpha	0.00039	--	--	21	1.9E-10
BHC, delta	0.0073	--	--	--	--
BHC, gamma (Lindane)	0.0044	1050	4.2E-06	101	4.4E-10
DDE, 4,4'-	0.36	--	--	386	9.3E-10
Dieldrin	0.12	175	6.86E-04	8.2	1.5E-07
Endosulfan (I, II, sulfate)	0.438	21000	2.09E-05	--	--
Endrin (and ketone, aldehyde)	0.24	1050	2.3E-04	--	--
Heptachlor epoxide	0.0047	45.5	1.0E-04	14.4	3.3E-09
Methoxychlor	0.0033	17500	1.9E-07	--	--
Polychlorinated Biphenyls					
Aroclor-1254	22.0	70	0.31	65.6	3.4E-07
Volatiles					
Acetone	0.59	3150000	1.9E-07	--	--
Methylene chloride	0.11	210000	5.2E-07	17500	6.3E-11
Totals					
Cumulative Hazard Quotient:			**0.350**		
Cumulative Excess Cancer Risk:					**1.1E-06**

Notes:
RAG = remedial action goal
-- = not applicable or no value available
[a] = Table 2 (WCH 2008b).
[b] = Value obtained from *Washington Administrative Code* (WAC) 173-340-740(4), Method C, 1996, unless otherwise noted.
[c]=Carcinogenic cleanup level calculated based on the inhalation exposure pathway; WAC 173-340-750(3), 1996.
[d]=Lead does not have a reference dose for calculation of a hazard quotient because toxic effects of lead are correlated with blood-lead levels rather than exposure levels or daily intake.

Washington Closure Hanford CALCULATION SHEET

Originator:	M. W. Perrott	Date:	9/25/08	Calc. No.:	0300X-CA-V0097	Rev.:	0
Project:	300 Area Field Remediation	Job No:	14655	Checked:	S. W. Clark	Date:	9/25/08
Subject:	Industrial Land Use Scenario 331 LSLDF Hazard Quotient and Carcinogenic Risk Calculations					Sheet No. 4 of 4	

CONCLUSION:

This calculation demonstrates that the 331 LSLDF waste site meets the industrial land use scenario requirements for the hazard quotients and carcinogenic (excess cancer) risk as identified in the RDR/RAWP (DOE-RL 2004).

APPENDIX D

DATA QUALITY ASSESSMENT

SAMPLING DATA QUALITY ASSESSMENT

A data quality assessment (DQA) was performed to compare the sampling approach and resulting analytical data with the sampling and data requirements specified in the site-specific sample design (WCH 2006) for the 331 Life Sciences Drain Field (331 LSDF) waste site. This DQA was performed in accordance with site specific data quality objectives found in the *300 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2004).

To ensure quality data, the SAP data assurance requirements and the data validation procedures for chemical and radiochemical analysis (BHI 2000a, 2000b) are used as appropriate. This review involves evaluation of the data to determine if they are of the right type, quality, and quantity to support the intended use (i.e., evaluate against cleanup criteria to indicate if remedial action goals have been met). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process (EPA 2000).

A review of the sample design (WCH 2006), the field logbook (WCH 2008), and applicable analytical data packages has been performed as part of this DQA. Due to conditions that only became apparent during sampling, several samples indicated in the work instruction were inaccessible or no material was at the location specified. In some cases alternate samples were collected. In cases where some material was available for sampling but of insufficient volume to run all of the specified analyses, the analyses requested were prioritized based on those analytes most likely to be present at levels above the remedial action goals. The sampling design for the 331 LSLDF consisted of focused samples. It is determined that the resulting data set is sufficient to indicate if the remedial action objectives and goals for direct exposure, protection of groundwater, and protection of the Columbia River have been met. The sample data collected at the 331 LSLDF were provided by the laboratories in three sample delivery groups (SDGs): SDG K0323, SDG K0770, and SDG K0771. No major deficiencies were identified in the analytical data. Minor deficiencies are discussed below.

SDG K0323

This SDG comprises two field samples (J11XP2, J11XP3) collected from the septic tanks of the 331 LSLDF septic system. These samples were collected April 18, 2006, prior to the development of the site-specific sample design (WCH 2006). These samples are considered to be informational in nature and were used to develop the sample design. These data are reviewed here for completeness. Both of the samples collected were residual water from within the septic tanks.

The field samples were analyzed for alpha-, beta-, and gamma-emitting radionuclides; isotopic uranium; isotopic plutonium; neptunium-237; americium-241; curium-243/244; volatile organic compounds (VOCs); semivolatile organic compounds (SVOCs); polychlorinated biphenyls (PCBs); ion chromatography (IC) anions; inductively coupled plasma (ICP) metals; and mercury. No major deficiencies were found in SDG K0323. Minor deficiencies are as follows:

The common laboratory contaminant methylene chloride was detected in the volatile organic analysis (VOA) method blank (MB) below the contract required quantitation limit (CRQL). Methylene chloride was not detected at significant concentrations in the field samples; therefore, this result did not have a significant impact of the field data. The data are useable for decision-making purposes.

In the semivolatile organic analysis (SVOA), two surrogate recoveries were below the acceptance criteria for sample J11XP3. However, the associated matrix spike (MS) and matrix spike duplicate (MSD) surrogate recoveries were within the acceptance criteria and fulfill the secondary criteria for sample J11XP3. The data are useable for decision-making purposes.

In the SVOA, the common laboratory contaminant bis(2-ethylhexyl)phthalate was detected in the MB below the CRQL. Bis(2-ethylhexyl)phthalate was not detected at significant concentrations in the field samples; therefore, this result did not have an impact on the field data. The data are useable for decision-making purposes.

In the SVOA, the analyte 3,3'-dichlorobenzidine was not recovered in the MS or the MSD. However, 3,3'-dichlorobenzidine was recovered in the laboratory control sample (LCS) at 80%. This confirms that 3,3'-dichlorobenzidine would have been recovered in the field samples if it were present. The data are useable for decision-making purposes.

In the ICP metals analysis, the relative percent difference (RPD) calculated for silver in the laboratory duplicate was outside the acceptance criteria at 43.1%. Data for silver in SDG K0323 may be considered estimated. Estimated data are useable for decision-making purposes.

SDG K0770

SDG K0770 comprises four field samples (J134V6, J134V7, J134V8, J134V9) collected from the 331 LSLDF on April 17, 2007.

The field samples were analyzed for alpha-, beta-, and gamma-emitting radionuclides; isotopic uranium; isotopic plutonium; neptunium-237; technetium-99; americium-241; curium-243/244; VOCs; SVOCs; PCBs; IC anions; chlorinated pesticides, petroleum hydrocarbons; ICP metals; and mercury. No major deficiencies were found in SDG K0770. Minor deficiencies are as follows:

In the technetium-99 analysis, the tracer yield in the LCS was below the laboratory control limit (20%) at 16%. However, the LCS recovery for technetium-99 was within the project's acceptance criteria at 94%. The data are useable for decision-making purposes.

In the VOA analysis, both of the MS and MSD recoveries for 1,1,2,2-tetrachloroethane are below the acceptance criteria (70% to 130 %) at 64%. The LCS recovery for 1,1,2,2-tetrachloroethane was also below the acceptance criteria at 58%. Data reported for 1,1,2,2-tetrachloroethane in SDG K0770 may be considered estimated. Estimated data are useable for decision-making purposes.

The common laboratory contaminants methylene chloride and acetone were detected in the VOA MB below the CRQLs. Neither analyte was detected at significant concentrations in the field samples; therefore, this result did not have an impact of the field data. The data are useable for decision-making purposes.

In the SVOA for sample J134V7, the surrogate 2,4,6-tribromophenol was below acceptance criteria at 18%. However, the surrogates for sample J134V7 met the secondary acceptance criterion that allows no more than one surrogate outlier per fraction (acid and base neutral). The data are useable for decision-making purposes.

In the SVOA, the LCS recovery for 2,4-dimethylphenol was below the acceptance criteria (50% to 120 %) at 48%. However, the MS and MSD recoveries were within criteria and confirm that the analytical system was performing adequately for MSs and, therefore, for the samples that were used to produce those MSs. The LCS recovery has no impact on the field sample data. The data are useable for decision-making purposes.

The common laboratory contaminants bis(2-ethylhexyl)phthalate and di-n-butylphthalate were detected in the SVOA MB below the CRQLs. Neither analyte was detected at significant concentrations in the field samples; therefore, this result did not have an impact on the field data. The data are useable for decision-making purposes.

In the ICP metals analysis, the MS recoveries for aluminum, calcium, iron, magnesium, manganese, antimony, and silicon were outside the acceptance criteria. In these cases the spiked amount was not significantly greater than the native amount identified in the sample. quantitation of these analytes was confirmed using post-digestion spikes (PDSs). The results of the PDSs were in the range of 80.2% to 108.3%. No qualification is needed for these results. The data are useable for decision-making purposes.

In the ICP metals analysis, the RPDs calculated for the laboratory duplicate for cadmium, mercury, and silicon are outside the acceptance criteria at 30.2%, 39.4%, and 52.7%, respectively. Elevated RPDs in environmental soil samples are attributed to natural heterogeneities in the sample matrix. The data are useable for decision-making purposes.

In the chlorinated pesticide analysis, the analyte(s) toxaphene was not included in the laboratory spikes. Because toxaphene is a mixture of chemical species it is common practice not to include it in the spikes because it would interfere with the analysis of other target compounds. The toxaphene data may be considered estimated. The data are useable for decision-making purposes.

In the IC anions analysis, the LCS recovery for phosphate was just below the acceptance criteria (90% to 110%) at 89.9%. This deficiency has no impact on the field sample data. The data are useable for decision-making purposes.

In the IC anion analysis, the MS recovery for nitrate/nitrite was above the acceptance criteria (70% to 130 %) at 144%. This suggests a high bias in the field sample data for nitrate/nitrite. High biased data are useable for decision-making purposes.

SDG K0771

SDG K0771 comprises six field samples (J134W0, J134W1, J134W2, J134W3, J134W4, J134W5) collected from the 331 LSLDF on April 18 and April 19, 2007.

All six of the field samples were analyzed for alpha-, beta-, and gamma-emitting radionuclides; isotopic uranium; isotopic plutonium; neptunium-237; technetium-99; americium-241; and curium-243/244. Samples J134W0, J134W1, J134W2, and J134W3 were analyzed for ICP metals (including mercury), chlorinated pesticides, PCBs, and SVOCs. Sample J134W0 (the equipment blank) was also analyzed for VOCs and IC anions. No major deficiencies were found in SDG K0771. Minor deficiencies are as follows:

In the ICP metals MB associated with sample J134W0 (the equipment blank), the analyte silicon was reported at a concentration less than $1/20^{th}$ of the silicon concentration reported in J134W0. The silicon result in sample J134W0 may be considered estimated. However, both results are below the CRQL, and there is no impact to the field sample data. The data are useable for decision-making purposes.

In the ICP metals MS associated with sample J134W0 (the equipment blank), the analyte silicon was outside of the acceptance criteria at 131%. Quantitation was confirmed using a PDS. The result of the PDS is 100.9%. No qualification is needed for this result. The data are useable for decision-making purposes.

In the ICP metals analysis, the RPDs associated with sample J134W0 (the equipment blank) for the analytes manganese and zinc were above the acceptance criteria (<30%) at 41.3% and 69.7%, respectively. Elevated RPDs in environmental soil samples are attributed to natural heterogeneities in the sample matrix. The data are useable for decision-making purposes.

In the ICP metals analysis associated with samples J134W1, J134W2, and J134W3, the MS recoveries for the analytes silver, aluminum, calcium, copper, iron, antimony, and silicon are outside of the acceptance criteria. Quantitation is confirmed for these analytes using PDSs. The PDS recoveries ranged from 95.1% to 118%. No qualification is needed for this result. The data are useable for decision-making purposes.

In the ICP metals analysis, the RPDs associated with samples J134W1, J134W2, and J134W3 for the analytes arsenic and silicon were above the acceptance criteria at 50.0% and 56.7%, respectively. Elevated RPDs in environmental soil samples are attributed to natural heterogeneities in the sample matrix. The data are useable for decision-making purposes.

In the VOA associated with sample J134W0 (the equipment blank), the common laboratory contaminant acetone was detected in the MB. The acetone concentration reported for sample J134W0 appears to have been augmented by the laboratory contamination, causing the MS and MSD recoveries to be below the acceptance criteria and the LCS recovery to be above the criteria. The acetone data reported for sample J134W0 is considered estimated. Estimated data are useable for decision-making purposes.

In the VOA associated with sample J134W0 (the equipment blank), the common laboratory contaminant methylene chloride was detected in both the sample and the MB at similar concentrations, 6 µg/kg and 5 µg/kg, respectively. Both concentrations are below the CRQL. The methylene chloride data reported for sample J134W0 may be considered estimated. Estimated data are useable for decision-making purposes.

In the SVOA, the surrogate 2,4,6-tribromophenol was below acceptance criteria in sample J134W0 and the associated MSD. However, the surrogates for these samples meet the secondary acceptance criterion that allows no more than one surrogate outlier per fraction (acid and base neutral). The data are useable for decision-making purposes.

In the SVOA, the MS recoveries for 2,4-dimethylphenol and 2,4,5-trichlorophenol were below the acceptance criteria at 49% and 27%, respectively. The LCS recovery for 2,4-dimethylphenol was also below the acceptance criteria at 48%. The data reported in SDG K0771 for 2,4-dimethylphenol and 2,4,5-trichlorophenol may be considered estimated. Estimated data are useable for decision-making purposes.

In the SVOA, the common laboratory contaminants bis(2-ethylhexyl)phthalate and di-n-phthalate were detected in the MB at concentrations below the CRQL. There is no impact on the field sample data. The data are useable for decision-making purposes.

In the chlorinated pesticide analysis, the surrogate recovery for decachlorobiphenyl was above the acceptance criteria with a recovery of 189%. However, the secondary criterion was met, which allows no more than one surrogate outlier per sample. The data are useable for decision-making purposes.

In the IC anions analysis, the LCS recovery for phosphate was just below the acceptance criteria (90% to 110%) at 89.9%. This deficiency has no impact on the field sample data. The data are useable for decision-making purposes.

FIELD QUALITY ASSURANCE/QUALITY CONTROL

RPD evaluations of main sample(s) versus the laboratory duplicate(s) are routinely performed and reported by the laboratory. Any deficiencies shown in those calculations are reported by SDG in the previous sections.

Field quality assurance/quality control (QA/QC) measures are used to assess potential sources of error and cross contamination of samples that could bias results. The field QA/QC samples for the 331 LSLDF waste site listed in the field logbook (WCH 2008) are sample J134V6 (primary) and sample J134V7 (duplicate). Field duplicate pairs are collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates that are used to evaluate precision in the analytical process.

The field duplicates are evaluated by computing the RPD of the duplicate samples for each contaminant of concern. Only analytes with values above five times the detection limits for both the main and duplicate samples are compared. The RPDs calculated for the 331 LSLDF field duplicate pair (J134V6/J134V7) are within the acceptance criteria (30%). The data are useable for decision-making purposes.

An overall visual inspection of all of the data is also performed. No additional major or minor deficiencies are noted. The data are suitable for the intended purpose of cleanup verification.

SUMMARY

Limited, random, or sample matrix-specific influenced batch QC issues such as those discussed above are a potential for any analysis. The number and types seen in these data sets are within expectations for the matrix types and analyses performed. The DQA review of the 331 LSLDF septic system sampling data found that the analytical results are accurate within the standard errors associated with the analytical methods, sampling, and sample handling. The DQA review for the 331 LSLDF waste site concludes that the data are of the right type, quality, and quantity to support the intended use. The analytical data are stored in the Environmental Restoration project-specific database prior to being submitted for inclusion in the Hanford Environmental Information System database. The verification sample analytical data are also summarized in Appendix A.

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