CVP-2006-00003
Rev. 0

Cleanup Verification Package for the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin and Underlying Soils; the 118-H-6:6 Fuel Storage Basin Deep Zone Side-Slope Soils; the 100-H-9, 100-H-10, and 100-H-13 French Drains; the 100-H-11 and 100-H-12 Expansion Box French Drains; and the 100-H-14 and 100-H-31 Surface Contamination Zones

Prepared for the U.S. Department of Energy
by Washington Closure Hanford

June 2006

EXECUTIVE SUMMARY

This cleanup verification package (CVP) documents completion of removal actions for the 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils (Waste Information Data System subsite 118-H-6:2); the 105-H Reactor Fuel Storage Basin (FSB) and Underlying Soils (118-H-6:3); and the 118-H-6:6 FSB Deep Zone Side-Slope Soils. This CVP also documents remedial actions for the following seven additional waste sites: French Drain C (100-H-9), French Drain D (100-H-10), Expansion Box French Drain E (100-H-11), Expansion Box French Drain F (100-H-12), French Drain G (100-H-13), Surface Contamination Zone H (100-H-14), and the Polychlorinated Biphenyl Surface Contamination Zone (100-H-31). The 105-H Reactor is located in the 100-H Area of the Hanford Site in southeastern Washington State. The 105-H Reactor is one of nine surplus plutonium production reactors located in the 100 Areas of the Hanford Site and is located approximately 32 km (20 mi) north of Richland, Washington.

Decontamination and decommissioning activities in support of the 105-H Reactor Interim Safe Storage Project (DOE-RL 2001b) have resulted in the removal of all above- and below-grade structures outside of the 105-H safe storage enclosure (SSE). These structures were demolished, removed in their entirety, and then disposed. All materials were disposed at the Environmental Restoration Disposal Facility in the 200 Areas of the Hanford Site (WCH 2005). The remaining structure of the 105-H Reactor within the shield walls has been preserved to act as temporary storage for the reactor core. Throughout this CVP, the soils and underground structures outside of the SSE, along with the seven remaining waste sites, will be collectively referred to as the 105-H site.

Removal action applicable or relevant and appropriate requirements and remedial action goals (RAGs) for the 105-H site were established by the U.S. Environmental Protection Agency and the U.S. Department of Energy, Richland Operations Office, in concurrence with the Washington State Department of Ecology. These applicable or relevant and appropriate requirements and RAGs are documented in *The Action Memorandum for the 105-D and 105-H Reactor Buildings and Ancillary Facilities* (Action

Memorandum) (Ecology et al. 2001) and the *Removal Action Work Plan for 105-D and 105-H Building Interim Safe Storage Projects and Ancillary Buildings* (DOE-RL 2002). The RAGs are further detailed in the *Sampling and Analysis Plan for Interim Closure of 105-D and 105-H Reactor Below-Grade Structures and Underlying Soils* (105-H Reactor SAP) (DOE-RL 2001b), the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2005a), and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b).

Results of sampling, laboratory analyses, and data evaluations for the soils underlying the former 105-H Reactor FSB (118-H-6:3) and the FSB excavation deep zone side-slope soils (118-H-6:6) indicate that all remedial action objectives and goals for direct exposure, protection of groundwater, and protection of the Columbia River have been met, as summarized in Table ES-1. Per the 105-H Reactor SAP (DOE-RL 2001b), the 105-H Reactor ancillary support areas and below-grade structures (118-H-6:2) did not require sampling and analysis because the structures were removed in their entirety. Also per the 105-H Reactor SAP (DOE-RL 2001b), sampling of the underlying soils was not required because the structures that were removed were not subjected to standing contaminated water and there was no mechanism for residual surface contamination to penetrate into the concrete and underlying soil.

The additional seven waste sites included in this CVP (100-H-9, 100-H-10, 100-H-11, 100-H-12, 100-H-13, 100-H-14, and 100-H-31) were removed during the decontamination and decommissioning excavations required to place the 105-H Reactor Building into interim safe storage. Remedial action objectives and goals for these additional sites are as stated in the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD) (EPA 1999). Statistical sampling of the FSB underlying soils and deep zone side-slope soils also pertains to the 100-H-11, 100-H-12, and 100-H-14 waste sites and therefore indicate that all remedial action objectives and goals for direct exposure, protection of groundwater, and protection of

the Columbia River have been met for the soils underlying these waste sites (see Table ES-1). The soils underlying the 100-H-9, 100-H-10, and 100-H-13 waste sites did not require further sampling and analysis based on data from analogous french drains surrounding the 105-C Reactor Building (118-C-3:3 waste site) and the 105-F Reactor (100-F-12 waste site), which were reclassified as interim closed out and no action, respectively (WCH 2006d, BHI 2005c).

The soil at 100-H-31, a former electrical transformer site, was completely removed to 4.6 m (15 ft) below grade. The RESidual RADioactivity modeling evaluation in the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a), using distribution coefficient values and vertical distance to groundwater, predicts that the residual contaminant levels of polychlorinated biphenyls at the site are protective of groundwater and the Columbia River. Based on these facts, the cleanup of the 100-H-31 waste site was determined to be protective of groundwater and consequently the Columbia River.

The 105-H site meets cleanup standards and has been reclassified as "interim closed out" in accordance with the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989) and the Waste Site Reclassification Guideline TPA-MP-14 (RL-TPA-90-0001) (DOE-RL 1998). A copy of the waste site reclassification forms for 118-H-6:2, 118-H-6:3, and 118-H-6:6 are included as Attachments ES-1, ES-2, and ES-3, respectively. A copy of the waste site reclassification forms for 100-H-9, 100-H-10, 100-H-11, 100-H-12, 100-H-13, 100-H-14, and 100-H-31 are included as Attachments ES-4, ES-5, ES-6, ES-7, ES-8, ES-9, and ES-10, respectively. Executive summary tables were not compiled for waste sites 118-H-6:2, 100-H-9, 100-H-10, 100-H-13, and 100-H-31 because soil sampling was not required in order to demonstrate attainment of the remedial action objectives.

Table ES-1. Summary of Cleanup Verification Results for the 105-H Fuel Storage Basin Underlying Soils (118-H-6:3) and Deep Zone Side-Slope Soils (118-H-6:6).[a]

Regulatory Requirement	Remedial Action Goals	Results	Removal Action Objectives Attained?	Ref.
Direct Exposure – Radionuclides	1. Attain 15 mrem/yr above background dose rate for 1,000 years.	1. All dose rate estimates are less than 15 mrem/yr.	Yes	b, c
Direct Exposure – Nonradionuclides	1. Attain individual COC RAGs.	1. Direct exposure RAGs, individual and cumulative noncarcinogenic hazard quotients, and individual and total carcinogenic risk limits have been met for post-drilling shallow zone soils.	Yes	d
Meet Nonradionuclide Risk Requirements	1. Hazard quotient of <1 for noncarcinogens.			d
	2. Cumulative hazard quotient of <1 for noncarcinogens.			d
	3. Excess cancer risk of <1 x 10^{-6} for individual carcinogens.			d
	4. Attain a total excess cancer risk of <1 x 10^{-5} for carcinogens.			d
Groundwater/River Protection – Radionuclides	1. Attain single COC groundwater and river protection RAGs.	1. All single COC groundwater and river RAGs have been attained.	Yes	b, e
	2. Attain National Primary Drinking Water Standards: 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.	2. All organ-specific dose rates are below the 4 mrem/yr dose rate limit.		e
	3. Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guidelines from DOE Order 5400.5.	3. All alpha-emitting COCs are below drinking water standards.	Yes	b, e
	4. Meet total uranium standard of 21.2 pCi/L.[e]	4. The total uranium standard has been met.		e
Groundwater/River Protection – Nonradionuclides	1. Attain individual nonradionuclide groundwater and river cleanup requirements.	1. All groundwater and river protection requirements have been met.	Yes	b, g
Other supporting Information	1. Sample location design (Appendix C).			h

Table ES-1. Summary of Cleanup Verification Results for the 105-H Fuel Storage Basin Underlying Soils (118-H-6:3) and Deep Zone Side-Slope Soils (118-H-6:6).[a]

Regulatory Requirement	Remedial Action Goals	Results	Removal Action Objectives Attained?	Ref.

[a] Cleanup verification results for 118-H-6:3 and 118-H-6:6 also demonstrate that remedial action goals have been met for the remaining sites 100-H-11, 100-H-12, and 100-H-14, which have been removed in their entirety. These remaining sites were located within the remediation footprint of the fuel storage basin and as such, the soil sampling for the fuel storage basin and deep zone side slopes also pertained to 100-H-11, 100-H-12, and 100-H-14.

[b] *105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification RESRAD Calculation Brief*, 0100H-CA-V0086, Rev. 0, Washington Closure Hanford, Richland, Washington (Appendix C). This calculation brief pertains to the 105-H Fuel Storage Basin Soils (118-H-6:3) and the Deep Zone-Side Slope Soils (118-H-6:6).

[c] All structures outside of the 105-H safe storage enclosure were removed based on experience at the 105-C Reactor and at other decommissioned reactors where surface contamination was present on the surface of similar structures (BHI 1998).

[d] *105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations*, 0100H-CA-V0085, Rev. 0, Washington Closure Hanford, Richland, Washington (Appendix C). This calculation brief pertains to the 105-H Fuel Storage Basin Soils (118-H-6:3) and the Deep Zone-Side Slope Soils (118-H-6:6).

[e] *105-H Reactor Building (118-H-6) Fuels Storage Basin Comparison to Drinking Water Standards (MCL)*, 0100H-CA-V0087, Rev. 0, Washington Closure Hanford, Richland, Washington.

[f] Based on the isotopic distribution of uranium in the 100 Areas, the 21.2 pCi/L corresponds to 30 µg/L MCL. 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*, 0100X-CA-V0038 (BHI 2001a).

[g] An analogous site contaminant depth and distribution coefficient (K_d value) model described in the RESRAD calculation in Appendix C (0100H-CA-V0086) was used to demonstrate that the site is protective of groundwater and the river (BHI 2005a, WCH 2006a).

[h] *Sampling and Analysis Plan for Interim Closure of the 105-D and 105-H Reactor Below-Grade Structures and Underlying Soils* (DOE-RL 2001b).

COC = contaminant of concern
MCL = maximum contaminant level
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose model)
UCL = upper confidence limit

Attachment ES-1
Waste Site Reclassification Form

Date Submitted: 4/19/06 **Originator:** L. M. Dittmer **Phone:** 372-9664	**Operable Unit(s):** 100-HR-1 **Waste Site ID:** 118-H-6:2 **Type of Reclassification Action:** Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number:** 2006-008 **Lead Agency:** Ecology

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List of no action or closed-out sites will occur at a future date.

Description of current waste site condition:

Remedial actions at this site have been performed in accordance with remedial action objectives and goals established by the U.S. Environmental Protection Agency and the U.S. Department of Energy, Richland Operations Office, in concurrence with the Washington State Department of Ecology. The selected remedial action involved (1) removing all below-grade structures, (2) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility in the 200 Areas of the Hanford Site, and (3) backfilling the site with clean soil to adjacent grade elevations.

Basis for reclassification:

The 118-H-6:2 site consists of the 105-H Reactor ancillary support areas, below-grade structures, and underlying soils and has been remediated to meet the cleanup standards specified by the *Action Memorandum for the 105-D and 105-H Reactor Buildings and Ancillary Facilities, Hanford Site, Benton County, Washington,* Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Removal actions were performed to allow rural-residential use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep) and to protect groundwater and the Columbia River. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin and Underlying Soils; the 118-H-6:6 Fuel Storage Basin Deep Zone Side-Slope Soils; the 100-H-9, 100-H-10, and 100-H-13 French Drains; the 100-H-11 and 100-H-12 Expansion Box French Drains; and the 100-H-14 and 100-H-31 Surface Contamination Zones* (CVP-2006-00003), Washington Closure Hanford, Richland, Washington. The cleanup verification package does not demonstrate the acceptability of unrestricted access to deep zone soils (i.e., below 4.6 m [15 ft]); therefore, institutional controls to prevent uncontrolled drilling or excavation into deep zone soils are required.

D. C. Smith DOE-RL Project Manager	Signature	6/21/06 Date
R. Bond Ecology Project Manager	Frederick H. Bond Signature	6/22/06 Date
NA EPA Project Manager	Signature	Date

Attachment ES-2
Waste Site Reclassification Form

Date Submitted: 4/19/06 **Originator:** L. M. Dittmer **Phone:** 372-9664	**Operable Unit(s):** 100-HR-1 **Waste Site ID:** 118-H-6:3 **Type of Reclassification Action:** Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number:** 2006-009 **Lead Agency:** Ecology

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List of no action or closed-out sites will occur at a future date.

Description of current waste site condition:

Remedial actions at this site have been performed in accordance with remedial action objectives and goals established by the U.S. Environmental Protection Agency and the U.S. Department of Energy, Richland Operations Office, in concurrence with the Washington State Department of Ecology. The selected remedial action involved (1) removing all below-ground structures, (2) verifying that soil left in place achieves specified cleanup standards, (3) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility in the 200 Areas of the Hanford Site, and (4) backfilling the site with clean soil to adjacent grade elevations.

Basis for reclassification:

The 118-H-6:3 site consists of the 105-H Reactor fuel storage basin and underlying soils and has been remediated to meet the cleanup standards specified by the *Action Memorandum for the 105-D and 105-H Reactor Buildings and Ancillary Facilities, Hanford Site, Benton County, Washington,* Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Removal actions were performed to allow rural-residential use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep) and to protect groundwater and the Columbia River. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin and Underlying Soils; the 118-H-6:6 Fuel Storage Basin Deep Zone Side-Slope Soils; the 100-H-9, 100-H-10, and 100-H-13 French Drains; the 100-H-11 and 100-H-12 Expansion Box French Drains; and the 100-H-14 and 100-H-31 Surface Contamination Zones* (CVP-2006-00003), Washington Closure Hanford, Richland, Washington. The cleanup verification package does not demonstrate the acceptability of unrestricted access to deep zone soils (i.e., below 4.6 m [15 ft]); therefore, institutional controls to prevent uncontrolled drilling or excavation into deep zone soils are required.

D. C. Smith DOE-RL Project Manager	Signature	6/21/06 Date
R. Bond Ecology Project Manager	Signature	6/22/06 Date
NA EPA Project Manager	Signature	Date

Attachment ES-3
Waste Site Reclassification Form

Date Submitted: 4/19/06 **Originator:** L. M. Dittmer **Phone:** 372-9664	**Operable Unit(s):** 100-HR-1 **Waste Site ID:** 118-H-6:6 **Type of Reclassification Action:** Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number:** 2006-022 **Lead Agency:** Ecology

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List of no action or closed-out sites will occur at a future date.

Description of current waste site condition:

Remedial actions at this site have been performed in accordance with remedial action objectives and goals established by the U.S. Environmental Protection Agency and the U.S. Department of Energy, Richland Operations Office, in concurrence with the Washington State Department of Ecology. The selected remedial action involved (1) disposing of contaminated excavation materials at the Environmental Restoration Disposal Facility in the 200 Areas of the Hanford Site, (2) verifying that soil left in place achieves specified cleanup standards and (3) backfilling the site with clean soil to adjacent grade elevations.

Basis for reclassification:

The 118-H-6:6 site consists of the fuel storage basin deep zone side-slope soils and has been remediated to meet the cleanup standards specified by the *Action Memorandum for the 105-D and 105-H Reactor Buildings and Ancillary Facilities, Hanford Site, Benton County, Washington,* Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Richland Operations Office, Richland, Washington. Removal actions were performed to allow rural-residential use of shallow zone soils (i.e., surface to 4.6 m [15 ft] deep) and to protect groundwater and the Columbia River. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin and Underlying Soils; the 118-H-6:6 Fuel Storage Basin Deep Zone Side-Slope Soils; the 100-H-9, 100-H-10, and 100-H-13 French Drains; the 100-H-11 and 100-H-12 Expansion Box French Drains; and the 100-H-14 and 100-H-31 Surface Contamination Zones* (CVP-2006-00003), Washington Closure Hanford, Richland, Washington. The cleanup verification package does not demonstrate the acceptability of unrestricted access to deep zone soils (i.e., below 4.6 m [15 ft]); therefore, institutional controls to prevent uncontrolled drilling or excavation into deep zone soils are required.

D. C. Smith DOE-RL Project Manager	Signature	6/21/06 Date
R. Bond Ecology Project Manager	Signature	6/22/06 Date
NA EPA Project Manager	Signature	Date

Attachment ES-4
Waste Site Reclassification Form

Date Submitted: 4/19/06 **Originator**: L. M. Dittmer **Phone**: 372-9664	**Operable Unit(s)**: 100-HR-1 **Waste Site ID**: 100-H-9 **Type of Reclassification Action**: Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number**: 2006-010 **Lead Agency**: Ecology

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, interim closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List (NPL) of no action, interim closed-out, or closed-out sites will occur at a future date.

Description of current waste site condition:

The 100-H-9 site consisted of a french drain located outside of the northeast corner of the former 105-H Reactor Building. The drain structure was removed during the excavations required to place the 105-H Reactor into interim safe storage. All excavation material was disposed at the Environmental Restoration Disposal Facility and the site was backfilled to grade with clean soil. Evaluation of analogous reactor french drains (118-C-3:3 and 100-F-12) demonstrated that possible residual soil contamination resulting from the 100-H-9 site meets remedial action objectives and goals as stated in the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Removal of the french drain structure and evaluation of analogous reactor french drains demonstrated that remediation cleanup goals have been met.

Basis for reclassification:

The 100-H-9 waste site meets the remedial action objectives specified in the Remaining Sites ROD. Evaluation of analogous waste site data indicates that residual contaminant concentrations at 100-H-9 do not preclude any future land uses (as bounded by a rural-residential scenario) and allows for unrestricted future use of shallow zone soils (i.e., surface to 4.6 m [15 ft]). The evaluation also shows that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin and Underlying Soils; the 118-H-6:6 Fuel Storage Basin Deep Zone Side-Slope Soils; the 100-H-9, 100-H-10, and 100-H-13 French Drains; the 100-H-11 and 100-H-12 Expansion Box French Drains; and the 100-H-14 and 100-H-31 Surface Contamination Zones* (CVP-2006-00003), Washington Closure Hanford, Richland, Washington.

K. R. Westover DOE-RL Project Manager	Signature	6/21/06 Date
R. Bond Ecology Project Manager	Frederick A. Bond Signature	6/22/06 Date
NA EPA Project Manager	Signature	Date

Attachment ES-5
Waste Site Reclassification Form

Date Submitted: 4/19/06 **Originator**: L. M. Dittmer **Phone**: 372-9664	**Operable Unit(s)**: 100-HR-1 **Waste Site ID**: 100-H-10 **Type of Reclassification Action**: Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number**: 2005-053 **Lead Agency**: Ecology

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, interim closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List (NPL) of no action, interim closed-out, or closed-out sites will occur at a future date.

Description of current waste site condition:

The 100-H-10 site consisted of a french drain located on the north side of the former 105-H Reactor Building. The drain structure was removed during the excavations required to place the 105-H Reactor into interim safe storage. All excavation material was disposed at the Environmental Restoration Disposal Facility, and the site was backfilled to grade with clean soil. Evaluation of analogous reactor french drains (118-C-3:3 and 100-F-12) demonstrated that possible residual soil contamination resulting from the 100-H-10 site meets remedial action objectives and goals as stated in the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Removal of the french drain structure and evaluation of analogous reactor french drains demonstrated that cleanup goals have been met.

Basis for reclassification:

The 100-H-10 waste site meets the remedial action objectives specified in the Remaining Sites ROD. Evaluation of analogous waste site data indicates that residual contaminant concentrations at 100-H-10 do not preclude any future land uses (as bounded by a rural-residential scenario) and allows for unrestricted future use of shallow zone soils (i.e., surface to 4.6 m [15 ft]). The evaluation also shows that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin and Underlying Soils; the 118-H-6:6 Fuel Storage Basin Deep Zone Side-Slope Soils; the 100-H-9, 100-H-10, and 100-H-13 French Drains; the 100-H-11 and 100-H-12 Expansion Box French Drains; and the 100-H-14 and 100-H-31 Surface Contamination Zones* (CVP-2006-00003), Washington Closure Hanford, Richland, Washington.

K. R. Westover DOE-RL Project Manager	Signature	6/21/06 Date
R. Bond Ecology Project Manager	Signature	6/22/06 Date
NA EPA Project Manager	Signature	Date

Attachment ES-6
Waste Site Reclassification Form

Date Submitted: 4/19/06 **Originator**: L. M. Dittmer **Phone**: 372-9664	**Operable Unit(s)**: 100-HR-1 **Waste Site ID**: 100-H-11 **Type of Reclassification Action**: Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number**: 2006-012 **Lead Agency**: Ecology

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, interim closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List (NPL) of no action, interim closed-out, or closed-out sites will occur at a future date.

Description of current waste site condition:

The 100-H-11 site consisted of a floor drain positioned underneath a concrete expansion box. The drain was located on the southwest corner of the former 105-H Reactor Building. Deep excavations required to remove the 105-H Fuel Storage Basin resulted in the complete removal of the 100-H-11 waste site. All excavation material was disposed at the Environmental Restoration Disposal Facility, and the site was backfilled to grade with clean soil. Verification sampling, modeling, and analyses of the soils underlying the fuel storage basin pertained to the soils underlying the 100-H-11 waste site and demonstrated that the remedial action objectives and remedial action goals have been met in accordance with *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

Basis for reclassification:

The 100-H-11 waste site meets the remedial action objectives specified in the Remaining Sites ROD. The results demonstrate that residual contaminant concentrations do not preclude any future land uses (as bounded by a rural-residential scenario) and allows for unrestricted future use of shallow zone soils (i.e., surface to 4.6 m [15 ft]). The results also show that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin and Underlying Soils; the 118-H-6:6 Fuel Storage Basin Deep Zone Side-Slope Soils; the 100-H-9, 100-H-10, and 100-H-13 French Drains; the 100-H-11 and 100-H-12 Expansion Box French Drains; and the 100-H-14 and 100-H-31 Surface Contamination Zones* (CVP-2006-00003), Washington Closure Hanford, Richland, Washington.

K. R. Westover DOE-RL Project Manager	Signature	6/21/06 Date
R. Bond Ecology Project Manager	Frederick Bond Signature	6/22/06 Date
NA EPA Project Manager	Signature	Date

Attachment ES-7
Waste Site Reclassification Form

Date Submitted: 4/19/06 **Originator**: L. M. Dittmer **Phone**: 372-9664	**Operable Unit(s)**: 100-HR-1 **Waste Site ID**: 100-H-12 **Type of Reclassification Action**: Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number**: 2006-013 **Lead Agency**: Ecology

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, interim closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List (NPL) of no action, interim closed-out, or closed-out sites will occur at a future date.

Description of current waste site condition:

The 100-H-12 site consisted of a floor drain positioned underneath a concrete expansion box. Lead bricks, for shielding, were placed on top of the concrete pad. The drain was located on the southeast corner of the former 105-H Reactor Building. Deep excavations required to remove the 105-H Fuel Storage Basin resulted in the complete removal of the 100-H-12 waste site. All excavation material was disposed at the Environmental Restoration Disposal Facility, and the site was backfilled to grade with clean soil. Verification sampling, modeling, and analyses of the soils underlying the fuel storage basin pertained to the 100-H-12 underlying soils and demonstrated that the remedial action objectives and remedial action goals have been met in accordance with *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

Basis for reclassification:

The 100-H-12 waste site meets the remedial action objectives specified in the Remaining Sites ROD. The results demonstrate that residual contaminant concentrations do not preclude any future land uses (as bounded by a rural-residential scenario) and allows for unrestricted future use of shallow zone soils (i.e., surface to 4.6 m [15 ft]). The results also show that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin and Underlying Soils; the 118-H-6:6 Fuel Storage Basin Deep Zone Side-Slope Soils; the 100-H-9, 100-H-10, and 100-H-13 French Drains; the 100-H-11 and 100-H-12 Expansion Box French Drains; and the 100-H-14 and 100-H-31 Surface Contamination Zones* (CVP-2006-00003), Washington Closure Hanford, Richland, Washington.

K. R. Westover DOE-RL Project Manager	Signature	6/21/06 Date
R. Bond Ecology Project Manager	Frederick F. Bond Signature	6/22/06 Date
NA EPA Project Manager	Signature	Date

Attachment ES-8
Waste Site Reclassification Form

Date Submitted: 4/19/06 **Originator**: L. M. Dittmer **Phone**: 372-9664	**Operable Unit(s)**: 100-HR-1 **Waste Site ID**: 100-H-13 **Type of Reclassification Action**: Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number**: 2006-011 **Lead Agency**: Ecology

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, interim closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List (NPL) of no action, interim closed-out, or closed-out sites will occur at a future date.

Description of current waste site condition:

The 100-H-13 waste site consisted of a french drain located on the east side of the former 105-H Reactor Building. The drain structure was removed during the excavations required to place the 105-H Reactor into interim safe storage. All excavation material was disposed at the Environmental Restoration Disposal Facility, and the site was backfilled to grade with clean soil. Evaluation of analogous reactor french drains (118-C-3:3 and 100-F-12) demonstrated that possible residual soil contamination resulting from the 100-H-13 site meets remedial action objectives and goals as stated in the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Removal of the french drain structure and evaluation of analogous reactor french drains demonstrated that cleanup goals have been met.

Basis for reclassification:

The 100-H-13 waste site meets the remedial action objectives specified in the Remaining Sites ROD. Evaluation of analogous waste site data indicates that residual contaminant concentrations at 100-H-13 do not preclude any future land uses (as bounded by a rural-residential scenario) and allows for unrestricted future use of shallow zone soils (i.e., surface to 4.6 m [15 ft]). The evaluation also shows that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin and Underlying Soils; the 118-H-6:6 Fuel Storage Basin Deep Zone Side-Slope Soils; the 100-H-9, 100-H-10, and 100-H-13 French Drains; the 100-H-11 and 100-H-12 Expansion Box French Drains; and the 100-H-14 and 100-H-31 Surface Contamination Zones* (CVP-2006-00003), Washington Closure Hanford, Richland, Washington.

K. R. Westover DOE-RL Project Manager	Signature	6/21/06 Date
R. Bond Ecology Project Manager	Signature	6/22/06 Date
NA EPA Project Manager	Signature	Date

Attachment ES-9
Waste Site Reclassification Form

Date Submitted: 4/19/06 **Originator**: L. M. Dittmer **Phone**: 372-9664	**Operable Unit(s)**: 100-HR-1 **Waste Site ID**: 100-H-14 **Type of Reclassification Action**: Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number**: 2006-014 **Lead Agency**: Ecology

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, interim closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List (NPL) of no action, interim closed-out, or closed-out sites will occur at a future date.

Description of current waste site condition:

The 100-H-14 waste site was an unplanned release site, located next to the former south wall of the 105-H Fuel Storage Basin (FSB). The contamination area was adjacent to the wash rack room associated with the former FSB. Deep excavations required to remove the FSB resulted in the removal of the contaminated soil. All excavation material was disposed at the Environmental Restoration Disposal Facility, and the site was backfilled to grade with clean soil. Verification sampling, modeling, and analyses of the 118-H-6:6 Deep Zone Side-Slope Soils pertained to the soils underlying the 100-H-14 waste site and demonstrated that the remedial action objectives and remedial action goals have been met in accordance with *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

Basis for reclassification:

The 100-H-14 waste site meets the remedial action objectives specified in the Remaining Sites ROD. The results demonstrate that residual contaminant concentrations do not preclude any future land uses (as bounded by a rural-residential scenario) and allows for unrestricted future use of shallow zone soils (i.e., surface to 4.6 m [15 ft]). The results also show that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin and Underlying Soils; the 118-H-6:6 Fuel Storage Basin Deep Zone Side-Slope Soils; the 100-H-9, 100-H-10, and 100-H-13 French Drains; the 100-H-11 and 100-H-12 Expansion Box French Drains; and the 100-H-14 and 100-H-31 Surface Contamination Zones* (CVP-2006-00003), Washington Closure Hanford, Richland, Washington.

K. R. Westover DOE-RL Project Manager	Signature	6/21/06 Date
R. Bond Ecology Project Manager	Signature	6/22/06 Date
NA EPA Project Manager	Signature	Date

Attachment ES-10
Waste Site Reclassification Form

Date Submitted: 4/19/06 **Originator**: L. M. Dittmer **Phone**: 372-9664	**Operable Unit(s)**: 100-HR-1 **Waste Site ID**: 100-H-31 **Type of Reclassification Action**: Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number**: 2006-015 **Lead Agency**: Ecology

This form documents agreement among the parties listed below authorizing classification of the subject unit as rejected, closed out, interim closed out, or no action and authorizing backfill of the site, if appropriate. Final removal from the National Priorities List (NPL) of no action, interim closed-out, or closed-out sites will occur at a future date.

Description of current waste site condition:

The 100-H-31 waste site was an unplanned release of polychlorinated biphenyls on the north side of the former 105-H Reactor Building. The soil at 100-H-31 was completely removed to 4.6 m (15 ft) below grade, disposed at the Environmental Restoration Disposal Facility (ERDF), and the site was backfilled to grade with clean soil. The RESidual RADioactivity modeling evaluation in the *100 Area Analogous Sites RESRAD Calculations,* using distribution coefficient values and vertical distance to groundwater, predicts that the residual contaminant levels of polychlorinated biphenyls at the site are protective of groundwater and the Columbia River. Therefore, the 100-H-31 waste site remedial action objectives and remedial action goals have been met in accordance with *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD), U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

Basis for reclassification:

The 100-H-31 waste site meets the remedial action objectives specified in the Remaining Sites ROD. Evaluation of the waste site using RESidual RADioactivity modeling indicates that residual contaminant concentrations do not preclude any future land uses (as bounded by a rural-residential scenario) and allows for unrestricted future use of shallow zone soils (i.e., surface to 4.6 m [15 ft]). The evaluation also shows that contaminant levels remaining in the soil are protective of groundwater and the Columbia River. This site does not have a deep zone; therefore, no deep zone institutional controls are required. The basis for reclassification is described in detail in the *Cleanup Verification Package for the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin and Underlying Soils; the 118-H-6:6 Fuel Storage Basin Deep Zone Side-Slope Soils; the 100-H-9, 100-H-10, and 100-H-13 French Drains; the 100-H-11 and 100-H-12 Expansion Box French Drains; and the 100-H-14 and 100-H-31 Surface Contamination Zones* (CVP-2006-00003), Washington Closure Hanford, Richland, Washington.

K. R. Westover DOE-RL Project Manager	Signature	6/21/06 Date
R. Bond Ecology Project Manager	Signature	6/22/06 Date
NA EPA Project Manager	Signature	Date

CONTENTS

APPENDICES

FIGURES

TABLES

ACRONYMS AND ABBREVIATIONS

bgs	below ground surface
CFR	*Code of Federal Regulations*
COC	contaminant of concern
CVP	cleanup verification package
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
DQA	data quality assessment
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FSB	fuel storage basin
ISS	interim safe storage
K_d	distribution coefficient
MCL	maximum contamination level
PCB	polychlorinated biphenyl
RAG	remedial action goal
RDR/RAWP	remedial design report/remedial action work plan
RESRAD	RESidual RADioactivity (dose assessment model)
ROD	record of decision
SAP	sampling and analysis plan
SSE	safe storage enclosure
UCL	upper confidence limit
WAC	*Washington Administrative Code*
WIDS	Waste Information Data System

1.0 INTRODUCTION

The purpose of this cleanup verification package (CVP) is to document that the 118-H-6:2, 105-H Reactor Ancillary Support Areas, Below-Grade Structures, and Underlying Soils; the 118-H-6:3, 105-H Reactor Fuel Storage Basin (FSB) and Underlying Soils; and the 118-H-6:6, 105-H FSB Deep Zone Side-Slope Soils were remediated in accordance with agreements by the U.S. Environmental Protection Agency (EPA) and the U.S. Department of Energy (DOE), Richland Operations Office, in concurrence with the Washington State Department of Ecology (Ecology). These agreements are presented in the *Action Memorandum for the 105-D and 105-H Reactor Buildings and Ancillary Facilities* (Action Memorandum) (Ecology et al. 2001). The Action Memorandum provides the DOE authority, guidelines, and objectives to conduct this removal action.

This CVP also includes the following seven waste sites: 100-H-9, 100-H-10, 100-H-11, 100-H-12, 100-H-13, 100-H-14, and 100-H-31. This CVP documents that these seven waste sites were remediated in accordance with the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units* (Remaining Sites ROD) (EPA 1999). The remedial action objectives and goals applicable to these sites are included in the Remaining Sites ROD (EPA 1999) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005b). The ROD (EPA 1999) provides the DOE, Richland Operations Office the authority, guidance, and objectives to conduct this remedial action.

The preferred remedy specified in the Action Memorandum (Ecology et al. 2001) and conducted for the 105-H site was (1) removal of below-grade structures to a minimum of 0.9 m (3 ft) below surrounding grade, (2) verification that structures and soil left in place achieve specified cleanup standards, and (3) disposal of contaminated materials at the Environmental Restoration Disposal Facility (ERDF). Excavation was driven by remedial action objectives for direct exposure, protection of groundwater, and protection of the Columbia River. For the respective points of compliance, remedial action goals (RAGs) were established for the radionuclide and nonradionuclide contaminants of concern (COCs). Waste site COCs were identified in the *Sampling and Analysis Plan for Interim Closure of the 105-D and 105-H Reactor Below-Grade Structures and Underlying Soils* (105-H Reactor SAP) (DOE-RL 2001b), and the *100 Area Remedial Action Sampling and Analysis Plan* (100 Area SAP) (DOE-RL 2005a). The COCs are provided in Section 3.2.1. Soil cleanup levels were established in the Remaining Sites ROD based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD, a comparison against ecological risk screening levels has been made for the site contaminants of potential concern and other constituents. Screening values were not exceeded for the COCs for this site with the exception of lead. Exceedance of screening values does not necessarily indicate the existence of risk to ecological receptors. It is believed that the presence of lead at this site does not pose a risk to ecological receptors because concentrations of lead are within the range of natural site background (DOE-RL 2001a). A baseline risk assessment for the river

corridor portion of the Hanford Site began in 2004, which includes a more complete quantitative ecological risk assessment. That baseline risk assessment will be used as part of the final ROD for these sites.

2.0 SITE DESCRIPTION AND SUPPORTING INFORMATION

2.1 SITE HISTORY

The 105-H Reactor is located in the 100-H Area of the Hanford Site as shown in Figure 1. The 105-H Reactor was one of eight single-pass plutonium production reactors built along the Columbia River. Construction of the 105-H Reactor began in March 1948 with operations commencing on October 29, 1949. The 105-H Reactor was shut down in April 1965 (WCH 2005). During the shutdown activities it was determined that the FSB had leaked. Miscellaneous process equipment and sludge was left in the basin, and the sludge was stabilized in place in 1970 with approximately 6 m (20 ft) of soil backfill (UNI 1986b). In the years following deactivation, several other significant cleanup efforts were completed at the 105-H Reactor complex. These include the 1983 demolition of the 116-H reactor exhaust stack and above-grade exhaust ducting (UNI 1986a) and the 1984 demolition of the 117-H exhaust air filter building (WHC 1990).

The primary source of contamination at the 105-H site was reactor coolant water and water in the FSB that became contaminated through contact with irradiated and ruptured fuel elements and components from the reactor cooling system. Effluent pipelines external to the reactor building were previously removed, remediated, and included in their own CVPs (*Cleanup Verification Package for the 100-H-21 Reactor Effluent Pipelines, 100-H-22 Effluent Pipeline Leakage, and 100-H-1 Rod Cave* [BHI 2001b]; *Cleanup Verification Package for the 116-H-7 Retention Basin* [BHI 2001d]; and the *Cleanup Verification Package for the 116-H-1 Process Effluent Trench* [BHI 2001c]).

2.1.1 Description and Disposition of 105-H Reactor Demolition Zones

The original footprint area of the 105-H Reactor Building was approximately 6,934 m^2 (74,640 ft^2). The final ground-level footprint area of the safe storage enclosure (SSE) is 1,387 m^2 (14,928 ft^2). The areas of the reactor building that have been removed to ERDF represent 80% of the original footprint of the reactor building. The entirety of the below-grade portion of the facility outside the SSE was completely demolished, removed, and all below-grade areas were backfilled to eliminate future subsidence (WCH 2005).

Figure 1. 100-H Area Hanford Site Map.

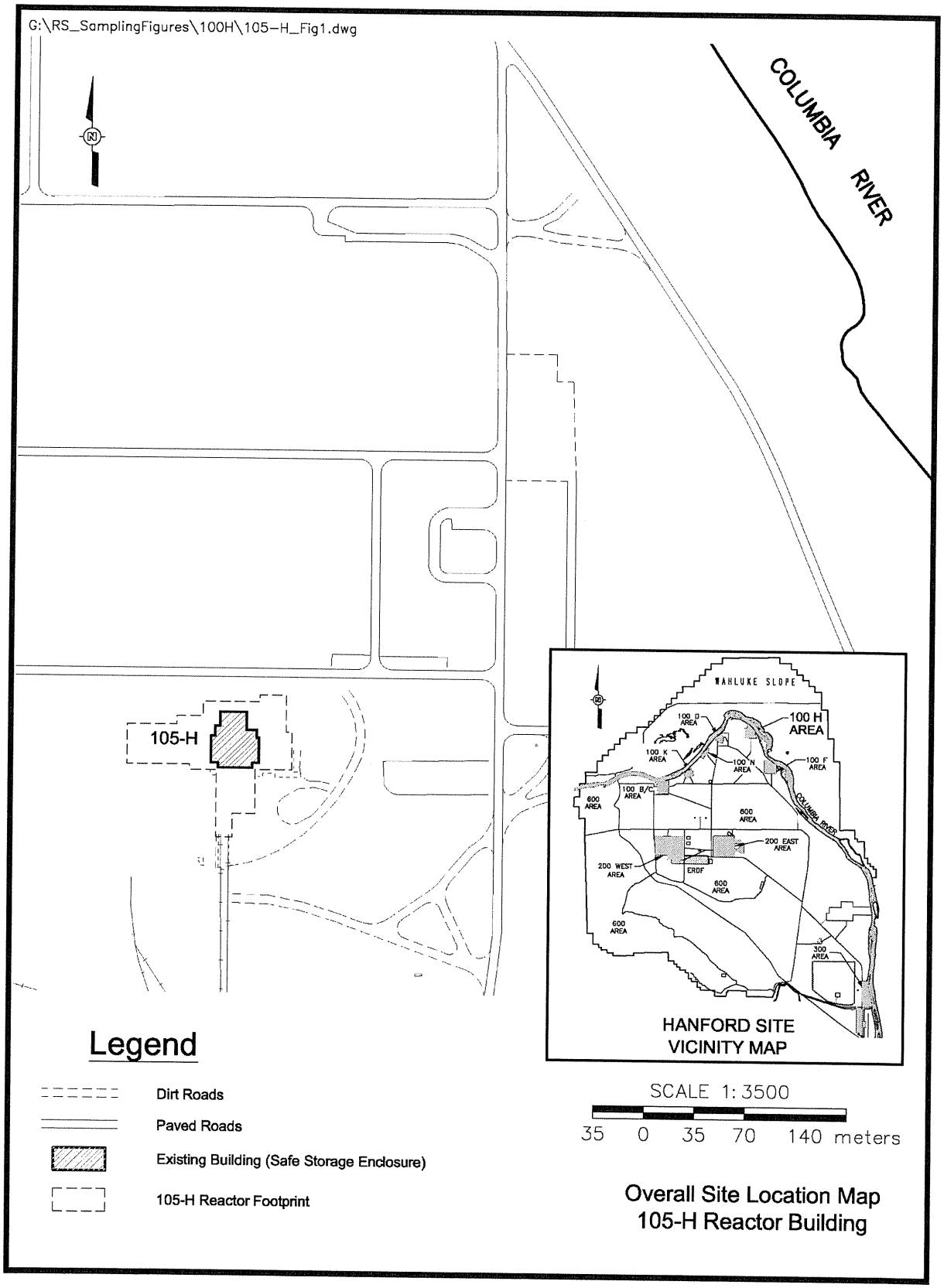


Figure 2 provides a plan view of the reactor and the five demolition zones. The features of the zones and the decontamination and decommissioning (D&D) activities conducted during remediation are described in the following subsections. Table 1 summarizes the demolition zones (and their disposition) included in this CVP for the 105-H site. The sample designs for the soils underlying the former FSB and the FSB side slopes are provided in Appendix C along with the excavation boundaries. Detailed discussions of demolition activities are provided in the *105-H Reactor Interim Safe Storage Project Final Report* (WCH 2005).

2.1.1.1 Safe Storage Enclosure. The SSE consists of the area within the reactor block shield walls, including the reactor block; the work area; the D and C elevators; and miscellaneous areas 113a, 112, 112a, 114, and 115. This part of the reactor building remains in place to act as temporary storage for the reactor block. As much as was practical, all objects (e.g., gas and water supply piping, electrical equipment) and surface contamination were removed within the SSE. A new roof was added as part of the interim safe storage (ISS) effort. All doors were permanently sealed except for one door that remains locked and is welded shut. The only planned entrance to this structure is for surveillance and maintenance activities that occur approximately every 5 years.

2.1.1.2 Demolition Zone 1. Demolition Zone 1, located on the west side of the building, included the 316b gas plenum, the 315 drying rooms, the 314 filter rooms, and the 313 exhaust fans. The only below-grade structure in this zone was the 316c fan plenum. The local contamination was removed in preparation for clean demolition, and a fixative was applied as required. All structures in this zone were removed due to surface contamination being present. Per the 105-H Reactor SAP, sampling of underlying soils was not required because structures in this demolition zone were not subjected to standing contaminated water and there was no mechanism for residual surface contamination to penetrate into the concrete and the underlying soil (DOE-RL 2001b). The above- and below-grade structures were demolished and the demolition debris sent to ERDF.

2.1.1.3 Demolition Zone 2. Demolition Zone 2 is located on the south side of the 105-H Reactor Building. This zone consisted of the 400 FSB; the 411 wash pad; and the 413, 413a, and 413b transfer bay areas. The local contamination was removed in preparation for clean demolition, and a fixative was applied as required. With one exception, there are no below-grade structures remaining in Zone 2. A portion of the FSB floor, at its northern end between the two access labyrinths to the D elevator, remains. Verification soil samples were collected from soils underlying the former FSB floor in conformance with the 105-H Reactor SAP (DOE-RL 2001b). All demolition debris from excavations associated with Demolition Zone 2 was sent to ERDF.

Figure 2. 105-H Reactor Plan View of Demolition Zones.

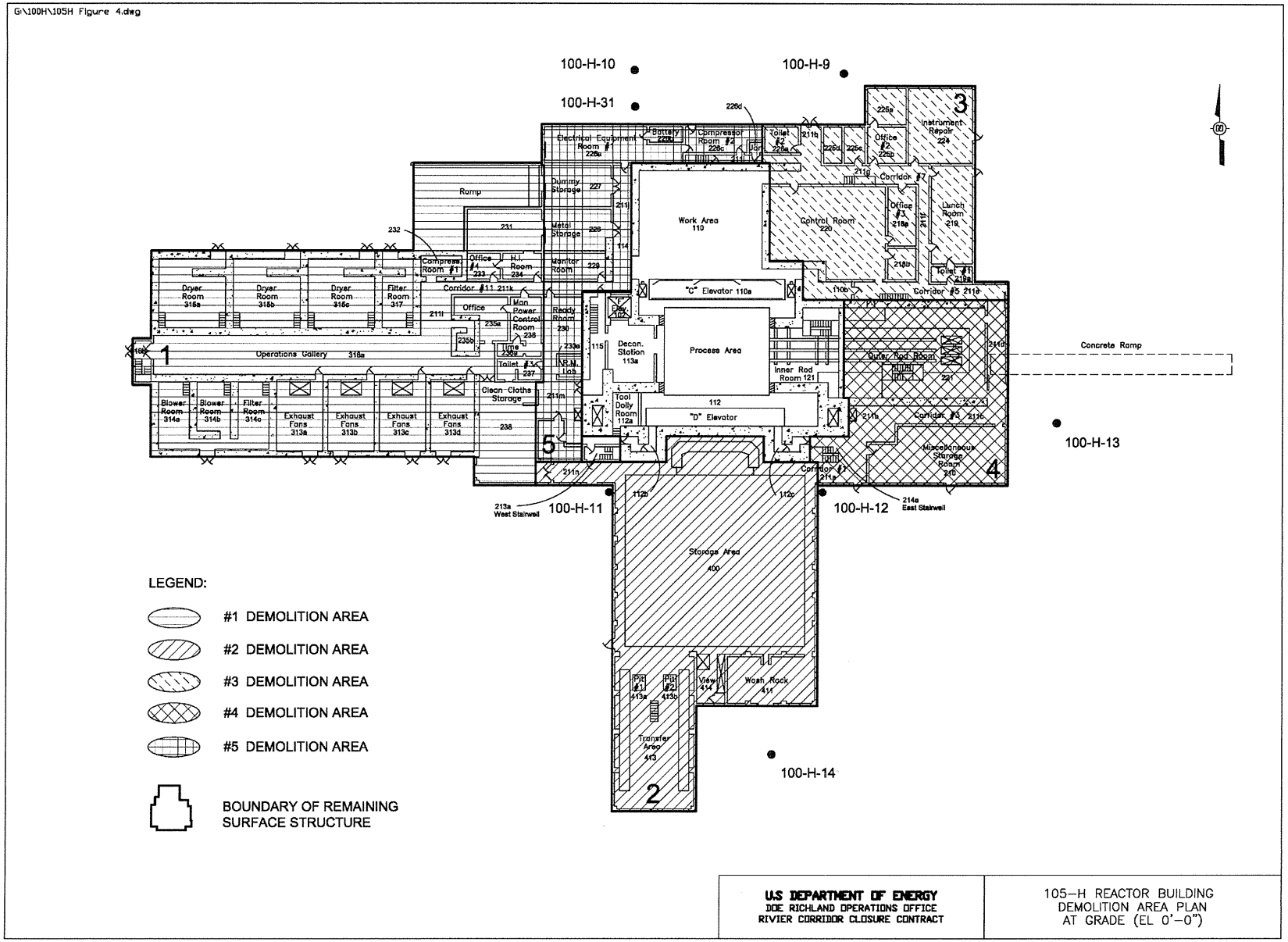


Table 1. 105-H Reactor Demolition Zones and Their Disposition. (2 Pages)

WIDS No.; Demolition Zone (If Applicable)	Description	Disposition (As of October 2005)
118-H-6:1	Remaining SSE including: • The reactor block • 110 work area • "D" elevator • "C" elevator • 112 work area • 112a, 113a, 114, and 115 (miscellaneous areas)	Placed into surveillance and maintenance for up to 75 years.
118-H-6:2; Demolition Zone 1	West side of the reactor building including: • 313 exhaust fans • 314 filter rooms • 315 drying rooms • 316b gas plenum • Below-grade 316c fan plenum	Above- and below-grade structures removed.
118-H-6:3; Demolition Zone 2	South side of the reactor building including: • 400 FSB • 411 wash pad • 413, 413a, and 413b (transfer bays) • 414 miscellaneous area	Above- and below-grade structures removed except a northern portion of the FSB between the two access labyrinths to the "D" elevator.
118-H-6:2; Demolition Zone 3	North East side of the reactor building including: • 219 lunch room • 220 control room • 224 instrument repair room • Offices (218a, 218b, 225a-d) • Corridors (211b, 211d-h) • Below-grade 106 corridor	Above- and below-grade structures removed.
118-H-6:2; Demolition Zone 4	Southeast corner of reactor building including: • Outer rod room • Corridor #3 • 210 miscellaneous storage room • Below-grade 104 battery room • Below-grade 105 electrical equipment room • Below-grade 107 corridor (and concrete ramp)	Above- and below-grade structures removed.
118-H-6:2; Demolition Zone 5	North and west side of reactor building including: • Equipment rooms • Instrument rooms • Storage rooms • Below-grade east and west influent cooling process water tunnels (100, 100a, 101, 101a, and 101b) • Below-grade 103 gas tunnel • Below-grade 102b air lock	Above- and below-grade structures removed.[a]
118-H-6:6	FSB deep zone side slopes	Remain in place/closed out in this CVP.
118-H-6:4	FSB shallow zone	Deferred to the Field Remediation Closure Project.

Table 1. 105-H Reactor Demolition Zones and Their Disposition. (2 Pages)

WIDS No.; Demolition Zone (If Applicable)	Description	Disposition (As of October 2005)
118-H-6:5	Three decontamination pads	Deferred to the Field Remediation Closure Project.

[a] The piping and tunnel was removed from the reactor SSE walls to the point where further removal would have undermined the 105-H fence and power lines.
CVP = cleanup verification package
FSB = fuel storage basin
SSE = safe storage enclosure
WIDS = Waste Information Data System

Excavations in Demolition Zone 2, required for the removal of the FSB, resulted in the removal of remaining waste sites 100-H-11 (French Drain E), 100-H-12 (French Drain F), and 100-H-14 (surface soil contamination). The features and removal of these waste sites is discussed in further detail in Section 2.1.2.

2.1.1.4 Demolition Zone 3. Demolition Zone 3 was on the northeast corner of the original reactor building. This zone consisted of the 220 control room, the 224 instrument repair room, the 219 lunch room, several offices (225a-d, 218a, 218b), and several corridors (211b, 211d-h). The only below-grade structure in this zone was the 106 corridor. The local contamination was removed in preparation for clean demolition, and a fixative was applied as required. All structures in this demolition zone were removed due to surface contamination being present. Per the 105-H Reactor SAP (DOE-RL 2001b), sampling of underlying soils was not required because structures in this demolition zone were not subjected to standing contaminated water and there was no mechanism for residual surface contamination to penetrate into the concrete and the underlying soil. Excavations in Demolition Zone 3 resulted in the removal of the remaining waste site 100-H-9 (French Drain C). The features and removal of this waste site are discussed in further detail in Section 2.1.2. All demolition debris from excavations associated with Demolition Zone 3 was sent to ERDF.

2.1.1.5 Demolition Zone 4. Demolition Zone 4, located on the southeast corner of the reactor building, included the outer rod room, corridor #3, and the 210 miscellaneous storage room. The only below-grade structures in this zone were the 104 battery room, the 105 electrical equipment room, and the 107 corridor that led to an outdoor concrete ramp. The local contamination was removed in preparation for clean demolition, and a fixative was applied as required. All structures in this demolition zone were removed due to surface contamination being present. Per the 105-H Reactor SAP (DOE-RL 2001b), sampling of underlying soils was not required because structures in this demolition zone were not subjected to standing contaminated water and there was no mechanism for residual surface contamination to penetrate into the concrete and the underlying soil. Excavations of the concrete ramp in Demolition Zone 4 resulted in the removal of the remaining waste site 100-H-13 (French Drain G). The features and removal of this waste site are discussed in further detail in Section 2.1.2. All demolition debris from excavations associated with Demolition Zone 4 was sent to ERDF.

2.1.1.6 Demolition Zone 5. Demolition Zone 5, which was an inverted "L"-shaped area, contained several equipment rooms on the north side of the original reactor building along with instrument and storage rooms on the west side of the reactor's work and process areas. The only below-grade structures in this zone were the east and west influent cooling process water tunnels (rooms 100, 100a, 101, 101a, and 101b), the 103 gas tunnel, and the 102b air lock. The local contamination was removed in preparation for clean demolition, and a fixative was applied as required. All structures in this zone were removed due to surface contamination being present, except a portion of the east and west water tunnels. (The water tunnels were removed from the reactor SSE walls to the point where further removal would have undermined the 105-H fence and power lines). Excavations in Demolition Zone 5 resulted in the removal of remaining waste sites 100-H-10 (French Drain D) and 100-H-31 (Polychlorinated Biphenyl [PCB] Surface Contamination Zone). The features and removal of these waste sites are discussed in further detail in Section 2.1.2. All demolition debris from excavations associated with Demolition Zone 5 was sent to ERDF.

2.1.1.7 FSB Side Slopes. The FSB side slopes are located in Demolition Zone 2 on the south side of the original reactor building. The side-slope soils include shallow zone soils (grade level to 4.6 m [15 ft] below grade level) and deep zone soils (below 4.6 m [15 ft]) located on the east, west, and south boundary of the FSB excavation. Excavation boundaries are provided for this demolition zone in Appendix C. The deep zone side-slope soils are included in this CVP as they met all remedial action objectives and goals for direct exposure, protection of groundwater, and protection of the Columbia River (Sections 6.0 and 7.0).

Laser-Assisted Ranging and Data System radiological surveys were performed on the FSB shallow zone side slopes, as specified in the 100 Area SAP (DOE-RL 2005a). These surveys indicated that radiological contamination existed above cleanup criteria and further remediation would be required in the shallow zone. The remediation and cleanup verification of the 105-H FSB shallow zone side-slope soils was deferred to the Field Remediation Closure Project in *Deferring 105-H Fuel Storage Basin Shallow Zone Side Slope Soils to the Remedial Actions* Program (BHI 2004) in accordance with the Action Memorandum (Ecology et al. 2001). The FSB shallow side slopes are not addressed in this CVP.

2.1.1.8 Decontamination Areas. Three decontamination (decon) pads were created by the Environmental Restoration Contractor Decommissioning and Demolition Project. The decon pads are arranged in an arc on the south-southeast side of the 105-H SSE. The three decon pads were deferred to the Field Remediation Closure Project in accordance with the Action Memorandum (Ecology et al. 2001) and the *Removal Action Work Plan for 105-D and 105-H Building Interim Safe Storage Projects and Ancillary Buildings* (DOE-RL 2002). This decision is documented in the *Deferral of Three Decontamination Areas to the Field Remediation Project* (BHI 2005b). The decontamination areas are not addressed in this CVP.

2.1.2 Description and Disposition of the Remaining Waste Sites

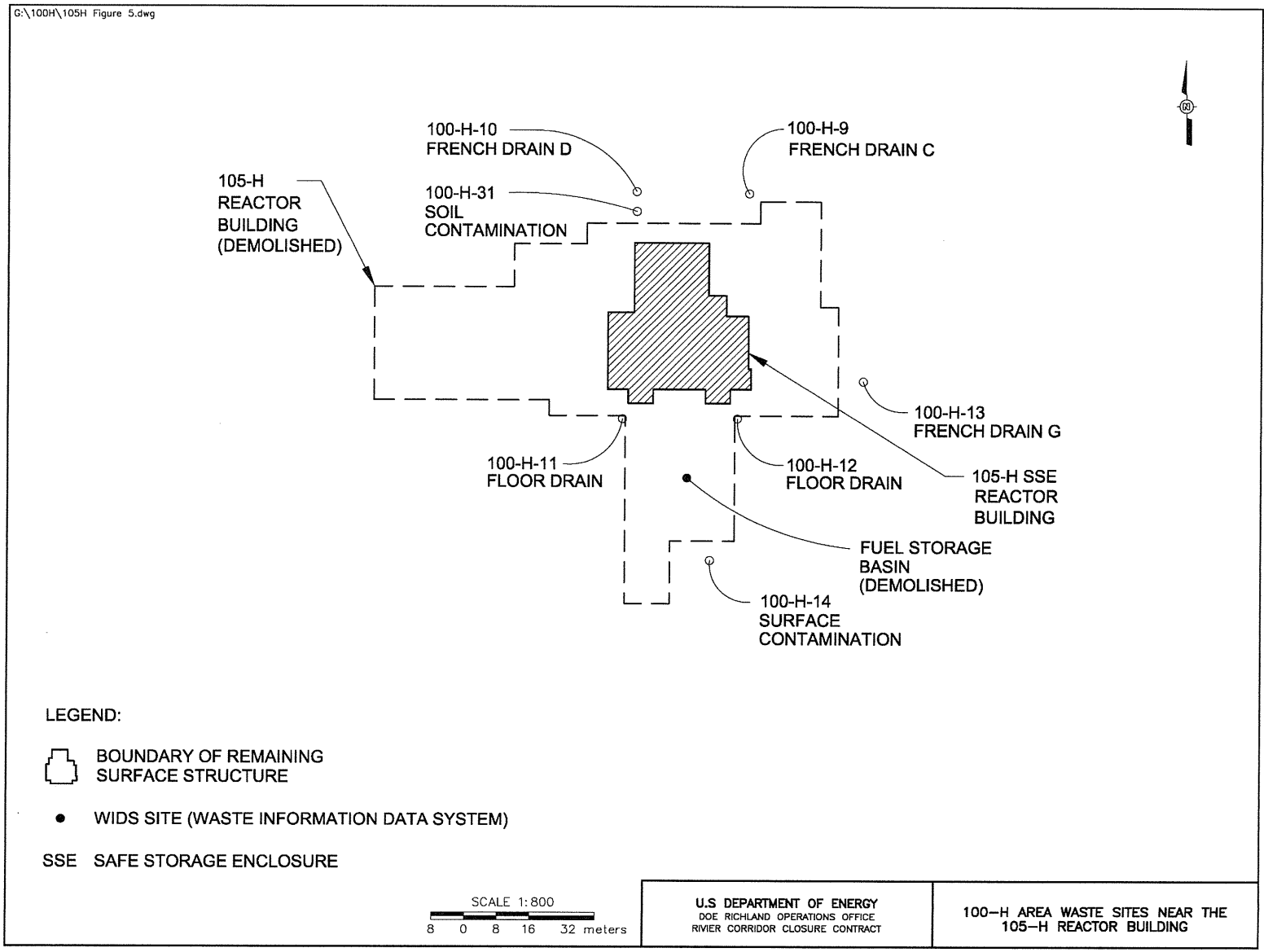
Figure 3 provides a plan view of the reactor and the location of the seven remaining waste sites around the 105-H Reactor Building that were removed with Demolition Zones 2, 3, 4, and 5 as discussed above. The features of the waste sites and the D&D activities conducted during remediation are described in the following subsections. Removal of the remaining waste sites is based on excavation boundaries of D&D activities. Location details of the seven waste sites relative to the D&D excavation boundaries for the SSE construction were determined by Mitchell and Wimett (2005) and are provided in Appendix C (Figures C3-C9).

2.1.2.1 French Drain C (Waste Information Data System [WIDS] Site 100-H-9). The 100-H-9 waste site was a french drain located outside the northeast corner of the original 105-H Reactor Building. The 100-H-9 waste site was a vertically buried 61-cm (24-in.)-diameter concrete pipe. Based on historical drawings of similar french drains in the 100-H Area, the 100-H-9 french drain would have extended approximately 1.8 m (6 ft) below ground surface (bgs) (GE 1948a, 1948b). The 100-H-9 french drain was likely a condensate drain for the steam heating system for the building and would not have been subject to contamination from within the reactor building.

D&D excavations required for the demolition of the 105-H Reactor Building (Demolition Zone 3) and construction of the 105-H Reactor SSE removed the 100-H-9 drain structure. All soil and demolition debris generated during excavation activities were shipped to ERDF (WCH 2005). Residual soil contamination that may remain as a result of waste site 100-H-9 (French Drain C) would be analogous to residual contamination in the analogous french drains surrounding the 105-C Reactor Building (118-C-3:3) and the 105-F Reactor Building (100-F-12). These analogous waste sites have been demonstrated to meet the remedial action objectives and RAGs as established in the RDR/RAWP (DOE-RL 2005b) and the Remaining Sites ROD (EPA 1999) and were reclassified as interim closed out and no action, respectively (WCH 2006d, BHI 2005c). Based on removal of the french drain and evaluation of analogous french drains, the 100-H-9 waste site meets RAGs and objectives as specified in the Remaining Sites ROD (EPA 1999).

2.1.2.2 French Drain D (WIDS Site 100-H-10). French Drain D was located on the north side of the 105-H Reactor Building about 8 m (26 ft) north of the original north wall. The drain structure was situated above and slightly west of the western below-grade process cooling water tunnel. The drain consisted of a vertically buried 122-cm (48-in.)-diameter vitrified clay pipe. Based on historical drawings, the french drain extended approximately 1.8 m (6 ft) bgs (GE 1948a, 1948b). The 100-H-10 french drain was likely a condensate drain for the steam heating system and would not have been subject to contamination from within the reactor building.

Figure 3. Location of WIDS Sites Located Around the Former 105-H Reactor Building.



The 100-H-10 structure was removed during the deep excavations required for the removal of the process cooling water tunnels on the north side of the 105-H Reactor Building (Demolition Zone 5). All soil and demolition debris generated during excavation activities were shipped to ERDF (WCH 2005). Residual soil contamination that may remain as a result of the 100-H-10 waste site (French Drain G) would be analogous to residual contamination in the analogous french drains surrounding the 105-C Reactor Building (118-C-3:3) and the 105-F Reactor Building (100-F-12). These analogous waste sites have been demonstrated to meet the remedial action objectives and RAGs as established in the RDR/RAWP (DOE-RL 2005b) and the Remaining Sites ROD (EPA 1999) and were reclassified as interim closed out and no action, respectively (WCH 2006d, BHI 2005c). Based on removal of the french drain and evaluation of analogous french drains, the 100-H-10 waste site meets RAGs and objectives as specified in the Remaining Sites ROD (EPA 1999).

2.1.2.3 Expansion Box French Drain E (WIDS Site 100-H-11). The 100-H-11 waste site was located in the southwest corner of the former 105-H Reactor Building. The site, although listed in WIDS as a french drain, was actually a floor drain positioned underneath a concrete expansion box. The floor drain is estimated to have been 0.76 m (2.5 ft) in diameter and to have fed into a 10.2-cm (4-in.) vertical drain line. A 0.76-m (2.5-ft)-diameter steel manhole was set in the concrete expansion box to provide access to the floor drain. Within the expansion box was a 1.5-m (5-ft)-diameter steel reactor effluent line that made a 45-degree turn from the south to southwest. The 100-H-11 french drain provided drainage for any leakage that might have occurred from the effluent line within the expansion box.

Deep excavations (approximately 6 m [20 ft] bgs) within Demolition Zone 2 removed the 100-H-11 expansion box, drain, and underlying soils (see excavation boundaries in Appendix C). Verification sampling of the soils underlying the FSB floor also pertains to the soils beneath the 100-H-11 waste site, and evaluation of sample data (Sections 6.0 and 7.0 of this CVP) demonstrates that the underlying soils meet the remedial action objectives and RAGs as established in the RDR/RAWP (DOE-RL 2005b) and the Remaining Sites ROD (EPA 1999). The effluent pipelines external to the reactor building were previously removed, remediated, and included in their own CVP (*Cleanup Verification Package for the 100-H-21 Reactor Effluent Pipelines, 100-H-22 Effluent Pipeline Leakage, and 100-H-1 Rod Cave* [BHI 2001b]). All soil and demolition debris generated during excavation activities were shipped to ERDF.

2.1.2.4 Expansion Box French Drain F and Shielding Lead (WIDS Site 100-H-12). The 100-H-12 waste site was located in the southeast corner of the former 105-H Reactor Building. The site, although listed in WIDS as a french drain, was actually a floor drain positioned underneath a concrete expansion box. The drain is estimated to have been 0.76 m (2.5 ft) in diameter and to have fed into a 10.2-cm (4-in.) vertical drain line. A 0.76-m (2.5-ft)-diameter steel manhole was set in the concrete expansion box to provide access to the floor drain. Within the expansion box was a 1.5-m (5-ft)-diameter steel reactor effluent line that made a 90-degree turn from the south to east.

The 100-H-12 waste site provided drainage for any leakage that might occur from the effluent line within the expansion box.

The surface of the concrete pad and manhole was covered with lead bricks. The lead bricks were installed as shielding from the nominally high dose rates coming from within the expansion box. Deep excavations (approximately 6 m [20 ft] bgs) within Demolition Zone 2 removed the 100-H-12 expansion box, drain, shielding lead, and underlying soils (see excavation boundaries in Appendix C). Verification sampling from the soils in the deep zone side slopes and underlying the FSB floor pertains to the soils beneath the 100-H-12 drain, and evaluation of sample data (Sections 6.0 and 7.0 of this CVP) demonstrates that the underlying soils meet the remedial action objectives and RAGs as established in the RDR/RAWP (DOE-RL 2005b) and the Remaining Sites ROD (EPA 1999). Effluent pipelines external to the reactor building were previously removed, remediated, and included in their own CVP (*Cleanup Verification Package for the 100-H-21 Reactor Effluent Pipelines, 100-H-22 Effluent Pipeline Leakage, and 100-H-1 Rod Cave* [BHI 2001b]). All soil and demolition debris generated during excavation activities were shipped to ERDF.

2.1.2.5 French Drain G (WIDS Site 100-H-13). The 100-H-13 waste site was located on the east side of the 105-H Reactor Building. The drain was constructed of vitrified clay pipe and covered by two metal lids (the second metal lid positioned 15.2 cm [6 in.] below the first). The drain was approximately 1.2 m (4 ft) in diameter and 1.8 m (6 ft) deep (GE 1948a, 1948b). The 100-H-13 french drain was likely a condensate drain for the steam heating system and would not have been subject to contamination from within the reactor building.

D&D excavations to remove the concrete ramp on the east side of the reactor building (Demolition Zone 4) also resulted in the removal of the 100-H-13 french drain. All soil and demolition debris generated during excavation activities were shipped to ERDF (WCH 2005). Residual soil contamination that could remain as a result of the 100-H-13 waste site would be analogous to residual contamination in the analogous french drains surrounding the 105-C Reactor Building (118-C-3:3) and 105-F Reactor Building (100-F-12). These analogous waste sites have been demonstrated to meet the remedial action objectives and RAGs as established in the RDR/RAWP (DOE-RL 2005b) and the Remaining Sites ROD (EPA 1999) and were reclassified as interim closed out and no action, respectively (WCH 2006d, BHI 2005c). Based on removal of the french drain and evaluation of analogous french drains, the 100-H-13 waste site meets RAGs and objectives as specified in the Remaining Sites ROD (EPA 1999).

2.1.2.6 Surface Contamination Zone H (WIDS Site 100-H-14). The 100-H-14 waste site was an unplanned release site, located next to the former south wall of the 105-H FSB. The site had been surface stabilized by 0.3 to 0.6 m (1 to 2 ft) of gravel and cobbles. The contamination area was adjacent to the wash rack room associated with the FSB. The excavation depths at the location of the 100-H-14 waste site are projected to be about 4.8 m (16 ft) bgs (Mitchell and Wimett 2005). Based on information provided by Mitchell and Wimett (2005), this waste site was removed during

D&D excavations of the FSB. Verification sampling from the soils in the deep zone side slopes pertains to the soils beneath the 100-H-14 surface contamination, and evaluation of these data (Sections 6.0 and 7.0 of this CVP) demonstrates that the underlying soils meet the remedial action objectives and RAGs as established in the RDR/RAWP (DOE-RL 2005b) and the Remaining Sites ROD (EPA 1999). All soil generated during excavation activities was shipped to ERDF.

2.1.2.7 Polychlorinated Biphenyl Surface Contamination Zone (WIDS Site 100-H-31). The 100-H-31 waste site was an unplanned release of PCBs on the north side of the former 105-H Reactor Building. The site was a gravel area near a former electrical substation with no visible oil stains or vegetation. Surface soil sampling (DOE-RL 1994) was conducted at this site based on its location near an inactive electrical facility. Aroclor-1260 was detected at a concentration of 1.2 mg/kg in the soil near the former electrical substation.

The surface contamination was removed, along with approximately 4.6 m (15 ft) of underlying soil (Mitchell and Wimett 2005), during the excavations required to remove the west influent water tunnel. All soil generated during excavation activities was shipped to ERDF (WCH 2005). Sampling of soils underlying the 100-H-31 waste site was not performed; however, any residual contamination would be below 4.6 m (15 ft) where direct exposure RAGs would not apply. Any residual contamination would be protective of groundwater and the river because aroclor-1260 has a high soil-partitioning coefficient (K_d value) of 530 mL/g and therefore a low mobility. Based on the RESidual RADioactivity (RESRAD) modeling evaluation in the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a) constituents with a soil partitioning coefficient (K_d) greater than 80 mL/g are predicted to move less than a meter through the soil column within a 1,000-year time frame. Therefore, the aroclor-1260 contamination would have been contained and removed along with the 4.6 m (15 ft) of soil. In the event that any residual contamination remains, the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a) predict that residual concentrations of the constituent in the soil column will not reach groundwater (at an elevation of 116 m [380 ft]) within a 1,000-year time frame. As such, any possible remaining residual soil concentration of the PCB contamination is protective of groundwater and consequently the Columbia River.

2.2 SUBSURFACE CONDITIONS

The soil column underlying the waste site and extending to groundwater consists of materials belonging to the Hanford and Ringold Formations. The shallower Hanford formation consists predominantly of medium dense to dense sand and gravel, with varying amounts of silt and cobble. The underlying Ringold Formation consists of dense, well-cemented gravels with sand and silt interbeds. The Hanford/Ringold contact is approximately 12 to 18 m (40 to 60 ft) below the surface grade level (DOE 1992). The depth to groundwater is estimated to be 14 m (46 ft) beneath surface grade level (surface elevation of 130 m [426 ft] and groundwater elevation of 116 m [380 ft]). The cited groundwater elevation is the average of groundwater elevations at

nearby wells from *Hanford Site Groundwater Monitoring for Fiscal Year 2004* (PNNL 2004).

2.3 CONTAMINANTS OF CONCERN

Waste site COCs identified through process knowledge are identified in the 105-H Reactor SAP (DOE-RL 2001b).

The 105-H Reactor SAP (DOE-RL 2001b) classified the different areas and structures into affected media that were similar in characteristics and contaminants. The COCs are summarized below:

- Americium-241
- Carbon-14
- Cesium-137
- Cobalt-60
- Europium-152
- Europium-154
- Europium-155
- Neptunium-237
- Nickel-63
- Plutonium-238
- Plutonium-239/240
- Strontium-90
- Thorium-228
- Thorium-232
- Tritium (H-3)
- Uranium-234
- Uranium-235
- Uranium-238
- Hexavalent chromium
- Lead
- Mercury
- PCBs.

3.0 SUMMARY OF REMOVAL ACTION OBJECTIVES AND REMEDIAL ACTION GOALS

3.1 REMOVAL ACTION OBJECTIVES

Removal action applicable or relevant and appropriate requirements and RAGs for the 105-H site were established by the EPA and DOE, in concurrence with Ecology. These applicable or relevant and appropriate requirements and RAGs are documented in detail in the Action Memorandum (Ecology et al. 2001) and in the *Removal Action Work Plan for the 105-D and 105-H Building Interim Safe Storage Projects and Ancillary Buildings* (DOE-RL 2002). The RAGs are further detailed in the 105-H Reactor SAP (DOE-RL 2001b), the 100 Area SAP (DOE-RL 2005a), and the RDR/RAWP (DOE-RL 2005b).

3.2 REMEDIAL ACTION GOALS

Remedial action goals are the quantitative goals against which the cleanup verification data are evaluated in order to demonstrate attainment of the removal action objectives. The attainment of the remedial action goals with respect to each reactor subsite or remaining waste site is discussed below.

- **118-H-6:2 -** For the 105-H ancillary support areas (118-H-6:2), the RAGs were met by the complete removal of contaminated materials. Per the 105-H Reactor SAP (DOE-RL 2001b), the 105-H Reactor ancillary support areas and below-grade structures (118-H-6:2) did not require sampling and analysis because the structures were removed in their entirety. Also per the 105-H Reactor SAP (DOE-RL 2001b), sampling of the underlying soils was not required because the structures that were removed were not subjected to standing contaminated water and there was no mechanism for residual surface contamination to penetrate into the concrete and underlying soil.

- **Remaining Sites 100-H-9, 100-H-10, 100-H-13 -** Residual soil contamination that could remain as a result of the french drains (100-H-9, 100-H-10, and 100-H-13) is analogous to residual contamination in the french drains surrounding the 105-C Reactor Building (118-C-3:3) and the 105-F Reactor Building (100-F-12), which were excavated, sampled, and without further remediation reclassified as interim closed out and no action, respectively (WCH 2006d, BHI 2005c). Therefore, removal of the french drains and evaluation of the subsurface soils at analogous french drains indicates that the RAGs and objectives have been met for waste sites 100-H-9, 100-H-10, and 100-H-13. The results of the analogous waste site french drains are presented below.

  - **118-C-3:3 French Drains -** The 118-C-3:3 site contained four french drains located adjacent to the 105-C Reactor Building (WCH 2006d). These french drains were presumed to be steam condensate drains for the sealed steam heating system that supported the 105-C Reactor Building.

    The contaminants of potential concern (COPCs) for the 118-C-3:3 french drains, based on the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2005a), included americium-241, cesium-137, cobalt-60, europium-152, europium-154, europium-155, plutonium-238, plutonium-239/240, strontium-90, uranium-238, lead, mercury, total chromium, and hexavalent chromium. Polychlorinated biphenyls (PCBs), semivolatile organic analysis, and the expanded inductively coupled plasma metals list (antimony, arsenic, barium, beryllium, boron, cadmium, chromium [total], cobalt, copper, lead, manganese, molybdenum, nickel, silver, selenium, vanadium, and zinc) were also included as COPCs. During confirmatory sampling, field screening for volatile organic compounds (VOCs) was performed to assess the need for volatile organic analysis. No VOCs were detected (WCH 2006d), and volatile organic analysis was not performed on any of the samples.

Confirmatory sampling was conducted at the 118-C-3:3 subsite on January 4, 2006 (WCH 2006d). Three of the four french drains were found partially intact. Focused samples were collected from the soils underlying these three french drains, at an approximate depth of 3 m (10 ft) below ground surface. The fourth french drain was determined to have been removed during the D&D excavations required to place the 105-C Reactor into interim safe storage. The location of the former french drain was excavated to 4.6 m (15 ft), and a soil sample was collected at the bottom of the excavation.

All detected analytes, with the exception of copper and mercury, were reported at concentrations below the direct exposure, groundwater protection, and river protection soil RAGs. Mercury was detected at a concentration (0.8 mg/kg) exceeding the soil RAGs for protection of groundwater (0.33 mg/kg) and the Columbia River (0.33 mg/kg). Copper was detected at a concentration (38.3 mg/kg) that exceeded the soil RAG for the protection of the Columbia River (22 mg/kg). The mercury result is from the northeast french drain, while the copper result is from the northwest drain. All other copper and mercury results are in accordance with the applicable RAGs. Based on a soil-partitioning coefficient (K_d value) of 22 mL/g for copper and 30 mL/g for mercury, the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a) indicate that these constituents will migrate no more than 3 m (10 ft) in 1,000 years. With a groundwater elevation of 121 m (397 ft) above mean sea level, a ground surface elevation of 151 m (492 ft) above mean sea level, and a sample depth of 3 m (10 ft), copper and mercury are not predicted to reach groundwater (and, therefore, the Columbia River) within 1,000 years. Therefore, residual concentrations of these constituents satisfy the remedial action objectives for protection of human health, groundwater, and the Columbia River.

- **100-F-12 French Drain -** The 100-F-12 site is located northeast of the 105-F Reactor Building. The 100-F-12 french drain was located within 30 cm (12 in.) of the Electrical Equipment Room Number 1 prior to removal of this portion of the building during 105-F Reactor D&D activities (BHI 2005c). This french drain was presumed to be a condensate drain from the sealed steam heating system that supported the 105-F Reactor Building.

  The COPCs for the 100-F-12 french drain were identified based on existing historical information and the drain's proximity to the 105-F Reactor Building. Potential contaminants included cobalt-60, cesium-137, europium-152, europium-154, europium-155, plutonium-238, plutonium-239/240, strontium-90, hexavalent chromium, and lead (DOE-RL 2005a). PCBs, arsenic, barium, cadmium, total chromium, silver, selenium, and mercury were also added as COPCs for this site. Field screening for VOCs was performed during sampling. None were observed, and therefore laboratory analysis of VOCs was not conducted.

Confirmatory sampling was conducted at the 100-F-12 site on October 11, 2004 (BHI 2005c). The drain, consisting of 1.8-m (6-ft)-diameter vitrified clay pipe, was found, and a sample of the drain contents was collected and analyzed according to the COPC list. The test pit was excavated to the bottom of the drain to native soil, approximately 4 m (13.1 ft) below ground surface. The soil sample was collected from inside the drain at a depth of approximately 4.0 m (13.1 ft).

All detected analytes, with the exception of aroclor-1260, were reported at concentrations below the direct exposure, groundwater protection, and river protection soil RAGs. The concentration of aroclor-1260 (0.055 mg/kg) is below the direct exposure cleanup level (0.5 mg/kg), but exceeds the groundwater and river protection (0.017 mg/kg) soil RAGs. Based on the soil-partitioning coefficient value of 530 mL/g for aroclor-1260, the results of the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a) indicate that these constituents will not reach groundwater (and, therefore, the Columbia River) within 1,000 years for a groundwater elevation of 114 m (374 ft) above mean sea level and a clean zone extending from groundwater to an elevation of 123 m (403 ft) above mean sea level. Therefore, residual concentrations of these constituents satisfy the remedial action objectives for protection of human health, groundwater, and the Columbia River.

- **Remaining Site 100-H-31 -** Removal of top soil and 4.6 m (15 ft) of underlying soil at the 100-H-31 waste site has sufficiently removed the PCB contamination. Based on the high K_d value for aroclor-1260, evaluation using the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a) predicts that any residual concentrations of PCBs in the soil column will not reach groundwater (at an elevation of 116 m [380 ft]) within a 1,000-year time frame. Therefore, any residual PCB concentrations in the soil are predicted to be protective of groundwater and the Columbia River, and the 100-H-31 waste achieves the remedial action objectives and goals as specified by the Remaining Sites ROD (EPA 1999).

- **118-H-6:3, 118-H-6:6 and Remaining Sites 100-H-11, 100-H-12, and 100-H-14 -** Additional evaluation was required in order to determine if the soils underlying the former FSB floor (118-H-6:3) and the deep zone side-slope soils (118-H-6:6) have achieved the RAGs. (As previously mentioned in Section 2.1.2, evaluation of the FSB underlying soils and deep zone side-slope soils also pertains to the soils underlying the expansion box french drains [100-H-11, 100-H-12] and the surface contamination zone [100-H-14]. Therefore, the evaluation of the FSB soils and deep zone side-slope soils will also refer to the soils underlying waste sites 100-H-11, 100-H-12, and 100-H-14.) To determine compliance with the RAGs, and in accordance with the 105-H Reactor SAP (DOE-RL 2001b), radiological surveys and verification sampling analysis were performed on the FSB underlying soils and deep zone side-slope soils. These data were used in the RESRAD computer model to verify that cleanup criteria are satisfied.

The residual radioactivity for the 105-H FSB underlying soils and deep zone side-slope soils was modeled with the RESRAD dose assessment model (ANL 2005) in the post-drilling rural-residential exposure scenario. This scenario assumes a resident could be exposed to vadose zone soils and concrete from any depth by virtue of materials being brought to the surface during drilling of a groundwater well (DOE-RL 1999). In the post-drilling scenario an individual is assumed to live for 30 years in a residence built on the waste site and to spend 60% of his or her time indoors, 20% outdoors, and 20% off site. It further assumes that he or she consumes crops, meat, and milk from plants and animals raised on the site and consumes fish from a pond downgradient from the site.

3.2.1 Direct Exposure RAGs

For the evaluation of the 105-H FSB underlying soils and deep zone side-slope soils under the post-drilling rural-residential scenario, direct exposure RAGs are applicable to drilling soils and concrete that could potentially be brought to the surface during the installation of a well on the site. Direct exposure RAGs are listed in Table 2 and summarized below.

- **Radionuclide COCs:** For radionuclide COCs in the shallow zone (external gamma, inhalation, plant ingestion, meat ingestion, drinking water, milk ingestion, aquatic food, and soil ingestion pathways) and in the deep zone (drinking water, plant ingestion, meat ingestion, milk ingestion, and aquatic food pathways), meet a total dose rate of 15 mrem/yr above background (this RAG must be met for 1,000 years).

- **Nonradionuclide COCs:**

  - Hazard quotient of less than 1.0 for noncarcinogenic contaminants in the shallow zone.

  - Excess cancer risk of less than 1×10^{-6} for individual carcinogenic contaminants in the shallow zone.

  - Cumulative excess cancer risk of less than 1×10^{-5}.

  - Cleanup verification sample results pass the *Washington Administrative Code* (WAC) 173-340-740(7)(e) (Model Toxics Control Act Cleanup Regulation) three-part test for each zone.

Table 2. Summary of Remedial Action Goals. (2 Pages)

Contaminant of Concern	Direct Exposure	Groundwater Protection (pCi/L)	River Protection (pCi/L)
Radionuclides			
Americium-241	15 mrem/yr (cumulative)[c]	15/1.2[a]	15/1.2[a]
Carbon-14		4 mrem/yr (cumulative)[b]	4 mrem/yr (cumulative)[b]
Cesium-137			
Cobalt-60			
Europium-152			
Europium-154			
Europium-155			
Nickel-63			
Neptunium-237	15 mrem/yr (cumulative)[c]	15/1.2[a]	15/1.2[a]
Plutonium-238		15/1.6[a]	15/1.6[a]
Plutonium-239/240		15/1.2[a]	15/1.2[a]
Strontium-90[d]		8[e]	8[e]
Thorium-228		15/16[a]	15/16[a]
Thorium-232		15/2.0[a]	15/2.0[a]
Tritium (H-3)[d]		20,000[e]	20,000[e]
Uranium-234		See total uranium	See total uranium
Uranium-235			
Uranium-238			
Total uranium		21.2[f]	21.2[f]

Table 2. Summary of Remedial Action Goals. (2 Pages)

Contaminant of Concern	Direct Exposure RAGs (mg/kg)	Soil RAG for Groundwater Protection (mg/kg)	Soil RAG for River Protection (mg/kg)
Nonradionuclides			
Hexavalent chromium	2.1[g,h]/240[i]	8[j]	2.0[k]
Lead	353[l]	10.2[m]	10.2[m]
Mercury	24[i]	0.33[m]	0.33[m]
PCBs	0.5[g]	0.02[n]	0.02[n]

[a] The two values are, respectively, the alpha emitter maximum contaminant level (MCL) from 40 *Code of Federal Regulations* (CFR) 141 (15 pCi/L) and the drinking water standard from DOE Order 5400.5 (1/25th of the derived concentration guidelines). The more conservative of the two values is used.
[b] Lookup values that correspond to the National Drinking Water Standard 4 mrem/yr dose rate equivalent for individual radionuclide beta and gamma emitters are presented in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005b).
[c] Lookup values that correspond to a 15 mrem/yr dose rate are presented in the RDR/RAWP (DOE-RL 2005b).
[d] Strontium-90 and tritium also contribute to the 4 mrem/yr dose rate limit (cumulative) for groundwater and river protection.
[e] Promulgated groundwater protection standard (40 CFR 141.66).
[f] Based on the isotopic distribution of uranium in the 100 Areas, the 30 µg/L MCL corresponds to 21.2 pCi/L. See *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038 (BHI 2001a).
[g] WAC 173-340 Method B carcinogenic cleanup limit
[h] WAC 173-340 Method B carcinogenic cleanup limit based on the inhalation pathway per *Calculation of Hexavalent Chromium Carcinogenic Risk*, 0100X-CA-V0031 (BHI 2000).
[i] WAC 173-340 Method B noncarcinogenic cleanup limit.
[j] Soil RAG based on "100 times groundwater cleanup" rule as presented in the RDR/RAWP (DOE-RL 2005b).
[k] Soil RAG based on 100 times surface water quality criteria times dilution-attenuation factor from the RDR/RAWP (DOE-RL 2005b).
[l] A WAC 173-340-740(3) value for lead is not available. This value is based on the *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children* (EPA 1994).
[m] The soil RAG based on the WAC 173-340-740(3)(ii)(A) 100 times rule is less than Hanford Site soil background (DOE-RL 2001a); therefore, background is identified as the RAG.
[n] RAG is less than required detection limit; therefore, the required detection limit is used as the lookup value (DOE-RL 2001b).
PCB = polychlorinated biphenyl
RAG = remedial action goal
WAC = *Washington Administrative Code*

3.2.2 Groundwater and River Protection

Groundwater and river protection RAGs are applicable to all vadose zone soils (shallow and deep zones). For this CVP, river protection and surface water protection are synonymous because the Columbia River is the only surface water in proximity to the Hanford Site. The term river protection is used throughout this CVP. The groundwater and river protection RAGs are listed in Table 2 and summarized below.

- **Beta- and gamma-emitting radionuclide COCs:** Meet "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* [CFR] 141.66) dose rate standards (4 mrem/yr total body or organ dose rate) for a period of 1,000 years from the time of site cleanup. Meet individual COC RAGs, as applicable.

- **Alpha-emitting radionuclide COCs:** Meet drinking water standards for nonuranium alpha-emitting radionuclides based on the more stringent of 15 pCi/L or 1/25th of the derived concentration guidelines per DOE Order 5400.5. The maximum contaminant level (MCL) for uranium is 30 µg/L (40 CFR 141). 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 2001a).

- **Nonradionuclide COCs:** Meet the individual RAGs listed in Table 2 with cleanup verification sample results passing the WAC 173-340-740(7)(e) three-part test or demonstrate by site-specific modeling that residual COC levels are protective of groundwater and surface water for 1,000 years (i.e., residual soil levels do not have the potential to exceed groundwater or river protection RAGs). The nonradionuclide groundwater and river protection RAGs listed in Table 2 were calculated using the WAC 173-340-740 rules as established in the Action Memorandum (Ecology et al. 2001).

4.0 REMOVAL ACTION FIELD ACTIVITIES

4.1 DECOMMISSIONING AND DISPOSAL

Removal and disposal activities at the 105-H site were completed in 2004. Per the decommissioning plan for this site, all known flammable and hazardous material (e.g., oils, grease, asbestos-containing material) was removed inside and outside the SSE, with the exception of nonremovable lead, generally in the form of lead-based paint inside the SSE (WCH 2005). Concentrations of lead in the lead-based paint were determined to be below regulatory limits, as discussed in the 105-H Reactor ISS final report (WCH 2005), which provides a more complete discussion of lead found in the 105-H Reactor facility. After the hazardous materials were removed, the above- and below-grade structures were segregated for disposal or salvage; all nonsalvageable material was shipped to ERDF for disposal.

The 105-H site D&D activities resulted in complete removal of all above- and below-grade structures outside of the 105-H SSE. A portion of the FSB floor remains, at its northern end between the two access labyrinths to the D elevator on the rear reactor face (Shea 2006). All materials from the 105-H Reactor ISS Project were demolished and disposed at ERDF (WCH 2005). The remaining structure of the 105-H Reactor within the shield walls has been preserved to act as temporary storage (up to 75 years) for the reactor core.

D&D activities for construction of the 105-H Reactor SSE also resulted in the removal of remaining waste sites 100-H-9, 100-H-10, 100-H-11, 100-H-12, 100-H-13, 100-H-14, and 100-H-31. All materials from the 105-H Reactor ISS Project were demolished and disposed at ERDF (WCH 2005). The removal of these waste sites is documented in Mitchell and Wimett (2005) and in Section 2.1.2 of this CVP.

The overburden piles produced during excavation were found to be contaminated. The overburden was deemed unsuitable for use as backfill of the site and was removed to ERDF. The site was backfilled with clean soil/aggregate from the 100-D Area borrow pit 21 and graded to match the surrounding terrain. The three decontamination pads (118-H-6:5) and the FSB shallow side-slope soils (118-H-6:4) remain to be addressed, having been deferred to the Field Remediation Closure Project (Ecology et al. 2001; DOE-RL 2002; BHI 2005b, 2004).

The 105-H D&D activities generated approximately 4,863 bulk containers of low-level contaminated material that were shipped to ERDF, accounting for approximately 73,966 metric tons (81,365 tons). Photographs taken before, during, and after these D&D activities are included in the 105-H Reactor ISS final report (WCH 2005).

4.2 CLEANUP VERIFICATION SAMPLING AND ANALYSIS

Final cleanup verification samples for the 105-H FSB underlying soils and deep zone side-slope soils were collected following evaluation of field screening for radiological contaminants using global positioning environmental radiological surveyor (GPERS) and laser-assisted ranging and data system (LARADS) surveys. This field screening was performed in order to obtain an initial assessment of attainment of radiological cleanup levels. Sampling and analysis methodology are presented in the 105-H Reactor SAP (DOE-RL 2001b). Specific sample locations are presented in the *Instruction Guide for Verification Sampling of the 105-D and 105-H Reactor Below-Grade Structures* (BHI 2001e). The sample design figures for the 105-H FSB underlying soils and deep zone side-slope soils, which were developed prior to D&D activities, are included in Appendix C.

The sample design for the 105-H FSB underlying soils (118-H-6:3) was developed specifically to address potential contamination from the known leakage of the 105-H FSB. Samples were collected from 10 random sample locations and 3 judgmental sample locations. At each location, soil grab samples were collected from two intervals: the first native soils below the FSB over a 0.3-m (1-ft) interval and also at 2.4 m (8 ft) to 3.1 m (10 ft) below the surface (DOE-RL 2001b). Soil samples were collected on March 24 and 25, 2004, and on April 6, 2004 (BHI 2001f). The results of the focused sampling (i.e., 3 judgmental samples) are consistent with the statistical sampling results (i.e., the 10 random sample locations) and are provided in Appendix A. As such, the focused sampling results will not be further discussed in this CVP.

The verification sample design for the deep zone side-slope soils (118-H-6:6) consisted of dividing the area into three equal sections, with a composite of four soil grab samples being collected within each area. Soil samples were collected on March 29, 2004 (BHI 2001f). The verification sample design for the deep zone side-slope soils is in accordance with the 100 Area SAP (DOE-RL 2005a) and is detailed in the 105-H Reactor SAP (DOE-RL 2001b).

For the 105-H ancillary support areas, the RAGs were met by the complete removal of all above- and below-grade structures. Per the 105-H Reactor SAP (DOE-RL 2001b) the removal action did not require soil sampling for 118-H-6:2 because there were no drivers for contamination to enter into the soil. In accordance with the 105-H Reactor SAP, no verification sampling or analysis was conducted for the 118-H-6:2 site.

5.0 CLEANUP VERIFICATION DATA EVALUATION

This section presents the evaluation and modeling of the 105-H site cleanup verification data for comparison with the data quality criteria and RAGs.

5.1 DATA QUALITY ASSESSMENT PROCESS

A data quality assessment (DQA) is performed to compare the verification sampling approach and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications. The field data presented in the field logbooks are reviewed as part of the DQA process to verify that the samples were collected in accordance with the verification sample designs.

The DQA for the 105-H FSB underlying soils and deep zone side-slope soils determined the data are of the right type, quality, and quantity to support site cleanup verification decisions within specified error tolerances. All analytical data were found acceptable for decision-making purposes. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. The cleanup verification sample analytical data are stored in the Environmental Restoration database prior to archiving in the Hanford Environmental Information System and are summarized in Appendix A. The detailed DQA is presented in Appendix B.

5.2 CONTAMINANT OF CONCERN 95% UPPER CONFIDENCE LIMIT

The primary statistical calculation to support cleanup verification is the 95% upper confidence limit (UCL) on the arithmetic mean of the data. The 95% UCL values for each COC are computed for each decision unit. Prior to calculating the 95% UCL, the individual sample results are reviewed and, as appropriate, adjusted. This process is summarized below.

- **Radionuclides:** The laboratory-reported value is used in the calculation of the 95% UCL. In cases where the laboratory does not report a value for data qualified with a "U" (i.e., less than the detection limit), half of the minimum detectable activity is used in the calculation of the 95% UCL.

- **Nonradionuclides:** For data flagged with a "U" (i.e., less than detection), a value equal to one-half the practical quantitation limit is used in the calculation of the 95% UCL in accordance with Ecology regulations (WAC 173-340-740[7][g]).

  For nonradionuclides, if greater than half of the sample results for a given COC are below detection, then the statistical value is set equal to the maximum concentration detected (i.e., versus computing a 95% UCL).

Statistical calculations are presented in the *105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations* (WCH 2006b). Verification sampling summary statistics (95% UCL values) are listed in Table 3. Individual sample cleanup verification results are presented in Appendix A. The values in Table 3 constitute the cleanup verification data set and were used for RESRAD modeling (Appendix C).

5.3 SITE-SPECIFIC CLEANUP VERIFICATION MODEL

The statistical values summarized in Table 3 were evaluated and used to develop a site-specific cleanup verification model. The remaining 105-H FSB underlying soils and deep zone side-slope soils are greater than 4.6 m (15 ft) below grade (i.e., in the deep zone). All of the overburden has been removed and sent to ERDF, and clean fill has been used to restore the site to surrounding grade. Therefore, the 105-H FSB site model is primarily a deep zone model, although the all-pathways scenario includes direct exposure pathways as part of the post-drilling residential scenario. This scenario evaluates a hypothetical case in which deep zone materials are brought to the surface during the drilling of a well. Schematic cross-section figures of the site-specific verification model for each zone are included in the RESRAD calculation briefs in Appendix C. The elements of the models are described in the following subsections.

Table 3. Cleanup Verification Data Set Using the 95% Upper Confidence Limit. (2 Pages)

Radionuclide COCs	Radionuclide Activity (pCi/g)				
	FSB Side-Slope Shallow Zone[a]	FSB Side-Slope Deep Zone[b]	Upper Deep Zone Beneath FSB Floor[b]	Lower Deep Zone Beneath FSB Floor[b]	Post-Drilling Scenario[c]
Am-241	3.15E-01	2.57E-01	3.69E-01	7.7E-02 U	2.75E-03
C-14	2.81E+00 U	4.43E+00 U	7.6E+00	1.59E+00 U	5.67E-02
Cs-137	7.2E+00	5.36E+00	1.13E+01	2.16E-01	6.75E-02
Co-60	1.87E-01	1.9E-01	1.99E-01	3.7E-02 U	1.45E-03
Eu-152	1.30E+00	1.26E+00	2.76E+00	8.8E-02 U	1.68E-02

Table 3. Cleanup Verification Data Set Using the 95% Upper Confidence Limit. (2 Pages)

Radionuclide COCs	Radionuclide Activity (pCi/g)				
	FSB Side-Slope Shallow Zone[a]	FSB Side-Slope Deep Zone[b]	Upper Deep Zone Beneath FSB Floor[b]	Lower Deep Zone Beneath FSB Floor[b]	Post-Drilling Scenario[c]
Eu-154	2.6E-01	1.5E-01 U	3.5E-01	1.2E-01 U	2.97E-03
Np-237	2.0E-02 U	3.5E-02	3.0E-02	1.0E-02 U	2.53E-04
Ni-63	1.30E+01	1.60E+01	2.59E+01	1.79E+00 U	1.65E-01
Pu-239	8.55E-01	8.06E-01	7.26E-01	5.9E-02 U	4.69E-03
Pu-240	2.05E-01	1.93E-01	1.74E-01	1.4E-02 U	1.12E-03
Sr-90	6.69E+00	5.56E+00	5.9E+00	1.74E-01	3.57E-02
Th-228	0 (<BG)	0 (<BG)	0 (<BG)	0 (<BG)	0 (<BG)
Th-230	3.35E-01	9.32E-01	6.4E-01	5.90E-01	8.32E-03
Th-232	0 (<BG)	0 (<BG)	0 (<BG)	0 (<BG)	0 (<BG)
Tritium (H-3)	2.0E-02 U	-2.0E-02 U	9.2E-02	3.32E-01	3.12E-03
U-233/234	0 (<BG)	0 (<BG)	0 (<BG)	0 (<BG)	0 (<BG)
U-235	0 (<BG) U	0 (<BG) U	0 (<BG)	0 (<BG) U	0 (<BG)
U-238	0 (<BG)	0 (<BG)	0 (<BG)	0 (<BG)	0 (<BG)
Nonradionuclide COCs[d]	Nonradionuclide Concentration (mg/kg)				
	FSB Side-Slope Shallow Zone[a]	FSB Side-Slope Deep Zone[b]	Upper Deep Zone Beneath FSB Floor[b]	Lower Deep Zone Beneath FSB Floor[b]	Post-Drilling Scenario[c]
Cr(VI)	8.7E-01	1.5E+00	9.4E-01	2.1E-01 U	7.11E-03
Lead	1.15E+01	2.01E+01	1.89E+01	2.6E+00 U	1.30E-01
Aroclor-1254	1.5E-02	1.4E-02	2.4E-02	1.4E-02 U	2.49E-04

[a] Soil in the FSB side-slope shallow zone has been deferred to the Field Remediation Closure Project for remedial action and is not evaluated further in this document.
[b] Results also pertain to the remaining waste sites 100-H-11, 100-H-12 and 100-H-14, which were located within the remediation footprint of the fuel storage basin and were removed in their entirety as a result of the deep excavations required for the 105-H Reactor Fuel Storage Basin remediation.
[c] The post-drilling resident scenario concentrations are calculated as described on page 4-22 of *Guidance for Radiological Release of DOE Real Property at Hanford*, DOE/RL-97-93, Rev. 1 (DOE-RL 1999).
[d] Mercury and all PCB congeners except aroclor-1254 were below detection limits and were not evaluated.
BG = background
COC = contaminant of concern
FSB = fuel storage basin
PCB = polychlorinated biphenyl
U = undetected

5.3.1 RESRAD Modeling

The individual radionuclide cleanup verification statistical values (Table 3) were entered into the RESRAD computer code, Version 6.30 (ANL 2005), to estimate the residential dose rate and to estimate the impact on groundwater and the Columbia River from residual COC concentrations in the soils underlying the former 105-H FSB floor (0 to 0.3 m [0 to 1 ft] and 2.4 to 3 m [8 to 10 ft]) and the deep zone side-slope soils. The direct radiation exposure dose rate to the resident living in his or her basement (rural-residential scenario) was conservatively estimated by substituting (for analysis purposes) a case where the resident is standing on level ground with the soil containing concentrations representative of residual (i.e., post-cleanup) shallow zone soils. This is conservative because it ignores the potential shielding effects of concrete basement walls and any clean backfill between residual soils and the basement walls. RESRAD runs were computed for the FSB deep zone side-slope rural-residential scenario and the soil beneath the FSB floor rural-residential and post-drilling scenarios using the radionuclide COCs given in Table 2.

A component of the residential scenario is the potential contribution to dose rate from direct exposure to well-drilling cuttings brought to the ground surface. This portion of the scenario is described as the post-drilling scenario in Washington Department of Health guidance (WDOH 1997) and DOE guidance (DOE-RL 1999) and allows for evaluation of potential human intrusion into the deep zone.

The RESRAD modeling methodologies, results, input values, and the site-specific cleanup verification model are included in the calculation briefs (Appendix C). Specific results from the calculations are discussed as part of the RAG attainment evaluation (Section 6.0).

5.3.2 RESRAD-BUILD Modeling

No RESRAD-BUILD computer modeling was performed because all potentially inhabitable structures in Demolition Zones 1, 3, 4, and 5 were removed.

6.0 EVALUATION OF REMEDIAL ACTION GOAL ATTAINMENT

This section demonstrates that removal actions at the 105-H site have achieved the applicable RAGs. Sections 6.1, 6.2, and 6.3 address attainment of direct exposure RAGs, groundwater protection RAGs, and Columbia River protection RAGs, respectively. Section 6.4 documents application of the WAC 173-340-740(7)(e) three-part test. This test is required for nonradionuclide COCs only.

For 118-H-6:2, 105-H Ancillary Support Areas and Underlying Soils, the RAGs were met by the complete removal of the above- and below-grade structures. Per the 105-H Reactor SAP (DOE-RL 2001b) the removal action did not require soil sampling for the

105-H ancillary support areas because there were no drivers for contamination to enter into the soil.

As mentioned in Section 2.1.2, evaluation of the soils underlying the FSB and the deep zone side-slope soils simultaneously addresses the soils underlying sites 100-H-11, 100-H-12, and 100-H-14. Therefore, all discussion of the FSB soils and deep zone side-slope soils will inherently refer to the 100-H-11, 100-H-12, and 100-H-14 waste sites.

6.1 DIRECT EXPOSURE SOIL REMEDIAL ACTION GOALS ATTAINED

6.1.1 Radionuclides

The results of the 105-H site RESRAD dose rate estimates for the FSB underlying soils and the FSB side-slope deep zone soils all-pathways scenarios are shown in Figures 4 and 5. These dose rates represent the dose contributions from soils at relevant time periods. The FSB deep zone side-slope soils were considered separately from the soils underlying the former FSB floor. The 2018 date corresponds to the 30-year site cleanup schedule of the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989). All dose rate estimates are less than the 15 mrem/yr RAG. The RESRAD computations are shown in detail in the calculation briefs presented in Appendix C.

Figure 4. RESRAD Analysis for the Combined 105-H Fuel Storage Basin Underlying Soils – All Radionuclides, All-Pathways Dose Rate Estimate.

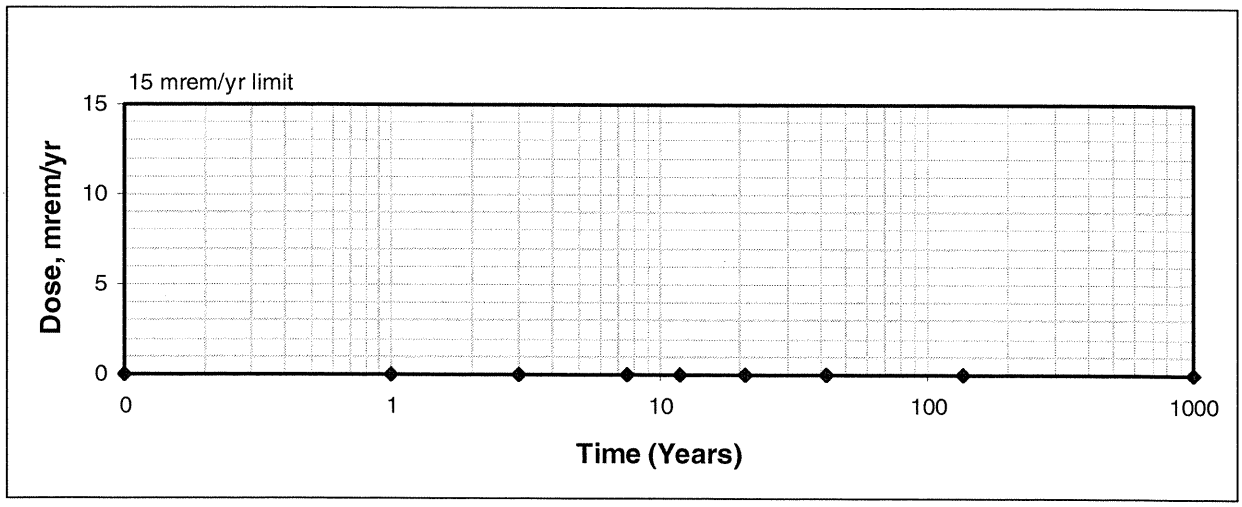
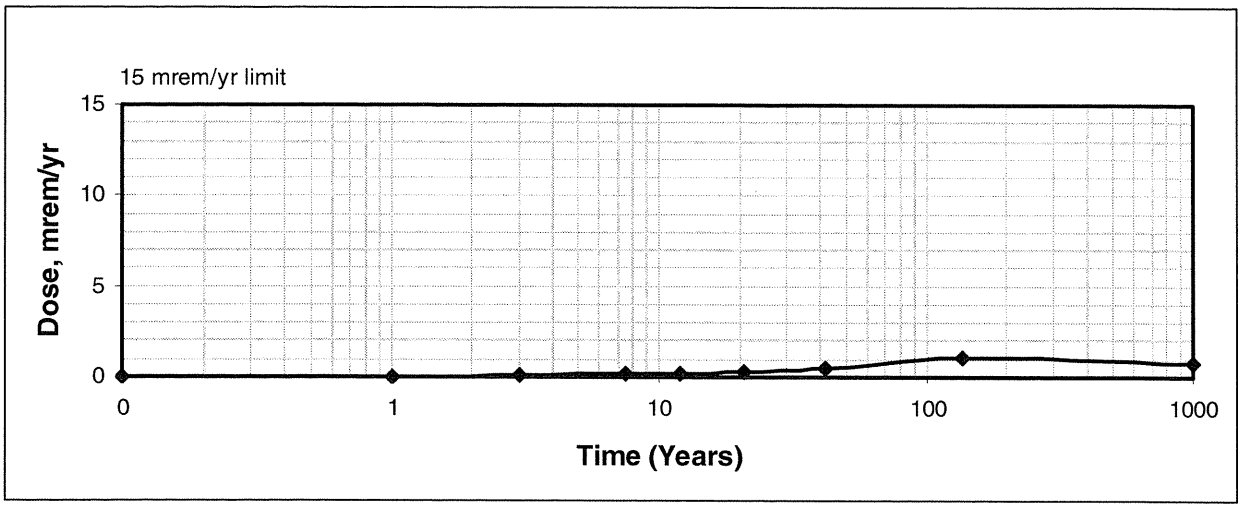


Figure 5. RESRAD Analysis 105-H Fuel Storage Basin Deep Zone Side-Slope Soils – All Radionuclides, All-Pathways Dose Rate Estimate.



6.1.1.1 105-H Reactor FSB Underlying Soils (118-H-6:3). The estimated maximum total all-pathways dose rate of 1.56 x 10^{-2} mrem/yr for the FSB deep zone and the post-drilling scenario occurs at year one (2007) and decreases to 1.75 x 10^{-4} mrem/yr in 1,000 years. The estimated dose rate in the year 2018 is 8.84 x 10^{-3} mrem/yr. The all-pathways dose rate estimate remains below the direct exposure RAG.

6.1.1.2 105-H Reactor FSB Deep Zone Side Slopes (118-H-6:6). The estimated maximum all-pathways dose rate for the FSB deep zone side-slope soils is 1.09 mrem/yr and occurs at year 137 (2143) and decreases to 7.76 x 10^{-1} mrem/yr in 1,000 years. The estimated dose rate in the year 2018 is 2.16 x 10^{-1} mrem/yr. The all-pathways dose rate estimate remains below the direct exposure RAG.

6.1.2 Nonradionuclides

6.1.2.1 Direct Comparison to RAGs. The shallow zone direct exposure criteria (Table 2) are applied to the post-drilling scenario soil concentrations (Table 3) and are shown in Table 4. All predicted post-drilling nonradionuclide soil concentrations are significantly below the RAGs. Therefore, the direct exposure criteria RAGs are attained.

Table 4. Attainment of Nonradionuclide Direct Exposure Remedial Action Goals.

COC	Direct Exposure RAG (mg/kg)	Cleanup Verification Data Set (mg/kg)	Direct Exposure RAG Attained?[a]
Hexavalent chromium	2.1[b] 240[c]	7.11×10^{-3}	Yes
Lead	353[d]	1.3×10^{-1}	Yes
Aroclor-1254	0.5[e]	2.4×10^{-2}	Yes

[a] Criterion is comparison to direct exposure RAG.
[b] WAC 173-340-750(3) Method B carcinogenic cleanup limit based on the inhalation exposure pathway, per *Calculation of Hexavalent Chromium Carcinogenic Risk* (BHI 2000).
[c] WAC 173-340-740(3) Method B noncarcinogenic cleanup limit.
[d] A WAC 173-340-740(3) value for lead is not available. This value is based on the *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children* (EPA 1994).
[e] WAC 173-340 Method B carcinogenic cleanup limit.
COC = contaminant of concern
RAG = remedial action goal
WAC = *Washington Administrative Code*

6.1.2.2 Noncarcinogenic Hazard Quotient RAG Attained. For noncarcinogenic COCs, WAC 173-340-740(5)(a) and (b) specify the evaluation of the hazard quotient, which is given as a daily intake divided by a reference dose (DOE-RL 2005b). This evaluation is shown in the 95% UCL calculation brief (WCH 2006b). The COCs with noncarcinogenic effects at this site are hexavalent chromium and aroclor-1254. (Hexavalent chromium and aroclor-1254 are also carcinogens and carcinogenic risk is discussed in Section 6.1.2.3.) The sum of the individual COC hazard quotients for the shallow zone post-drilling scenario is 1.9×10^{-4}. Based on a limit of 1.0, the noncarcinogenic risk requirements have been attained.

6.1.2.3 Carcinogenic Risk RAG. For individual nonradionuclide carcinogenic COCs, the WAC 173-340-740(3) Method B cleanup limits are based on an individual cancer risk of 1×10^{-6}. For all nonradionuclide carcinogenic COCs, the cumulative excess cancer risk must be less than 1×10^{-5} (EPA et al. 1998). The two nonradionuclide carcinogenic COCs at this site are hexavalent chromium and aroclor-1254. The excess cancer risks calculated for hexavalent chromium and aroclor-1254 for the post-drilling shallow zone scenario are, respectively, 3.4×10^{-9} and 5×10^{-10}. The total cancer risk is 3.9×10^{-9}. All values are below the individual and total risk limits; therefore, the carcinogenic risk standards have been attained.

6.2 GROUNDWATER REMEDIAL ACTION GOALS ATTAINED

6.2.1 Radionuclides

The predicted groundwater concentrations for all of the radionuclide COCs contributed by the site soils are shown in the RESRAD calculation briefs (Appendix C). Table 5 gives the total peak concentrations predicted for each radionuclide COC along with the individual RAGs for comparison. No COC concentration is predicted to exceed the RAGs; therefore, the RAGs are attained.

Table 5. Estimated Peak Radionuclide Groundwater Concentrations in the Soils Underlying the 105-H Fuel Storage Basin Compared to RAGs.[a] (2 Pages)

Radionuclide	Peak Concentration (pCi/L)	RAG (pCi/L)	RAGS Attained? (Yes/No)
Americium-241	0[b]	1.2[c]	Yes
Carbon-14	0[b]	2,000[d]	Yes
Cobalt-60	0[b]	100[d]	Yes
Cesium-137	0.0083	60[d]	Yes
Europium-152	0[b]	200[d]	Yes
Europium -154	0[b]	60[d]	Yes
Europium -155	0[b]	600[d]	Yes
Neptunium-237	0[b]	1.2[c]	Yes
Nickel-63	0[b]	50[d]	Yes
Plutonium-238	0[b]	1.6[c]	Yes
Plutonium-239	0[b]	1.2[c]	Yes
Plutonium-240	0[b]	1.2[c]	Yes
Strontium-90	0.0502	8[e]	Yes
Thorium-228	0[b]	15[e]	Yes
Thorium-232	0[b]	2[c]	Yes
Tritium	232	20,000[e]	Yes
Uranium-233/234	See total uranium	See total uranium	See total uranium
Uranium-235	See total uranium	See total uranium	See total uranium
Uranium-238	See total uranium	See total uranium	See total uranium

Table 5. Estimated Peak Radionuclide Groundwater Concentrations in the Soils Underlying the 105-H Fuel Storage Basin Compared to RAGs.[a] (2 Pages)

Radionuclide	Peak Concentration (pCi/L)	RAG (pCi/L)	RAGS Attained? (Yes/No)
Uranium (total)	0[b]	21.2[f]	Yes

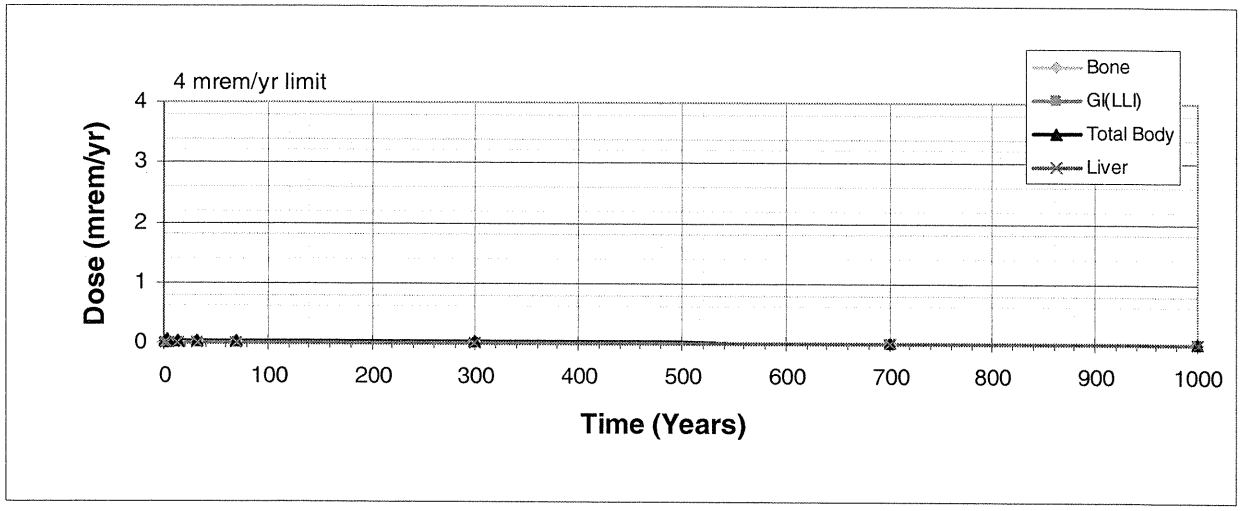
[a] Includes both soil and concrete modeled as soil.
[b] Based on RESRAD modeling, these radionuclides do not reach groundwater in 1,000 years.
[c] 1/25th of the derived concentration guidelines from DOE Order 5400.5.
[d] Lookup value corresponding to a dose rate of 4 mrem/yr.
[e] EPA drinking water promulgated MCL (40 CFR 141.66).
[f] 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*, 0100X-CA-V0038 (BHI 2001a).

CFR = *Code of Federal Regulations*
EPA = U.S. Environmental Protection Agency
MCL = maximum contaminant level
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose model)

Figure 6 shows the individual organ dose rate for beta- and gamma-emitting radionuclides predicted over 1,000 years as shown in the comparison to drinking water standards calculation brief (MCL calculation brief in Appendix C; WCH 2006c). The cumulative dose for each total body, bone, liver, and gastrointestinal tract for all beta- and gamma-emitting COCs is less than the 4 mrem/yr standard over 1,000 years.

The drinking water concentration standard for nonuranium alpha emitters and the uranium standard of 30 µg/L have been met. Results of the RESRAD calculations are shown in the MCL calculation brief (Appendix C; WCH 2006c).

Figure 6. Dose Rate to Organs from Groundwater.



6.2.2 Nonradionuclides

Table 6 illustrates the comparison of nonradionuclide cleanup verification statistical values to the groundwater protection RAGs presented in Table 2. All nonradionuclide COCs were below the detection limits for the lower deep zone soils (2.4 to 3.0 m [8 to 10 ft]) under the FSB floor and are therefore not presented in Table 6.

Table 6 shows that residual concentrations (95% UCL statistical value) of hexavalent chromium meet the RAGs. Table 6 also shows that residual concentrations (95% UCL statistical value) of lead and aroclor-1254 meet the river protection RAGs. Based on the generic site RESRAD assessment included in the 105-H Reactor SAP (DOE-RL 2001b) and the RDR/RAWP (DOE-RL 2005b), and on the RESRAD modeling evaluation in the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a, WCH 2006a) using K_d values and the vertical distance to groundwater, the residual contaminant levels of lead and aroclor-1254 at the 105-H site are not predicted to migrate to groundwater or the Columbia River within 1,000 years. Therefore, the RAGS have been attained.

Table 6. Attainment of Nonradionuclide Remedial Action Goals for Protection of Groundwater and the Columbia River.

Nonradionuclides	RAG for Groundwater Protection (mg/kg)	RAG for Columbia River Protection (mg/kg)	Cleanup Verification Data Value (mg/kg)	Does RESRAD Predict Migration to Groundwater in 1,000 Years?	RAGs Attained? (Yes/No)
Upper Deep Zone Soils Beneath FSB Floor (0-1 ft [0-0.3 m])					
Hexavalent chromium	8[a]	2	0.94	No	Yes
Lead	10.2[b]	10.2[b]	18.9	No	Yes[c]
Aroclor-1254	0.02[d]	0.02[d]	0.024	No	Yes[c]
FSB Deep Zone Side-Slope Soils					
Hexavalent chromium	8[a]	2	1.5	No	Yes
Lead	10.2[b]	10.2[b]	20.1	No	Yes[c]
Aroclor-1254	0.02[d]	0.02[d]	0.014	No	Yes

[a] Soil RAG based on "100 times groundwater cleanup" rule from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005b).

[b] The soil RAG based on the WAC 173-340-740(3)(ii)(A) 100 times rule is less than Hanford Site soil background (DOE-RL 2001a); therefore, background is identified as the RAG.

[c] Based on the generic site RESRAD assessment included in the *Sampling and Analysis Plan for Interim Closure of the 105-D and 105-H Reactor Below-Grade Structures and Underlying Soils* (DOE-RL 2001b) and the RDR/RAWP (DOE-RL 2005b), and on a RESRAD modeling evaluation based on K_d values and vertical distance to groundwater presented in the RESRAD calculation brief in Appendix C, the residual contaminant levels of lead and aroclor-1254 at the 105-H site are protective of groundwater and the Columbia River.

[d] RAG is less than required detection limit; therefore, the required detection limit is used as the lookup value (DOE-RL 2001b).

FSB = fuel storage basin
K_d = distribution coefficient
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose model)
WAC = *Washington Administrative Code*

6.3 COLUMBIA RIVER REMEDIAL ACTION GOALS ATTAINED

6.3.1 Radionuclides

The river protection RAGs for radionuclides are identical to the groundwater protection RAGs. The RESRAD modeling results are compared to the groundwater protection RAGs in Table 5. The results of RESRAD modeling indicate that radionuclides are not predicted to reach groundwater (and by extension not predicted to reach the Columbia River) at levels that exceed the RAGs; therefore, the Columbia River protection RAGs have been attained.

6.3.2 Nonradionuclides

Table 6 shows that residual concentrations (95% UCL statistical value) of hexavalent chromium meets the RAGs. Table 6 also shows that residual concentrations (95% UCL statistical value) of lead and aroclor-1254 meet the river protection RAGs on the basis that the RESRAD calculation brief in Appendix C predicts that these contaminants will not migrate to groundwater or the Columbia River within 1,000 years; therefore, the RAGs have been attained.

6.4 WAC 173-340 THREE-PART TEST FOR NONRADIONUCLIDES

The WAC 173-340-740(7)(e) three-part test is required for nonradionuclide statistical verification data sets. The three part test uses the most restrictive RAGs applicable. (The most restrictive RAGs are defined as the lowest of the direct exposure, groundwater protection, and river protection RAGs. The direct exposure RAGs are applicable to the shallow zone soil. Groundwater and river protection RAGs are applicable to both the shallow zone and the deep zone.) The WAC 173-340-740(7)(e) three-part test consists of the following criteria: (1) the cleanup verification statistical value must be less than the cleanup level, (2) no single detection can exceed two times the cleanup criteria, and (3) the numbers of samples exceeding the cleanup criteria must be less than 10%.

Table 7 summarizes the results of the WAC 173-340-740(7)(e) three-part test for the data set. For the nonradionuclide COCs, hexavalent chromium, lead, and aroclor-1254, the table lists the most restrictive applicable RAG (selected from the RAGs in Table 2), the maximum detected value, the total number of samples collected, and the number of samples exceeding the most restrictive RAG. The final column of the table describes the result of applying the three WAC 173-340-740(7)(e) criteria using the values listed in the preceding columns.

The data pass the WAC 173-340-740(7)(e) three-part test (Table 7).

Table 7. Application of the WAC 173-340 Three-Part Test.

Nonradionuclide	Most Stringent Applicable RAG (mg/kg)	Statistical Value (mg/kg)	Maximum Detected (mg/kg)	Total Number of Samples	Number Exceeding Criteria	RAGs Attained? (Yes/No)
Upper Deep Zone Soils Beneath FSB Floor (0-0.3 m [0-1 ft])						
Hexavalent chromium	2.0[a]	0.94	0.94	10	0	Yes
Lead	10.2[b]	18.9	34.8	10	1	Yes [c]
Aroclor-1254	0.02[d]	0.024	0.024	10	0	Yes [c]
Lower Deep Zone Soils Beneath FSB Floor (2.4-3 m [8-10 ft])						
Hexavalent chromium	2.0[a]	U	U	10	0	Yes
Lead	10.2[b]	U	U	10	0	Yes
Aroclor-1254	0.02[d]	U	U	10	0	Yes
FSB Deep Zone Side-Slope Soils						
Hexavalent chromium	2.0[a]	1.5	1.5	3	0	Yes
Lead	10.2[b]	20.1	22.4	3	1	Yes[c]
Aroclor-1254	0.02[d]	0.014	0.014	3	0	Yes

[a] Soil RAG based on 100 times surface water quality criteria times dilution-attenuation factor from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005b).

[b] The soil RAG based on the WAC 173-340-740(3)(ii)(A) 100 times rule is less than Hanford Site soil background (DOE-RL 2001a); therefore, background is identified as the RAG.

[c] Based on the generic site RESRAD assessment included in the *Sampling and Analysis Plan for Interim Closure of the 105-D and 105-H Reactor Below-Grade Structures and Underlying Soils* (DOE-RL 2001b), the RDR/RAWP (DOE-RL 2005b), and on the RESRAD modeling evaluation in the *100 Area Analogous Sites RESRAD Calculations* (BHI 2005a, WCH 2006a) using K_d values and vertical distance to groundwater, the residual contaminant levels of lead and Aroclor-1254 at the 105-H site are protective of groundwater and the Columbia River.

[d] RAG is less than required detection limit; therefore, the required detection limit is used as the lookup value (DOE-RL 2001b).

FSB = fuel storage basin
K_d = distribution coefficient
RAG = remedial action goal
U = undetected
WAC = *Washington Administrative Code*

7.0 RADIONUCLIDE RISK INFORMATION

The RAG evaluation (Section 6.0) used RESRAD modeling to predict total annual radiation dose rates for 1,000 years for comparison to the RAGs. Radiation presents a carcinogenic risk, and the RESRAD model calculates the excess lifetime cancer risk associated with the estimated radiation dose rates using the EPA's Health Effects Assessment Summary Tables (updated April 16, 2001, "Update of Radionuclide Carcinogenicity Slope Factors," available on the Internet at www.epa.gov/radiation/heast). The "National Oil and Hazardous Substances Pollution Contingency Plan" (40 CFR 300) presents a target range for residual risk of 10^{-4} to 10^{-6}.

Figure 7 illustrates excess lifetime cancer risk for the soils underlying the former FSB floor and the post-drilling scenario. Figure 8 illustrates the excess lifetime cancer risk for the FSB deep zone side slopes. Risk decreases over time because of radioactive decay and migration through the soil. The maximum total excess lifetime cancer risk for the soils underlying the former FSB floor and post-drilling scenario is 3.22×10^{-7} and occurs at year zero (2006). The FSB deep zone side slopes have a maximum excess lifetime cancer risk of 3.23×10^{-6}, which occurs at year 42 (2048).

Figure 7. Combined Radionuclide Excess Lifetime Cancer Risk for the Soils Underlying the Former FSB Floor and the Post-Drilling Scenario.

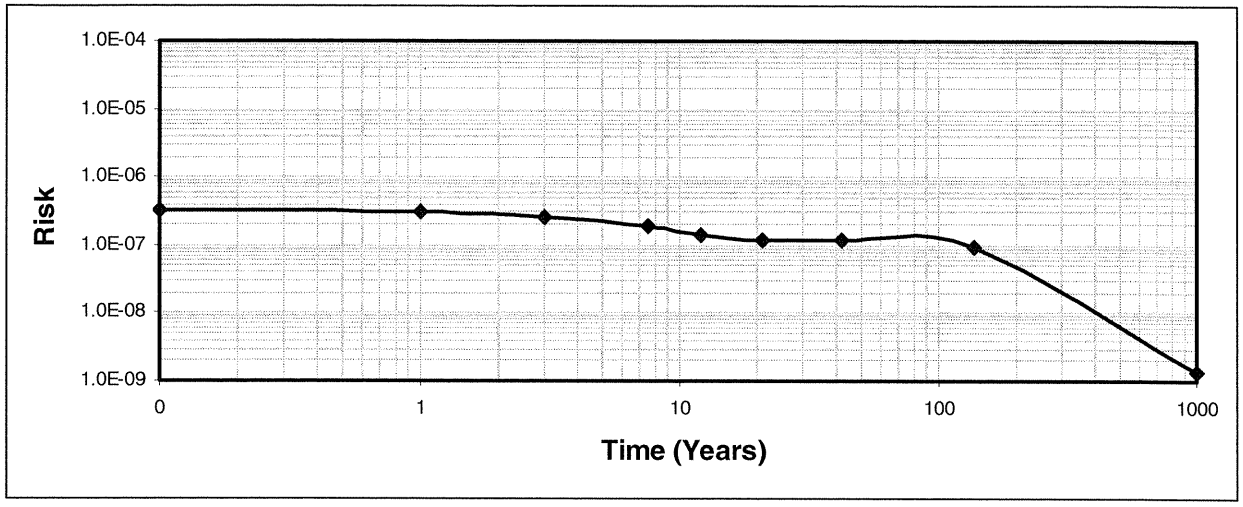
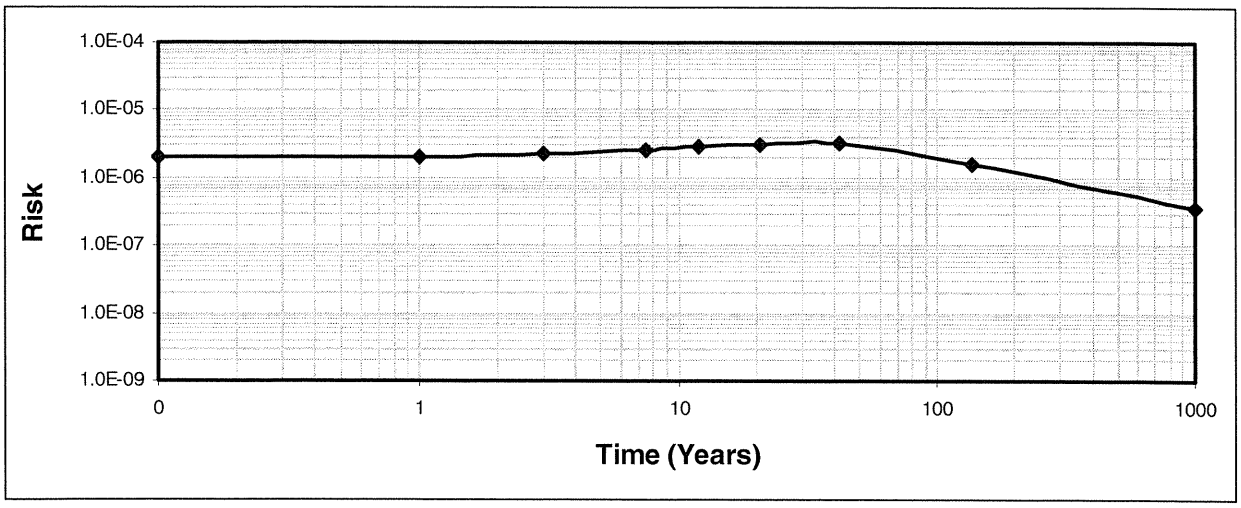


Figure 8. Radionuclide Excess Lifetime Cancer Risk for the FSB Deep Zone Side-Slope Soils.



8.0 STATEMENT OF PROTECTIVENESS

This CVP demonstrates that removal action at the 105-H Reactor sites 118-H-6:2, 118-H-6:3, and 118-H-6:6 has achieved the removal action objectives established in the Action Memorandum (Ecology et al. 2001) and has achieved the corresponding RAGs established in the removal action work plan (DOE-RL 2002), the 105-H Reactor SAP (DOE-RL 2001b), and the RDR/RAWP (DOE-RL 2005b). Furthermore, this CVP demonstrates that removal action of the 100-H-9, 100-H-10, 100-H-11, 100-H-12, 100-H-13, 100-H-14, and 100-H-31 waste sites has achieved the remedial action objectives and corresponding RAGs established in the Remaining Sites ROD (EPA 1999) and the RDR/RAWP (DOE-RL 2005b). The remaining soils at the 105-H Reactor site have either been deferred to the Field Remediation Closure Project or have been shown to meet the applicable RAGs through verification sampling, analysis, and RESRAD modeling. All excavated materials generated during the D&D activities at the 105-H Reactor site were disposed at ERDF, and the area was backfilled to grade with clean backfill. These results also indicate that residual concentrations in the shallow zone will support future land uses that can be represented (or bounded) by a rural-residential scenario and that residual concentrations throughout the site pose no threat to groundwater or the Columbia River. The three 105-H Reactor sites (118-H-6:2, 118-H-6:3, and 118-H-6:6), along with the seven remaining waste sites (100-H-9, 100-H-10, 100-H-11, 100-H-12, 100-H-13, 100-H-14, and 100-H-31), have been verified to be remediated in accordance with the *Removal Action Work Plan for 105-D and 105-H Building Interim Safe Storage Projects and Ancillary* Buildings (DOE-RL 2002) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b) and can be interim closed. The CVP does not demonstrate the acceptability of unrestricted access to deep zone soils (i.e., below 4.6 m [15 ft]) for 118-H-6:3 and 118-H-6:6; therefore, institutional controls to prevent uncontrolled drilling or excavation into these deep zone soils are required.

9.0 REFERENCES

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APPENDIX A

SUMMARY OF VERIFICATION SOIL SAMPLING AND ANALYTICAL RESULTS

Table A-1. Fuel Storage Basin Side Slope (Shallow Zone) Cleanup Verification Data.

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1	J01C47	3/29/2004	2.1E-01	U	2.1E-01	7.2E+00		2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
Duplicate of J01C47	J01C51	3/29/2004	2.1E-01	U	2.1E-01	7.9E+00		2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A2	J01C48	3/29/2004	8.7E-01		2.1E-01	1.30E+01		2.3E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A3	J01C49	3/29/2004	2.1E-01	U	2.1E-01	9.5E+00		2.2E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A4	J01C50	3/29/2004	2.1E-01	U	2.1E-01	7.9E+00		2.4E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
Split of J01C47	J01C56	3/29/2004	3.50E-01	U	3.50E-01	1.35E+01		5.0E-01	1.7E-02	U	1.7E-02	6.7E-03	U	6.7E-03	7.4E-03	U	7.4E-03	8.4E-03	U	8.4E-03	7.9E-03	U	7.9E-03	9.9E-03	U	9.9E-03

Sampling Area	HEIS Number	Sample Date	Aroclor-1254			Aroclor-1260			Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			mg/kg	Q	PQL	mg/kg	Q	PQL	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J01C47	3/29/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	-6.4E-02	U	4.9E-01	7.29E-01	U	5.4E+00	1.32E-01		7.7E-02	7.5E-02	U	7.5E-02	2.2E-01	U	2.2E-01	2.4E-01	U	2.4E-01
Duplicate of J01C47	J01C51	3/29/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	-3.7E-02	U	2.8E-01	2.33E+00	U	5.7E+00	1.59E-01		5.9E-02	5.9E-02	U	5.9E-02	1.8E-01	U	1.8E-01	1.8E-01	U	1.8E-01
A2	J01C48	3/29/2004	1.4E-02		1.4E-02	1.4E-02	U	1.4E-02	-5.2E-02	U	4.0E-01	1.40E+00	U	4.6E+00	1.78E+00		1.2E-01	1.0E-01	U	1.0E-01	3.96E-01		2.1E-01	3.0E-01	U	3.0E-01
A3	J01C49	3/29/2004	1.7E-02		1.4E-02	1.4E-02	U	1.4E-02	4.99E-01		2.5E-01	3.54E+00	U	5.9E+00	1.04E+01		8.6E-02	2.64E-01		4.8E-02	1.85E+00		2.0E-01	3.32E-01		1.8E-01
A4	J01C50	3/29/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	-3.2E-02	U	2.4E-01	1.20E+00	U	5.0E+00	7.1E-02	U	7.1E-02	5.0E-02	U	5.0E-02	1.2E-01	U	1.2E-01	1.7E-01	U	1.7E-01
Split of J01C47	J01C56	3/29/2004	8.2E-03	U	8.2E-03	7.8E-03	U	7.8E-03	4.86E-02	U	6.58E-02	3.53E-01		3.13E-01	2.59E-01		1.89E-02	3.27E-02	U	2.31E-02	2.67E-02	U	4.74E-02	-1.74E-03	U	6.06E-02

Sampling Area	HEIS Number	Sample Date	Europium-155			Neptunium-237			Nickel-63			Plutonium-238			Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J01C47	3/29/2004	1.8E-01	U	1.8E-01	1.8E-02	U	4.3E-02	0	U	5.3E+00	3.1E-02	U	2.4E-01	6.2E-02	U	2.4E-01	1.31E-01	U	2.3E-01	7.01E-01		2.7E-01	1.40E-01	U	2.7E-01
Duplicate of J01C47	J01C51	3/29/2004	1.5E-01	U	1.5E-01	2.1E-02	U	3.2E-02	-2.16E+00	U	5.5E+00	0	U	2.4E-01	6.4E-02	U	2.4E-01	1.38E-01	U	2.2E-01	9.63E-01		2.9E-01	4.99E-01		2.9E-01
A2	J01C48	3/29/2004	2.0E-01	U	2.0E-01	1.7E-02	U	4.1E-02	2.20E+00	U	5.8E+00	0	U	2.6E-01	3.43E-01		2.6E-01	1.49E+00		2.0E-01	8.49E-01		2.6E-01	3.05E-01		2.6E-01
A3	J01C49	3/29/2004	1.7E-01	U	1.7E-01	1.0E-02	U	5.3E-02	1.96E+01		6.5E+00	3.6E-02	U	2.8E-01	1.52E+00		2.8E-01	9.78E+00		1.9E-01	8.60E-01		2.9E-01	3.35E-01		2.8E-01
A4	J01C50	3/29/2004	1.3E-01	U	1.3E-01	1.8E-02	U	3.5E-02	-1.75E+00	U	5.4E+00	0	U	2.4E-01	0	U	2.4E-01	2.9E-02	U	2.3E-01	7.80E-01		3.0E-01	2.33E-01	U	3.0E-01
Split of J01C47	J01C56	3/29/2004	1.50E-02	U	4.28E-02	0	U	8.40E-02	-2.01E+00	U	7.99E+00	1.80E-02	U	4.89E-02	5.41E-02	U	4.88E-02	1.02E+00		8.75E-02	6.95E-01		6.50E-02	1.10E+00		7.18E-02

Sampling Area	HEIS Number	Sample Date	Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J01C47	3/29/2004	7.68E-01		2.7E-01	4.1E-02	U	7.1E-01	6.47E-01		2.8E-01	8.7E-02	U	3.3E-01	6.11E-01		2.8E-01
Duplicate of J01C47	J01C51	3/29/2004	7.29E-01		2.9E-01	-3.73E-01	U	7.2E-01	4.36E-01		2.0E-01	0	U	2.4E-01	3.85E-01		2.0E-01
A2	J01C48	3/29/2004	8.12E-01		2.6E-01	-2.8E-02	U	7.4E-01	5.24E-01		3.1E-01	4.9E-02	U	3.7E-01	3.63E-01		3.1E-01
A3	J01C49	3/29/2004	7.45E-01		2.8E-01	-4.2E-02	U	7.4E-01	6.55E-01		2.2E-01	1.04E-01	U	2.6E-01	4.56E-01		2.2E-01
A4	J01C50	3/29/2004	4.66E-01		3.0E-01	3.7E-02	U	6.4E-01	4.41E-01		2.4E-01	0	U	2.9E-01	4.09E-01		2.4E-01
Split of J01C47	J01C56	3/29/2004	3.92E-01		1.44E-01	2.64E+01		9.81E+00	5.59E-01		1.47E-01	-2.07E-03	U	8.64E-02	7.16E-01		1.09E-01

The following acronyms apply to all tables in this appendix.
C = blank contamination
HEIS = Hanford Environmental Information System
J = estimate
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
U = undetected

Table A-2. Fuel Storage Basin Side Slope (Deep Zone) Cleanup Verification Data.

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1	J01C52	3/29/2004	2.1E-01	U	2.1E-01	1.89E+01		2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
Duplicate of J01C52	J01C55	3/29/2004	1.5E+00		2.1E-01	2.24E+01		2.4E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A2	J01C53	3/29/2004	2.1E-01	U	2.1E-01	1.46E+01		2.5E+00	2.E-02	U	2.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A3	J01C54	3/29/2004	2.1E-01	U	2.1E-01	1.06E+01		2.5E+00	2.E-02	U	2.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
Split of J01C52	J01C57	3/29/2004	3.50E-01	U	3.50E-01	2.29E+01		5.0E-01	1.7E-02	U	1.7E-02	6.6E-03	U	6.6E-03	7.3E-03	U	7.3E-03	8.4E-03	U	8.4E-03	7.8E-03	U	7.8E-03	9.9E-03	U	9.9E-03

Sampling Area	HEIS Number	Sample Date	Aroclor-1254			Aroclor-1260			Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			mg/kg	Q	PQL	mg/kg	Q	PQL	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J01C52	3/29/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	2.01E-01	U	3.1E-01	2.52E+00	U	5.6E+00	9.94E-01		1.3E-01	1.2E-01	U	1.2E-01	2.68E-01	U	2.7E-01	3.4E-01	U	3.4E-01
Duplicate of J01C52	J01C55	3/29/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	0	U	2.4E-01	1.10E+00	U	6.1E+00	8.75E-01		7.2E-02	9.6E-02	U	9.6E-02	2.8E-01	U	2.8E-01	2.4E-01	U	2.4E-01
A2	J01C53	3/29/2004	1.4E-02	J	1.4E-02	1.4E-02	U	1.4E-02	1.40E-01	U	3.6E-01	4.32E+00	U	6.0E+00	5.01E+00		8.7E-02	1.25E-01		4.4E-02	1.26E+00		3.0E-01	2.4E-01	U	2.4E-01
A3	J01C54	3/29/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	2.73E-01		2.1E-01	3.52E+00	U	6.3E+00	4.07E+00		1.1E-01	1.92E-01		5.1E-02	8.02E-01		3.8E-01	2.9E-01	U	2.9E-01
Split of J01C52	J01C57	3/29/2004	8.2E-03	U	8.2E-03	7.8E-03	U	7.8E-03	2.09E-01		6.30E-02	-4.25E-03	U	3.13E-01	9.42E-01		1.74E-02	2.66E-02	U	2.19E-02	3.10E-01		4.62E-02	2.82E-02	U	6.02E-02

Sampling Area	HEIS Number	Sample Date	Europium-155			Neptunium-237			Nickel-63			Plutonium-238			Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J01C52	3/29/2004	2.3E-01	U	2.3E-01	2.5E-02	U	3.8E-02	3.09E+00	U	5.9E+00	0	U	2.5E-01	2.89E-01		2.5E-01	1.27E+00		2.0E-01	5.98E-01		3.3E-01	5.95E-01		3.3E-01
Duplicate of J01C52	J01C55	3/29/2004	2.1E-01	U	2.1E-01	5.2E-02		4.5E-02	6.81E+00		5.1E+00	0	U	2.7E-01	3.20E-01		2.7E-01	6.55E-01		2.0E-01	6.05E-01		3.1E-01	2.01E-01	U	3.1E-01
A2	J01C53	3/29/2004	1.7E-01	U	1.7E-01	5.E-03	U	4.3E-02	1.32E+01		5.2E+00	3.2E-02	U	2.4E-01	7.56E-01		2.4E-01	3.42E+00		2.0E-01	5.41E-01		2.8E-01	5.39E-01		2.7E-01
A3	J01C54	3/29/2004	2.5E-01	U	2.5E-01	1.0E-02	U	1.4E-02	1.48E+01		5.6E+00	3.6E-02	U	2.7E-01	9.69E-01		2.7E-01	5.64E+00		1.9E-01	6.74E-01		3.4E-01	9.85E-01		3.4E-01
Split of J01C52	J01C57	3/29/2004	2.07E-02	U	4.30E-02	1.79E-02	U	1.34E-01	6.01E+00	U	7.57E+00	0	U	5.12E-02	2.08E-01		5.12E-02	1.01E+00		1.13E-01	5.78E-01		6.27E-02	1.04E+00		6.27E-02

Sampling Area	HEIS Number	Sample Date	Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1	J01C52	3/29/2004	6.38E-01		3.3E-01	-1.21E-01	U	6.3E-01	2.56E-01		2.4E-01	1.16E-01	U	3.0E-01	7.68E-01		2.4E-01
Duplicate of J01C52	J01C55	3/29/2004	6.03E-01		3.1E-01	-2.46E-01	U	7.2E-01	6.97E-01		2.3E-01	1.10E-01	U	2.8E-01	5.76E-01		2.3E-01
A2	J01C53	3/29/2004	5.39E-01		2.7E-01	-2.73E-01	U	7.2E-01	3.19E-01		2.2E-01	0	U	2.7E-01	5.51E-01		2.2E-01
A3	J01C54	3/29/2004	1.12E+00		3.4E-01	0	U	6.6E-01	2.78E-01		2.4E-01	3.7E-02	U	2.9E-01	3.71E-01		2.4E-01
Split of J01C52	J01C57	3/29/2004	1.10E+00		1.39E-01	1.28E+01		8.76E+00	6.85E-01		1.06E-01	-2.23E-03	U	9.30E-02	7.54E-01		9.30E-02

Table A-3. Fuel Storage Basin Underlying Soils 0-1' Below Ground Surface (Deep Zone) Cleanup Verification Data. (2 Pages)

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1-1	J018B9	3/22/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
Duplicate of J018B9	J018F5	3/22/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	2.E-02	UC	2.E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02
A1-2	J018C1	3/22/2004	2.0E-01	U	2.0E-01	2.5E+00	U	2.5E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
A2-1	J018C3	3/22/2004	2.2E-01		2.0E-01	1.24E+01		1.9E+00	1.E-02	UC	1.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
A2-2	J018C5	3/22/2004	2.0E-01	U	2.0E-01	2.3E+00	U	2.3E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
A2-3	J018C7	3/22/2004	2.1E-01	U	2.1E-01	1.92E+01		2.4E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
A3-1	J018C9	3/22/2004	2.1E-01	U	2.1E-01	3.48E+01		2.6E+00	1.E-02	UC	1.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
A3-2	J018D1	3/22/2004	2.1E-01	U	2.1E-01	1.64E+01		2.5E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
A4-1	J018D3	3/22/2004	2.1E-01	U	2.1E-01	2.04E+01		2.5E+00	1.E-02	UC	1.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
A4-2	J018D5	3/22/2004	4.4E-01		2.1E-01	8.7E+00		2.0E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
A4-3	J018D7	3/22/2004	9.4E-01		2.0E-01	1.15E+01		2.2E+00	1.E-02	UC	1.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
CR2	J018D9	3/22/2004	2.1E-01	U	2.1E-01	1.40E+01		2.3E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
CR3	J018F1	3/22/2004	2.1E-01	U	2.1E-01	3.43E+01		2.5E+00	1.E-02	UC	1.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
EX3	J018F3	3/22/2004	2.0E-01	U	2.0E-01	2.2E+00	U	2.2E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
Split of J018B9	J01BC6	3/22/2004	3.50E-01	U	3.50E-01	1.3E+00		5.0E-01	3.4E-02	U	3.4E-02	6.4E-03	U	6.4E-03	7.1E-03	U	7.1E-03				7.6E-03	U	7.6E-03	9.6E-03	U	9.6E-03

Sampling Area	HEIS Number	Sample Date	Aroclor-1254			Aroclor-1260			Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			mg/kg	Q	PQL	mg/kg	Q	PQL	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1-1	J018B9	3/22/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	2.3E-02	U	1.8E-01	1.20E+00	UJ	4.7E+00	9.1E-02	U	9.1E-02	8.5E-02	U	8.5E-02	1.9E-01	U	1.9E-01	2.8E-01	U	2.8E-01
Duplicate of J018B9	J018F5	3/22/2004	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	2.7E-02	U	2.0E-01	1.07E+00	UJ	4.9E+00	7.7E-02	U	7.7E-02	7.4E-02	U	7.4E-02	1.7E-01	U	1.7E-01	3.0E-01	U	3.0E-01
A1-2	J018C1	3/22/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.93E-01	U	2.5E-01	-7.8E-02	UJ	5.7E+00	9.9E-02		6.1E-02	5.4E-02	U	5.4E-02	1.1E-01	U	1.1E-01	1.4E-01	U	1.4E-01
A2-1	J018C3	3/22/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	5.11E-01		2.0E-01	1.01E+00	UJ	6.2E+00	4.28E+00		1.0E-01	1.79E-01		6.3E-02	1.25E+00		2.2E-01	2.22E-01		1.9E-01
A2-2	J018C5	3/22/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.37E-01	U	1.7E-01	-9.87E-01	UJ	5.6E+00	1.27E+00		9.1E-02	2.10E-01		7.7E-02	2.5E-01	U	2.5E-01	2.3E-01	U	2.3E-01
A2-3	J018C7	3/22/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	0	U	1.7E-01	6.69E-01	UJ	6.2E+00	3.56E-01		6.6E-02	6.3E-02	U	6.3E-02	2.0E-01	U	2.0E-01	2.0E-01	U	2.0E-01
A3-1	J018C9	3/22/2004	1.4E-02	J	1.4E-02	1.4E-02	UJ	1.4E-02	8.4E-02	U	1.6E-01	1.95E+00	UJ	6.0E+00	2.24E+00		1.4E-01	1.8E-01	U	1.8E-01	1.04E+00		2.7E-01	3.2E-01	U	3.2E-01
A3-2	J018D1	3/22/2004	2.4E-02	J	1.4E-02	1.4E-02	UJ	1.4E-02	2.09E-01		1.8E-01	2.04E+00	UJ	6.0E+00	2.90E+01		1.2E-01	1.00E-01		5.0E-02	8.69E-01		4.5E-01	2.18E-01		1.6E-01
A4-1	J018D3	3/22/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	2.6E-02	U	2.0E-01	5.54E-01	UJ	5.1E+00	6.59E-01		7.9E-02	7.8E-02	U	7.8E-02	1.64E-01	U	1.9E-01	2.3E-01	U	2.3E-01
A4-2	J018D5	3/22/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	7.65E-01		2.0E-01	3.34E+00	UJ	5.6E+00	1.60E+01		1.5E-01	3.74E-01		5.8E-02	5.30E+00		5.4E-01	3.9E-01	U	3.9E-01
A4-3	J018D7	3/22/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	4.27E-01		2.2E-01	2.54E+01	J	5.3E+00	9.82E+00		2.2E-01	2.80E-01		1.2E-01	6.42E+00		4.0E-01	8.93E-01		3.2E-01
CR2	J018D9	3/22/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	2.97E-01		2.3E-01	4.90E+00	UJ	5.5E+00	3.26E+00		1.0E-01	2.13E-01		5.2E-02	5.17E+00		2.0E-01	6.60E-01		2.2E-01
CR3	J018F1	3/22/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	2.4E-02	U	1.8E-01	3.16E-01	UJ	5.8E+00	4.87E-01		7.6E-02	7.4E-02	U	7.4E-02	2.0E-01	U	2.0E-01	2.4E-01	U	2.4E-01
EX3	J018F3	3/22/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	-4.7E-02	U	1.8E-01	4.61E-01	UJ	4.9E+00	1.40E-01		6.0E-02	6.7E-02	U	6.7E-02	1.8E-01	U	1.8E-01	1.6E-01	U	1.6E-01
Split of J018B9	J01BC6	3/22/2004	8.0E-03	U	8.0E-03	7.6E-03	U	7.6E-03	1.53E-02	U	7.09E-02	1.85E-01	U	3.12E-01	5.84E-03	U	1.85E-02	-1.90E-03	U	1.82E-02	-1.67E-02	U	4.14E-02	-1.07E-02	U	6.12E-02

Table A-3. Fuel Storage Basin Underlying Soils 0-1' Below Ground Surface (Deep Zone) Cleanup Verification Data. (2 Pages)

Sampling Area	HEIS Number	Sample Date	Europium-155			Neptunium-237			Nickel-63			Plutonium-238			Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1-1	J018B9	3/22/2004	2.8E-01	U	2.8E-01	9.E-03	UJ	8.5E-02	4.86E+00		4.7E+00	4.E-03	U	3.0E-02	4.E-03	U	3.0E-02	1.2E-02	U	2.0E-01	7.52E-01	J	2.7E-01	1.07E-01	U	2.7E-01
Duplicate of J018B9	J018F5	3/22/2004	1.8E-01	U	1.8E-01	1.4E-02	UJ	6.8E-02	-7.21E-01	U	4.7E+00	0	U	2.2E-01	0	U	2.2E-01	9.1E-02	U	2.4E-01	8.48E-01	J	6.7E-02	6.60E-01		2.2E-01
A1-2	J018C1	3/22/2004	9.4E-02	U	9.4E-02	1.1E-02	UJ	4.3E-02	2.32E+00	U	4.6E+00	0	U	2.1E-01	8.3E-02	U	2.1E-01	1.22E-01	U	2.0E-01	4.17E-01	J	2.9E-01	1.51E-01	U	2.9E-01
A2-1	J018C3	3/22/2004	2.2E-01	U	2.2E-01	1.9E-02	UJ	4.9E-02	2.17E+01		4.5E+00	6.1E-02	U	2.3E-01	1.65E+00		2.3E-01	1.26E+01		2.0E-01	4.52E-01	J	2.5E-01	6.13E-01		2.5E-01
A2-2	J018C5	3/22/2004	1.9E-01	U	1.9E-01	4.8E-02	J	1.6E-02	5.17E+00		4.5E+00	2.7E-02	U	2.1E-01	3.78E-01		2.1E-01	3.08E+00		1.8E-01	4.88E-01	J	2.9E-01	6.00E-01		2.9E-01
A2-3	J018C7	3/22/2004	1.5E-01	U	1.5E-01	1.4E-02	UJ	6.6E-02	1.27E+00	U	4.6E+00	0	U	2.2E-01	2.9E-02	U	2.2E-01	1.27E-01	U	2.1E-01	4.50E-01	J	2.9E-01	2.25E-01	U	2.9E-01
A3-1	J018C9	3/22/2004	2.5E-01	U	2.5E-01	2.9E-02	J	2.8E-02	1.33E+01		4.7E+00	2.7E-02	U	2.1E-01	3.82E-01		2.1E-01	1.85E+00		1.9E-01	8.94E-01	J	3.1E-01	6.49E-01		3.1E-01
A3-2	J018D1	3/22/2004	2.9E-01	U	2.9E-01	2.1E-02	UJ	4.1E-02	8.34E+00		4.6E+00	2.6E-02	U	2.0E-01	4.38E-01		2.0E-01	3.49E+00		2.2E-01	8.99E-01	J	2.9E-01	4.12E-01		2.9E-01
A4-1	J018D3	3/22/2004	1.9E-01	U	1.9E-01	2.3E-02	UJ	7.3E-02	5.69E+00		4.8E+00	0	U	2.1E-01	1.66E-01	U	2.1E-01	8.68E-01		2.2E-01	5.71E-01	J	2.9E-01	6.46E-01		2.9E-01
A4-2	J018D5	3/22/2004	3.9E-01	U	3.9E-01	4.2E-02	UJ	5.3E-02	5.75E+01		4.7E+00	5.2E-02	U	2.0E-01	1.64E+00		2.0E-01	8.90E+00		2.1E-01	5.54E-01	J	3.3E-01	1.06E+00		3.3E-01
A4-3	J018D7	3/22/2004	4.0E-01	U	4.0E-01	1.4E-02	UJ	5.3E-02	4.19E+01		4.6E+00	9.1E-02	U	2.3E-01	9.74E-01		2.3E-01	5.90E+00		2.3E-01	8.46E-01	J	3.2E-01	3.38E-01	U	3.2E-01
CR2	J018D9	3/22/2004	2.0E-01	U	2.0E-01	2.9E-02	J	2.1E-02	2.50E+01		4.6E+00	0	U	2.2E-01	4.00E-01		2.2E-01	6.29E-01		2.2E-01	9.49E-01	J	4.0E-01	5.79E-01		4.0E-01
CR3	J018F1	3/22/2004	1.6E-01	U	1.6E-01	8.E-03	UJ	6.3E-02	1.89E-01	U	4.5E+00	0	U	2.2E-01	1.14E-01	U	2.2E-01	5.52E-01		2.2E-01	7.18E-01	J	2.9E-01	3.40E-01		2.9E-01
EX3	J018F3	3/22/2004	1.5E-01	U	1.5E-01	0	UJ	7.3E-02	1.86E+00	U	4.6E+00	0	U	2.1E-01	0	U	2.1E-01	2.71E-01		2.4E-01	6.58E-01	J	3.0E-01	7.34E-01		3.0E-01
Split of J018B9	J01BC6	3/22/2004	3.70E-02	U	4.10E-02	-4.12E-03	U	9.86E-02	1.86E+00	U	6.13E+00	0.00E+00	U	1.20E-01	7.55E-02	U	2.33E-01	-1.41E-02	U	1.37E-01	6.75E-01		9.57E-02	4.82E-01		9.00E-02

Sampling Area	HEIS Number	Sample Date	Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1-1	J018B9	3/22/2004	4.29E-01	J	2.7E-01	5.0E-02	U	2.5E-01	4.50E-01		3.6E-02	2.0E-02	U	3.0E-02	4.20E-01		2.5E-02
Duplicate of J018B9	J018F5	3/22/2004	6.73E-01	J	5.3E-02	1.37E-01	U	4.9E-01	5.27E-01		3.0E-02	4.2E-02		2.9E-02	5.11E-01		3.0E-02
A1-2	J018C1	3/22/2004	5.30E-01	J	2.9E-01	9.0E-02	U	2.3E-01	4.86E-01		2.8E-02	9.E-03	U	3.4E-02	4.20E-01		2.8E-02
A2-1	J018C3	3/22/2004	5.48E-01	J	2.5E-01	2.47E-01		2.3E-01	4.59E-01		3.2E-02	2.8E-02		2.7E-02	5.57E-01		2.2E-02
A2-2	J018C5	3/22/2004	6.00E-01	J	2.9E-01	-4.3E-02	U	2.1E-01	5.20E-01		2.8E-02	2.2E-02	U	3.4E-02	5.53E-01		2.8E-02
A2-3	J018C7	3/22/2004	6.37E-01	J	2.9E-01	1.4E-02	U	5.2E-01	4.57E-01		3.6E-02	3.2E-02		3.0E-02	4.86E-01		3.1E-02
A3-1	J018C9	3/22/2004	3.65E-01	J	3.1E-01	-1.40E-01	U	5.1E-01	4.91E-01		3.0E-02	3.4E-02		2.9E-02	4.67E-01		3.0E-02
A3-2	J018D1	3/22/2004	4.49E-01	J	2.9E-01	-8.1E-02	U	5.7E-01	5.02E-01		4.1E-02	2.7E-02	U	3.4E-02	4.16E-01		3.6E-02
A4-1	J018D3	3/22/2004	8.37E-01	J	2.9E-01	-7.5E-02	U	5.2E-01	5.29E-01		3.9E-02	4.7E-02		3.3E-02	4.90E-01		2.7E-02
A4-2	J018D5	3/22/2004	5.95E-01	J	3.3E-01	2.20E-01	U	5.0E-01	6.65E-01		3.0E-02	3.4E-02		2.9E-02	6.65E-01		2.4E-02
A4-3	J018D7	3/22/2004	7.19E-01	J	3.2E-01	-1.24E-01	U	5.1E-01	4.92E-01		2.5E-02	2.0E-02	U	3.0E-02	5.11E-01		2.5E-02
CR2	J018D9	3/22/2004	1.16E+00	J	4.0E-01	-1.35E-01	U	5.6E-01	5.74E-01		2.6E-02	1.7E-02	U	3.2E-02	5.78E-01		2.6E-02
CR3	J018F1	3/22/2004	7.55E-01	J	2.9E-01	-2.7E-02	U	4.9E-01	5.36E-01		3.2E-02	2.4E-02	U	3.1E-02	5.73E-01		3.2E-02
EX3	J018F3	3/22/2004	9.28E-01	J	3.0E-01	8.6E-02	U	5.2E-01	5.41E-01		3.3E-02	3.8E-02		3.2E-02	4.96E-01		3.3E-02
Split of J018B9	J01BC6	3/22/2004	6.04E-01		8.68E-02	9.40E-02		3.18E-02	3.94E-01		1.05E-01	1.58E-02	U	7.32E-02	3.80E-01		9.21E-02

Table A-4. Fuel Storage Basin Underlying Soils 8-10' Below Ground Surface (Deep Zone) Cleanup Verification Data. (2 Pages)

Sampling	HEIS	Sample	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248		
Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1-1	J018C0	3/24/2004	2.0E-01	U	2.0E-01	2.5E+00	U	2.5E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
Duplicate of J018C0	J018F6	3/24/2004	2.1E-01	U	2.1E-01	2.3E+00	U	2.3E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
A1-2	J018C2	3/24/2004	2.1E-01	U	2.1E-01	2.6E+00	U	2.6E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
A2-1	J018C4	3/25/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A2-2	J018C6	3/25/2004	2.1E-01	U	2.1E-01	2.5E+00	U	2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A2-3	J018C8	3/25/2004	2.1E-01	U	2.1E-01	2.5E+00	U	2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A3-1	J018D0	3/25/2004	2.1E-01	U	2.1E-01	2.5E+00	U	2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A3-2	J018D2	3/25/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A4-1	J018D4	3/25/2004	2.1E-01	U	2.1E-01	2.5E+00	U	2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A4-2	J018D6	3/25/2004	2.1E-01	U	2.1E-01	2.5E+00	U	2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
A4-3	J018D8	3/25/2004	2.1E-01	U	2.1E-01	2.3E+00	U	2.3E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
CR2	J018F0	3/25/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
CR3	J018F2	3/25/2004	2.0E-01	U	2.0E-01	2.9E+00		2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
EX3	J018F4	3/24/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
Split of J018C0	J01BC7	3/24/2004	3.50E-01	U	3.50E-01	1.7E+00		5.1E-01	3.4E-02	U	3.4E-02	6.5E-03	U	6.5E-03	7.2E-03	U	7.2E-03	8.3E-03	U	8.3E-03	7.7E-03	U	7.7E-03	9.8E-03	U	9.8E-03

Sampling	HEIS	Sample	Aroclor-1254			Aroclor-1260			Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154		
Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1-1	J018C0	3/24/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	0	U	1.8E-01	5.88E-01	UJ	6.2E+00	4.5E-02	U	4.5E-02	4.3E-02	U	4.3E-02	1.1E-01	U	1.1E-01	1.8E-01	U	1.8E-01
Duplicate of J018C0	J018F6	3/24/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.20E-01	U	2.3E-01	6.73E-01	UJ	5.5E+00	5.6E-02	U	5.6E-02	6.6E-02	U	6.6E-02	1.5E-01	U	1.5E-01	1.8E-01	U	1.8E-01
A1-2	J018C2	3/24/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	4.8E-02	U	1.8E-01	-3.20E-01	UJ	5.9E+00	4.9E-02	U	4.9E-02	5.7E-02	U	5.7E-02	1.3E-01	U	1.3E-01	1.9E-01	U	1.9E-01
A2-1	J018C4	3/25/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	6.5E-02	U	2.5E-01	2.05E+00	U	4.9E+00	3.0E-02	U	3.0E-02	2.6E-02	U	2.6E-02	6.6E-02	U	6.6E-02	9.4E-02	U	9.4E-02
A2-2	J018C6	3/25/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	6.3E-02	U	2.4E-01	3.00E+00	U	5.6E+00	1.75E-01		2.3E-02	2.2E-02	U	2.2E-02	6.5E-02	U	6.5E-02	6.6E-02	U	6.6E-02
A2-3	J018C8	3/25/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.43E-01	U	2.7E-01	6.43E-01	U	5.2E+00	9.5E-02	U	9.5E-02	1.1E-01	U	1.1E-01	2.1E-01	U	2.1E-01	3.1E-01	U	3.1E-01
A3-1	J018D0	3/25/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	3.6E-02	U	2.8E-01	-1.61E+00	U	4.7E+00	1.6E-01	U	1.6E-01	5.7E-02	U	5.7E-02	1.3E-01	U	1.3E-01	1.6E-01	U	1.6E-01
A3-2	J018D2	3/25/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	7.9E-02	U	3.0E-01	1.25E+00	U	4.8E+00	1.65E-01		7.6E-02	7.0E-02	U	7.0E-02	1.7E-01	U	1.7E-01	2.4E-01	U	2.4E-01
A4-1	J018D4	3/25/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	6.5E-02	U	2.5E-01	-5.80E-01	U	6.0E+00	3.87E-01		7.2E-02	7.7E-02	U	7.7E-02	2.1E-01	U	2.1E-01	2.1E-01	U	2.1E-01
A4-2	J018D6	3/25/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	0	U	2.4E-01	1.62E+00	U	5.6E+00	4.22E-01		1.0E-01	8.2E-02	U	8.2E-02	2.3E-01	U	2.3E-01	2.9E-01	U	2.9E-01
A4-3	J018D8	3/25/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	0	U	2.9E-01	1.96E+00	U	4.7E+00	4.7E-02	U	4.7E-02	5.8E-02	U	5.8E-02	1.1E-01	U	1.1E-01	1.6E-01	U	1.6E-01
CR2	J018F0	3/25/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.00E-01	U	2.5E-01	8.77E-01	U	5.3E+00	6.8E-02		6.8E-02	7.6E-02	U	7.6E-02	1.7E-01	U	1.7E-01	2.4E-01	U	2.4E-01
CR3	J018F2	3/25/2004	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	-3.3E-02	U	2.5E-01	2.45E+00	U	5.9E+00	1.19E+00		9.6E-02	9.7E-02	U	9.7E-02	3.8E-01	U	3.8E-01	3.6E-01	U	3.6E-01
EX3	J018F4	3/24/2004	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	-2.5E-02	U	1.9E-01	1.76E+00	UJ	5.0E+00	7.7E-02	U	7.7E-02	8.7E-02	U	8.7E-02	1.7E-01	U	1.7E-01	2.5E-01	U	2.5E-01
Split of J018C0	J01BC7	3/24/2004	8.1E-03	U	8.1E-03	7.7E-03	U	7.7E-03	-3.17E-03	U	7.58E-02	8.11E-02	U	3.12E-01	-3.59E-03	U	1.41E-02	1.23E-03	U	1.60E-02	-2.29E-02	U	3.59E-02	-2.47E-02	U	4.65E-02

Table A-4. Fuel Storage Basin Underlying Soils 8-10' Below Ground Surface (Deep Zone) Cleanup Verification Data. (2 Pages)

Sampling	HEIS	Sample	Europium-155			Neptunium-237			Nickel-63			Plutonium-238			Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230		
Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1-1	J018C0	3/24/2004	8.9E-02	U	8.9E-02	0	UJ	4.0E-02	3.62E+00	U	4.6E+00	0	U	2.1E-01	0	U	2.1E-01	-2.7E-02	U	1.9E-01	3.40E-01	J	2.9E-01	3.78E-01		2.9E-01
Duplicate of J018C0	J018F6	3/24/2004	1.5E-01	U	1.5E-01	2.1E-02	UJ	5.4E-02	1.00E+00	U	4.5E+00	0	U	2.6E-01	0	U	2.6E-01	-1.5E-02	U	2.4E-01	4.23E-01	J	9.0E-02	5.03E-01		1.9E-01
A1-2	J018C2	3/24/2004	1.3E-01	U	1.3E-01	-6.E-03	UJ	6.1E-02	3.56E+00	U	4.6E+00	0	U	2.2E-01	0	U	2.2E-01	-5.0E-02	U	2.1E-01	2.33E-01	UJ	3.0E-01	8.13E-01		3.0E-01
A2-1	J018C4	3/25/2004	6.3E-02	U	6.3E-02	-5.E-03	U	5.2E-02	1.77E+00	U	4.9E+00	0	U	3.2E-01	0	U	3.2E-01	-3.4E-02	U	2.4E-01	3.92E-01		2.7E-01	4.27E-01		2.7E-01
A2-2	J018C6	3/25/2004	5.5E-02	U	5.5E-02	0	U	5.7E-02	-5.37E-01	U	5.1E+00	0	U	2.4E-01	9.6E-02	U	2.4E-01	9.2E-02	U	2.1E-01	2.76E-01	U	4.2E-01	2.20E-01	U	4.2E-01
A2-3	J018C8	3/25/2004	1.9E-01	U	1.9E-01	5.E-03	U	5.2E-02	7.48E-01	U	5.0E+00	3.4E-02	U	2.6E-01	3.4E-02	U	2.6E-01	-7.8E-02	U	2.3E-01	3.23E-01	U	6.2E-01	3.23E-01	U	6.2E-01
A3-1	J018D0	3/25/2004	1.0E-01	U	1.0E-01	1.4E-02	U	5.2E-02	1.62E+00	U	5.4E+00	0	U	2.3E-01	3.0E-02	U	2.3E-01	1.63E-01	U	2.0E-01	4.91E-01		3.4E-01	8.92E-01		3.4E-01
A3-2	J018D2	3/25/2004	1.7E-01	U	1.7E-01	0	U	6.4E-02	-1.09E+00	U	5.2E+00	3.6E-02	U	2.8E-01	7.2E-02	U	2.8E-01	1.07E-01	U	2.4E-01	4.39E-01		3.1E-01	3.98E-01		3.0E-01
A4-1	J018D4	3/25/2004	1.8E-01	U	1.8E-01	7.E-03	U	2.0E-02	2.61E+00	U	5.3E+00	3.6E-02	U	2.8E-01	1.82E-01	U	2.8E-01	5.70E-01		2.0E-01	5.07E-01		3.0E-01	6.62E-01		3.0E-01
A4-2	J018D6	3/25/2004	1.9E-01	U	1.9E-01	-5.E-03	U	4.9E-02	-1.11E+00	U	5.3E+00	0	U	2.6E-01	0	U	2.6E-01	-5.0E-02	U	2.6E-01	3.60E-01		3.1E-01	2.79E-01	U	3.1E-01
A4-3	J018D8	3/25/2004	1.1E-01	U	1.1E-01	2.7E-02	U	6.5E-02	-9.62E-01	U	4.9E+00	0	U	2.9E-01	0	U	2.9E-01	4.7E-02	U	2.3E-01	4.50E-01		2.9E-01	1.12E-01	U	2.9E-01
CR2	J018F0	3/25/2004	1.5E-01	U	1.5E-01	3.3E-02		2.5E-02	1.71E+00	U	5.2E+00	0	U	2.6E-01	0	U	2.6E-01	-3.2E-02	U	2.5E-01	5.91E-01		3.0E-01	5.11E-01		3.8E-01
CR3	J018F2	3/25/2004	2.3E-01	U	2.3E-01	-8.E-03	U	7.8E-02	1.45E+01		5.8E+00	0	U	2.8E-01	2.52E-01	U	2.8E-01	7.9E-02	U	2.3E-01	5.86E-01		3.2E-01	5.85E-01		3.2E-01
EX3	J018F4	3/24/2004	1.6E-01	U	1.6E-01	6.E-03	UJ	5.0E-02	-1.52E+00	U	4.6E+00	0	U	2.1E-01	0	U	2.1E-01	4.E-03	U	2.3E-01	3.96E-01	J	7.8E-02	4.02E-01		2.2E-01
Split of J018C0	J01BC7	3/24/2004	1.82E-02	U	3.75E-02	0.00E+00	U	5.46E-02	1.08E+00	U	6.20E+00	-2.79E-03	U	1.17E-01	2.79E-02	U	7.55E-02	9.09E-02	U	1.50E-01	5.88E-01		8.85E-02	4.12E-01		4.86E-02

Sampling	HEIS	Sample	Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1-1	J018C0	3/24/2004	4.53E-01	J	2.9E-01	1.53E-01	U	5.0E-01	3.28E-01		3.3E-02	2.1E-02	U	3.2E-02	4.50E-01		2.7E-02
Duplicate of J018C0	J018F6	3/24/2004	4.16E-01	J	7.0E-02	2.70E-01	U	5.8E-01	3.52E-01		3.2E-02	2.0E-02	U	3.1E-02	3.82E-01		2.5E-02
A1-2	J018C2	3/24/2004	4.26E-01	J	3.0E-01	3.98E-01	U	4.9E-01	3.62E-01		4.3E-02	2.1E-02	U	3.2E-02	2.96E-01		3.3E-02
A2-1	J018C4	3/25/2004	4.27E-01		2.7E-01	3.74E-01	U	5.0E-01	4.19E-01		2.0E-01	9.5E-02	U	2.4E-01	5.50E-01		2.0E-01
A2-2	J018C6	3/25/2004	3.31E-01	U	4.2E-01	2.7E-02	U	5.2E-01	3.46E-01		2.0E-01	3.2E-02	U	2.5E-01	2.93E-01		2.0E-01
A2-3	J018C8	3/25/2004	8.88E-01		6.2E-01	-7.2E-02	U	4.7E-01	4.31E-01		2.1E-01	6.5E-02	U	2.5E-01	3.23E-01		2.1E-01
A3-1	J018D0	3/25/2004	5.80E-01		3.4E-01	2.13E-01	U	5.2E-01	2.66E-01		2.3E-01	0	U	2.7E-01	4.72E-01		2.3E-01
A3-2	J018D2	3/25/2004	1.99E-01	U	3.0E-01	3.56E-01	U	4.6E-01	3.28E-01		2.1E-01	0	U	2.5E-01	4.38E-01		2.1E-01
A4-1	J018D4	3/25/2004	5.06E-01		3.0E-01	8.2E-02	U	4.6E-01	3.45E-01		2.2E-01	0	U	2.7E-01	4.60E-01		2.2E-01
A4-2	J018D6	3/25/2004	4.0E-02	U	3.1E-01	5.68E-01		4.3E-01	4.29E-01		2.2E-01	3.5E-02	U	2.6E-01	4.57E-01		2.2E-01
A4-3	J018D8	3/25/2004	1.50E-01	U	2.9E-01	1.45E-01	U	4.7E-01	4.28E-01		2.0E-01	3.2E-02	U	2.5E-01	4.55E-01		2.0E-01
CR2	J018F0	3/25/2004	3.14E-01		3.0E-01	2.27E-01	U	4.9E-01	5.89E-01		2.6E-01	4.2E-02	U	3.2E-01	3.81E-01		2.6E-01
CR3	J018F2	3/25/2004	3.76E-01		3.2E-01	1.3E-02	U	5.0E-01	4.88E-01		2.3E-01	3.7E-02	U	2.8E-01	5.18E-01		2.3E-01
EX3	J018F4	3/24/2004	3.39E-01	J	6.8E-02	2.32E-01	U	5.0E-01	3.41E-01		3.2E-02	1.6E-02	U	3.1E-02	3.55E-01		2.6E-02
Split of J018C0	J01BC7	3/24/2004	4.11E-01		7.22E-02	5.68E-02		2.60E-02	4.13E-01		8.27E-02	-1.98E-03	U	8.27E-02	4.73E-01		8.27E-02

APPENDIX B

DATA QUALITY ASSESSMENT

B1.0 DATA QUALITY ASSESSMENT FOR THE 105-H SITE

B1.1 OVERVIEW

This data quality assessment (DQA) was performed to compare the verification sampling approach and resulting analytical data with the sampling and data quality requirements specified by project objectives and performance specifications. The DQA involves the scientific and statistical evaluation of the data to determine if they are of the right type, quality, and quantity to support their intended use (i.e., closeout decisions [EPA 2000]). The DQA completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data quality objectives process.

This DQA was performed in accordance with WCH-EE-01, *Environmental Investigations Procedures.* Specific data quality objectives for the site are found in the *Sampling and Analysis Plan for Interim Closure of the 105-D and 105-H Reactor Below-Grade Structures and Underlying Soils* (hereinafter referred to as the 105-H Reactor SAP) (DOE-RL 2001). The DQA is based on the guidelines presented in *Guidance for Data Quality Assessment* (EPA 2000). Statistical tests used in this DQA were performed as specified in the *100 Area Remedial Action Sampling and Analysis Plan* (DOE-RL 2005a) and the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b).

All of the analytical data are evaluated and a portion validated for compliance with quality assurance (QA) project plan requirements (DOE-RL 2001). Data evaluation is performed to determine if the laboratory carried out all steps required by the 105-H Reactor SAP and the laboratory contract governing the conduct of analysis and reporting of the data. This evaluation also examines the laboratory data to determine if an analyte is present or absent in a sample and the degree of overall uncertainty associated with that determination. Data validation was done in accordance with validation procedures (BHI 2000a, 2000b) as part of data evaluation. The appropriate statistical test is performed on the adjusted raw analytical data (see calculation briefs in Appendix C) to determine statistical values for each contaminant. The number of samples collected for cleanup verification is then evaluated to confirm assumptions concerning contaminant variability.

The DQA for the 105-H site determined that the data are of the right type, quality, and quantity to support site cleanup verification decisions within specified error tolerances. All analytical data were found acceptable for decision-making purposes. The evaluation verified that the sample design was sufficient for the purpose of clean site verification. Additional quality requirements of the QA project plan included data acquisition requirements. The cleanup verification sample analytical data are stored in the Environmental Restoration (ENRE) database until they are archived in the Hanford Environmental Information System (HEIS) and are summarized in Appendix A.

The following subsections describe the DQA results for the 105-H site, including formal data validation, supplementary data evaluation, and field QA/quality control (QC) program results. The statistical evaluation of the data is provided in the calculation brief excerpts included in Appendix C.

B1.1.1 Laboratory Quality Assurance/Quality Control Analysis

All verification samples are subject to laboratory-specific QA requirements, including instrument procurement, maintenance, calibration, and operation. Additional laboratory requirements for internal QC checks are performed as appropriate for the analytical method at a rate of 1 per sample delivery group (SDG), or 1 in 20, whichever is more frequent. Laboratory internal QC checks include the following:

- Laboratory Contamination. Each analytical batch contains a laboratory (method) blank (material of similar composition as the samples with known/minimal contamination of the analytes of interest) carried through the complete analytical process. The method blank is used to evaluate false-positive results in samples due to contamination during handling at the laboratory.

- Analytical Accuracy. For most analyses, a known quantity of representative analytes of interest (matrix spike [MS] and matrix spike duplicate [MSD]) is added to a separate aliquots of a sample from the analytical batch. The recovery percentage of the added MS is used to evaluate analytical accuracy. For analyses not amenable to MS techniques (e.g., gamma energy analysis) or where analytical recovery is corrected via internal standards (e.g., alpha spectral analyses), accuracy is evaluated from recovery of the QC reference sample (e.g., laboratory control spike [LCS] or blank spike [BS] sample).

- Analytical Precision. Separate aliquots removed from the same sample container (duplicate or replicate samples) are analyzed for each analytical batch. The replicate sample results (evaluated by relative percent difference [RPD]) are used to assess analytical precision.

- QC Reference Samples. A QC reference sample is prepared from an independent standard at a concentration other than that used for calibration, but within the calibration range. Reference samples provide an independent check on analytical technique and methodology.

Verification sample laboratories are also subject to periodic and random assessments of the laboratory performance, systems, and overall program. These assessments are performed by the Washington Closure Hanford (WCH) Quality Assurance and Services group to ensure that the laboratories are performing to meet laboratory contract requirements.

B1.2 DATA VALIDATION RESULTS

After sampling, the laboratory data from SDG H2540 were validated to Level C per WCH-EE-01, Procedure 2.5, "Data Package Validation Process." Level C validation procedures are specified in *Data Validation Procedure for Radiochemical Analysis* (BHI 2000a) and *Data Validation Procedure for Chemical Analysis* (BHI 2000b). Validation was performed by Lionville Laboratory Incorporated.

Under the Level C validation procedure, the following items were reviewed, as appropriate, for each analytical method:

- Sample holding times
- Method blanks
- MS recovery
- Surrogate recovery
- Tracer and/or carrier recovery (applies only to radionuclides)
- Sample duplicates or MS/MSD
- Associated LCS results
- Data package completeness
- Achievement of practical quantitation limits (PQLs) as specified in Table 2-2 of the 105-H Reactor SAP (DOE-RL 2001).

Data flagged as estimated (i.e., "J") indicate that the associated concentration is an estimate but that the data may be used for decision-making purposes. Data flagged as below detection limits (i.e., "U") indicate the contaminant was analyzed for but not detected and the concentration is below the minimum detectable activity (MDA) for radionuclides or the PQL (i.e., reporting limit) for nonradionuclides. For nonradionuclides, nondetects are reported as the PQL. For radionuclides, nondetects report the actual value obtained from analysis (positive or negative but less than the MDA) except for limited analyses where no value can be calculated. In these cases, the MDA is reported. This situation is applicable for sample results that are below detection limits. All other validated results are considered accurate within the standard errors associated with the methods.

The adequacy of laboratory QA/QC was evaluated for precision, accuracy, completeness, and target detection limits (TDLs) pursuant to the 105-H Reactor SAP. The data validation reported that, of the data given formal validation, the laboratory met the majority of the standards for performance for precision (±30%), accuracy (±30% or ±20% for analysis by gamma spectroscopy), detection limits, and completeness (>90%).

The DQA noted no major deficiencies. A summary of minor deficiencies noted during validation of SDG H2540 include the following.

B1.2.1 Sample Holding Times

No deficiencies were noted.

B1.2.2 Method Blanks

The PQL and/or TDL requirements identified in Table 2-2 of the 105-H Reactor SAP (DOE-RL 2001) were used to evaluate the method blanks. For radionuclides, the correct term analogous to the nonradionuclide PQL is MDA. Table 2-2 of the 105-H Reactor SAP lists the target analytical PQLs and MDAs under a single PQL column.

No deficiencies were noted.

B1.2.3 Equipment Blanks

No deficiencies were noted.

B1.2.4 Matrix Spike Recovery

All carbon-14 and tritium results from SDG H2540 were qualified as estimated and flagged as "J" due to the lack of an MS analysis.

Detected polychlorinated biphenyl (PCB) results in samples J018C9 and J018D1 were qualified as estimated and flagged "J" due to high MS and MSD recoveries at 220% and 231%, respectively.

Matrix spikes for radionuclides are not typically done by the laboratory. Other accuracy measures, such as blind audit samples, are used to assess laboratory accuracy for radionuclides. High recoveries in the PCB analysis indicate a positive interference in the matrix but do not mean that the analytical system cannot detect these analytes. These issues are minor and do not impact the quality or usability of the cleanup verification data.

B1.2.5 Surrogate Recovery

All of the surrogate recoveries in the PCB analysis were above acceptance criteria. This was also reflected in the MS recoveries discussed in Section B1.2.4. The high bias in the data was recognized, and only detected results were qualified as estimates and flagged “J.” Samples J018C9 and J018D1 had the only PCB detections in SDG 2540 with aroclor-1254 at 0.014 mg/kg and 0.024 mg/kg, respectively.

B1.2.6 Tracer Recovery

No deficiencies were noted.

B1.2.7 Sample Duplicates/Matrix Spike Duplicate

For SDG H2540, due to an RPD of 39%, all thorium-228 results were qualified as estimates and flagged as "J."

For SDG H2540, due to RPDs of 81% and 88% associated with the MSs, all PCB results were qualified as estimates and flagged as "J."

The out-of-limit RPDs are likely due to sample heterogeneity. Heterogeneity of soil samples is well known. Contaminants are not always distributed evenly throughout the sample. It is likely that the individual sample aliquots did not have equivalent amounts of inert material, such as rocks. The out-of-limit RPDs do not affect data quality and usability.

B1.2.8 Associated Batch Laboratory Control Sample Results

All thorium-228 and thorium-232 results from SDG H2540 were qualified as estimated and flagged "J" due to the lack of an LCS analysis.

Other accuracy measures such as blind audit samples against known standards or quantitation by comparison to analogous analytes may be used to access laboratory accuracy.

B1.2.9 Data Package Completeness

SDG H2540 met the completion requirements of the 105-H Reactor SAP (DOE-RL 2001).

B1.2.10 Achievement of Target Detection Limits

The nonradionuclide PQL and radionuclide MDA (listed as PQL in the 105-H Reactor SAP) TDL goals identified in Table 2-2 of the 105-H Reactor SAP (DOE-RL 2001) were used to develop the RDLs submitted to the laboratory by the project.

- For SDG H2540, the MDAs were above the specified target RDLs in 52 instances.

In all cases where the RDLs were not met, the achieved detected limits are below the applicable cleanup criteria. The data are sufficient for making cleanup decisions.

B1.3 DATA EVALUATION

The formal data validation described in the previous section included evaluation of SDG H2540; however, DQA is required for all SDGs. Therefore, supplementary data evaluation was performed on all the SDGs whether validated or unvalidated. The following paragraphs include the results of the data evaluation of all other SDGs.

To ensure adequate data quality, DQA investigators reviewed the study objectives in the 105-H Reactor SAP (DOE-RL 2001) to determine the context for assessing the data. The field data presented in the field logbooks were reviewed as part of the DQA process to verify that the samples were collected in accordance with the verification sample designs. The context for assessing the data includes evaluating the sample data using a comparison of analytical results to the precision, accuracy, representativeness, comparability, and completeness (PARCC) parameters as specified in the 105-H Reactor SAP. This section summarizes the results of the PARCC parameter comparison and presents an evaluation of the affected data.

B1.3.1 Supplemental Data Evaluation

In accordance with Appendix G of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005b), the following evaluations were performed:

- Assessment of detection limits
- Laboratory accuracy and precision via MS, MSD, or duplicates and LCSs
- Contamination during sampling via equipment blanks
- Sampling heterogeneity via field duplicates
- Sampling and laboratory variability via field splits.

The following additional information was evaluated because this information directly affects data quality.

B1.3.2 Sample Holding Times

No deficiencies were noted.

B1.3.3 Method Blanks (MBs)

Samples J01BC6 and J01BC7 in SDG W04286 had a low tracer yield in the associated MB. However, the laboratory reagent blank yield was within criteria. Data quality and usability are not affected.

B1.3.4 Matrix Spike, Tracer, Carrier Recovery

SDG W04286 had low tracer yields in the MB and LCS. The data set was accepted based on tracer yields in the laboratory reagent blank and the matrix LCS that were within criteria. Data quality and usability are not affected.

The MSD in SDG H2542 was not spiked. The MS recovery results were within criteria. This laboratory error does not affect the field sample data quality and usability.

B1.3.5 Sample Duplicates, Matrix Spike/Matrix Spike Duplicate Results

Insufficient sample was available to prepare a sample duplicate in SDG W04286. Alternate methodology for obtaining duplicate results was applied. The main sample was analyzed on two separate analytical systems. The results were within acceptance criteria. Data quality and usability are not affected.

The RPDs between the MS and MSD in SDG H2542 were not evaluated because of a laboratory error in which the MSD was not spiked. The MS recovery results were within criteria. The field sample data quality and usability are not affected.

In SDG H2544 the RPD for thorium-228 was 150%. High RPDs are generally attributed to sample heterogeneity. Heterogeneity in soil samples is well known. It is likely that the individual sample aliquots did not have equivalent amounts of inert material, such as rocks. RPDs that are out of criteria do not affect data quality and usability.

B1.3.6 Associated Batch Laboratory Control Sample Results

The LCS assesses the accuracy of the sample preparation and analysis process in both radiological and nonradiological analyses. Each SDG has one or more LCS associated with it.

SDG W04286 had a low tracer yields in the LCS. The data set was accepted based on the associated matrix LCS tracer yield that is within criteria. Data quality and usability are not affected.

B1.3.7 Data Package Completeness

All data packages were complete.

B1.3.8 Achievement of Target Detection Limits

The nonradionuclide PQL and radionuclide MDA (listed as PQL in the 105-H Reactor SAP) TDL goals identified in Table 2-2 of the 105-H Reactor SAP (DOE-RL 2001) were used to develop the RDLs submitted to the laboratory by the project.

In all cases where the RDLs were not met, the achieved detected limits would allow detections at the applicable cleanup criteria. The data are sufficient for making cleanup decisions.

B1.4 FIELD QUALITY ASSURANCE/QUALITY CONTROL (QA/QC)

Field QA/QC measures were used to assess potential cross-contamination of the collected samples. The QA/QC sample results are used to assess analytical precision and accuracy and contamination. The equipment blank is used to show what contamination, if any, is the result of equipment or procedures used during sample collection. The lack of an equipment blank will not impact the usability of this data set for the intended use.

The field duplicates are used to assess precision and the field splits are used to assess accuracy. Duplicate samples were collected to provide a relative measure of the degree of local heterogeneity in the sampling medium, unlike laboratory duplicates which 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 105-H Reactor SAP (DOE-RL 2001) required a minimum of one field duplicate for every 20 (or less) field samples. As shown in Appendix A, sufficient field duplicates were taken. The duplicates show an expected amount of variability due to heterogeneity.

Based on the validation criteria (BHI 2000a, 2000b) and U.S. Environmental Protection Agency functional guidelines for precision, the data are usable.

B1.5 SUITABILITY OF DATA

Samples taken from around and below the FSB floor were collected in accordance with the *Instruction Guide for Verification Sampling of the 105-D and 105-H Reactor Below-Grade Structures* (BHI 2001a), as documented in the field logbook (BHI 2001b).

The conclusion of the DQA is that the data are of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and SDG completeness were analyzed to determine if any analytical results should be rejected as a result of QA/QC deficiencies. All contaminant of concern analytical data were found acceptable for decision-making purposes, and the raw data are acceptable for calculating the required statistical values.

B2.0 REFERENCES

BHI, 2000a, *Data Validation Procedure for Radiochemical Analysis*, BHI-01433, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2000b, *Data Validation Procedure for Chemical Analysis*, BHI-01435, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001a, *Instruction Guide for Verification Sampling of the 105-D and 105-H Reactor Below-Grade Structures*, 0100X-IG-G0004, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.

BHI, 2001b, *Site Wide Miscellaneous Sampling*, Logbook EL-1516-2, Bechtel Hanford, Inc., Richland, Washington.

DOE-RL, 2001, *Sampling and Analysis Plan for Interim Closure of the 105-D and 105-H Reactor Below-Grade Structures and Underlying Soils*, DOE/RL-2001-18, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2005a, *100 Area Remedial Action Sampling and Analysis Plan*, DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE-RL, 2005b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area*, DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

EPA, 2000, *Guidance for Data Quality Assessment: Practical Methods for Data Analysis,* EPA/600/R-96/084, U.S. Environmental Protection Agency, Office of Research and Development, Washington, D.C.

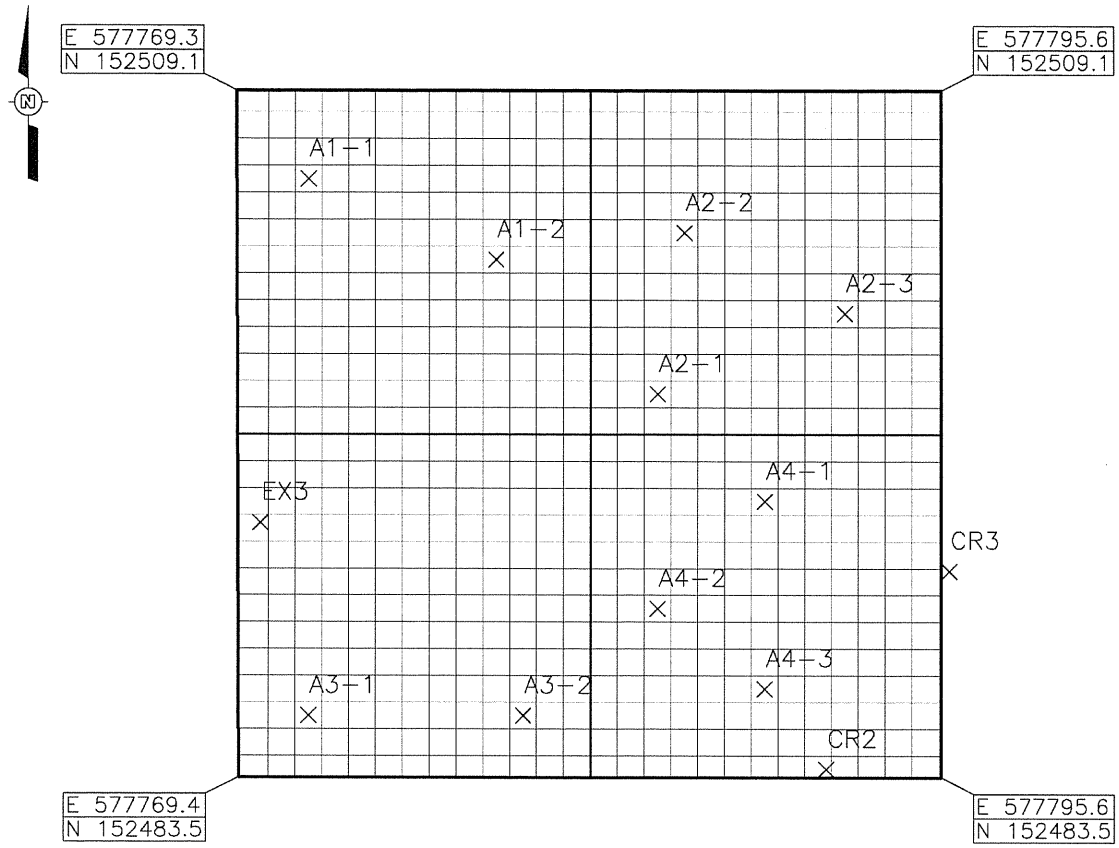
WCH-EE-01, *Environmental Investigations Procedures*, Washington Closure Hanford, Richland, Washington.

APPENDIX C

VERIFICATION SAMPLING DESIGNS, EXCAVATION BOUNDARIES, RESRAD INPUT PARAMETERS, AND CALCULATION BRIEF EXCERPTS

VERIFICATION SAMPLING DESIGNS

Figure C-1. 105-H Fuel Storage Basin Sample Location Design.



SITE PLAN

105-H Fuel Storage Basin	Sample Location	Northing	Easting
	A1-1	152505.80	577772.00
	A1-2	152502.80	577779.00
	A2-1	152497.80	577785.00
	A2-2	152503.80	577786.00
	A2-3	152500.80	577792.00
	A3-1	152485.80	577772.00
	A3-2	152485.80	577780.00
	A4-1	152493.80	577789.00
	A4-2	152489.80	577785.00
	A4-3	152486.80	577789.00
	CR2	152483.80	577791.30
Visible Crack	CR3	152491.20	577795.90
Expansion Joint	EX3	152493.00	577770.20

SCALE 1:250

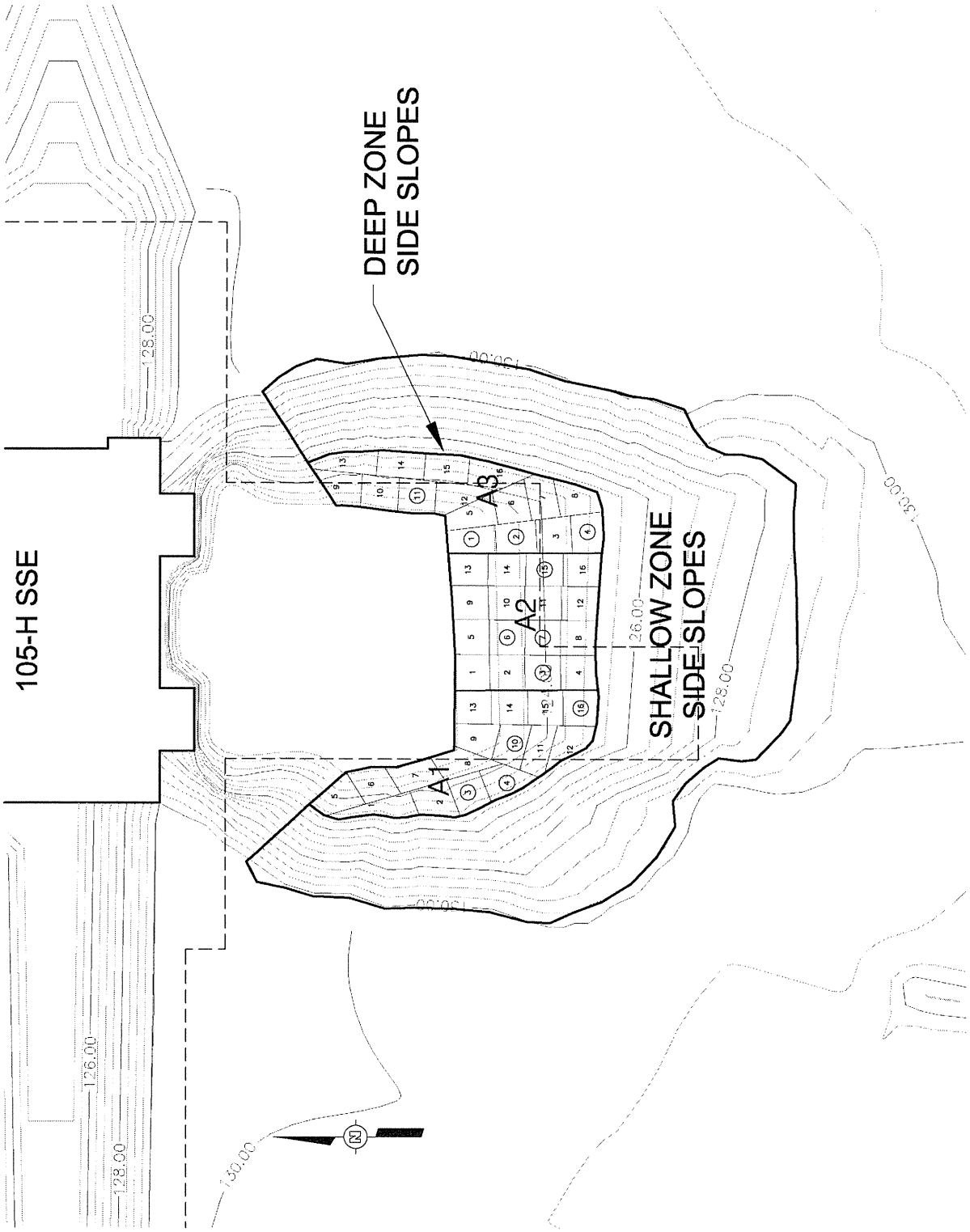
2.5 0 2.5 5 10 meters

105-H FUEL STORAGE BASIN

(SAMPLING PLAN)

G:\100H\030404A.dwg

Figure C-2. Verification Sample Design for Deep Zone Side-Slope Soils.



EXCAVATION BOUNDARIES

Figure C-3. Fuel Storage Basin Excavation Boundaries and Locations of Waste Sites 100-H-11, 100-H-12, and 100-H-14.

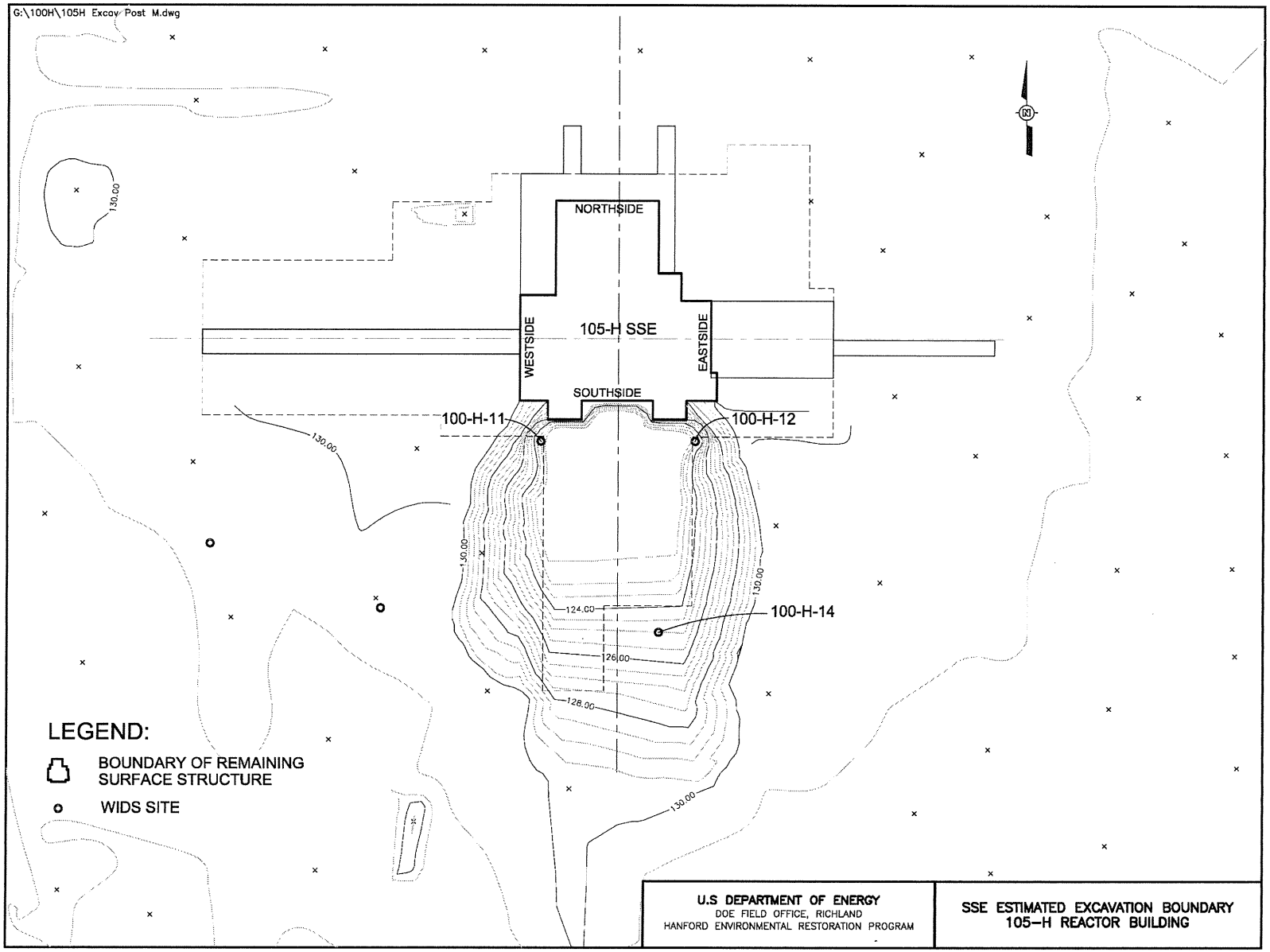


Figure C-4. Location of Waste Sites 100-H-11 and 100-H-12 Within the Fuel Storage Basin Excavation.

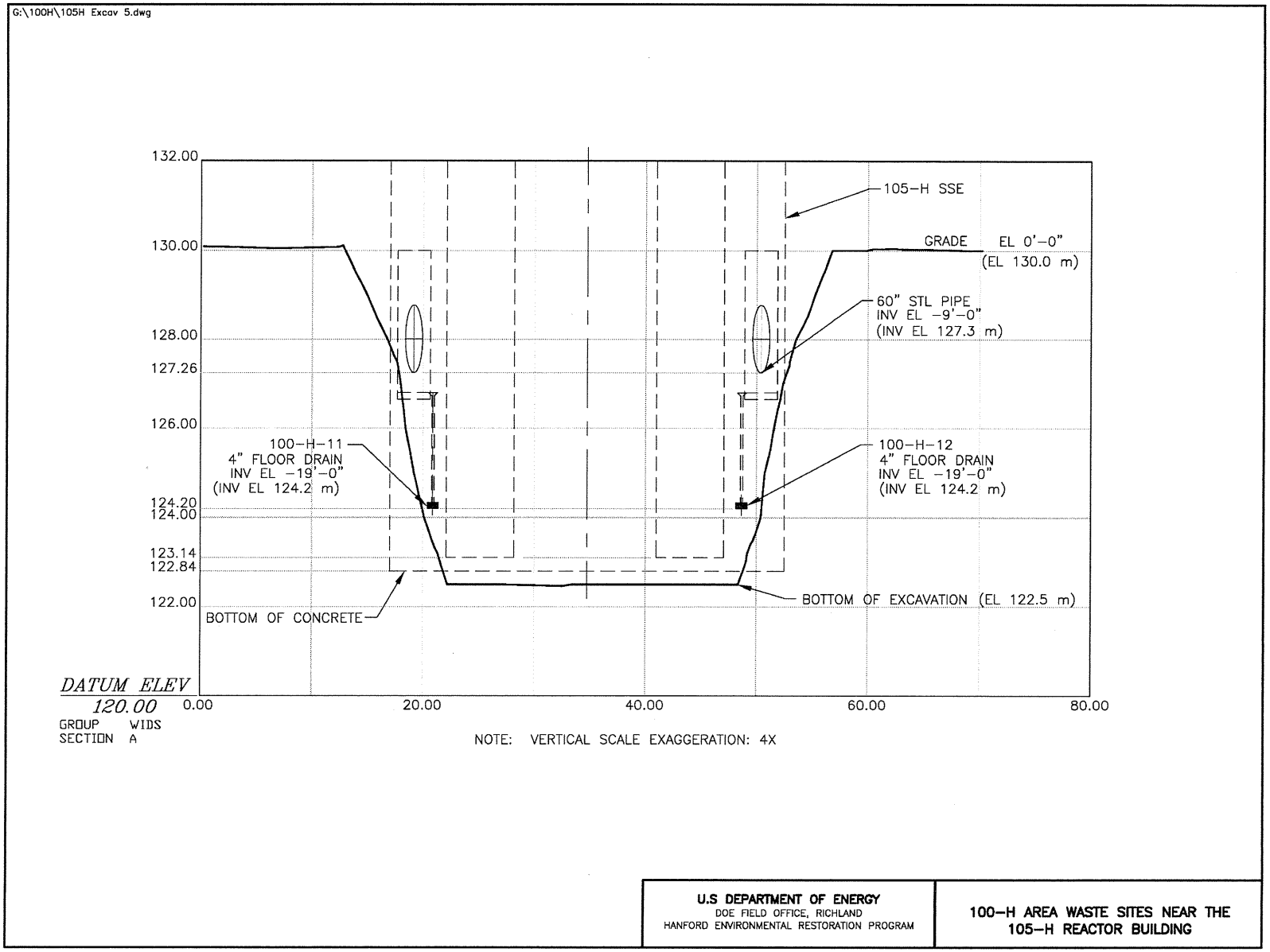


Figure C-5. Location of Waste Sites 100-H-12 and 100-H-14 Within the Fuel Storage Basin Excavation.

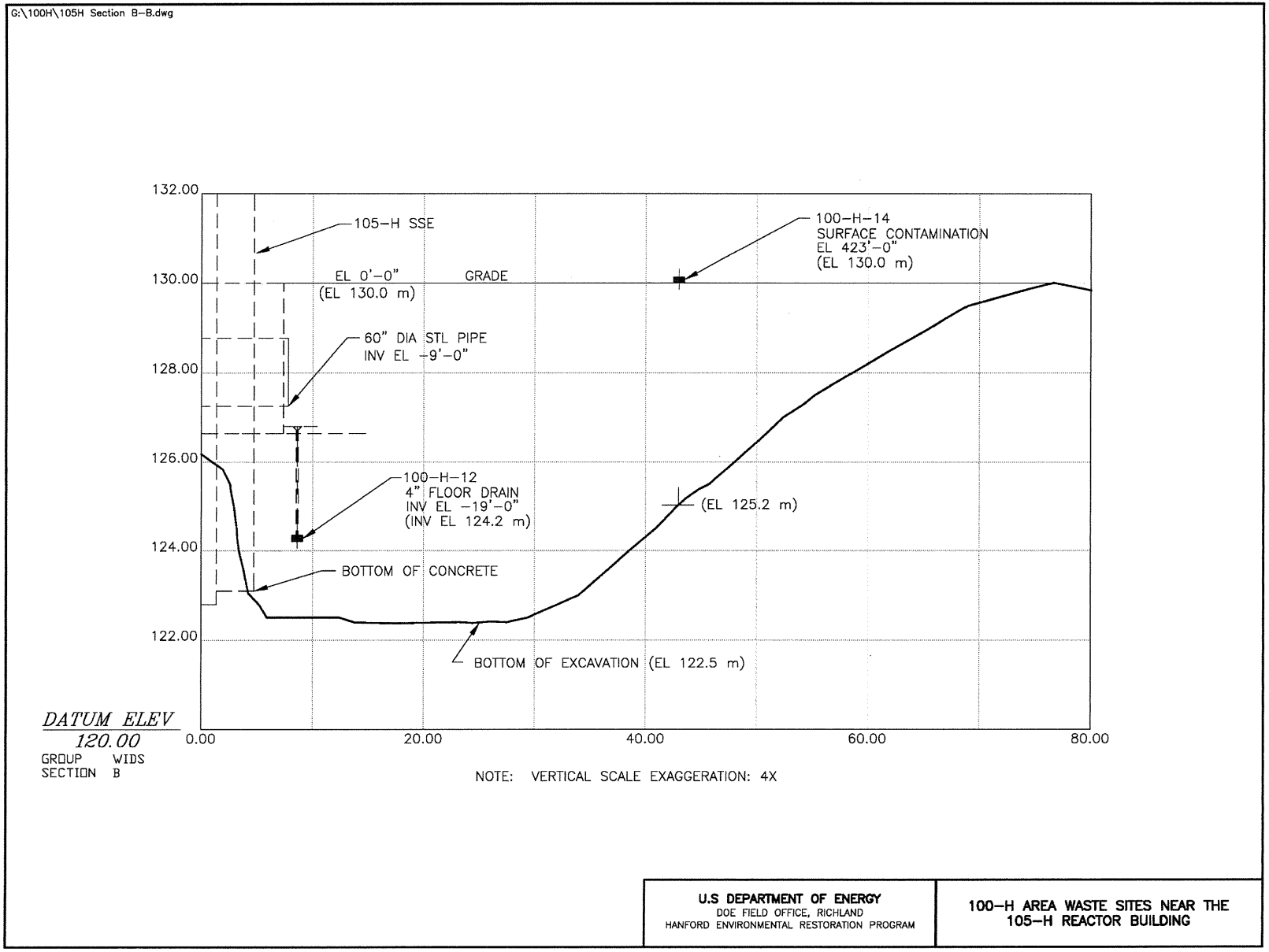


Figure C-6. Excavation Boundaries and Locations of Waste Sites 100-H-9, 100-H-10, 100-H-13, and 100-H-31.

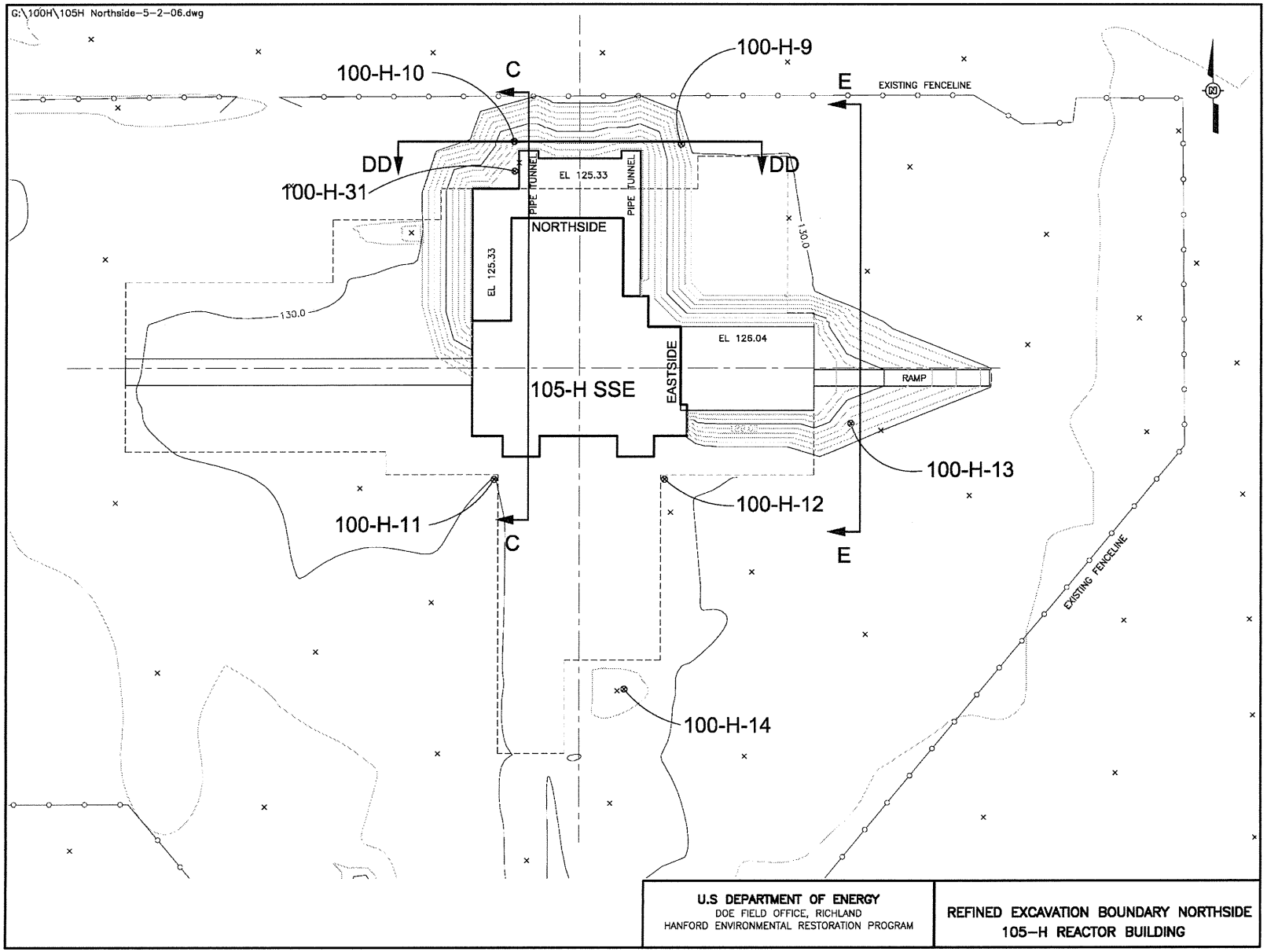


Figure C-7. Location of Waste Sites 100-H-10 and 100-H-31 Within the Excavation Boundaries.

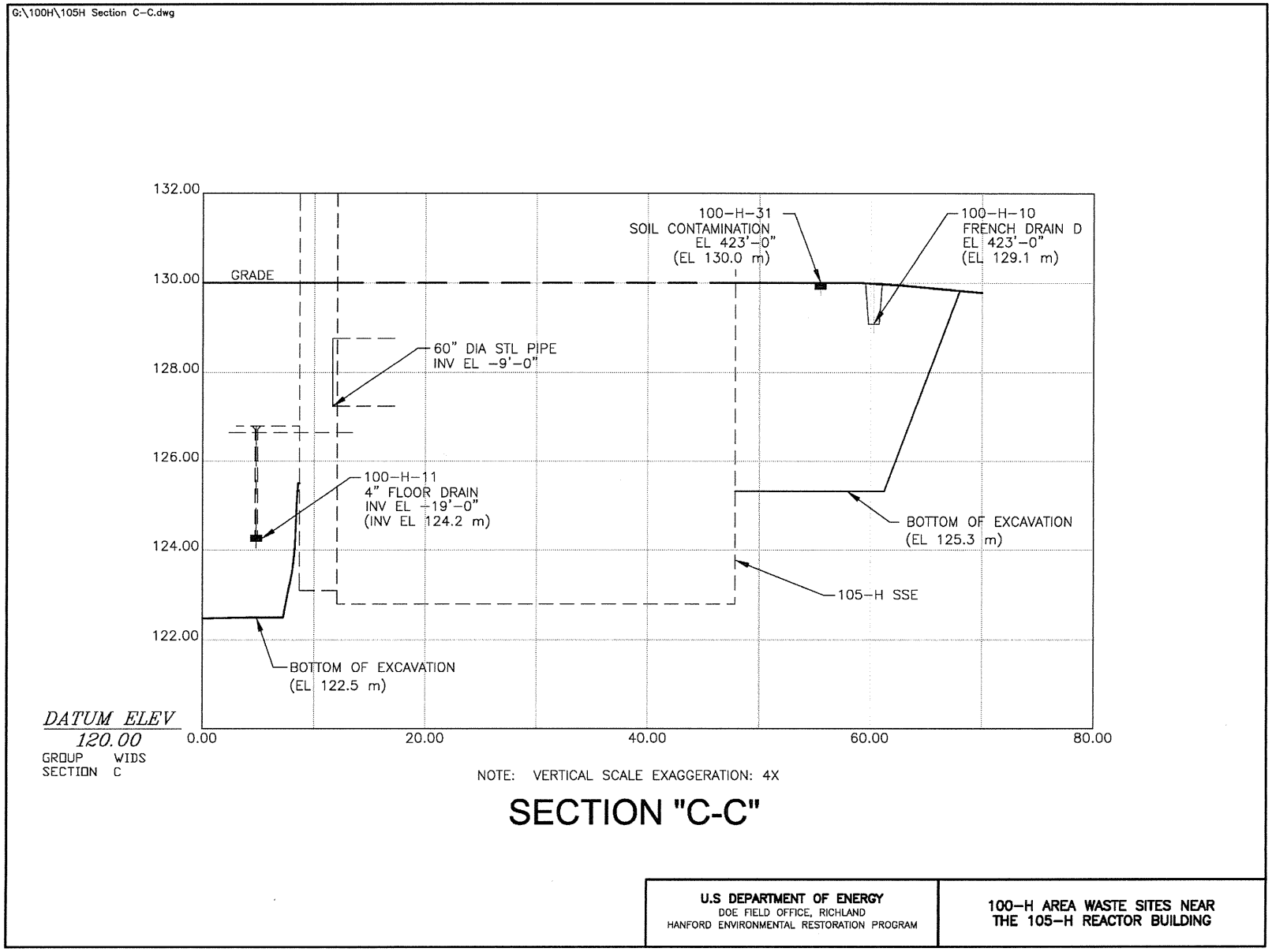


Figure C-8. Location of Waste Sites 100-H-9, 100-H-10, and 100-H-31 Within the Excavation Boundaries.

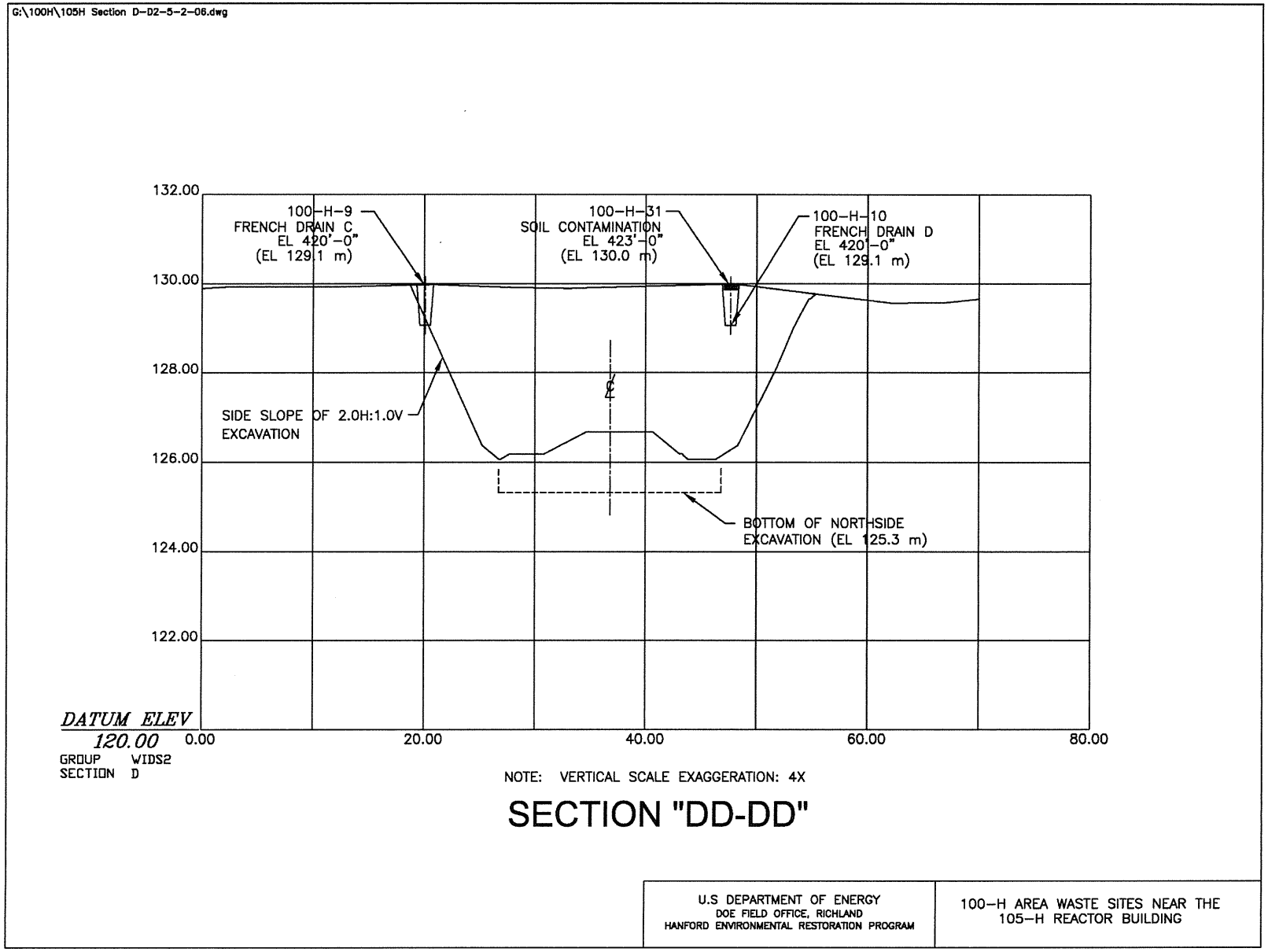
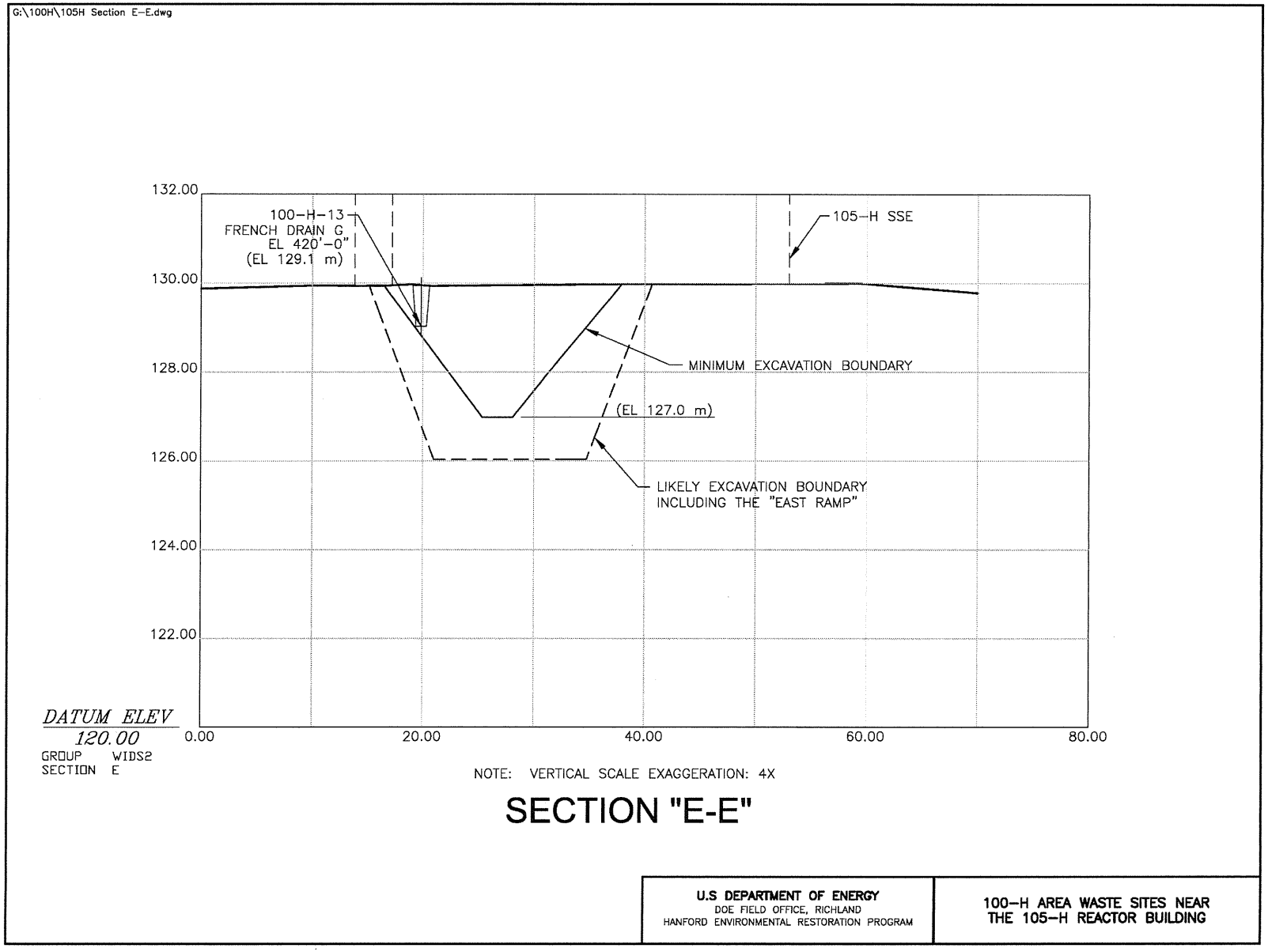


Figure C-9. Location of Waste Site 100-H-13 Within the Excavation Boundaries.



RESRAD INPUT PARAMETERS FOR THE RURAL-RESIDENTIAL SCENARIO

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 1
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Table of Contents
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ

Part I: Mixture Sums and Single Radionuclide Guidelines
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1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 2
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	C-14	2.090E-06	2.090E-06	DCF2(3)
B-1	Co-60	2.190E-04	2.190E-04	DCF2(4)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(5)
B-1	Eu-152	2.210E-04	2.210E-04	DCF2(6)
B-1	Eu-154	2.860E-04	2.860E-04	DCF2(8)
B-1	Gd-152	2.430E-01	2.430E-01	DCF2(9)
B-1	H-3	6.400E-08	6.400E-08	DCF2(10)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(11)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(12)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(13)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(14)
B-1	Pu-238	3.920E-01	3.920E-01	DCF2(15)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(16)
B-1	Pu-240	4.290E-01	4.290E-01	DCF2(17)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(18)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(19)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(20)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(21)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(22)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(23)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(24)
B-1	U-233	1.350E-01	1.350E-01	DCF2(25)
B-1	U-234	1.320E-01	1.320E-01	DCF2(26)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(27)
B-1	U-236	1.250E-01	1.250E-01	DCF2(28)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(29)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	C-14	2.090E-06	2.090E-06	DCF3(3)
D-1	Co-60	2.690E-05	2.690E-05	DCF3(4)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(5)
D-1	Eu-152	6.480E-06	6.480E-06	DCF3(6)
D-1	Eu-154	9.550E-06	9.550E-06	DCF3(8)
D-1	Gd-152	1.610E-04	1.610E-04	DCF3(9)
D-1	H-3	6.400E-08	6.400E-08	DCF3(10)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(11)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(12)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(13)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(14)
D-1	Pu-238	3.200E-03	3.200E-03	DCF3(15)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(16)
D-1	Pu-240	3.540E-03	3.540E-03	DCF3(17)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(18)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(19)
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(20)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 3
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(21)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(22)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(23)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(24)
D-1	U-233	2.890E-04	2.890E-04	DCF3(25)
D-1	U-234	2.830E-04	2.830E-04	DCF3(26)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(27)
D-1	U-236	2.690E-04	2.690E-04	DCF3(28)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(29)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				
D-34	C-14 , plant/soil concentration ratio, dimensionless	5.500E+00	5.500E+00	RTF(3,1)
D-34	C-14 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.100E-02	3.100E-02	RTF(3,2)
D-34	C-14 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.200E-02	1.200E-02	RTF(3,3)
D-34				
D-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(4,1)
D-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(4,2)
D-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(4,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(5,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(5,3)
D-34				
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(6,2)
D-34	Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(6,3)
D-34				
D-34	Eu-154 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	Eu-154 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(8,2)
D-34	Eu-154 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(8,3)
D-34				
D-34	Gd-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(9,2)
D-34	Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(9,3)
D-34				
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(10,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(10,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(10,3)
D-34				
D-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(11,1)
D-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(11,2)
D-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(11,3)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 4
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(12,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(12,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(12,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(13,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(13,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(13,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(14,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(14,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(14,3)
D-34				
D-34	Pu-238 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(15,1)
D-34	Pu-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
D-34	Pu-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(15,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(16,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(16,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(16,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(17,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(17,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(17,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(18,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(18,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(18,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(19,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(19,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(19,3)
D-34				
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(20,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(20,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(20,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(21,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(21,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(21,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(22,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(22,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(22,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(23,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(23,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(23,3)
D-34				

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 5
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(24,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(24,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(24,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(25,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(25,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(25,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(26,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(26,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(26,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(27,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(27,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(27,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(28,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(28,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(28,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(29,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(29,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(29,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	C-14 , fish	5.000E+04	5.000E+04	BIOFAC(3,1)
D-5	C-14 , crustacea and mollusks	9.100E+03	9.100E+03	BIOFAC(3,2)
D-5				
D-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(4,1)
D-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(4,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(5,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(5,2)
D-5				
D-5	Eu-152 , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Eu-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(6,2)
D-5				
D-5	Eu-154 , fish	5.000E+01	5.000E+01	BIOFAC(8,1)
D-5	Eu-154 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(8,2)
D-5				
D-5	Gd-152 , fish	2.500E+01	2.500E+01	BIOFAC(9,1)
D-5	Gd-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(9,2)
D-5				

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 6
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
D-5	H-3 , fish	1.000E+00	1.000E+00	BIOFAC(10,1)
D-5	H-3 , crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(10,2)
D-5				
D-5	Ni-63 , fish	1.000E+02	1.000E+02	BIOFAC(11,1)
D-5	Ni-63 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(11,2)
D-5				
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(12,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(12,2)
D-5				
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(13,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(13,2)
D-5				
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(14,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(14,2)
D-5				
D-5	Pu-238 , fish	3.000E+01	3.000E+01	BIOFAC(15,1)
D-5	Pu-238 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(15,2)
D-5				
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(16,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(16,2)
D-5				
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(17,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(17,2)
D-5				
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(18,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(18,2)
D-5				
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(19,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(19,2)
D-5				
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(20,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(20,2)
D-5				
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(21,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(21,2)
D-5				
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(22,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(22,2)
D-5				
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(23,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(23,2)
D-5				
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(24,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(24,2)
D-5				
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(25,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(25,2)
D-5				
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(26,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(26,2)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 7
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(27,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(27,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(28,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(28,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(29,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(29,2)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 8
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Site-Specific Parameter Summary

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.313E+03	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	4.600E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	5.050E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	1.500E+01	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	7.500E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.200E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	2.050E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	3.800E+01	3.000E+02	---	T(7)
R011	Times for calculations (yr)	4.200E+01	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.370E+02	0.000E+00	---	T(9)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	3.150E-01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Co-60	1.870E-01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Cs-137	7.200E+00	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Eu-152	1.300E+00	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Eu-154	2.600E-01	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): Ni-63	1.300E+01	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): Pu-239	8.550E-01	0.000E+00	---	S1(16)
R012	Initial principal radionuclide (pCi/g): Pu-240	2.050E-01	0.000E+00	---	S1(17)
R012	Initial principal radionuclide (pCi/g): Sr-90	6.690E+00	0.000E+00	---	S1(20)
R012	Initial principal radionuclide (pCi/g): Th-230	3.350E-01	0.000E+00	---	S1(23)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Eu-154	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): Ni-63	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(16)
R012	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---	W1(17)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(20)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(23)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	1.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.400E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	8.000E+00	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.100E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.600E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	7.600E-01	2.000E-01	---	RI

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 9
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	1.500E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.530E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	1.250E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	4.600E+00	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	9.200E+00	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.500E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	1.500E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.166E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.166E-04	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 10
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Eu-154				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for Ni-63				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.605E-04	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(17,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCC(20)
R016	Unsaturated zone 1 (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCU(20,1)
R016	Saturated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.323E-04	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(23)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(23,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(23)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(23)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(23)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 11
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	1.000E+02	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.397E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter C-14				
R016	Contaminated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	1.000E+02	-1.000E+00	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	-1.000E+00	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.085E-04	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	8.969E-02	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter Np-237				
R016	Contaminated zone (cm**3/g)	1.500E+01	-1.000E+00	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	1.500E+01	-1.000E+00	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	1.500E+01	-1.000E+00	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	7.181E-04	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	1.000E+02	5.000E+01	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	5.000E+01	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.085E-04	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+02	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	1.000E+02	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+02	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.605E-04	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 12
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(15,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCU(18,1)
R016	Saturated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCC(19)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCU(19,1)
R016	Saturated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(21)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(21,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(21)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(21)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(21)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(22)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(22,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(22)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(22)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(22)
R016	Distribution coefficients for daughter Th-232				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(24)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(24,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(24)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.426E-05	ALEACH(24)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(24)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(25)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(25,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(25)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.119E-03	ALEACH(25)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(25)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 13
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter U-234				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(26)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(26,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(26)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.119E-03	ALEACH(26)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(26)
R016	Distribution coefficients for daughter U-235				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(27)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(27,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(27)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.119E-03	ALEACH(27)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(27)
R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(28)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(28,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(28)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.119E-03	ALEACH(28)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(28)
R016	Distribution coefficients for daughter U-238				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(29)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(29,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(29)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.119E-03	ALEACH(29)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(29)
R017	Inhalation rate (m**3/yr)	7.300E+03	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	1.000E-04	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	4.000E-01	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	8.000E-01	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	6.000E-01	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	2.000E-01	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	1.000E+00	1.000E+00	>0 shows circular AREA.	FS
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 14
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.100E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.700E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	3.600E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	1.970E+01	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	7.300E+01	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.656E-01	FMEAT
R018	Contamination fraction of milk	-1	-1	0.656E-01	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 15
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	2.000E-05	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	3.000E-02	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	2.000E-02	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	9.800E-01	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	3.000E-01	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	7.000E-07	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	1.000E-10	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	8.000E-01	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	2.000E-01	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	8.894E+01	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/21/2006 06:26 Page 16
Summary : 105-H Fuel Storage Basin Side Slope Shallow Zone Evaluation
File : 105H-FSB-Side_Slope_Shallow_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
TITL	Number of graphical time points	128	---	---	NPTS
TITL	Maximum number of integration points for dose	5	---	---	LYMAX
TITL	Maximum number of integration points for risk	17	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	active
2 -- inhalation (w/o radon)	active
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	active
9 -- radon	suppressed
Find peak pathway doses	suppressed

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 1
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Table of Contents
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ

Part I: Mixture Sums and Single Radionuclide Guidelines
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1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 2
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	C-14	2.090E-06	2.090E-06	DCF2(3)
B-1	Co-60	2.190E-04	2.190E-04	DCF2(4)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(5)
B-1	Eu-152	2.210E-04	2.210E-04	DCF2(6)
B-1	Eu-154	2.860E-04	2.860E-04	DCF2(8)
B-1	Gd-152	2.430E-01	2.430E-01	DCF2(9)
B-1	H-3	6.400E-08	6.400E-08	DCF2(10)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(11)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(12)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(13)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(14)
B-1	Pu-238	3.920E-01	3.920E-01	DCF2(15)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(16)
B-1	Pu-240	4.290E-01	4.290E-01	DCF2(17)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(18)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(19)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(20)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(21)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(22)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(23)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(24)
B-1	U-233	1.350E-01	1.350E-01	DCF2(25)
B-1	U-234	1.320E-01	1.320E-01	DCF2(26)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(27)
B-1	U-236	1.250E-01	1.250E-01	DCF2(28)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(29)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	C-14	2.090E-06	2.090E-06	DCF3(3)
D-1	Co-60	2.690E-05	2.690E-05	DCF3(4)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(5)
D-1	Eu-152	6.480E-06	6.480E-06	DCF3(6)
D-1	Eu-154	9.550E-06	9.550E-06	DCF3(8)
D-1	Gd-152	1.610E-04	1.610E-04	DCF3(9)
D-1	H-3	6.400E-08	6.400E-08	DCF3(10)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(11)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(12)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(13)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(14)
D-1	Pu-238	3.200E-03	3.200E-03	DCF3(15)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(16)
D-1	Pu-240	3.540E-03	3.540E-03	DCF3(17)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(18)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(19)
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(20)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 3
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(21)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(22)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(23)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(24)
D-1	U-233	2.890E-04	2.890E-04	DCF3(25)
D-1	U-234	2.830E-04	2.830E-04	DCF3(26)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(27)
D-1	U-236	2.690E-04	2.690E-04	DCF3(28)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(29)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				
D-34	C-14 , plant/soil concentration ratio, dimensionless	5.500E+00	5.500E+00	RTF(3,1)
D-34	C-14 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.100E-02	3.100E-02	RTF(3,2)
D-34	C-14 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.200E-02	1.200E-02	RTF(3,3)
D-34				
D-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(4,1)
D-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(4,2)
D-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(4,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(5,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(5,3)
D-34				
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(6,2)
D-34	Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(6,3)
D-34				
D-34	Eu-154 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	Eu-154 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(8,2)
D-34	Eu-154 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(8,3)
D-34				
D-34	Gd-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(9,2)
D-34	Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(9,3)
D-34				
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(10,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(10,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(10,3)
D-34				
D-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(11,1)
D-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(11,2)
D-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(11,3)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 4
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(12,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(12,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(12,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(13,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(13,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(13,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(14,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(14,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(14,3)
D-34				
D-34	Pu-238 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(15,1)
D-34	Pu-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
D-34	Pu-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(15,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(16,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(16,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(16,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(17,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(17,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(17,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(18,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(18,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(18,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(19,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(19,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(19,3)
D-34				
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(20,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(20,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(20,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(21,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(21,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(21,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(22,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(22,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(22,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(23,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(23,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(23,3)
D-34				

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 5
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(24,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(24,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(24,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(25,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(25,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(25,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(26,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(26,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(26,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(27,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(27,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(27,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(28,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(28,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(28,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(29,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(29,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(29,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	C-14 , fish	5.000E+04	5.000E+04	BIOFAC(3,1)
D-5	C-14 , crustacea and mollusks	9.100E+03	9.100E+03	BIOFAC(3,2)
D-5				
D-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(4,1)
D-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(4,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(5,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(5,2)
D-5				
D-5	Eu-152 , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Eu-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(6,2)
D-5				
D-5	Eu-154 , fish	5.000E+01	5.000E+01	BIOFAC(8,1)
D-5	Eu-154 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(8,2)
D-5				
D-5	Gd-152 , fish	2.500E+01	2.500E+01	BIOFAC(9,1)
D-5	Gd-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(9,2)
D-5				

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 6
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

Menu	Parameter		Current Value	Default	Parameter Name
D-5	H-3	fish	1.000E+00	1.000E+00	BIOFAC(10,1)
D-5	H-3	crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(10,2)
D-5	Ni-63	fish	1.000E+02	1.000E+02	BIOFAC(11,1)
D-5	Ni-63	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(11,2)
D-5	Np-237+D	fish	3.000E+01	3.000E+01	BIOFAC(12,1)
D-5	Np-237+D	crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(12,2)
D-5	Pa-231	fish	1.000E+01	1.000E+01	BIOFAC(13,1)
D-5	Pa-231	crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(13,2)
D-5	Pb-210+D	fish	3.000E+02	3.000E+02	BIOFAC(14,1)
D-5	Pb-210+D	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(14,2)
D-5	Pu-238	fish	3.000E+01	3.000E+01	BIOFAC(15,1)
D-5	Pu-238	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(15,2)
D-5	Pu-239	fish	3.000E+01	3.000E+01	BIOFAC(16,1)
D-5	Pu-239	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(16,2)
D-5	Pu-240	fish	3.000E+01	3.000E+01	BIOFAC(17,1)
D-5	Pu-240	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(17,2)
D-5	Ra-226+D	fish	5.000E+01	5.000E+01	BIOFAC(18,1)
D-5	Ra-226+D	crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(18,2)
D-5	Ra-228+D	fish	5.000E+01	5.000E+01	BIOFAC(19,1)
D-5	Ra-228+D	crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(19,2)
D-5	Sr-90+D	fish	6.000E+01	6.000E+01	BIOFAC(20,1)
D-5	Sr-90+D	crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(20,2)
D-5	Th-228+D	fish	1.000E+02	1.000E+02	BIOFAC(21,1)
D-5	Th-228+D	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(21,2)
D-5	Th-229+D	fish	1.000E+02	1.000E+02	BIOFAC(22,1)
D-5	Th-229+D	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(22,2)
D-5	Th-230	fish	1.000E+02	1.000E+02	BIOFAC(23,1)
D-5	Th-230	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(23,2)
D-5	Th-232	fish	1.000E+02	1.000E+02	BIOFAC(24,1)
D-5	Th-232	crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(24,2)
D-5	U-233	fish	1.000E+01	1.000E+01	BIOFAC(25,1)
D-5	U-233	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(25,2)
D-5	U-234	fish	1.000E+01	1.000E+01	BIOFAC(26,1)
D-5	U-234	crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(26,2)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 7
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(27,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(27,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(28,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(28,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(29,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(29,2)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 8
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Site-Specific Parameter Summary

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	5.618E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	9.200E+00	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	5.050E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	4.000E+00	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	7.500E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.200E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	2.080E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	4.200E+01	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.370E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	2.570E-01	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): Co-60	1.900E-01	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Cs-137	5.360E+00	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Eu-152	1.260E+00	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Ni-63	1.600E+01	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): Np-237	3.500E-02	0.000E+00	---	S1(12)
R012	Initial principal radionuclide (pCi/g): Pu-239	8.060E-01	0.000E+00	---	S1(16)
R012	Initial principal radionuclide (pCi/g): Pu-240	1.930E-01	0.000E+00	---	S1(17)
R012	Initial principal radionuclide (pCi/g): Sr-90	5.560E+00	0.000E+00	---	S1(20)
R012	Initial principal radionuclide (pCi/g): Th-230	9.320E-01	0.000E+00	---	S1(23)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Ni-63	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): Np-237	not used	0.000E+00	---	W1(12)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(16)
R012	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---	W1(17)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(20)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(23)
R013	Cover depth (m)	4.600E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	1.000E-03	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	1.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCCZ
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.400E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.100E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.600E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	7.600E-01	2.000E-01	---	RI

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 9
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	1.500E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.530E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	1.250E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	4.600E+00	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	0	1	---	NS
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(2)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(4)
R016	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.083E-04	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(5)
R016	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.083E-04	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(6)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Ni-63				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCC(11)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.803E-04	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 10
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Np-237				
R016	Contaminated zone (cm**3/g)	1.500E+01	-1.000E+00	---	DCNUCC(12)
R016	Saturated zone (cm**3/g)	1.500E+01	-1.000E+00	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.591E-04	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(16)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(17)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCC(20)
R016	Saturated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.161E-04	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(23)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(23)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(23)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(23)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Saturated zone (cm**3/g)	1.000E+02	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.698E-04	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter C-14				
R016	Contaminated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCC(3)
R016	Saturated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)
R016	Distribution coefficients for daughter Eu-154				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(8)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 11
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	1.000E+02	-1.000E+00	---	DCNUCC(9)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.423E-05	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(10)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	4.484E-02	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	1.000E+02	5.000E+01	---	DCNUCC(13)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	5.423E-05	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+02	---	DCNUCC(14)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+02	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.803E-04	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(15)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCC(18)
R016	Saturated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCC(19)
R016	Saturated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(21)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(21)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(21)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(21)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 12
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(22)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(22)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(22)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(22)
R016	Distribution coefficients for daughter Th-232				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(24)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(24)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.713E-05	ALEACH(24)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(24)
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(25)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(25)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-03	ALEACH(25)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(25)
R016	Distribution coefficients for daughter U-234				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(26)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(26)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-03	ALEACH(26)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(26)
R016	Distribution coefficients for daughter U-235				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(27)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(27)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-03	ALEACH(27)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(27)
R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(28)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(28)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-03	ALEACH(28)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(28)
R016	Distribution coefficients for daughter U-238				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(29)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(29)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.560E-03	ALEACH(29)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(29)
R017	Inhalation rate (m**3/yr)	not used	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	not used	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	not used	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	not used	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	not used	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	not used	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	not used	1.000E+00	>0 shows circular AREA.	FS

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 13
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.100E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.700E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	3.600E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	1.970E+01	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.281E+00	FPLANT
R018	Contamination fraction of meat	-1	-1	0.281E-01	FMEAT
R018	Contamination fraction of milk	-1	-1	0.281E-01	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 14
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	2.000E-05	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	3.000E-02	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	2.000E-02	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	9.800E-01	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	3.000E-01	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	7.000E-07	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	1.000E-10	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	8.000E-01	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	2.000E-01	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	8.894E+01	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 15:27 Page 15
Summary : 105-H Fuel Storage Basin Side Slope Deep Zone Evaluation
File : 105H-FSB-Side_Slope_Deep_Zone.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	256	---	---	NPTS
TITL	Maximum number of integration points for dose	9	---	---	LYMAX
TITL	Maximum number of integration points for risk	17	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	suppressed
2 -- inhalation (w/o radon)	suppressed
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	suppressed
9 -- radon	suppressed
Find peak pathway doses	suppressed

RESRAD INPUT PARAMETERS FOR THE POST-DRILLING SCENARIO

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 1
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Table of Contents
ÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ

Part I: Mixture Sums and Single Radionuclide Guidelines
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1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 2
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Dose Conversion Factor (and Related) Parameter Summary
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
B-1	Dose conversion factors for inhalation, mrem/pCi:			
B-1	Ac-227+D	6.720E+00	6.720E+00	DCF2(1)
B-1	Am-241	4.440E-01	4.440E-01	DCF2(2)
B-1	C-14	2.090E-06	2.090E-06	DCF2(3)
B-1	Co-60	2.190E-04	2.190E-04	DCF2(4)
B-1	Cs-137+D	3.190E-05	3.190E-05	DCF2(5)
B-1	Eu-152	2.210E-04	2.210E-04	DCF2(6)
B-1	Eu-154	2.860E-04	2.860E-04	DCF2(8)
B-1	Gd-152	2.430E-01	2.430E-01	DCF2(9)
B-1	H-3	6.400E-08	6.400E-08	DCF2(10)
B-1	Ni-63	6.290E-06	6.290E-06	DCF2(11)
B-1	Np-237+D	5.400E-01	5.400E-01	DCF2(12)
B-1	Pa-231	1.280E+00	1.280E+00	DCF2(13)
B-1	Pb-210+D	2.320E-02	2.320E-02	DCF2(14)
B-1	Pu-238	3.920E-01	3.920E-01	DCF2(15)
B-1	Pu-239	4.290E-01	4.290E-01	DCF2(16)
B-1	Pu-240	4.290E-01	4.290E-01	DCF2(17)
B-1	Ra-226+D	8.600E-03	8.600E-03	DCF2(18)
B-1	Ra-228+D	5.080E-03	5.080E-03	DCF2(19)
B-1	Sr-90+D	1.310E-03	1.310E-03	DCF2(20)
B-1	Th-228+D	3.450E-01	3.450E-01	DCF2(21)
B-1	Th-229+D	2.160E+00	2.160E+00	DCF2(22)
B-1	Th-230	3.260E-01	3.260E-01	DCF2(23)
B-1	Th-232	1.640E+00	1.640E+00	DCF2(24)
B-1	U-233	1.350E-01	1.350E-01	DCF2(25)
B-1	U-234	1.320E-01	1.320E-01	DCF2(26)
B-1	U-235+D	1.230E-01	1.230E-01	DCF2(27)
B-1	U-236	1.250E-01	1.250E-01	DCF2(28)
B-1	U-238+D	1.180E-01	1.180E-01	DCF2(29)
D-1	Dose conversion factors for ingestion, mrem/pCi:			
D-1	Ac-227+D	1.480E-02	1.480E-02	DCF3(1)
D-1	Am-241	3.640E-03	3.640E-03	DCF3(2)
D-1	C-14	2.090E-06	2.090E-06	DCF3(3)
D-1	Co-60	2.690E-05	2.690E-05	DCF3(4)
D-1	Cs-137+D	5.000E-05	5.000E-05	DCF3(5)
D-1	Eu-152	6.480E-06	6.480E-06	DCF3(6)
D-1	Eu-154	9.550E-06	9.550E-06	DCF3(8)
D-1	Gd-152	1.610E-04	1.610E-04	DCF3(9)
D-1	H-3	6.400E-08	6.400E-08	DCF3(10)
D-1	Ni-63	5.770E-07	5.770E-07	DCF3(11)
D-1	Np-237+D	4.440E-03	4.440E-03	DCF3(12)
D-1	Pa-231	1.060E-02	1.060E-02	DCF3(13)
D-1	Pb-210+D	7.270E-03	7.270E-03	DCF3(14)
D-1	Pu-238	3.200E-03	3.200E-03	DCF3(15)
D-1	Pu-239	3.540E-03	3.540E-03	DCF3(16)
D-1	Pu-240	3.540E-03	3.540E-03	DCF3(17)
D-1	Ra-226+D	1.330E-03	1.330E-03	DCF3(18)
D-1	Ra-228+D	1.440E-03	1.440E-03	DCF3(19)
D-1	Sr-90+D	1.530E-04	1.530E-04	DCF3(20)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 3
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-1	Th-228+D	8.080E-04	8.080E-04	DCF3(21)
D-1	Th-229+D	4.030E-03	4.030E-03	DCF3(22)
D-1	Th-230	5.480E-04	5.480E-04	DCF3(23)
D-1	Th-232	2.730E-03	2.730E-03	DCF3(24)
D-1	U-233	2.890E-04	2.890E-04	DCF3(25)
D-1	U-234	2.830E-04	2.830E-04	DCF3(26)
D-1	U-235+D	2.670E-04	2.670E-04	DCF3(27)
D-1	U-236	2.690E-04	2.690E-04	DCF3(28)
D-1	U-238+D	2.690E-04	2.690E-04	DCF3(29)
D-34	Food transfer factors:			
D-34	Ac-227+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(1,1)
D-34	Ac-227+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,2)
D-34	Ac-227+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(1,3)
D-34				
D-34	Am-241 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(2,1)
D-34	Am-241 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-05	5.000E-05	RTF(2,2)
D-34	Am-241 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-06	2.000E-06	RTF(2,3)
D-34				
D-34	C-14 , plant/soil concentration ratio, dimensionless	5.500E+00	5.500E+00	RTF(3,1)
D-34	C-14 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.100E-02	3.100E-02	RTF(3,2)
D-34	C-14 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.200E-02	1.200E-02	RTF(3,3)
D-34				
D-34	Co-60 , plant/soil concentration ratio, dimensionless	8.000E-02	8.000E-02	RTF(4,1)
D-34	Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-02	2.000E-02	RTF(4,2)
D-34	Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(4,3)
D-34				
D-34	Cs-137+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(5,1)
D-34	Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.000E-02	3.000E-02	RTF(5,2)
D-34	Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	8.000E-03	8.000E-03	RTF(5,3)
D-34				
D-34	Eu-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(6,1)
D-34	Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(6,2)
D-34	Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(6,3)
D-34				
D-34	Eu-154 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(8,1)
D-34	Eu-154 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(8,2)
D-34	Eu-154 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(8,3)
D-34				
D-34	Gd-152 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(9,1)
D-34	Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	2.000E-03	2.000E-03	RTF(9,2)
D-34	Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-05	2.000E-05	RTF(9,3)
D-34				
D-34	H-3 , plant/soil concentration ratio, dimensionless	4.800E+00	4.800E+00	RTF(10,1)
D-34	H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.200E-02	1.200E-02	RTF(10,2)
D-34	H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-02	1.000E-02	RTF(10,3)
D-34				
D-34	Ni-63 , plant/soil concentration ratio, dimensionless	5.000E-02	5.000E-02	RTF(11,1)
D-34	Ni-63 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(11,2)
D-34	Ni-63 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-02	2.000E-02	RTF(11,3)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 4
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Np-237+D , plant/soil concentration ratio, dimensionless	2.000E-02	2.000E-02	RTF(12,1)
D-34	Np-237+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(12,2)
D-34	Np-237+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(12,3)
D-34				
D-34	Pa-231 , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(13,1)
D-34	Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	5.000E-03	5.000E-03	RTF(13,2)
D-34	Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(13,3)
D-34				
D-34	Pb-210+D , plant/soil concentration ratio, dimensionless	1.000E-02	1.000E-02	RTF(14,1)
D-34	Pb-210+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-04	8.000E-04	RTF(14,2)
D-34	Pb-210+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	3.000E-04	3.000E-04	RTF(14,3)
D-34				
D-34	Pu-238 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(15,1)
D-34	Pu-238 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(15,2)
D-34	Pu-238 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(15,3)
D-34				
D-34	Pu-239 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(16,1)
D-34	Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(16,2)
D-34	Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(16,3)
D-34				
D-34	Pu-240 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(17,1)
D-34	Pu-240 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(17,2)
D-34	Pu-240 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-06	1.000E-06	RTF(17,3)
D-34				
D-34	Ra-226+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(18,1)
D-34	Ra-226+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(18,2)
D-34	Ra-226+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(18,3)
D-34				
D-34	Ra-228+D , plant/soil concentration ratio, dimensionless	4.000E-02	4.000E-02	RTF(19,1)
D-34	Ra-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-03	1.000E-03	RTF(19,2)
D-34	Ra-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	1.000E-03	1.000E-03	RTF(19,3)
D-34				
D-34	Sr-90+D , plant/soil concentration ratio, dimensionless	3.000E-01	3.000E-01	RTF(20,1)
D-34	Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	8.000E-03	8.000E-03	RTF(20,2)
D-34	Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	2.000E-03	2.000E-03	RTF(20,3)
D-34				
D-34	Th-228+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(21,1)
D-34	Th-228+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(21,2)
D-34	Th-228+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(21,3)
D-34				
D-34	Th-229+D , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(22,1)
D-34	Th-229+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(22,2)
D-34	Th-229+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(22,3)
D-34				
D-34	Th-230 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(23,1)
D-34	Th-230 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(23,2)
D-34	Th-230 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(23,3)
D-34				

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 5
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
D-34	Th-232 , plant/soil concentration ratio, dimensionless	1.000E-03	1.000E-03	RTF(24,1)
D-34	Th-232 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	1.000E-04	1.000E-04	RTF(24,2)
D-34	Th-232 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	5.000E-06	5.000E-06	RTF(24,3)
D-34				
D-34	U-233 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(25,1)
D-34	U-233 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(25,2)
D-34	U-233 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(25,3)
D-34				
D-34	U-234 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(26,1)
D-34	U-234 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(26,2)
D-34	U-234 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(26,3)
D-34				
D-34	U-235+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(27,1)
D-34	U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(27,2)
D-34	U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(27,3)
D-34				
D-34	U-236 , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(28,1)
D-34	U-236 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(28,2)
D-34	U-236 , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(28,3)
D-34				
D-34	U-238+D , plant/soil concentration ratio, dimensionless	2.500E-03	2.500E-03	RTF(29,1)
D-34	U-238+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d)	3.400E-04	3.400E-04	RTF(29,2)
D-34	U-238+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d)	6.000E-04	6.000E-04	RTF(29,3)
D-5	Bioaccumulation factors, fresh water, L/kg:			
D-5	Ac-227+D , fish	1.500E+01	1.500E+01	BIOFAC(1,1)
D-5	Ac-227+D , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(1,2)
D-5				
D-5	Am-241 , fish	3.000E+01	3.000E+01	BIOFAC(2,1)
D-5	Am-241 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(2,2)
D-5				
D-5	C-14 , fish	5.000E+04	5.000E+04	BIOFAC(3,1)
D-5	C-14 , crustacea and mollusks	9.100E+03	9.100E+03	BIOFAC(3,2)
D-5				
D-5	Co-60 , fish	3.000E+02	3.000E+02	BIOFAC(4,1)
D-5	Co-60 , crustacea and mollusks	2.000E+02	2.000E+02	BIOFAC(4,2)
D-5				
D-5	Cs-137+D , fish	2.000E+03	2.000E+03	BIOFAC(5,1)
D-5	Cs-137+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(5,2)
D-5				
D-5	Eu-152 , fish	5.000E+01	5.000E+01	BIOFAC(6,1)
D-5	Eu-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(6,2)
D-5				
D-5	Eu-154 , fish	5.000E+01	5.000E+01	BIOFAC(8,1)
D-5	Eu-154 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(8,2)
D-5				
D-5	Gd-152 , fish	2.500E+01	2.500E+01	BIOFAC(9,1)
D-5	Gd-152 , crustacea and mollusks	1.000E+03	1.000E+03	BIOFAC(9,2)
D-5				

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 6
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

Menu	Parameter	Current Value	Default	Parameter Name
D-5	H-3 , fish	1.000E+00	1.000E+00	BIOFAC(10,1)
D-5	H-3 , crustacea and mollusks	1.000E+00	1.000E+00	BIOFAC(10,2)
D-5	Ni-63 , fish	1.000E+02	1.000E+02	BIOFAC(11,1)
D-5	Ni-63 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(11,2)
D-5	Np-237+D , fish	3.000E+01	3.000E+01	BIOFAC(12,1)
D-5	Np-237+D , crustacea and mollusks	4.000E+02	4.000E+02	BIOFAC(12,2)
D-5	Pa-231 , fish	1.000E+01	1.000E+01	BIOFAC(13,1)
D-5	Pa-231 , crustacea and mollusks	1.100E+02	1.100E+02	BIOFAC(13,2)
D-5	Pb-210+D , fish	3.000E+02	3.000E+02	BIOFAC(14,1)
D-5	Pb-210+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(14,2)
D-5	Pu-238 , fish	3.000E+01	3.000E+01	BIOFAC(15,1)
D-5	Pu-238 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(15,2)
D-5	Pu-239 , fish	3.000E+01	3.000E+01	BIOFAC(16,1)
D-5	Pu-239 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(16,2)
D-5	Pu-240 , fish	3.000E+01	3.000E+01	BIOFAC(17,1)
D-5	Pu-240 , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(17,2)
D-5	Ra-226+D , fish	5.000E+01	5.000E+01	BIOFAC(18,1)
D-5	Ra-226+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(18,2)
D-5	Ra-228+D , fish	5.000E+01	5.000E+01	BIOFAC(19,1)
D-5	Ra-228+D , crustacea and mollusks	2.500E+02	2.500E+02	BIOFAC(19,2)
D-5	Sr-90+D , fish	6.000E+01	6.000E+01	BIOFAC(20,1)
D-5	Sr-90+D , crustacea and mollusks	1.000E+02	1.000E+02	BIOFAC(20,2)
D-5	Th-228+D , fish	1.000E+02	1.000E+02	BIOFAC(21,1)
D-5	Th-228+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(21,2)
D-5	Th-229+D , fish	1.000E+02	1.000E+02	BIOFAC(22,1)
D-5	Th-229+D , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(22,2)
D-5	Th-230 , fish	1.000E+02	1.000E+02	BIOFAC(23,1)
D-5	Th-230 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(23,2)
D-5	Th-232 , fish	1.000E+02	1.000E+02	BIOFAC(24,1)
D-5	Th-232 , crustacea and mollusks	5.000E+02	5.000E+02	BIOFAC(24,2)
D-5	U-233 , fish	1.000E+01	1.000E+01	BIOFAC(25,1)
D-5	U-233 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(25,2)
D-5	U-234 , fish	1.000E+01	1.000E+01	BIOFAC(26,1)
D-5	U-234 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(26,2)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 7
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Dose Conversion Factor (and Related) Parameter Summary (continued)
File: HEAST 2001 Morbidity

0 Menu	Parameter	Current Value	Default	Parameter Name
D-5	U-235+D , fish	1.000E+01	1.000E+01	BIOFAC(27,1)
D-5	U-235+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(27,2)
D-5				
D-5	U-236 , fish	1.000E+01	1.000E+01	BIOFAC(28,1)
D-5	U-236 , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(28,2)
D-5				
D-5	U-238+D , fish	1.000E+01	1.000E+01	BIOFAC(29,1)
D-5	U-238+D , crustacea and mollusks	6.000E+01	6.000E+01	BIOFAC(29,2)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 8
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Site-Specific Parameter Summary

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R011	Area of contaminated zone (m**2)	1.000E+02	1.000E+04	---	AREA
R011	Thickness of contaminated zone (m)	1.500E-01	2.000E+00	---	THICK0
R011	Length parallel to aquifer flow (m)	1.000E+01	1.000E+02	---	LCZPAQ
R011	Basic radiation dose limit (mrem/yr)	4.000E+00	2.500E+01	---	BRDL
R011	Time since placement of material (yr)	0.000E+00	0.000E+00	---	TI
R011	Times for calculations (yr)	1.000E+00	1.000E+00	---	T(2)
R011	Times for calculations (yr)	3.000E+00	3.000E+00	---	T(3)
R011	Times for calculations (yr)	7.000E+00	1.000E+01	---	T(4)
R011	Times for calculations (yr)	1.200E+01	3.000E+01	---	T(5)
R011	Times for calculations (yr)	2.080E+01	1.000E+02	---	T(6)
R011	Times for calculations (yr)	4.200E+01	3.000E+02	---	T(7)
R011	Times for calculations (yr)	1.370E+02	1.000E+03	---	T(8)
R011	Times for calculations (yr)	1.000E+03	0.000E+00	---	T(9)
R011	Times for calculations (yr)	not used	0.000E+00	---	T(10)
R012	Initial principal radionuclide (pCi/g): Am-241	2.750E-03	0.000E+00	---	S1(2)
R012	Initial principal radionuclide (pCi/g): C-14	5.670E-02	0.000E+00	---	S1(3)
R012	Initial principal radionuclide (pCi/g): Co-60	1.450E-03	0.000E+00	---	S1(4)
R012	Initial principal radionuclide (pCi/g): Cs-137	6.750E-02	0.000E+00	---	S1(5)
R012	Initial principal radionuclide (pCi/g): Eu-152	1.680E-02	0.000E+00	---	S1(6)
R012	Initial principal radionuclide (pCi/g): Eu-154	2.970E-03	0.000E+00	---	S1(8)
R012	Initial principal radionuclide (pCi/g): H-3	3.120E-03	0.000E+00	---	S1(10)
R012	Initial principal radionuclide (pCi/g): Ni-63	1.650E-01	0.000E+00	---	S1(11)
R012	Initial principal radionuclide (pCi/g): Np-237	2.500E-04	0.000E+00	---	S1(12)
R012	Initial principal radionuclide (pCi/g): Pu-239	4.690E-03	0.000E+00	---	S1(16)
R012	Initial principal radionuclide (pCi/g): Pu-240	1.120E-03	0.000E+00	---	S1(17)
R012	Initial principal radionuclide (pCi/g): Sr-90	3.570E-02	0.000E+00	---	S1(20)
R012	Initial principal radionuclide (pCi/g): Th-230	8.320E-03	0.000E+00	---	S1(23)
R012	Concentration in groundwater (pCi/L): Am-241	not used	0.000E+00	---	W1(2)
R012	Concentration in groundwater (pCi/L): C-14	not used	0.000E+00	---	W1(3)
R012	Concentration in groundwater (pCi/L): Co-60	not used	0.000E+00	---	W1(4)
R012	Concentration in groundwater (pCi/L): Cs-137	not used	0.000E+00	---	W1(5)
R012	Concentration in groundwater (pCi/L): Eu-152	not used	0.000E+00	---	W1(6)
R012	Concentration in groundwater (pCi/L): Eu-154	not used	0.000E+00	---	W1(8)
R012	Concentration in groundwater (pCi/L): H-3	not used	0.000E+00	---	W1(10)
R012	Concentration in groundwater (pCi/L): Ni-63	not used	0.000E+00	---	W1(11)
R012	Concentration in groundwater (pCi/L): Np-237	not used	0.000E+00	---	W1(12)
R012	Concentration in groundwater (pCi/L): Pu-239	not used	0.000E+00	---	W1(16)
R012	Concentration in groundwater (pCi/L): Pu-240	not used	0.000E+00	---	W1(17)
R012	Concentration in groundwater (pCi/L): Sr-90	not used	0.000E+00	---	W1(20)
R012	Concentration in groundwater (pCi/L): Th-230	not used	0.000E+00	---	W1(23)
R013	Cover depth (m)	0.000E+00	0.000E+00	---	COVER0
R013	Density of cover material (g/cm**3)	not used	1.500E+00	---	DENSCV
R013	Cover depth erosion rate (m/yr)	not used	1.000E-03	---	VCV
R013	Density of contaminated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSCZ
R013	Contaminated zone erosion rate (m/yr)	0.000E+00	1.000E-03	---	VCZ
R013	Contaminated zone total porosity	4.000E-01	4.000E-01	---	TPCZ
R013	Contaminated zone field capacity	1.500E-01	2.000E-01	---	FCCZ
R013	Contaminated zone hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCCZ

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 9
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R013	Contaminated zone b parameter	4.050E+00	5.300E+00	---	BCZ
R013	Average annual wind speed (m/sec)	3.400E+00	2.000E+00	---	WIND
R013	Humidity in air (g/m**3)	not used	8.000E+00	---	HUMID
R013	Evapotranspiration coefficient	9.100E-01	5.000E-01	---	EVAPTR
R013	Precipitation (m/yr)	1.600E-01	1.000E+00	---	PRECIP
R013	Irrigation (m/yr)	7.600E-01	2.000E-01	---	RI
R013	Irrigation mode	overhead	overhead	---	IDITCH
R013	Runoff coefficient	2.000E-01	2.000E-01	---	RUNOFF
R013	Watershed area for nearby stream or pond (m**2)	1.000E+06	1.000E+06	---	WAREA
R013	Accuracy for water/soil computations	1.000E-03	1.000E-03	---	EPS
R014	Density of saturated zone (g/cm**3)	1.600E+00	1.500E+00	---	DENSAQ
R014	Saturated zone total porosity	4.000E-01	4.000E-01	---	TPSZ
R014	Saturated zone effective porosity	2.500E-01	2.000E-01	---	EPSZ
R014	Saturated zone field capacity	1.500E-01	2.000E-01	---	FCSZ
R014	Saturated zone hydraulic conductivity (m/yr)	5.530E+03	1.000E+02	---	HCSZ
R014	Saturated zone hydraulic gradient	1.250E-03	2.000E-02	---	HGWT
R014	Saturated zone b parameter	4.050E+00	5.300E+00	---	BSZ
R014	Water table drop rate (m/yr)	1.000E-03	1.000E-03	---	VWT
R014	Well pump intake depth (m below water table)	4.600E+00	1.000E+01	---	DWIBWT
R014	Model: Nondispersion (ND) or Mass-Balance (MB)	ND	ND	---	MODEL
R014	Well pumping rate (m**3/yr)	2.500E+02	2.500E+02	---	UW
R015	Number of unsaturated zone strata	1	1	---	NS
R015	Unsat. zone 1, thickness (m)	1.365E+01	4.000E+00	---	H(1)
R015	Unsat. zone 1, soil density (g/cm**3)	1.600E+00	1.500E+00	---	DENSUZ(1)
R015	Unsat. zone 1, total porosity	4.000E-01	4.000E-01	---	TPUZ(1)
R015	Unsat. zone 1, effective porosity	2.500E-01	2.000E-01	---	EPUZ(1)
R015	Unsat. zone 1, field capacity	1.500E-01	2.000E-01	---	FCUZ(1)
R015	Unsat. zone 1, soil-specific b parameter	4.050E+00	5.300E+00	---	BUZ(1)
R015	Unsat. zone 1, hydraulic conductivity (m/yr)	2.500E+02	1.000E+01	---	HCUZ(1)
R016	Distribution coefficients for Am-241				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCC(2)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCU(2,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+01	---	DCNUCS(2)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(2)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(2)
R016	Distribution coefficients for C-14				
R016	Contaminated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCC(3)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCU(3,1)
R016	Saturated zone (cm**3/g)	2.000E+02	0.000E+00	---	DCNUCS(3)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(3)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(3)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 10
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Co-60				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(4)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCU(4,1)
R016	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(4)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.644E-03	ALEACH(4)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(4)
R016	Distribution coefficients for Cs-137				
R016	Contaminated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCC(5)
R016	Unsaturated zone 1 (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCU(5,1)
R016	Saturated zone (cm**3/g)	5.000E+01	1.000E+03	---	DCNUCS(5)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	6.644E-03	ALEACH(5)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(5)
R016	Distribution coefficients for Eu-152				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(6)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(6,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(6)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(6)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(6)
R016	Distribution coefficients for Eu-154				
R016	Contaminated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCC(8)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCU(8,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(8)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(8)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(8)
R016	Distribution coefficients for H-3				
R016	Contaminated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCC(10)
R016	Unsaturated zone 1 (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCU(10,1)
R016	Saturated zone (cm**3/g)	0.000E+00	0.000E+00	---	DCNUCS(10)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.750E+00	ALEACH(10)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(10)
R016	Distribution coefficients for Ni-63				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCC(11)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCU(11,1)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+03	---	DCNUCS(11)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.106E-02	ALEACH(11)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(11)
R016	Distribution coefficients for Np-237				
R016	Contaminated zone (cm**3/g)	1.500E+01	-1.000E+00	---	DCNUCC(12)
R016	Unsaturated zone 1 (cm**3/g)	1.500E+01	-1.000E+00	---	DCNUCU(12,1)
R016	Saturated zone (cm**3/g)	1.500E+01	-1.000E+00	---	DCNUCS(12)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	2.202E-02	ALEACH(12)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(12)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 11
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for Pu-239				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(16)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(16,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(16)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(16)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(16)
R016	Distribution coefficients for Pu-240				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(17)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(17,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(17)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(17)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(17)
R016	Distribution coefficients for Sr-90				
R016	Contaminated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCC(20)
R016	Unsaturated zone 1 (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCU(20,1)
R016	Saturated zone (cm**3/g)	2.500E+01	3.000E+01	---	DCNUCS(20)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.326E-02	ALEACH(20)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(20)
R016	Distribution coefficients for Th-230				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(23)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(23,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(23)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(23)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(23)
R016	Distribution coefficients for daughter Ac-227				
R016	Contaminated zone (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCC(1)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+01	2.000E+01	---	DCNUCU(1,1)
R016	Saturated zone (cm**3/g)	1.000E+02	2.000E+01	---	DCNUCS(1)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.655E-02	ALEACH(1)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(1)
R016	Distribution coefficients for daughter Gd-152				
R016	Contaminated zone (cm**3/g)	1.000E+02	-1.000E+00	---	DCNUCC(9)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	-1.000E+00	---	DCNUCU(9,1)
R016	Saturated zone (cm**3/g)	2.000E+02	-1.000E+00	---	DCNUCS(9)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.326E-03	ALEACH(9)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(9)
R016	Distribution coefficients for daughter Pa-231				
R016	Contaminated zone (cm**3/g)	1.000E+02	5.000E+01	---	DCNUCC(13)
R016	Unsaturated zone 1 (cm**3/g)	1.000E+02	5.000E+01	---	DCNUCU(13,1)
R016	Saturated zone (cm**3/g)	5.000E+01	5.000E+01	---	DCNUCS(13)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	3.326E-03	ALEACH(13)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(13)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 12
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter Pb-210				
R016	Contaminated zone (cm**3/g)	3.000E+01	1.000E+02	---	DCNUCC(14)
R016	Unsaturated zone 1 (cm**3/g)	3.000E+01	1.000E+02	---	DCNUCU(14,1)
R016	Saturated zone (cm**3/g)	3.000E+01	1.000E+02	---	DCNUCS(14)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.106E-02	ALEACH(14)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(14)
R016	Distribution coefficients for daughter Pu-238				
R016	Contaminated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCC(15)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCU(15,1)
R016	Saturated zone (cm**3/g)	2.000E+02	2.000E+03	---	DCNUCS(15)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(15)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(15)
R016	Distribution coefficients for daughter Ra-226				
R016	Contaminated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCC(18)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCU(18,1)
R016	Saturated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCS(18)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(18)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(18)
R016	Distribution coefficients for daughter Ra-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCC(19)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCU(19,1)
R016	Saturated zone (cm**3/g)	2.000E+02	7.000E+01	---	DCNUCS(19)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(19)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(19)
R016	Distribution coefficients for daughter Th-228				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(21)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(21,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(21)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(21)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(21)
R016	Distribution coefficients for daughter Th-229				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(22)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(22,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(22)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(22)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(22)
R016	Distribution coefficients for daughter Th-232				
R016	Contaminated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCC(24)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCU(24,1)
R016	Saturated zone (cm**3/g)	2.000E+02	6.000E+04	---	DCNUCS(24)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.664E-03	ALEACH(24)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(24)

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 13
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R016	Distribution coefficients for daughter U-233				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(25)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(25,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(25)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.570E-01	ALEACH(25)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(25)
R016	Distribution coefficients for daughter U-234				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(26)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(26,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(26)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.570E-01	ALEACH(26)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(26)
R016	Distribution coefficients for daughter U-235				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(27)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(27,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(27)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.570E-01	ALEACH(27)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(27)
R016	Distribution coefficients for daughter U-236				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(28)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(28,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(28)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.570E-01	ALEACH(28)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(28)
R016	Distribution coefficients for daughter U-238				
R016	Contaminated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCC(29)
R016	Unsaturated zone 1 (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCU(29,1)
R016	Saturated zone (cm**3/g)	2.000E+00	5.000E+01	---	DCNUCS(29)
R016	Leach rate (/yr)	0.000E+00	0.000E+00	1.570E-01	ALEACH(29)
R016	Solubility constant	0.000E+00	0.000E+00	not used	SOLUBK(29)
R017	Inhalation rate (m**3/yr)	not used	8.400E+03	---	INHALR
R017	Mass loading for inhalation (g/m**3)	not used	1.000E-04	---	MLINH
R017	Exposure duration	3.000E+01	3.000E+01	---	ED
R017	Shielding factor, inhalation	not used	4.000E-01	---	SHF3
R017	Shielding factor, external gamma	not used	7.000E-01	---	SHF1
R017	Fraction of time spent indoors	not used	5.000E-01	---	FIND
R017	Fraction of time spent outdoors (on site)	not used	2.500E-01	---	FOTD
R017	Shape factor flag, external gamma	not used	1.000E+00	>0 shows circular AREA.	FS

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 14
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Site-Specific Parameter Summary (continued)

Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R017	Radii of shape factor array (used if FS = -1):				
R017	Outer annular radius (m), ring 1:	not used	5.000E+01	---	RAD_SHAPE(1)
R017	Outer annular radius (m), ring 2:	not used	7.071E+01	---	RAD_SHAPE(2)
R017	Outer annular radius (m), ring 3:	not used	0.000E+00	---	RAD_SHAPE(3)
R017	Outer annular radius (m), ring 4:	not used	0.000E+00	---	RAD_SHAPE(4)
R017	Outer annular radius (m), ring 5:	not used	0.000E+00	---	RAD_SHAPE(5)
R017	Outer annular radius (m), ring 6:	not used	0.000E+00	---	RAD_SHAPE(6)
R017	Outer annular radius (m), ring 7:	not used	0.000E+00	---	RAD_SHAPE(7)
R017	Outer annular radius (m), ring 8:	not used	0.000E+00	---	RAD_SHAPE(8)
R017	Outer annular radius (m), ring 9:	not used	0.000E+00	---	RAD_SHAPE(9)
R017	Outer annular radius (m), ring 10:	not used	0.000E+00	---	RAD_SHAPE(10)
R017	Outer annular radius (m), ring 11:	not used	0.000E+00	---	RAD_SHAPE(11)
R017	Outer annular radius (m), ring 12:	not used	0.000E+00	---	RAD_SHAPE(12)
R017	Fractions of annular areas within AREA:				
R017	Ring 1	not used	1.000E+00	---	FRACA(1)
R017	Ring 2	not used	2.732E-01	---	FRACA(2)
R017	Ring 3	not used	0.000E+00	---	FRACA(3)
R017	Ring 4	not used	0.000E+00	---	FRACA(4)
R017	Ring 5	not used	0.000E+00	---	FRACA(5)
R017	Ring 6	not used	0.000E+00	---	FRACA(6)
R017	Ring 7	not used	0.000E+00	---	FRACA(7)
R017	Ring 8	not used	0.000E+00	---	FRACA(8)
R017	Ring 9	not used	0.000E+00	---	FRACA(9)
R017	Ring 10	not used	0.000E+00	---	FRACA(10)
R017	Ring 11	not used	0.000E+00	---	FRACA(11)
R017	Ring 12	not used	0.000E+00	---	FRACA(12)
R018	Fruits, vegetables and grain consumption (kg/yr)	1.100E+02	1.600E+02	---	DIET(1)
R018	Leafy vegetable consumption (kg/yr)	2.700E+00	1.400E+01	---	DIET(2)
R018	Milk consumption (L/yr)	1.000E+02	9.200E+01	---	DIET(3)
R018	Meat and poultry consumption (kg/yr)	3.600E+01	6.300E+01	---	DIET(4)
R018	Fish consumption (kg/yr)	1.970E+01	5.400E+00	---	DIET(5)
R018	Other seafood consumption (kg/yr)	9.000E-01	9.000E-01	---	DIET(6)
R018	Soil ingestion rate (g/yr)	not used	3.650E+01	---	SOIL
R018	Drinking water intake (L/yr)	7.300E+02	5.100E+02	---	DWI
R018	Contamination fraction of drinking water	1.000E+00	1.000E+00	---	FDW
R018	Contamination fraction of household water	not used	1.000E+00	---	FHHW
R018	Contamination fraction of livestock water	1.000E+00	1.000E+00	---	FLW
R018	Contamination fraction of irrigation water	1.000E+00	1.000E+00	---	FIRW
R018	Contamination fraction of aquatic food	5.000E-01	5.000E-01	---	FR9
R018	Contamination fraction of plant food	-1	-1	0.500E-01	FPLANT
R018	Contamination fraction of meat	-1	-1	0.500E-02	FMEAT
R018	Contamination fraction of milk	-1	-1	0.500E-02	FMILK
R019	Livestock fodder intake for meat (kg/day)	6.800E+01	6.800E+01	---	LFI5
R019	Livestock fodder intake for milk (kg/day)	5.500E+01	5.500E+01	---	LFI6
R019	Livestock water intake for meat (L/day)	5.000E+01	5.000E+01	---	LWI5
R019	Livestock water intake for milk (L/day)	1.600E+02	1.600E+02	---	LWI6
R019	Livestock soil intake (kg/day)	5.000E-01	5.000E-01	---	LSI

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 15
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R019	Mass loading for foliar deposition (g/m**3)	1.000E-04	1.000E-04	---	MLFD
R019	Depth of soil mixing layer (m)	1.500E-01	1.500E-01	---	DM
R019	Depth of roots (m)	9.000E-01	9.000E-01	---	DROOT
R019	Drinking water fraction from ground water	1.000E+00	1.000E+00	---	FGWDW
R019	Household water fraction from ground water	not used	1.000E+00	---	FGWHH
R019	Livestock water fraction from ground water	1.000E+00	1.000E+00	---	FGWLW
R019	Irrigation fraction from ground water	1.000E+00	1.000E+00	---	FGWIR
R19B	Wet weight crop yield for Non-Leafy (kg/m**2)	7.000E-01	7.000E-01	---	YV(1)
R19B	Wet weight crop yield for Leafy (kg/m**2)	1.500E+00	1.500E+00	---	YV(2)
R19B	Wet weight crop yield for Fodder (kg/m**2)	1.100E+00	1.100E+00	---	YV(3)
R19B	Growing Season for Non-Leafy (years)	1.700E-01	1.700E-01	---	TE(1)
R19B	Growing Season for Leafy (years)	2.500E-01	2.500E-01	---	TE(2)
R19B	Growing Season for Fodder (years)	8.000E-02	8.000E-02	---	TE(3)
R19B	Translocation Factor for Non-Leafy	1.000E-01	1.000E-01	---	TIV(1)
R19B	Translocation Factor for Leafy	1.000E+00	1.000E+00	---	TIV(2)
R19B	Translocation Factor for Fodder	1.000E+00	1.000E+00	---	TIV(3)
R19B	Dry Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RDRY(1)
R19B	Dry Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RDRY(2)
R19B	Dry Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RDRY(3)
R19B	Wet Foliar Interception Fraction for Non-Leafy	2.500E-01	2.500E-01	---	RWET(1)
R19B	Wet Foliar Interception Fraction for Leafy	2.500E-01	2.500E-01	---	RWET(2)
R19B	Wet Foliar Interception Fraction for Fodder	2.500E-01	2.500E-01	---	RWET(3)
R19B	Weathering Removal Constant for Vegetation	2.000E+01	2.000E+01	---	WLAM
C14	C-12 concentration in water (g/cm**3)	2.000E-05	2.000E-05	---	C12WTR
C14	C-12 concentration in contaminated soil (g/g)	3.000E-02	3.000E-02	---	C12CZ
C14	Fraction of vegetation carbon from soil	2.000E-02	2.000E-02	---	CSOIL
C14	Fraction of vegetation carbon from air	9.800E-01	9.800E-01	---	CAIR
C14	C-14 evasion layer thickness in soil (m)	3.000E-01	3.000E-01	---	DMC
C14	C-14 evasion flux rate from soil (1/sec)	7.000E-07	7.000E-07	---	EVSN
C14	C-12 evasion flux rate from soil (1/sec)	1.000E-10	1.000E-10	---	REVSN
C14	Fraction of grain in beef cattle feed	8.000E-01	8.000E-01	---	AVFG4
C14	Fraction of grain in milk cow feed	2.000E-01	2.000E-01	---	AVFG5
C14	DCF correction factor for gaseous forms of C14	8.894E+01	8.894E+01	---	CO2F
STOR	Storage times of contaminated foodstuffs (days):				
STOR	Fruits, non-leafy vegetables, and grain	1.400E+01	1.400E+01	---	STOR_T(1)
STOR	Leafy vegetables	1.000E+00	1.000E+00	---	STOR_T(2)
STOR	Milk	1.000E+00	1.000E+00	---	STOR_T(3)
STOR	Meat and poultry	2.000E+01	2.000E+01	---	STOR_T(4)
STOR	Fish	7.000E+00	7.000E+00	---	STOR_T(5)
STOR	Crustacea and mollusks	7.000E+00	7.000E+00	---	STOR_T(6)
STOR	Well water	1.000E+00	1.000E+00	---	STOR_T(7)
STOR	Surface water	1.000E+00	1.000E+00	---	STOR_T(8)
STOR	Livestock fodder	4.500E+01	4.500E+01	---	STOR_T(9)
R021	Thickness of building foundation (m)	not used	1.500E-01	---	FLOOR1
R021	Bulk density of building foundation (g/cm**3)	not used	2.400E+00	---	DENSFL
R021	Total porosity of the cover material	not used	4.000E-01	---	TPCV

1RESRAD, Version 6.30 T« Limit = 0.5 year 02/17/2006 16:38 Page 16
Summary : 105-H Fuel Storage Basin Post-Drilling Scenario
File : 105H-FSB_Post-Drilling_Scenario.RAD

Site-Specific Parameter Summary (continued)

0 Menu	Parameter	User Input	Default	Used by RESRAD (If different from user input)	Parameter Name
R021	Total porosity of the building foundation	not used	1.000E-01	---	TPFL
R021	Volumetric water content of the cover material	not used	5.000E-02	---	PH2OCV
R021	Volumetric water content of the foundation	not used	3.000E-02	---	PH2OFL
R021	Diffusion coefficient for radon gas (m/sec):				
R021	in cover material	not used	2.000E-06	---	DIFCV
R021	in foundation material	not used	3.000E-07	---	DIFFL
R021	in contaminated zone soil	not used	2.000E-06	---	DIFCZ
R021	Radon vertical dimension of mixing (m)	not used	2.000E+00	---	HMIX
R021	Average building air exchange rate (1/hr)	not used	5.000E-01	---	REXG
R021	Height of the building (room) (m)	not used	2.500E+00	---	HRM
R021	Building interior area factor	not used	0.000E+00	---	FAI
R021	Building depth below ground surface (m)	not used	-1.000E+00	---	DMFL
R021	Emanating power of Rn-222 gas	not used	2.500E-01	---	EMANA(1)
R021	Emanating power of Rn-220 gas	not used	1.500E-01	---	EMANA(2)
TITL	Number of graphical time points	128	---	---	NPTS
TITL	Maximum number of integration points for dose	5	---	---	LYMAX
TITL	Maximum number of integration points for risk	17	---	---	KYMAX

Summary of Pathway Selections

Pathway	User Selection
1 -- external gamma	suppressed
2 -- inhalation (w/o radon)	suppressed
3 -- plant ingestion	active
4 -- meat ingestion	active
5 -- milk ingestion	active
6 -- aquatic foods	active
7 -- drinking water	active
8 -- soil ingestion	suppressed
9 -- radon	suppressed
Find peak pathway doses	suppressed

CALCULATION BRIEF EXCERPTS

DISCLAIMER FOR CALCULATIONS

The calculations that are provided in the following 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.

CALCULATION BRIEFS

The following calculation briefs have been prepared in accordance with WCH-DE-01, *Design Engineering Procedures Manual*, EDPI-4.37-01, "Project Calculations," Washington Closure Hanford, Richland, Washington.

WCH, 2006, *105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification RESRAD Calculation Brief,* Calculation No. 0100H-CA-V0086, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2006, *105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations*, Calculation No. 0100H-CA-V0085, Rev. 0, Washington Closure Hanford, Richland, Washington.

WCH, 2006*, 105-H Reactor Building Fuel Storage Basin Comparison to Drinking Water Standards (MCL)*, Calculation No. 0100H-CA-V0087, Rev. 0, Washington Closure Hanford, Richland, Washington.

NOTE: The calculation briefs referenced in this appendix are kept in the active Washington Closure Hanford project files and are available upon request. When the project is completed, the files will be stored in a U.S. Department of Energy, Richland Operations Office repository. Only excerpts of the calculation briefs are included in this appendix.

105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification RESRAD Calculation Brief

(This calculation brief only pertains to the 105-H Fuel Storage Basin Soils [118-H-6:3] and Deep Zone Side-Slope Soils [118-H-6:6])

CALCULATION COVER SHEET

Project Title 105-H Reactor Interim Safe Storage **Job No.** 14655
Area 100-H Area
Discipline Environmental ***Calc. No.** 0100H-CA-V0086
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification RESRAD Calculation Brief
Computer Program RESRAD **Program No.** Version 6.30

The attached calculations have been generated to document compliance with established cleanup levels.
These documents 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 – 8 pg Attm. 1 - 3 pg Attm. 2 - 31 pg Attm. 3 - 32 pg Attm. 4 - 50 pg Attm. 5 - 19 pg Attm. 6 - 33 pg Attm. 7 - 50 pg Attm. 8 - 19 pg Attm. 9 - 27 pg Attm. 10 - 50 pg Attm. 11 - 19 pg Attm. 12 - 33 pg Attm. 13 - 50 pg Attm. 14 - 19 pg Total – 444 pages	S. W. Clark S.W. Clark 2/28/06	M. W. Perrott MW Perrott 2/28/06	D. W. Shea DWShea 3/6/06	E. G. Ison EGI G. Ison	03/09/06

SUMMARY OF REVISION	

*Obtain Calc. No. from DIS

DE01-437.03 (12/09/2004)

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark SWC	Date:	2/28/06	Calc. No.:	0100H-CA-V0086	Rev.:	0
Project:	105-H Reactor Cleanup Verification	Job No:	14655	Checked:	M. W. Perrott MWP	Date:	3/28/06
Subject:	105-H Reactor Bldg. (118-H-6) Fuel Storage Basin Cleanup Verification RESRAD Calculations					Sheet No. 1 of 8	

PURPOSE:

Use the Rural Residential and Post-Drilling Scenarios to predict the soil and groundwater concentrations, dose, and risk contributions from radionuclide and nonradionuclide contaminants in residual shallow and deep zone soil at the Fuel Storage Basin of the 105-H Reactor (118-H-6) Interim Safe Storage project over a period of 1,000 years. The Sleeping Resident Scenario is not evaluated because all structures have been removed to more than 4.6 m (15 ft) below ground surface.

GIVEN/REFERENCES:

1) Cleanup verification data from the *105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculation*, Calculation No. 0100H-CA-V0085, Rev. 0, Bechtel Hanford, Inc., Richland, Washington.
2) Rural Residential Scenario background and radionuclide and nonradionuclide cleanup levels are from the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
3) Post-Drilling Resident Scenario background and details are from the *Guidance for Radiological Release of DOE Real Property at Hanford,* DOE/RL-97-93, Rev. 1, U.S. Department of Energy, Richland Operations Office, Richland, Washington, 1999.
4) Radioactive and nonradioactive contaminants of concern (COCs) are from the *Sampling and Analysis Plan for Interim Closure of the 105-D and 105-H Reactor Below-Grade Structures and Underlying Soils*, (SAP) DOE/RL-2001-18, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington. The radionuclide COCs are americium-241, carbon-14, cesium-137, cobalt-60, europium-152, europium-154, europium-155, neptunium-237, nickel-63, plutonium-238, plutonium-239/240, strontium-90, thorium-228, thorium-232, tritium (H-3), uranium-233/234, uranium-235, and uranium-238. However, europium-155 and plutonium-238 were undetected in all samples and are therefore not considered further in these calculations. The nonradionuclide COCs are hexavalent chromium, lead, mercury, and Polychlorinated Biphenyls (PCB)s. However, mercury and all of the PCB congeners except Aroclor-1254 were undetected and are therefore not considered further in these calculations.
5) Compliance with residual radioactivity guidelines was determined using the RESidual RADioactivity (RESRAD) computer code, version 6.30, developed for the U.S. Department of Energy by the Environmental Assessment Division of Argonne National Laboratory, Argonne, Illinois.
6) General RESRAD modeling input parameters and scenario background and details for the Post-Drilling Resident Scenario are from Appendix B and Appendix C of the SAP, DOE/RL-2001-18, Rev. 0. Updated RESRAD modeling input parameters are from the RDR/RAWP. The rationale for using updated RESRAD modeling input parameters are included in CCN 096531, S.W. Clark to M.R. Morton, March 18, 2002, *Comparison of RESRAD Input Parameters for the Interim Safe Storage Project to RESRAD Input Parameters for the 100 Area Remedial Action Project,* Bechtel Hanford, Inc., Richland, Washington.
7) Sampling locations are from the *Instruction Guide for Verification Sampling of the 105-D and 105-H Reactor Below-Grade Structures,* Calculation No. 0100X-IG-G0004, Rev. 0,

Bechtel Hanford, Inc., Richland, Washington. Maps of sample locations are provided in the CVP for 105-H Reactor.

8) Relative individual Pu-239 and Pu-240 activities were calculated from the reported Pu-239/240 results per *Ratios of Plutonium Isotopes at 100 Areas Remedial Action Sites*, Calculation No. 0100B-CA-V0013, Bechtel Hanford, Inc., Richland, Washington.
9) *100 Area Analogous Sites RESRAD Evaluation*, Calculation No. 0100X-CA-V0050, Rev. 0, Bechtel Hanford Inc., Richland, Washington, was used for RESRAD modeling evaluations to predict if contaminants at analogous sites in 100 Area soils would migrate to groundwater within a 1,000-year period based on the K_d value of the constituent(s) and the vertical distance to groundwater.
10) The *Cleanup Verification Package for the 116-H-1 Process Effluent Trench*, CVP-2000-00026, Rev. 0, Bechtel Hanford, Inc., Richland, Washington, and the *Cleanup Verification Package for the 116-H-7 Retention Basin*, CVP-2000-00027, Rev. 0, Bechtel Hanford, Inc., Richland, Washington, show that uncontaminated vadose zone soil exists beneath the waste site, based on analogous site test pit data from the 100-H Area. The test pit data show that contaminant concentrations (that are below direct exposure cleanup levels) decrease to background concentrations within less than 3 m (10 ft) below the elevation at which the contamination occurs.
11) Residual shallow zone soil contamination has been deferred to Field Remediation per an agreement recorded in the *Unit Managers Meeting: 100 Areas Remedial Action Operable Unit and Source Operable Units 06/24/04*, CCN 119468, Bechtel Hanford, Inc., Richland, Washington.

SOLUTION:

1) Table 1 shows the site dimensions used for the RESRAD modeling evaluation of the Rural Residential Scenario of the RDR/RAWP, DOE/RL-96-17, Rev. 5. Soil contamination was left in place in the shallow and deep zones after the removal of the 118-H-6 Fuel Storage concrete structure. The shallow zone contamination has been deferred to Field Remediation per agreement recorded in CCN 119468, the 06/24/04 100 Area UMM minutes.

Table 1. Waste Site Dimensions for RESRAD Modeling

Parameter	Units	FSB Side Slope Shallow Zone	FSB Side Slope Deep Zone	Upper Deep Zone Beneath FSB Floor	Lower Deep Zone Beneath FSB Floor
Cover Depth	m	0	4.6	0	4.6
Area of Contaminated Zone	m^2	1312.84	561.8	672.0	672.0
Length Parallel to Aquifer Flow	m	50.5	50.5	50.5	50.5
Elevation: Surface	m	130.0	130.0	130.0	130.0
Elevation: Bottom of Excavation	m	122.5	122.5	122.5	122.5
Elevation: Groundwater	m	116.2	116.2	116.2	116.2
Thickness: Contaminated Zone	m	4.6	9.2	2.7	3.6
Thickness: Uncontaminated Unsaturated Zone	m	9.2	0	3.6	0

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark	Date:	2/28/06	Calc. No.:	0100H-CA-V0086	Rev.:	0
Project:	105-H Reactor Cleanup Verification	Job No:	14655	Checked:	M. W. Perrott	Date:	2/28/06
Subject:	105-H Reactor Bldg. (118-H-6) Fuel Storage Basin Cleanup Verification RESRAD Calculations					Sheet No. 3 of 8	

2) Table 2 shows the site dimensions used for the RESRAD modeling evaluation of the Post-Drilling Residential Scenario. As described in DOE/RL-97-93, a 100 m^2 area of the ground surface is assumed to be contaminated by hypothetical drill cuttings brought to the surface. A 0.203 m (8 inch) diameter core of the 2.7 m layer of Fuel Storage Basin upper deep zone soil and the 3.6 m layer of Fuel Storage Basin lower deep zone soil is assumed to be mixed into a surface layer of soil that has an area 100 m^2 and is 0.15 m (6 in) thick. That mixing is calculated to result in surface soil concentrations in the Post-Drilling Residential Scenario as shown in the last column of Table 4.

Table 2. Site Dimensions for RESRAD Evaluation of the Post-Drilling Scenario

Parameter	Units	Value	Comments
Cover Depth	m	0	Drill Cuttings on Ground Surface
Area of Shallow Zone	m^2	100	Per DOE/RL-99-35
Length Parallel to Aquifer Flow	m	10	Square Root of Area
Elevation: Surface	m	130.0	NAVD88
Elevation: Groundwater	m	116.2	NAVD88
Thickness: Contaminated Zone	m	0.15	Per DOE/RL-99-35
Thickness: Unsaturated Zone	m	13.65	Unsaturated Zone Soil

3) Pu-239/240 Conversion: The relative individual Pu-239 and Pu-240 activities were calculated from the combined Pu-239/240 analytical results in accordance with Calculation No. 0100B-CA-V0013. Table 3 shows the results of these calculations.

Table 3. Conversion of Pu-239/240 Activity to Relative Pu-239 and Pu-240 Activities

Evaluation	Pu-239/240 Activity (pCi/g)	Pu-239, (pCi/g) (0.807 multiplier)	Pu-240, (pCi/g) (0.193 multiplier)
Fuel Storage Basin Side Slope Shallow Zone	1.06	0.855	0.205
Fuel Storage Basin Side Slope Deep Zone	0.999	0.806	0.193
FSB Upper Deep Zone; Samples 0-1 ft Beneath Fuel Storage Basin Floor	0.90	0.726	0.174
FSB Lower Deep Zone; Samples 8-10 ft Beneath Fuel Storage Basin Floor	0.073 U	0.059 U	0.014 U
Post-Drilling Scenario	0.00581	0.00469	0.00112

4) Table 4 shows the radionuclide activities for each COC. Input factors for each RESRAD run are shown in the "Summary" section of the RESRAD "Mixture Sums and Single Radionuclide Guidelines" printouts in the Attachments to this Calculation Summary.

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark	Date:	2/28/06	Calc. No.:	0100H-CA-V0086	Rev.:	0
Project:	105-H Reactor Cleanup Verification	Job No:	14655	Checked:	M. W. Perrott	Date:	2/28/06
Subject:	105-H Reactor Bldg. (118-H-6) Fuel Storage Basin Cleanup Verification RESRAD Calculations					Sheet No. 4 of 8	

Table 4. Cleanup Verification Data Set

Radionuclide COCs	Radionuclide Activity, pCi/g				
	FSB Side Slope Shallow Zone	FSB Side Slope Deep Zone	Upper Deep Zone Beneath FSB Floor	Lower Deep Zone Beneath FSB Floor	Post-Drilling Scenario [a]
Am-241	3.15E-01	2.57E-01	3.69E-01	7.7E-02 U [b]	2.75E-03
C-14	2.81E+00 U [b]	4.43E+00 U [b]	7.6E+00	1.59E+00 U [b]	5.67E-02
Cs-137	7.2E+00	5.36E+00	1.13E+01	2.16E-01	6.75E-02
Co-60	1.87E-01	1.9E-01	1.99E-01	3.7E-02 U [b]	1.45E-03
Eu-152	1.30E+00	1.26E+00	2.76E+00	8.8E-02 U [b]	1.68E-02
Eu-154	2.6E-01	1.5E-01 U [b]	3.5E-01	1.2E-01 U [b]	2.97E-03
Np-237	2.0E-02 U [b]	3.5E-02	3.0E-02	1.0E-02 U [b]	2.53E-04
Ni-63	1.30E+01	1.60E+01	2.59E+01	1.79E+00 U [b]	1.65E-01
Pu-239	8.55E-01	8.06E-01	7.26E-01	5.9E-02 U [b]	4.69E-03
Pu-240	2.05E-01	1.93E-01	1.74E-01	1.4E-02 U [b]	1.12E-03
Sr-90	6.69E+00	5.56E+00	5.9E+00	1.74E-01	3.57E-02
Th-228	0 (<BG) [b]	0 (<BG) [b]	0 (<BG) [b]	0 (<BG) [b]	0 (<BG) [b]
Th-230	3.35E-01	9.32E-01	6.4E-01	5.90E-01	8.32E-03
Th-232	0 (<BG) [b]	0 (<BG) [b]	0 (<BG) [b]	0 (<BG) [b]	0 (<BG)
Tritium (H-3)	2.0E-02 U [b]	-2.0E-02 U [b]	9.2E-02	3.32E-01	3.12E-03
U-233/234	0 (<BG) [b]	0 (<BG) [b]	0 (<BG) [b]	0 (<BG) [b]	0 (<BG) [b]
U-235	0 (<BG) U [b]	0 (<BG) U [b]	0 (<BG) [b]	0 (<BG) U [b]	0 (<BG) [b]
U-238	0 (<BG) [b]	0 (<BG) [b]	0 (<BG) [b]	0 (<BG) [b]	0 (<BG) [b]
Nonradionuclide COCs [c]	**Nonradionuclide Concentration, mg/Kg**				
Cr(VI)	8.7E-01 [b]	1.5E+00 [b]	9.4E-01 [b]	2.1E-01 U [b]	7.11E-03
Lead	1.15E+01	2.01E+01	1.89E+01	2.6E+00 U [b]	1.30E-01
Aroclor-1254	1.5E-02 [b]	1.4E-02 [b]	2.4E-02	1.4E-02 U [b]	2.49E-04

[a] The Post-Drilling Resident Scenario concentrations are calculated as described on page 4-22 of DOE/RL-97-93, Rev. 1.
[b] Constituent was not evaluated further because concentration is below remedial action goals per the RDR/RAWP or the analyte is below detection limits in soil.
[c] Mercury and all PCB congeners except Aroclor 1254 were below detection limits and were not evaluated.
NA = Not applicable

METHODOLOGY:

1) The year where the peak dose (or concentration) occurs from each individual radionuclide COC was determined by a preliminary run. This year was then included in all final RESRAD runs. For the direct exposure pathway (i.e. soil ingestion and inhalation and external radiation), the peak year occurred at year zero (year 2006) for all COCs. For the water pathways (i.e., drinking water and food ingestion) the peak years were 7.5 for cobalt-60 and tritium in the Rural Residential Scenario from the deep zone, 20.8 for tritium in the Post-Drilling Scenario, 42 for cesium-137 and strontium-90 in the Rural Residential Scenario from the deep zone, and 137 for neptunium-237 and nickel-63 in the Rural Residential Scenario from the deep zone. The 7.5-, 20.8-, 42-, and 137-year time periods were included in all of the RESRAD runs.

2) Runs of RESRAD version 6.30 were completed for the Fuel Storage Basin side slope shallow and deep zone Rural Residential Scenario and the soil beneath the Fuel Storage Basin floor Rural Residential and Post-Drilling Scenarios using the radionuclide concentrations shown in Table 4. RESRAD numerical output reports for radionuclide dose, risk, and concentration for these determinations are presented in the Attachments to this Calculation Summary.

3) Of the nonradionuclides, deep zone hexavalent chromium is below remedial action goals per the RDR/RAWP and all nonradionuclides are below remedial action goals in the Post-Drilling Scenario. Deep zone concentrations of lead and Aroclor-1254 exceed soil lookup values for groundwater protection per the RDR/RAWP and therefore require modeling to demonstrate compliance. A RESRAD modeling evaluation (Calculation No. 0100X-CA-V0050) comparing contaminant K_d value and the vertical distance to groundwater was used to determine if contaminants are predicted to migrate to groundwater within a 1,000 year time frame. The analogous site contaminant depth distribution model assumes an uncontaminated zone between the waste site and groundwater based on analogous site data that includes test pits completed in the 100-H Area (CVP-2000-00026 and CVP-2000-00027). The test pit data show that contaminant depth distributions that are below direct exposure cleanup levels decrease to concentrations below background within less than 3 m (10 ft) below the elevation at which the contamination occurs. For this site the surface elevation is 130 m above mean sea level and the groundwater elevation is 116.2 m above mean sea level. The deep zone contamination is 4.6 m below ground surface. Using these values, the uncontaminated vadose zone thickness is more than 6.2 m and the lookup value from Calculation No. 0100X-CA-V0050 for the minimum K_d value at which contaminants are not predicted to migrate to groundwater within 1,000 years is 12 mL/g. Therefore, the residual deep zone concentrations of lead, mercury, and Aroclor-1254 in Table 4 are protective of groundwater because the K_d values of all these contaminants are greater than 12 mL/g, per the RDR/RAWP.

RESULTS:

1) **Radionuclide "All Pathways" Dose Rate.** Direct exposure dose rates, for the Fuel Storage Basin shallow zone side slopes that have been deferred to Field Remediation for remedial action, exceed the 15 mrem/yr above background limitation cited in the RDR/RAWP for 38 years. The Fuel Storage Basin shallow zone side slopes predicted dose rates at each time interval are given in Attachment 2 and are not discussed further. The "all pathways" (maximum) dose rates for the Fuel Storage Basin deep zone and Post-Drilling Scenario evaluations are shown in Table 5. "All pathways" refers to direct exposure pathways (e.g. soil ingestion, inhalation, external radiation) and the water dependent pathways (e.g. drinking water, plant and meat ingestion). The maximum total all pathways dose rate of 1.56×10^{-2} mrem/yr for the Fuel Storage Basin deep zone and the Post-Drilling Scenario occurs at year one (2007). The Fuel Storage Basin side slopes deep zone is considered separately and has a maximum all pathways dose rate of 1.09 mrem/yr, occurring at year 137.

Table 5. All Pathways Dose Rate (mrem/yr)

Scenario	"All Pathways" Dose Contributions in mrem/yr at Each Time Slice (yr)								
	0	1	3	7.5	12	20.8	42	137	1000
Soil 0-1 ft Beneath FSB Floor	0.00E+00	0.00E+00	0.00E+00	2.72E-03	1.06E-03	1.69E-04	2.03E-06	5.68E-08	8.05E-12
Soil 8-10 ft Beneath FSB Floor	5.09E-03	1.39E-02	1.34E-02	8.41E-03	6.61E-03	6.34E-03	8.24E-03	1.28E-02	1.13E-04
Post-Drilling Scenario	1.79E-03	1.71E-03	1.60E-03	1.39E-03	1.16E-03	8.59E-04	4.25E-04	7.51E-05	6.17E-05
Total All Pathways Dose Rate (mrem/yr)	6.88E-03	1.56E-02	1.50E-02	1.25E-02	8.84E-03	7.37E-03	8.66E-03	1.29E-02	1.75E-04
FSB Side Slope Deep Zone	1.01E-02	3.02E-02	6.86E-02	1.47E-01	2.16E-01	3.29E-01	5.22E-01	1.09E+00	7.76E-01

2) **Radionuclide Excess Cancer Risk.** The radionuclide excess lifetime cancer risk results are shown in Table 6. The maximum total excess lifetime cancer risk for the Fuel Storage Basin deep zone and the Post-Drilling Scenario (3.22×10^{-7}) occurs at year zero (2006). The Fuel Storage Basin side slopes deep zone is considered separately and has a maximum excess lifetime cancer risk of 3.23×10^{-6}, occurring at year 42.

Table 6. Radionuclide Excess Lifetime Cancer Risk

Scenario	Excess Cancer Risk at Each Time Slice (yr)								
	0	1	3	7.5	12	20.8	42	137	1000
Soil 0-1 ft Beneath FSB Floor	3.12E-08	3.40E-08	3.22E-08	2.64E-08	1.03E-08	1.65E-09	1.97E-11	5.99E-13	3.72E-17
Soil 8-10 ft Beneath FSB Floor	2.70E-07	2.52E-07	2.11E-07	1.47E-07	1.21E-07	1.09E-07	1.12E-07	9.42E-08	6.15E-10
Post-Drilling Scenario	2.07E-08	1.99E-08	1.85E-08	1.60E-08	1.34E-08	9.87E-09	4.80E-09	7.26E-10	7.39E-10
Total Excess Cancer Risk	3.22E-07	3.05E-07	2.62E-07	1.90E-07	1.45E-07	1.21E-07	1.17E-07	9.50E-08	1.35E-09
FSB Side Slope Deep Zone	1.97E-06	2.07E-06	2.26E-06	2.60E-06	2.86E-06	3.17E-06	3.23E-06	1.55E-06	3.66E-07

3) **Radionuclide Groundwater Protection.** The radionuclide concentrations in groundwater calculated by the RESRAD model are summarized in Table 7. The organ specific dose via the groundwater (and river) pathway is calculated in a separate calculation brief [*105-H Reactor Building (118-H-6) Fuel Storage Basin Comparison to Drinking Water Standards (MCL)*, Calculation No. 0100H-CA-V0087, Rev. 0, Bechtel Hanford, Inc., Richland, Washington]. Only concentrations are presented here. Cesium-137, tritium (H-3), and strontium-90 were the only contaminants calculated to reach groundwater in the 1,000 years of the RESRAD model run for the vadose zone. These radionuclide contaminants reach groundwater at concentrations significantly below the RAGs.

Table 5. All Pathways Dose Rate (mrem/yr)

Scenario	"All Pathways" Dose Contributions in mrem/yr at Each Time Slice (yr)								
	0	1	3	7.5	12	20.8	42	137	1000
Soil 0-1 ft Beneath FSB Floor	0.00E+00	0.00E+00	0.00E+00	2.72E-03	1.06E-03	1.69E-04	2.03E-06	5.68E-08	8.05E-12
Soil 8-10 ft Beneath FSB Floor	5.09E-03	1.39E-02	1.34E-02	8.41E-03	6.61E-03	6.34E-03	8.24E-03	1.28E-02	1.13E-04
Post-Drilling Scenario	1.79E-03	1.71E-03	1.60E-03	1.39E-03	1.16E-03	8.59E-04	4.25E-04	7.51E-05	6.17E-05
Total All Pathways Dose Rate (mrem/yr)	6.88E-03	1.56E-02	1.50E-02	1.25E-02	8.84E-03	7.37E-03	8.66E-03	1.29E-02	1.75E-04
FSB Side Slope Deep Zone	1.01E-02	3.02E-02	6.86E-02	1.47E-01	2.16E-01	3.29E-01	5.22E-01	1.09E+00	7.76E-01

2) **Radionuclide Excess Cancer Risk.** The radionuclide excess lifetime cancer risk results are shown in Table 6. The maximum total excess lifetime cancer risk for the Fuel Storage Basin deep zone and the Post-Drilling Scenario (3.22×10^{-7}) occurs at year zero (2006). The Fuel Storage Basin side slopes deep zone is considered separately and has a maximum excess lifetime cancer risk of 3.23×10^{-6}, occurring at year 42.

Table 6. Radionuclide Excess Lifetime Cancer Risk

Scenario	Excess Cancer Risk at Each Time Slice (yr)								
	0	1	3	7.5	12	20.8	42	137	1000
Soil 0-1 ft Beneath FSB Floor	3.12E-08	3.40E-08	3.22E-08	2.64E-08	1.03E-08	1.65E-09	1.97E-11	5.99E-13	3.72E-17
Soil 8-10 ft Beneath FSB Floor	2.70E-07	2.52E-07	2.11E-07	1.47E-07	1.21E-07	1.09E-07	1.12E-07	9.42E-08	6.15E-10
Post-Drilling Scenario	2.07E-08	1.99E-08	1.85E-08	1.60E-08	1.34E-08	9.87E-09	4.80E-09	7.26E-10	7.39E-10
Total Excess Cancer Risk	3.22E-07	3.05E-07	2.62E-07	1.90E-07	1.45E-07	1.21E-07	1.17E-07	9.50E-08	1.35E-09
FSB Side Slope Deep Zone	1.97E-06	2.07E-06	2.26E-06	2.60E-06	2.86E-06	3.17E-06	3.23E-06	1.55E-06	3.66E-07

3) **Radionuclide Groundwater Protection.** The radionuclide concentrations in groundwater calculated by the RESRAD model are summarized in Table 7. The organ specific dose via the groundwater (and river) pathway is calculated in a separate calculation brief [*105-H Reactor Building (118-H-6) Fuel Storage Basin Comparison to Drinking Water Standards (MCL)*, Calculation No. 0100H-CA-V0087, Rev. 0, Bechtel Hanford, Inc., Richland, Washington]. Only concentrations are presented here. Cesium-137, tritium (H-3), and strontium-90 were the only contaminants calculated to reach groundwater in the 1,000 years of the RESRAD model run for the vadose zone. These radionuclide contaminants reach groundwater at concentrations significantly below the RAGs.

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark	Date:	2/28/06	Calc. No.:	0100H-CA-V0086	Rev.:	0
Project:	105-H Reactor Cleanup Verification	Job No:	14655	Checked:	M. W. Perrott	Date:	2/28/06
Subject:	105-H Reactor Bldg. (118-H-6) Fuel Storage Basin Cleanup Verification RESRAD Calculations					Sheet No. 7 of 8	

Table 7. RESRAD Predicted Groundwater (Well Water/Drinking Water) Concentrations

COC	Vadose Zone Horizon	Groundwater Concentrations at Each Time Slice (yr)									RAGs from RDR
		0	1	3	7.5	12	20.8	42	137	1000	
Cesium pCi/L	FSB 0-1 ft	0	0	0	0	0	0	0	0	0	60 pCi/L
	FSB 8-10 ft	0	5.39E-04	1.55E-03	3.50E-03	5.05E-03	7.14E-03	8.83E-03	3.19E-03	0	
	Post-Drilling	0	0	0	0	0	0	0	0	0	
	Total	0	5.39E-04	1.55E-03	3.50E-03	5.05E-03	7.14E-03	8.83E-03	3.19E-03	0	
	Side Slope	0	0	0	0	0	0	0	0	0	
Tritium pCi/L	FSB 0-1 ft	0	0	0	5.35E+01	2.09E+01	3.33E+00	3.99E-02	9.74E-11	0	20,000 pCi/L
	FSB 8-10 ft	0	1.70E+02	2.32E+02	1.08E+02	5.00E+01	1.11E+01	3.00E-01	2.74E-08	0	
	Post-Drilling	0	0	0	0	0	0	0	0	0	
	Total	0	1.70E+02	2.32E+02	1.61E+02	7.09E+01	1.45E+01	3.39E-01	2.75E-08	0	
	Side Slope	0	0	0	0	0	0	0	0	0	
Strontium pCi/L	FSB 0-1 ft	0	0	0	0	0	0	0	0	0	8 pCi/L
	FSB 8-10 ft	0	3.18E-03	9.12E-03	2.05E-02	2.94E-02	4.13E-02	5.01E-02	1.67E-02	2.91E-11	
	Post-Drilling	0	0	0	0	0	0	0	0	0	
	Total	0	3.18E-03	9.12E-03	2.05E-02	2.94E-02	4.13E-02	5.01E-02	1.67E-02	2.91E-11	
	Side Slope	0	0	0	0	0	0	0	0	0	

CONCLUSIONS:

- The maximum combined all-pathways dose rate for the Fuel Storage Basin deep zone soils and Post-Drilling Scenario is 1.56×10^{-2} mrem/yr and occurs at year one (2007).
- The Fuel Storage Basin side slopes deep zone is considered separately and has a maximum all pathways dose rate of 1.09 mrem/yr at year 137.
- The dominant pathway for the dose rate is drinking water exposure for the Fuel Storage Basin deep zone soils and Post-Drilling Scenario and for the Fuel Storage Basin side slopes deep zone.
- None of the site COCs are predicted to exceed remedial action goals (RAGs).
- The maximum total excess lifetime cancer risk for the Fuel Storage Basin deep zone and the Post-Drilling Scenario (3.22×10^{-7}) occurs at year zero (2006). The Fuel Storage Basin side slopes deep zone is considered separately and has a maximum excess lifetime cancer risk of 3.23×10^{-6}, occurring at year 42.
- Among the radionuclide contaminants of concern, cesium-137, tritium (H-3), and strontium-90 are calculated to reach groundwater within the 1,000 years of the RESRAD model run. These radionuclides are predicted to reach groundwater at concentrations significantly below the RAGs.

Washington Closure Hanford CALCULATION SHEET

Originator:	S. W. Clark	Date:	2/28/06	Calc. No.:	0100H-CA-V0086	Rev.:	0
Project:	105-H Reactor Cleanup Verification	Job No:	14655	Checked:	M. W. Perrott	Date:	2/28/06
Subject:	105-H Reactor Bldg. (118-H-6) Fuel Storage Basin Cleanup Verification RESRAD Calculations					Sheet No. 8 of 8	

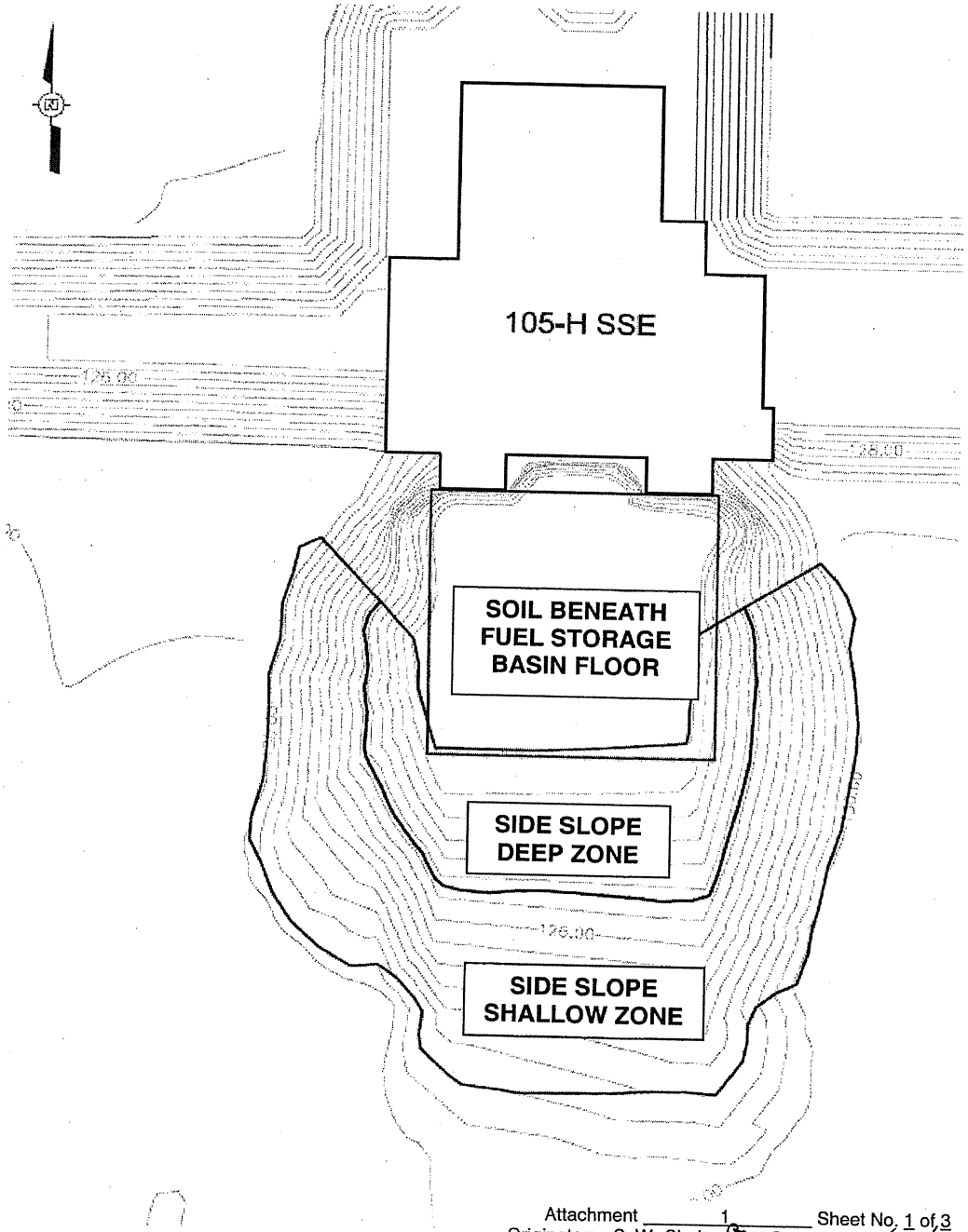
ATTACHMENTS:

1. Graphic showing 105-H Reactor Fuel Storage Basin Cleanup Verification Model (3 pages)
2. RESRAD Output: 105-H Reactor Fuel Storage Basin Side Slopes Shallow Zone Radionuclides; Mixture Sums and Single Radionuclide Guidelines (31 pages)
3. RESRAD Output: 105-H Reactor Fuel Storage Basin Side Slopes Deep Zone Radionuclides; Mixture Sums and Single Radionuclide Guidelines (32 pages)
4. RESRAD Output: 105-H Reactor Fuel Storage Basin Side Slopes Deep Zone Radionuclides, Intake Quantities and Health Risk Factors (50 pages)
5. RESRAD Output: 105-H Reactor Fuel Storage Basin Side Slopes Deep Zone Radionuclides, Concentration of Radionuclides, (19 pages)
6. RESRAD Output: 105-H Reactor Fuel Storage Basin Soil 0-1 ft Beneath Floor Deep Zone Radionuclides; Mixture Sums and Single Radionuclide Guidelines (33 pages)
7. RESRAD Output: 105-H Reactor Fuel Storage Basin Soil 0-1 ft Beneath Floor Deep Zone Radionuclides, Intake Quantities and Health Risk Factors (50 pages)
8. RESRAD Output: 105-H Reactor Fuel Storage Basin Soil 0-1 ft Beneath Floor Deep Zone Radionuclides, Concentration of Radionuclides, (19 pages)
9. RESRAD Output: 105-H Reactor Fuel Storage Basin Soil 8-10 ft Beneath Floor Deep Zone Radionuclides; Mixture Sums and Single Radionuclide Guidelines (27 pages)
10. RESRAD Output: 105-H Reactor Fuel Storage Basin Soil 8-10 ft Beneath Floor Deep Zone Radionuclides, Intake Quantities and Health Risk Factors (50 pages)
11. RESRAD Output: 105-H Reactor Fuel Storage Basin Soil 8-10 ft Beneath Floor Deep Zone Radionuclides, Concentration of Radionuclides, (19 pages)
12. RESRAD Output: 105-H Reactor Post-Drilling Scenario Radionuclides; Mixture Sums and Single Radionuclide Guidelines (33 pages)
13. RESRAD Output: 105-H Reactor Post-Drilling Scenario Radionuclides, Intake Quantities and Health Risk Factors (50 pages)
14. RESRAD Output: 105-H Reactor Post-Drilling Scenario Radionuclides, Concentration of Radionuclides, (19 pages)

ATTACHMENT 1

105-H Reactor Fuel Storage Basin Cleanup Verification Model (3 Pages)

Waste Site Areas

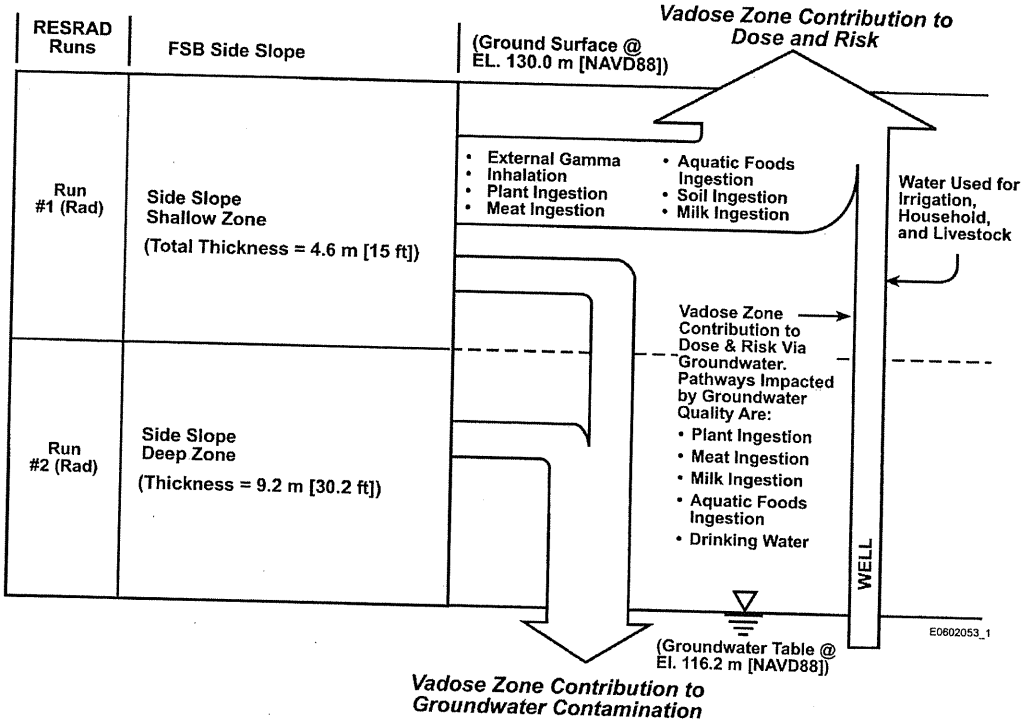


Attachment 1 Sheet No. 1 of 3
Originators: S. W. Clark Date 2/28/06
Chk'd By M. W. Perrott Date 2/28/06
Calc. No. 0100H-CA-V0086 Rev. No. 0

ATTACHMENT 1

105-H Reactor Fuel Storage Basin Cleanup Verification Model (3 Pages)

Fuel Storage Basin Side Slopes
105-H Reactor Fuel Storage Basin Cleanup Verification Model

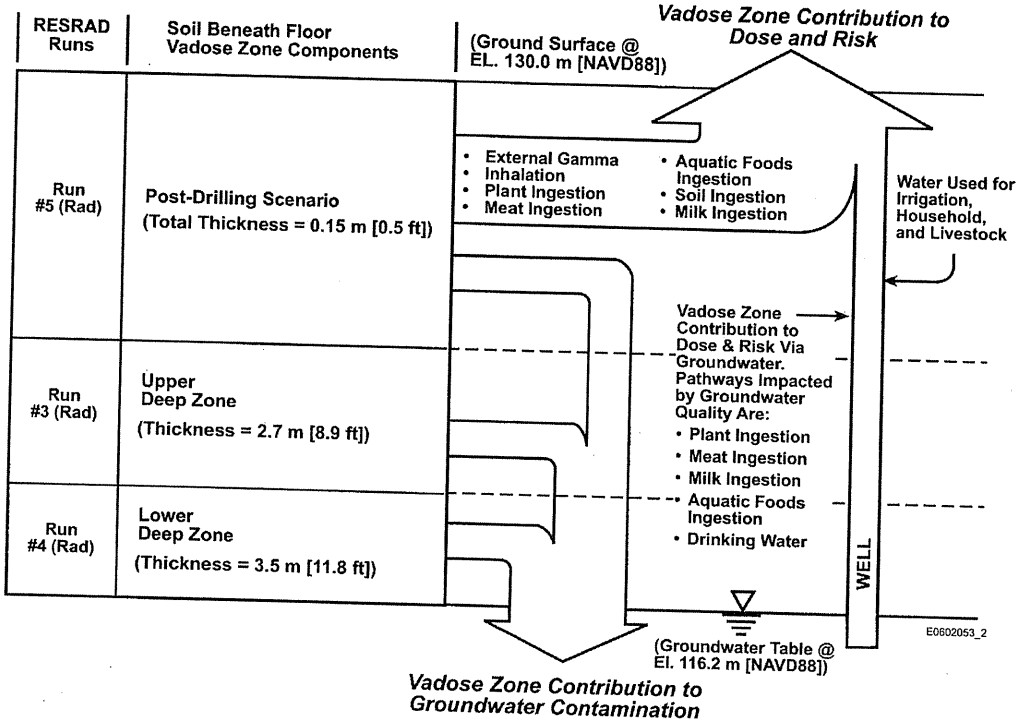


Attachment	1	Sheet No. 2 of 3	
Originators:	S. W. Clark	Date	
Chk'd By	M. W. Perrott	Date	
Calc. No.	0100H-CA-V0086	Rev. No.	0

ATTACHMENT 1

105-H Reactor Fuel Storage Basin Cleanup Verification Model (3 Pages)

Post-Drilling Scenario and Deep Zone Beneath Fuel Storage Basin Floor
105-H Reactor Fuel Storage Basin Cleanup Verification Model



Attachment 1 Sheet No. 3 of 3
Originators: S. W. Clark Date
Chk'd By M. W. Perrott Date
Calc. No. 0100H-CA-V0086 Rev. No. 0

The 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

(This calculation brief only pertains to the 105-H Fuel Storage Basin Soils [118-H-6:3 and 118-H-6:4] and Deep Zone Side-Slope Soils [118-H-6:6])

CALCULATION COVER SHEET

Project Title: Reactor Interim Safe Storage
Job No. 14655
Area 100-H
Discipline Environmental
***Calc. No.** 0100H-CA-V0085
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations
Computer Program Excel
Program No. Excel 2003

The attached calculations have been generated to document compliance with established cleanup levels. These documents 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 Sheets = 21 Total = 22	JMC 2/23/06 J. M. Capron	J.M. Blakley 2/28/06 T. M. Blakley	DWS 3/2/06 D. W. Shea	ERIC G ISON E. G. Ison	03/08/06

SUMMARY OF REVISIONS

* Obtain calc no. from DIS

DE01437.03 (12/09/2004)

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron JMC **Date** 02/23/06 **Calc. No.** 0100H-CA-V0085 **Rev. No.** 0
Project Reactor Interim Safe Storage **Job No.** 14655 **Checked** T. M. Blakley TMB **Date** 2/28/06
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations **Sheet No.** 1 of 21

Summary

Purpose:

Calculate the 95% upper confidence limit (UCL) to evaluate compliance with cleanup standards for the subject site. Also, calculate the carcinogenic risk for applicable nonradionuclide analytes, perform the *Washington Administrative Code* (WAC) 173-340 (Model Toxics Control Act [MTCA]) 3-part test, if required, and calculate the relative percent difference (RPD) for each contaminant of concern (COC).

Table of Contents:

Given/References:

1) Sample Results.
2) All lookup values, remedial action goals (RAGs), and background values are taken from DOE-RL (1996, 2001, and 2005b) and Ecology (1996). The background value for thorium-228 was determined based on secular equilibrium with background thorium-232.
3) DOE-RL, 1996, Hanford Site Background: Part 2, Soil Background for Radionuclides, DOE/RL-96-12, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
4) DOE-RL, 2001, Hanford Site Background: Part 1, Soil Background for Nonradioactive Analytes, DOE/RL-92-24, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
5) DOE-RL, 2005a, *100 Area Remedial Action Sampling and Analysis Plan* (SAP), DOE/RL-96-22, Rev. 4, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
6) DOE-RL, 2005b, *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.
7) Ecology, 1992, *Statistical Guidance for Ecology Site Managers,* Publication #92-54, Washington State Department of Ecology, Olympia, Washington.
8) Ecology, 1993, *Statistical Guidance for Ecology Site Managers, Supplement S-6, Analyzing Site or Background Data with Below-Detection Limit or Below-PQL Values (Censored Data Sets)*, Publication #92-54, Washington State Department of Ecology, Olympia, Washington.
9) Ecology, 1996, *Model Toxics Control Act Cleanup Levels and Risk Calculations (CLARC II)*, Publication #94-145, Washington State Department of Ecology, Olympia, Washington.
10) EPA, 1994, *USEPA Contract Laboratory Program National Functional Guidelines for Inorganic Data Review*, EPA 540/R-94/013, U.S. Environmental Protection Agency, Washington, D.C.
11) WAC 173-340, 1996, "Model Toxics Control Act--Cleanup," *Washington Administrative Code*.

Solution:

Calculation methodology is described in Ecology Pub. #92-54 (Ecology 1992, 1993), below, and in the RDR/RAWP (DOE-RL 2005b). Use data from the attached worksheets to calculate the 95% UCL, hazard quotients, excess carcinogenic risk, perform the WAC 173-340 3-part test for nonradionuclides, and calculate the RPD for each COC in the primary-duplicate and primary-split sample pairs.

Calculation Description:

The subject calculations were performed on data from soil verification samples from the fuel storage basin at the 118-H-6 waste site (105-H Reactor Building). The data were entered into an EXCEL 2003 spreadsheet and calculations performed by utilizing the built-in spreadsheet functions and/or creating formulae within the cells. The statistical evaluation of data for use in accordance with the RDR/RAWP (DOE-RL 2005b) is documented by this calculation. Split and duplicate RPD results are used in evaluation of data quality and are presented in the cleanup verification package (CVP) for this site.

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron JMC **Date** 02/23/06 **Calc. No.** 0100H-CA-V0085 **Rev. No.** 0
Project Reactor Interim Safe Storage **Job No.** 14655 **Checked** T. M. Blakley TMB **Date** 2/28/06
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations **Sheet No.** 2 of 21

Summary (continued)

Methodology:

For nonradioactive analytes with <50% of the data below detection limits and all radionuclide analytes, the statistical value calculated to evaluate the effectiveness of cleanup is the 95% UCL. For nonradioactive analytes with >50% of the data below detection limits, the maximum value for the data set is used instead of the 95% UCL. All nonradionuclide data reported as being below detection limits are set to ½ the detection limit value for calculation of the statistics (Ecology 1993). For radionuclide data, calculation of the statistics was done on the reported value. In cases where the laboratory does not report a value below the minimal detectable activity (MDA), half of the MDA is used in the calculation. For the statistical evaluation of primary-duplicate sample pairs, the samples are averaged before being included in the data set, after adjustments for censored data as described above. (The resulting adjusted data is identified as "Statistical Computation Input Data" in the calculation sheets. Where multiple data sets were available for an individual COC due to quantification by gamma energy analysis and isotope-specific analysis (americium-241, thorium-228, thorium-232, uranium-235, and uranium-238), only data from the isotope-specific analysis was considered.

For nonradionuclides, the WAC 173-340 statistical guidance suggests that a test for distributional form be performed on the data and the 95% UCL calculated on the appropriate distribution using Ecology software. For nonradionuclide small data sets (n < 10) and all radionuclide data sets, the calculations are performed assuming nonparametric distribution, so no test for distribution is performed. For nonradionuclide data sets of ten or greater, distributional testing is done using Ecology's MTCAStat software (Ecology 1993).

The hazard quotient (for shallow zone nonradionuclide COCs) is determined by dividing the statistical value (derived in this calculation) by the WAC 173-340 non-carcinogenic cleanup limit. The excess nonradionuclide carcinogenic risk is determined by dividing the statistical value by the WAC 173-340 carcinogenic cleanup limit and then multiplying by 10^{-6}.

The WAC 173-340 3-part test is performed for nonradionuclide analytes only and determines if:
1) the 95% UCL value exceeds the most stringent cleanup limit for each non-radionuclide COC,
2) greater than 10% of the raw data exceed the most stringent cleanup limit for each non-radionuclide COC,
3) the maximum value in the raw data set exceeds two times the most stringent cleanup limit for each non-radionuclide COC.

The RPD is calculated when both the primary value and either the duplicate or split values are above detection limits and are greater than 5 times the target detection limit (TDL). The TDL is a laboratory detection limit pre-determined for each analytical method, listed in Table II-1 of the SAP (DOE-RL 2005a). The RPD calculations use the following
formula: RPD =[|M-S|/((M+S)/2)]*100

where, M = Main Sample Value S = Split (or duplicate) Sample Value

For quality assurance/quality control (QA/QC) split and duplicate RPD calculations, a value less than +/- 30% indicates the data compare favorably. For regulatory splits, a threshold of 35% is used (EPA 1994). If the RPD is greater than 30% (or 35% for regulatory split data), further investigation regarding the usability of the data is performed. Additional discussion as necessary is provided in the data quality assessment section of the applicable CVP.

If regulator split comparison is required, an additional parameter is evaluated. A control limit of +/- 2 times the TDL shall be used if either the main or regulator split value is less than 5 times the TDL and above detection. In the case where only one result is greater than 5 times the TDL and the other is below, the +/- 2 times the TDL criteria applies. Therefore, the following calculation is performed as part of the evaluation for these two cases involving regulator split data: difference = main - regulator split. If the difference is greater than +/- 2 times the TDL, then further investigation regarding the usability of the data is performed and presented in the applicable CVP data quality assessment section.

No regulatory split samples were collected for this site.

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage

Date 02/23/06 **Calc. No.** 0100H-CA-V0085 **Rev. No.** 0
Job No. 14655 **Checked** T. M. Blakley TMB **Date** 2/28/06
Sheet No. 3 of 21

Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Summary (continued)

Results:

The results presented in the summary tables that follow are for use in RESidual RADioactivity dose/risk analysis and the CVP for this site.

Statistical Results Summary

Analyte	FSB Side Slope (SZ)		FSB Side Slope (DZ)		FSB 0-1' bgs (DZ)		FSB 8-10' bgs (DZ)		Units
	Result	Qualifier	Result	Qualifier	Result	Qualifier	Result	Qualifier	
Hexavalent Chromium	8.7E-01		1.5E+00		9.4E-01		2.1E-01	U	mg/kg
Lead	1.15E+01		2.01E+01		1.89E+01		2.6E+00	U	mg/kg
Mercury	1.E-02	U	2.E-02	U	2.E-02	U	2.E-02	U	mg/kg
Aroclor-1016	1.4E-02	U	1.4E-02	U	1.4E-02	U	1.4E-02	U	mg/kg
Aroclor-1221	1.4E-02	U	1.4E-02	U	1.4E-02	U	1.4E-02	U	mg/kg
Aroclor 1232	1.4E-02	U	1.4E-02	U	1.4E-02	U	1.4E-02	U	mg/kg
Aroclor-1242	1.4E-02	U	1.4E-02	U	1.4E-02	U	1.4E-02	U	mg/kg
Aroclor-1248	1.4E-02	U	1.4E-02	U	1.4E-02	U	1.4E-02	U	mg/kg
Aroclor-1254	1.5E-02		1.4E-02		2.4E-02		1.4E-02	U	mg/kg
Aroclor-1260	1.4E-02	U	1.4E-02	U	1.4E-02	U	1.4E-02	U	mg/kg
Americium-241	3.15E-01		2.57E-01		3.69E-01		7.7E-02	U	pCi/g
Carbon-14	2.81E+00	U	4.43E+00	U	7.6E+00		1.59E+00	U	pCi/g
Cesium-137	7.2E+00		5.36E+00		1.13E+01		2.16E-01		pCi/g
Cobalt-60	1.87E-01		1.9E-01		1.99E-01		3.7E-02	U	pCi/g
Europium-152	1.30E+00		1.26E+00		2.76E+00		8.8E-02	U	pCi/g
Europium-154	2.6E-01		1.5E-01	U	3.5E-01		1.2E-01	U	pCi/g
Europium-155	9.E-02	U	1.3E-01	U	1.5E-01	U	7.8E-02	U	pCi/g
Neptunium-237	2.0E-02	U	3.5E-02		3.0E-02		1.0E-02	U	pCi/g
Nickel-63	1.30E+01		1.60E+01		2.59E+01		1.79E+00	U	pCi/g
Plutonium-238	2.7E-02	U	4.1E-02	U	4.5E-02	U	1.9E-02	U	pCi/g
Plutonium-239/240	1.06E+00		9.99E-01		9.0E-01		7.3E-02	U	pCi/g
Strontium-90	6.69E+00		5.56E+00		5.9E+00		1.74E-01		pCi/g
Thorium-228	0 (<BG)		0 (<BG)		0 (<BG)		0 (<BG)		pCi/g
Thorium-230	3.35E-01		9.32E-01		6.4E-01		5.90E-01		pCi/g
Thorium-232	0 (<BG)		0 (<BG)		0 (<BG)		0 (<BG)		pCi/g
Tritium	2.0E-02	U	-2.0E-02	U	9.2E-02		3.32E-01		pCi/g
Uranium-233/234	0 (<BG)		0 (<BG)		0 (<BG)		0 (<BG)		pCi/g
Uranium-235	0 (<BG)	U	0 (<BG)	U	0 (<BG)		0 (<BG)	U	pCi/g
Uranium-238	0 (<BG)		0 (<BG)		0 (<BG)		0 (<BG)		pCi/g

BG = background
bgs = below ground surface
DZ = deep zone
FSB = fuel storage basin
SZ = shallow zone
U = undetected

WAC 173-340 Evaluation (Shallow Zone Side Slope)

3-Part Test:

95% UCL > Cleanup Limit? YES
> 10% above Cleanup Limit? YES
Any sample > 2x Cleanup Limit? NO

Because of the "yes" answers to the MTCA 3-part test, additional site-specific evaluation will be performed for lead within the CVP.

Risk Estimate:

Nonrad noncarcinogenic index sum: 4.6E-02
Nonrad carcinogenic risk: 4.5E-07

WAC 173-340 Evaluation (Deep Zone Side Slope)

3-Part Test:

95% UCL > Cleanup Limit? YES
> 10% above Cleanup Limit? YES
Any sample > 2x Cleanup Limit? YES

Because of the "yes" answers to the MTCA 3-part test, additional site-specific evaluation will be performed for lead within the CVP.

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Date 02/23/06 **Calc. No.** 0100H-CA-V0085 **Rev. No.** 0
Job No. 14655 **Checked** T. M. Blakley **Date** 2/28/06
Sheet No. 4 of 21
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Summary (continued)

WAC 173-340 Evaluation (FSB Underlying Soil 0-1' bgs)

3-Part Test:

95% UCL > Cleanup Limit?	YES
> 10% above Cleanup Limit?	YES
Any sample > 2x Cleanup Limit?	YES

Because of the "yes" answers to the MTCA 3-part test, additional site-specific evaluation will be performed for lead within the CVP.

WAC 173-340 Evaluation (FSB Underlying Soil 8-10' bgs)

3-Part Test:

95% UCL > Cleanup Limit?	NO
> 10% above Cleanup Limit?	NO
Any sample > 2x Cleanup Limit?	NO

Residual nonradionuclide COC concentrations meet all criteria of the 3-part test.

Relative Percent Difference Results* QA/QC Analysis

Analyte	FSB Side Slope (SZ)		FSB Side Slope (DZ)		FSB 0-1' bgs (DZ)		FSB 8-10' bgs (DZ)	
	Duplicate Analysis**	Split Analysis**	Duplicate Analysis**	Split Analysis**	Duplicate Analysis**	Split Analysis**	Duplicate Analysis**	Split Analysis**
Cesium-137	--	--	13%	5.4%	--	--	--	--

*RPD evaluation was required only for Cesium-137 data from the fuel storage basin deep zone side slopes.
**The significance of the reported RPD values is addressed within the Data Quality Assessment for the CVP for this site.
QA/QC = quality assurance/quality control
RPD = relative percent difference

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 5 of 21

1 **Fuel Storage Basin Side Slope (Shallow Zone)**

2	Sampling	HEIS	Sample	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248			Aroclor-1254			Aroclor-1260		
3	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	A1	J01C47	3/29/2004	2.1E-01	U	2.1E-01	7.2E+00		2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
5	Duplicate of J01C47	J01C51	3/29/2004	2.1E-01	U	2.1E-01	7.9E+00		2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
6	A2	J01C48	3/29/2004	8.7E-01		2.1E-01	1.30E+01		2.3E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02		1.4E-02	1.4E-02	U	1.4E-02
7	A3	J01C49	3/29/2004	2.1E-01	U	2.1E-01	9.5E+00		2.2E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.7E-02		1.7E-02	1.4E-02	U	1.4E-02
8	A4	J01C50	3/29/2004	2.1E-01	U	2.1E-01	7.9E+00		2.4E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02

9 **Statistical Computation Input Data**

10	Sampling	HEIS	Sample	Hexavalent Chromium	Lead	Mercury	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
11	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
12	A1	J01C47/J01C51	3/29/2004	1.1E-01	7.6E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
13	A2	J01C48	3/29/2004	8.7E-01	1.30E+01	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	1.4E-02	7.0E-03
14	A3	J01C49	3/29/2004	1.1E-01	9.5E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	1.7E-02	7.0E-03
15	A4	J01C50	3/29/2004	1.1E-01	7.9E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03

16 **Statistical Computations**

17		Hexavalent Chromium	Lead	Mercury	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
18	95% UCL value based on	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Small data set. Use nonparametric z-statistic.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Small data set. Use nonparametric z-statistic.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.
19	N	4	4	4	4	4	4	4	4	4	4
20	% < Detection limit	75%	0%	100%	100%	100%	100%	100%	100%	50%	100%
21	mean	3.0E-01	9.5E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	1.1E-02	7.0E-03
22	st. dev.	3.8E-01	2.5E+00	0	0	0	0	0	0	5.E-03	0
23	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
24	95% UCL on mean	NA	1.15E+01	NA	NA	NA	NA	NA	NA	1.5E-02	NA
25	max value	8.7E-01	1.30E+01	1.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.7E-02	1.4E-02 U
26	Statistical value	8.7E-01	1.15E+01	1.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.5E-02	1.4E-02 U
27	Background	NA	1.02E+01	3.3E-01	NA	NA	NA	NA	NA	NA	NA
28	Statistical value above background	8.7E-01	1.15E+01	1.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.5E-02	1.4E-02 U
29	**Most Stringent Cleanup Limit for nonradionuclide and RAG type**	2 River Protection	10.2 BG/GW/River Protection	0.33 BG/GW/River Protection	0.017 RDL/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection
30	**WAC 173-340 3-PART Test**										
31	Statistical value > Cleanup Limit?	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
32	> 10% above Cleanup Limit?	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
33	Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
34	**EXCESS RISK EVALUATION**										
35	**WAC 173-340 Non-Carcinogenic Cleanup:**	240	353	24	14.3	NA	NA	NA	NA	1.6	NA
36	Hazard quotient for nonradionuclide:	3.6E-03	3.3E-02	0	0	0	0	0	0	9.6E-03	0
37	**WAC 173-340 Carcinogenic Cleanup:**	2.1	NA	NA	5.6	0.5	0.5	0.5	0.5	0.5	0.5
38	Risk for carcinogenic nonradionuclide:	4.1E-07	0	0	0	0	0	0	0	3.1E-08	0
39	**WAC 173-340 3-Part-Test Compliance?**	NO									
40	**Nonrad noncarcinogenic index sum:**	4.6.E-02									
41	**Nonrad carcinogenic risk:**	4.5E-07									

42 BG = background
43 GW = groundwater
44 HEIS = Hanford Environmental Information System
45 NA = not applicable

PQL = practical quantitation limit
Q = qualifier
RAG = remedial action goal
RDL = required detection limit

U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley

Rev. No. 0
Date 2/28/06
Sheet No. 6 of 21

1 **Fuel Storage Basin Side Slope (Shallow Zone) (continued)**

2	Sampling	HEIS	Sample	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Neptunium-237			Nickel-63			Plutonium-238		
3	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	A1	J01C47	3/29/2004	-6.4E-02	U	4.9E-01	7.29E-01	U	5.4E+00	1.32E-01		7.7E-02	7.5E-02	U	7.5E-02	2.2E-01	U	2.2E-01	2.4E-01	U	2.4E-01	1.8E-01	U	1.8E-01	1.8E-02	U	4.3E-02	0	U	5.3E+00	3.1E-02	U	2.4E-01
5	Duplicate of J01C47	J01C51	3/29/2004	-3.7E-02	U	2.8E-01	2.33E+00	U	5.7E+00	1.59E-01		5.9E-02	5.9E-02	U	5.9E-02	1.8E-01	U	1.8E-01	1.8E-01	U	1.8E-01	1.5E-01	U	1.5E-01	2.1E-02	U	3.2E-02	-2.16E+00	U	5.5E+00	0	U	2.4E-01
6	A2	J01C48	3/29/2004	-5.2E-02	U	4.0E-01	1.40E+00	U	4.6E+00	1.78E+00		1.2E-01	1.0E-01	U	1.0E-01	3.96E-01		2.1E-01	3.0E-01	U	3.0E-01	2.0E-01	U	2.0E-01	1.7E-02	U	4.1E-02	2.20E+00	U	5.8E+00	0	U	2.6E-01
7	A3	J01C49	3/29/2004	4.99E-01		2.5E-01	3.54E+00	U	5.9E+00	1.04E+01		8.6E-02	2.64E-01		4.8E-02	1.85E+00		2.0E-01	3.32E-01		1.8E-01	1.7E-01	U	1.7E-01	1.0E-02	U	5.3E-02	1.96E+01		6.5E+00	3.6E-02	U	2.8E-01
8	A4	J01C50	3/29/2004	-3.2E-02	U	2.4E-01	1.20E+00	U	5.0E+00	7.1E-02	U	7.1E-02	5.0E-02	U	5.0E-02	1.2E-01	U	1.2E-01	1.7E-01	U	1.7E-01	1.3E-01	U	1.3E-01	1.8E-02	U	3.5E-02	-1.75E+00	U	5.4E+00	0	U	2.4E-01

9 Note: Radiological analytical methods use statistically-determined floating calibration curves that are not forced through the origin; therefore, negative values are routinely reported for undetected analytes. This does not diminish the usability of the data.

10 **Statistical Computation Input Data**

11	Sampling	HEIS	Sample	Americium-241	Carbon-14	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Neptunium-237	Nickel-63	Plutonium-238
12	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
13	A1	J01C47/J01C51	3/29/2004	-5.1E-02	1.53E+00	1.46E-01	3.4E-02	1.0E-01	1.1E-01	8.3E-02	2.0E-02	-1.08E+00	1.6E-02
14	A2	J01C48	3/29/2004	-5.2E-02	1.40E+00	1.78E+00	5.0E-02	3.96E-01	1.5E-01	1.0E-01	1.7E-02	2.20E+00	0
15	A3	J01C49	3/29/2004	4.99E-01	3.54E+00	1.04E+01	2.64E-01	1.85E+00	3.32E-01	8.5E-02	1.0E-02	1.96E+01	3.6E-02
16	A4	J01C50	3/29/2004	-3.2E-02	1.20E+00	3.6E-02	2.5E-02	6.0E-02	8.5E-02	6.5E-02	1.8E-02	-1.75E+00	0

17 **Statistical Computations**

18		Americium-241	Carbon-14	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Neptunium-237	Nickel-63	Plutonium-238
19	95% UCL value based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
20	N	4	4	4	4	4	4	4	4	4	4
21	% < Detection limit	75%	100%	25%	75%	50%	75%	100%	100%	75%	100%
22	mean	9.1E-02	1.92E+00	3.1E+00	9.3E-02	6.0E-01	1.7E-01	8.E-02	1.6E-02	4.7E+00	1.3E-02
23	st. dev.	2.72E-01	1.09E+00	4.9E+00	1.14E-01	8.5E-01	1.1E-01	1.E-02	4.E-03	1.01E+01	1.7E-02
24	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
25	95% UCL on mean	3.15E-01	2.81E+00	7.2E+00	1.87E-01	1.30E+00	2.6E-01	9.E-02	2.0E-02	1.30E+01	2.7E-02
26	max value	4.99E-01	3.54E+00 U	1.04E+01	2.64E-01	1.85E+00	3.32E-01	2.0E-01 U	2.1E-02 U	1.96E+01	3.6E-02 U
27	Statistical value	3.15E-01	2.81E+00 U	7.2E+00	1.87E-01	1.30E+00	2.6E-01	9.E-02 U	2.0E-02 U	1.30E+01	2.7E-02 U
28	Background	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
29	Statistical value above background	3.15E-01	2.81E+00 U	7.2E+00	1.87E-01	1.30E+00	2.6E-01	9.E-02 U	2.0E-02 U	1.30E+01	2.7E-02 U

30 HEIS = Hanford Environmental Information System
31 MDA = minimum detectable activity
32 NA = not applicable

Q = qualifier
U = undetected
UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
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Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

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Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 7 of 21

1 **Fuel Storage Basin Side Slope (Shallow Zone) (continued)**

2	Sampling	HEIS	Sample	Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230			Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
3	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	A1	J01C47	3/29/2004	6.2E-02	U	2.4E-01	1.31E-01	U	2.3E-01	7.01E-01		2.7E-01	1.40E-01	U	2.7E-01	7.68E-01		2.7E-01	4.1E-02	U	7.1E-01	6.47E-01		2.8E-01	8.7E-02	U	3.3E-01	6.11E-01		2.8E-01
5	Duplicate of J01C47	J01C51	3/29/2004	6.4E-02	U	2.4E-01	1.38E-01	U	2.2E-01	9.63E-01		2.9E-01	4.99E-01		2.9E-01	7.29E-01		2.9E-01	-3.73E-01	U	7.2E-01	4.36E-01		2.0E-01	0	U	2.4E-01	3.85E-01		2.0E-01
6	A2	J01C48	3/29/2004	3.43E-01		2.6E-01	1.49E+00		2.0E-01	8.49E-01		2.6E-01	3.05E-01		2.6E-01	8.12E-01		2.6E-01	-2.8E-02	U	7.4E-01	5.24E-01		3.1E-01	4.9E-02	U	3.7E-01	3.63E-01		3.1E-01
7	A3	J01C49	3/29/2004	1.52E+00		2.8E-01	9.78E+00		1.9E-01	8.60E-01		2.9E-01	3.35E-01		2.8E-01	7.45E-01		2.8E-01	-4.2E-02	U	7.4E-01	6.55E-01		2.2E-01	1.04E-01	U	2.6E-01	4.56E-01		2.2E-01
8	A4	J01C50	3/29/2004	0	U	2.4E-01	2.9E-02	U	2.3E-01	7.80E-01		3.0E-01	2.33E-01	U	3.0E-01	4.66E-01		3.0E-01	3.7E-02	U	6.4E-01	4.41E-01		2.4E-01	0	U	2.9E-01	4.09E-01		2.4E-01

9 Note: Radiological analytical methods use statistically-determined floating calibration curves that are not forced through the origin; therefore, negative values are routinely reported for undetected analytes. This does not diminish the usability of the data.

10 **Statistical Computation Input Data**

11	Sampling	HEIS	Sample	Plutonium-239/240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Tritium	Uranium-233/234	Uranium-235	Uranium-238
12	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
13	A1	J01C47/J01C51	3/29/2004	6.3E-02	1.35E-01	8.32E-01	3.20E-01	7.49E-01	-1.66E-01	5.42E-01	4.4E-02	4.98E-01
14	A2	J01C48	3/29/2004	3.43E-01	1.49E+00	8.49E-01	3.05E-01	8.12E-01	-2.8E-02	5.24E-01	4.9E-02	3.63E-01
15	A3	J01C49	3/29/2004	1.52E+00	9.78E+00	8.60E-01	3.35E-01	7.45E-01	-4.2E-02	6.55E-01	1.04E-01	4.56E-01
16	A4	J01C50	3/29/2004	0	2.9E-02	7.80E-01	2.33E-01	4.66E-01	3.7E-02	4.41E-01	0	4.09E-01

17 **Statistical Computations**

18		Plutonium-239/240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Tritium	Uranium-233/234	Uranium-235	Uranium-238
19	95% UCL value based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
20	N	4	4	4	4	4	4	4	4	4
21	% < Detection limit	50%	50%	0%	25%	0%	100%	0%	100%	0%
22	mean	4.8E-01	2.86E+00	8.30E-01	2.98E-01	6.93E-01	-5.0E-02	5.40E-01	4.9E-02	4.32E-01
23	st. dev.	7.1E-01	4.66E+00	3.5E-02	4.5E-02	1.54E-01	8.5E-02	8.8E-02	4.3E-02	5.8E-02
24	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
25	95% UCL on mean	1.06E+00	6.69E+00	8.59E-01	3.35E-01	8.20E-01	2.0E-02	6.13E-01	8.4E-02	4.80E-01
26	max value	1.52E+00	9.78E+00	9.63E-01	4.99E-01	8.12E-01	4.1E-02 U	6.55E-01	1.04E-01 U	6.11E-01
27	Statistical value	1.06E+00	6.69E+00	8.59E-01	3.35E-01	8.20E-01	2.0E-02 U	6.13E-01	8.4E-02 U	4.80E-01
28	Background	NA	NA	1.32E+00	NA	1.32E+00	NA	1.1E+00	1.1E-01	1.1E+00
29	Statistical value above background	1.06E+00	6.69E+00	0 (<BG)	3.35E-01	0 (<BG)	2.0E-02 U	0 (<BG)	0 (<BG) U	0 (<BG)

30 BG = background
31 HEIS = Hanford Environmental Information System
32 MDA = minimum detectable activity
33 NA = not applicable

Q = qualifier
U = undetected
UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 8 of 21

1 **Fuel Storage Basin Side Slope (Shallow Zone) (continued)**

2 **Split-Duplicate Analysis**

3	Sampling	HEIS	Sample	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248			Aroclor-1254			Aroclor-1260		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	A1	J01C47	3/29/2004	2.1E-01	U	2.1E-01	7.2E+00		2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
6	Duplicate of J01C47	J01C51	3/29/2004	2.1E-01	U	2.1E-01	7.9E+00		2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
7	Split of J01C47	J01C56	3/29/2004	3.50E-01	U	3.50E-01	3.50E-01	U	3.50E-01	3.50E-01	U	3.50E-01	3.50E-01	U	3.50E-01	3.50E-01	U	3.50E-01	3.50E-01	U	3.50E-01	3.50E-01	U	3.50E-01	3.50E-01	U	3.50E-01	3.50E-01	U	3.50E-01	3.50E-01	U	3.50E-01
8	**TDL**			0.5			5			0.2			0.017			0.017			0.017			0.017			0.017			0.017			0.017		
9	Duplicate Analysis	Both > PQL?		No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
10		Both > 5xTDL?					No-Stop (acceptable)																										
11		RPD																															
12	Split Analysis	Both > PQL?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
13		Both > 5xTDL?																															
14		RPD																															

15

16	Sampling	HEIS	Sample	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Neptunium-237			Nickel-63			Plutonium-238		
17	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
18	A1	J01C47	3/29/2004	-6.4E-02	U	4.9E-01	7.29E-01	U	5.4E+00	1.32E-01		7.7E-02	7.5E-02	U	7.5E-02	2.2E-01	U	2.2E-01	2.4E-01	U	2.4E-01	1.8E-01	U	1.8E-01	1.8E-02	U	4.3E-02	0	U	5.3E+00	3.1E-02	U	2.4E-01
19	Duplicate of J01C47	J01C51	3/29/2004	-3.7E-02	U	2.8E-01	2.33E+00	U	5.7E+00	1.59E-01		5.9E-02	5.9E-02	U	5.9E-02	1.8E-01	U	1.8E-01	1.8E-01	U	1.8E-01	1.5E-01	U	1.5E-01	2.1E-02	U	3.2E-02	-2.16E+00	U	5.5E+00	0	U	2.4E-01
20	Split of J01C47	J01C56	3/29/2004	4.86E-02	U	6.58E-02	3.53E-01		3.13E-01	2.59E-01		1.89E-02	3.27E-02	U	2.31E-02	2.67E-02	U	4.74E-02	-1.74E-03	U	6.06E-02	1.50E-02	U	4.28E-02	0	U	8.40E-02	-2.01E+00	U	7.99E+00	1.80E-02	U	4.89E-02
21	**TDL**			1			5			0.1			0.05			0.1			0.1			0.1			1			30			1		
22	Duplicate Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
23		Both > 5xTDL?								No-Stop (acceptable)																							
24		RPD																															
25	Split Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
26		Both > 5xTDL?								No-Stop (acceptable)																							
27		RPD																															

28

29	Sampling	HEIS	Sample	Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230			Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
30	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
31	A1	J01C47	3/29/2004	6.2E-02	U	2.4E-01	1.31E-01	U	2.3E-01	7.01E-01		2.7E-01	1.40E-01	U	2.7E-01	7.68E-01		2.7E-01	4.1E-02	U	7.1E-01	6.47E-01		2.8E-01	8.7E-02	U	3.3E-01	6.11E-01		2.8E-01
32	Duplicate of J01C47	J01C51	3/29/2004	6.4E-02	U	2.4E-01	1.38E-01	U	2.2E-01	9.63E-01		2.9E-01	4.99E-01		2.9E-01	7.29E-01		2.9E-01	-3.73E-01	U	7.2E-01	4.36E-01		2.0E-01	0	U	2.4E-01	3.85E-01		2.0E-01
33	Split of J01C47	J01C56	3/29/2004	5.41E-02	U	4.88E-02	1.02E+00		8.75E-02	6.95E-01		6.50E-02	1.10E+00		7.18E-02	3.92E-01		1.44E-01	2.64E+01		9.81E+00	5.59E-01		1.47E-01	-2.07E-03	U	8.64E-02	7.16E-01		1.09E-01
34	**TDL**			1			1			1			1			1			10			1			0.5			1		
35	Duplicate Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**		
36		Both > 5xTDL?								No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)		
37		RPD																												
38	Split Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**		
39		Both > 5xTDL?								No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)		
40		RPD																												

41 HEIS = Hanford Environmental Information System
42 MDA = minimum detectable activity
43 PQL = practical quantitation limit
44 Q = qualifier

RPD = relative percent difference
TDL = target detection limit
U = undetected

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 9 of 21

1 **Fuel Storage Basin Side Slope (Deep Zone)**

2	Sampling	HEIS	Sample	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248			Aroclor-1254			Aroclor-1260		
3	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	A1	J01C52	3/29/2004	2.1E-01	U	2.1E-01	1.89E+01		2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
5	Duplicate of J01C52	J01C55	3/29/2004	1.5E+00		2.1E-01	2.24E+01		2.4E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
6	A2	J01C53	3/29/2004	2.1E-01	U	2.1E-01	1.46E+01		2.5E+00	2.E-02	U	2.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	J	1.4E-02	1.4E-02	U	1.4E-02
7	A3	J01C54	3/29/2004	2.1E-01	U	2.1E-01	1.06E+01		2.5E+00	2.E-02	U	2.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02

8 **Statistical Computation Input Data**

9	Sampling	HEIS	Sample	Hexavalent Chromium	Lead	Mercury	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
10	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
11	A1	J01C52/J01C55	3/29/2004	8.E-01	2.07E+01	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
12	A2	J01C53	3/29/2004	1.1E-01	1.46E+01	1.E-02	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	1.4E-02	7.0E-03
13	A3	J01C54	3/29/2004	1.1E-01	1.06E+01	1.E-02	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03

14 **Statistical Computations**

15		Hexavalent Chromium	Lead	Mercury	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
16	95% UCL value based on	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Small data set. Use nonparametric z-statistic.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.
17	N	3	3	3	3	3	3	3	3	3	3
18	% < Detection limit	67%	0%	100%	100%	100%	100%	100%	100%	67%	100%
19	mean	3.E-01	1.53E+01	8.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	9.3E-03	7.0E-03
20	st. dev.	4.E-01	5.1E+00	3.E-03	0	0	0	0	0	4.E-03	0
21	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
22	95% UCL on mean	NA	2.01E+01	NA	NA	NA	NA	NA	NA	NA	NA
23	max value	1.5E+00	2.24E+01	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02	1.4E-02 U
24	Statistical value	1.5E+00	2.01E+01	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02	1.4E-02 U
25	Background	NA	1.02E+01	3.3E-01	NA	NA	NA	NA	NA	NA	NA
26	Statistical value above background	1.5E+00	2.01E+01	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02	1.4E-02 U
27	**Most Stringent Cleanup Limit for nonradionuclide and RAG type**	2 River Protection	10.2 BG/GW/River Protection	0.33 BG/GW/River Protection	0.017 RDL/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection
28	**WAC 173-340 3-PART Test**										
29	Statistical value > Cleanup Limit?	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
30	> 10% above Cleanup Limit?	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
31	Any sample > 2X Cleanup Limit?	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO

32 BG = background
33 GW = groundwater
34 HEIS = Hanford Environmental Information System
35 J = estimated
36 NA = not applicable
37 PQL = practical quantitation limit

Q = qualifier
RAG = remedial action goal
RDL = required detection limit
U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 9 of 21

1 **Fuel Storage Basin Side Slope (Deep Zone)**

2	Sampling	HEIS	Sample	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248			Aroclor-1254			Aroclor-1260		
3	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	A1	J01C52	3/29/2004	2.1E-01	U	2.1E-01	1.89E+01		2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
5	Duplicate of J01C52	J01C55	3/29/2004	1.5E+00		2.1E-01	2.24E+01		2.4E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
6	A2	J01C53	3/29/2004	2.1E-01	U	2.1E-01	1.46E+01		2.5E+00	2.E-02	U	2.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	J	1.4E-02	1.4E-02	U	1.4E-02
7	A3	J01C54	3/29/2004	2.1E-01	U	2.1E-01	1.06E+01		2.5E+00	2.E-02	U	2.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02

8 **Statistical Computation Input Data**

9	Sampling	HEIS	Sample	Hexavalent Chromium	Lead	Mercury	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
10	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
11	A1	J01C52/J01C55	3/29/2004	8.E-01	2.07E+01	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
12	A2	J01C53	3/29/2004	1.1E-01	1.46E+01	1.E-02	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	1.4E-02	7.0E-03
13	A3	J01C54	3/29/2004	1.1E-01	1.06E+01	1.E-02	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03

14 **Statistical Computations**

15		Hexavalent Chromium	Lead	Mercury	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
16	95% UCL value based on	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Small data set. Use nonparametric z-statistic.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.
17	N	3	3	3	3	3	3	3	3	3	3
18	% < Detection limit	67%	0%	100%	100%	100%	100%	100%	100%	67%	100%
19	mean	3.E-01	1.53E+01	8.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	9.3E-03	7.0E-03
20	st. dev.	4.E-01	5.1E+00	3.E-03	0	0	0	0	0	4.E-03	0
21	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
22	95% UCL on mean	NA	2.01E+01	NA	NA	NA	NA	NA	NA	NA	NA
23	max value	1.5E+00	2.24E+01	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02	1.4E-02 U
24	Statistical value	1.5E+00	2.01E+01	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02	1.4E-02 U
25	Background	NA	1.02E+01	3.3E-01	NA	NA	NA	NA	NA	NA	NA
26	Statistical value above background	1.5E+00	2.01E+01	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02	1.4E-02 U
27	**Most Stringent Cleanup Limit for nonradionuclide and RAG type**	2 River Protection	10.2 BG/GW/River Protection	0.33 BG/GW/River Protection	0.017 RDL/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection
28	**WAC 173-340 3-PART Test**										
29	Statistical value > Cleanup Limit?	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
30	> 10% above Cleanup Limit?	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
31	Any sample > 2X Cleanup Limit?	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO

32 BG = background
33 GW = groundwater
34 HEIS = Hanford Environmental Information System
35 J = estimated
36 NA = not applicable
37 PQL = practical quantitation limit

Q = qualifier
RAG = remedial action goal
RDL = required detection limit
U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code

CALCULATION SHEET

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Rev. No. 0
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Sheet No. 10 of 21

1 **Fuel Storage Basin Side Slope (Deep Zone) (continued)**

2 Sampling Area	HEIS Number	Sample Date	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Neptunium-237			Nickel-63			Plutonium-238		
3			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	A1	J01C52	3/29/2004	2.01E-01	U	3.1E-01	2.52E+00	U	5.6E+00	9.94E-01		1.3E-01	1.2E-01	U	1.2E-01	2.68E-01	U	2.7E-01	3.4E-01	U	3.4E-01	2.3E-01	U	2.3E-01	2.5E-02	U	3.8E-02	3.09E+00	U	5.9E+00	0	U	2.5E-01
5	Duplicate of J01C52	J01C55	3/29/2004	0	U	2.4E-01	1.10E+00	U	6.1E+00	8.75E-01		7.2E-02	9.6E-02	U	9.6E-02	2.8E-01	U	2.8E-01	2.4E-01	U	2.4E-01	2.1E-01	U	2.1E-01	5.2E-02		4.5E-02	6.81E+00		5.1E+00	0	U	2.7E-01
6	A2	J01C53	3/29/2004	1.40E-01	U	3.6E-01	4.32E+00	U	6.0E+00	5.01E+00		8.7E-02	1.25E-01		4.4E-02	1.26E+00		3.0E-01	2.4E-01	U	2.4E-01	1.7E-01	U	1.7E-01	5.E-03	U	4.3E-02	1.32E+01		5.2E+00	3.2E-02	U	2.4E-01
7	A3	J01C54	3/29/2004	2.73E-01		2.1E-01	3.52E+00	U	6.3E+00	4.07E+00		1.1E-01	1.92E-01		5.1E-02	8.02E-01		3.8E-01	2.9E-01	U	2.9E-01	2.5E-01	U	2.5E-01	1.0E-02	U	1.4E-02	1.48E+01		5.6E+00	3.6E-02	U	2.7E-01

8 **Statistical Computation Input Data**

9 Sampling Area	HEIS Number	Sample Date	Americium-241	Carbon-14	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Neptunium-237	Nickel-63	Plutonium-238
10			pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
11 A1	J01C52/J01C55	3/29/2004	1.01E-01	1.81E+00	9.35E-01	5.E-02	2.0E-01	1.5E-01	1.1E-01	3.9E-02	4.95E+00	0
12 A2	J01C53	3/29/2004	1.40E-01	4.32E+00	5.01E+00	1.25E-01	1.26E+00	1.2E-01	8.5E-02	5.E-03	1.32E+01	3.2E-02
13 A3	J01C54	3/29/2004	2.73E-01	3.52E+00	4.07E+00	1.92E-01	8.02E-01	1.5E-01	1.3E-01	1.0E-02	1.48E+01	3.6E-02

14 **Statistical Computations**

15	Americium-241	Carbon-14	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Neptunium-237	Nickel-63	Plutonium-238
16 95% UCL value based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
17 N	3	3	3	3	3	3	3	3	3	3
18 % < Detection limit	67%	100%	0%	33%	33%	100%	100%	67%	0%	100%
19 mean	1.71E-01	3.22E+00	3.34E+00	1.2E-01	7.6E-01	1.4E-01	1.1E-01	1.8E-02	1.10E+01	2.3E-02
20 st. dev.	9.0E-02	1.28E+00	2.13E+00	7.E-02	5.3E-01	1.E-02	2.E-02	1.8E-02	5.3E+00	2.0E-02
21 Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
22 95% UCL on mean	2.57E-01	4.43E+00	5.36E+00	1.9E-01	1.26E+00	1.5E-01	1.3E-01	3.5E-02	1.60E+01	4.1E-02
23 max value	2.73E-01	4.32E+00 U	5.01E+00	1.92E-01	1.26E+00	3.4E-01 U	2.5E-01 U	5.2E-02	1.48E+01	3.6E-02 U
24 Statistical value	2.57E-01	4.43E+00 U	5.36E+00	1.9E-01	1.26E+00	1.5E-01 U	1.3E-01 U	3.5E-02	1.60E+01	4.1E-02 U
25 Background	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
26 Statistical value above background	2.57E-01	4.43E+00 U	5.36E+00	1.9E-01	1.26E+00	1.5E-01 U	1.3E-01 U	3.5E-02	1.60E+01	4.1E-02 U

27 HEIS = Hanford Environmental Information System
28 MDA = minimum detectable activity
29 NA = not applicable

Q = qualifier
U = undetected
UCL = upper confidence limit

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Rev. No. 0
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Sheet No. 10 of 21

1 **Fuel Storage Basin Side Slope (Deep Zone) (continued)**

2	Sampling	HEIS	Sample	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Neptunium-237			Nickel-63			Plutonium-238		
3	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	A1	J01C52	3/29/2004	2.01E-01	U	3.1E-01	2.52E+00	U	5.6E+00	9.94E-01		1.3E-01	1.2E-01	U	1.2E-01	2.68E-01	U	2.7E-01	3.4E-01	U	3.4E-01	2.3E-01	U	2.3E-01	2.5E-02	U	3.8E-02	3.09E+00	U	5.9E+00	0	U	2.5E-01
5	Duplicate of J01C52	J01C55	3/29/2004	0	U	2.4E-01	1.10E+00	U	6.1E+00	8.75E-01		7.2E-02	9.6E-02	U	9.6E-02	2.8E-01	U	2.8E-01	2.4E-01	U	2.4E-01	2.1E-01	U	2.1E-01	5.2E-02		4.5E-02	6.81E+00		5.1E+00	0	U	2.7E-01
6	A2	J01C53	3/29/2004	1.40E-01	U	3.6E-01	4.32E+00	U	6.0E+00	5.01E+00		8.7E-02	1.25E-01		4.4E-02	1.26E+00		3.0E-01	2.4E-01	U	2.4E-01	1.7E-01	U	1.7E-01	5.E-03	U	4.3E-02	1.32E+01		5.2E+00	3.2E-02	U	2.4E-01
7	A3	J01C54	3/29/2004	2.73E-01		2.1E-01	3.52E+00	U	6.3E+00	4.07E+00		1.1E-01	1.92E-01		5.1E-02	8.02E-01		3.8E-01	2.9E-01	U	2.9E-01	2.5E-01	U	2.5E-01	1.0E-02	U	1.4E-02	1.48E+01		5.6E+00	3.6E-02	U	2.7E-01

8 **Statistical Computation Input Data**

9	Sampling	HEIS	Sample	Americium-241	Carbon-14	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Neptunium-237	Nickel-63	Plutonium-238
10	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
11	A1	J01C52/J01C55	3/29/2004	1.01E-01	1.81E+00	9.35E-01	5.E-02	2.0E-01	1.5E-01	1.1E-01	3.9E-02	4.95E+00	0
12	A2	J01C53	3/29/2004	1.40E-01	4.32E+00	5.01E+00	1.25E-01	1.26E+00	1.2E-01	8.5E-02	5.E-03	1.32E+01	3.2E-02
13	A3	J01C54	3/29/2004	2.73E-01	3.52E+00	4.07E+00	1.92E-01	8.02E-01	1.5E-01	1.3E-01	1.0E-02	1.48E+01	3.6E-02

14 **Statistical Computations**

15		Americium-241	Carbon-14	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Neptunium-237	Nickel-63	Plutonium-238
16	95% UCL value based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
17	N	3	3	3	3	3	3	3	3	3	3
18	% < Detection limit	67%	100%	0%	33%	33%	100%	100%	67%	0%	100%
19	mean	1.71E-01	3.22E+00	3.34E+00	1.2E-01	7.6E-01	1.4E-01	1.1E-01	1.8E-02	1.10E+01	2.3E-02
20	st. dev.	9.0E-02	1.28E+00	2.13E+00	7.E-02	5.3E-01	1.E-02	2.E-02	1.8E-02	5.3E+00	2.0E-02
21	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
22	95% UCL on mean	2.57E-01	4.43E+00	5.36E+00	1.9E-01	1.26E+00	1.5E-01	1.3E-01	3.5E-02	1.60E+01	4.1E-02
23	max value	2.73E-01	4.32E+00 U	5.01E+00	1.92E-01	1.26E+00	3.4E-01 U	2.5E-01 U	5.2E-02	1.48E+01	3.6E-02 U
24	Statistical value	2.57E-01	4.43E+00 U	5.36E+00	1.9E-01	1.26E+00	1.5E-01 U	1.3E-01 U	3.5E-02	1.60E+01	4.1E-02 U
25	Background	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
26	Statistical value above background	2.57E-01	4.43E+00 U	5.36E+00	1.9E-01	1.26E+00	1.5E-01 U	1.3E-01 U	3.5E-02	1.60E+01	4.1E-02 U

27 HEIS = Hanford Environmental Information System
28 MDA = minimum detectable activity
29 NA = not applicable

Q = qualifier
U = undetected
UCL = upper confidence limit

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Rev. No. 0
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Sheet No. 11 of 21

1 **Fuel Storage Basin Side Slope (Deep Zone) (continued)**

2 Sampling Area	HEIS Number	Sample Date	Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230			Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
3			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4 A1	J01C52	3/29/2004	2.89E-01		2.5E-01	1.27E+00		2.0E-01	5.98E-01		3.3E-01	5.95E-01		3.3E-01	6.38E-01		3.3E-01	-1.21E-01	U	6.3E-01	2.56E-01		2.4E-01	1.16E-01	U	3.0E-01	7.68E-01		2.4E-01
5 Duplicate of J01C52	J01C55	3/29/2004	3.20E-01		2.7E-01	6.55E-01		2.0E-01	6.05E-01		3.1E-01	2.01E-01	U	3.1E-01	6.03E-01		3.1E-01	-2.46E-01	U	7.2E-01	6.97E-01		2.3E-01	1.10E-01	U	2.8E-01	5.76E-01		2.3E-01
6 A2	J01C53	3/29/2004	7.56E-01		2.4E-01	3.42E+00		2.0E-01	5.41E-01		2.8E-01	5.39E-01		2.7E-01	5.39E-01		2.7E-01	-2.73E-01	U	7.2E-01	3.19E-01		2.2E-01	0	U	2.7E-01	5.51E-01		2.2E-01
7 A3	J01C54	3/29/2004	9.69E-01		2.7E-01	5.64E+00		1.9E-01	6.74E-01		3.4E-01	9.85E-01		3.4E-01	1.12E+00		3.4E-01	0	U	6.6E-01	2.78E-01		2.4E-01	3.7E-02	U	2.9E-01	3.71E-01		2.4E-01

8 Note: Radiological analytical methods use statistically-determined floating calibration curves that are not forced through the origin; therefore, negative values are routinely reported for undetected analytes. This does not diminish the usability of the data.

9 **Statistical Computation Input Data**

10 Sampling Area	HEIS Number	Sample Date	Plutonium-239/240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Tritium	Uranium-233/234	Uranium-235	Uranium-238
11			pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
12 A1	J01C52/J01C55	3/29/2004	3.05E-01	9.6E-01	6.02E-01	3.98E-01	6.21E-01	-1.84E-01	4.77E-01	1.13E-01	6.72E-01
13 A2	J01C53	3/29/2004	7.56E-01	3.42E+00	5.41E-01	5.39E-01	5.39E-01	-2.73E-01	3.19E-01	0	5.51E-01
14 A3	J01C54	3/29/2004	9.69E-01	5.64E+00	6.74E-01	9.85E-01	1.12E+00	0	2.78E-01	3.7E-02	3.71E-01

15 **Statistical Computations**

16	Plutonium-239/240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Tritium	Uranium-233/234	Uranium-235	Uranium-238
17 95% UCL value based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
18 N	3	3	3	3	3	3	3	3	3
19 % < Detection limit	0%	0%	0%	0%	0%	100%	0%	100%	0%
20 mean	6.77E-01	3.34E+00	6.06E-01	6.41E-01	7.6E-01	-1.52E-01	3.58E-01	5.0E-02	5.31E-01
21 st. dev.	3.39E-01	2.34E+00	6.7E-02	3.06E-01	3.1E-01	1.39E-01	1.05E-01	5.8E-02	1.51E-01
22 Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
23 95% UCL on mean	9.99E-01	5.56E+00	6.69E-01	9.32E-01	1.06E+00	-2.0E-02	4.57E-01	1.05E-01	6.75E-01
24 max value	9.69E-01	5.64E+00	6.74E-01	9.85E-01	1.12E+00	0 U	6.97E-01	1.16E-01 U	7.68E-01
25 Statistical value	9.99E-01	5.56E+00	6.69E-01	9.32E-01	1.06E+00	-2.0E-02 U	4.57E-01	1.05E-01 U	6.75E-01
26 Background	NA	NA	1.32E+00	NA	1.32E+00	NA	1.1E+00	1.1E-01	1.1E+00
27 Statistical value above background	9.99E-01	5.56E+00	0 (<BG)	9.32E-01	0 (<BG)	-2.0E-02 U	0 (<BG)	0 (<BG) U	0 (<BG)

28 **Split-Duplicate Analysis**

29 Sampling Area	HEIS Number	Sample Date	Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230			Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
30			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
31 A1	J01C52	3/29/2004	2.89E-01		2.5E-01	1.27E+00		2.0E-01	5.98E-01		3.3E-01	5.95E-01		3.3E-01	6.38E-01		3.3E-01	-1.21E-01	U	6.3E-01	2.56E-01		2.4E-01	1.16E-01	U	3.0E-01	7.68E-01		2.4E-01
32 Duplicate of J01C52	J01C55	3/29/2004	3.20E-01		2.7E-01	6.55E-01		2.0E-01	6.05E-01		3.1E-01	2.01E-01	U	3.1E-01	6.03E-01		3.1E-01	-2.46E-01	U	7.2E-01	6.97E-01		2.3E-01	1.10E-01	U	2.8E-01	5.76E-01		2.3E-01
33 Split of J01C52	J01C57	3/29/2004	2.08E-01		5.12E-02	1.01E+00		1.13E-01	5.78E-01		6.27E-02	1.04E+00		6.27E-02	1.10E+00		1.39E-01	1.28E+01		8.76E+00	6.85E-01		1.06E-01	-2.23E-03	U	9.30E-02	7.54E-01		9.30E-02
34	TDL		1			1			1			1			1			10			1			0.5			1		
35 Duplicate Analysis	Both > MDA?		Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			No-Stop (acceptable)			Yes (continue)		
36	Both > 5xTDL?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)		
37	RPD																												
38 Split Analysis	Both > MDA?		Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			Yes (continue)			No-Stop (acceptable)			Yes (continue)			No-Stop (acceptable)			Yes (continue)		
39	Both > 5xTDL?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)		
40	RPD																												

41 BG = background
42 HEIS = Hanford Environmental Information System
43 MDA = minimum detectable activity
44 NA = not applicable
45 Q = qualifier

RPD = relative percent difference
TDL = target detection limit
U = undetected
UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 12 of 21

1 **Fuel Storage Basin Side Slope (Deep Zone) (continued)**

2 **Split-Duplicate Analysis**

3	Sampling	HEIS	Sample	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248			Aroclor-1254			Aroclor-1260		
4	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
5	A1	J01C52	3/29/2004	2.1E-01	U	2.1E-01	1.89E+01		2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
6	Duplicate of J01C52	J01C55	3/29/2004	1.5E+00		2.1E-01	2.24E+01		2.4E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
7	Split of J01C52	J01C57	3/29/2004	3.50E-01	U	3.50E-01	2.29E+01		5.0E-01	1.7E-02	U	1.7E-02	6.6E-03	U	6.6E-03	7.3E-03	U	7.3E-03	8.4E-03	U	8.4E-03	7.8E-03	U	7.8E-03	9.9E-03	U	9.9E-03	8.2E-03	U	8.2E-03	7.8E-03	U	7.8E-03
8		TDL		0.5			5			0.2			0.017			0.017			0.017			0.017			0.017			0.017			0.017		
9	Duplicate Analysis	Both > PQL?		No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
10		Both > 5xTDL?					No-Stop (acceptable)																										
11		RPD																															
12	Split Analysis	Both > PQL?		No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
13		Both > 5xTDL?					No-Stop (acceptable)																										
14		RPD																															
15																																	

16	Sampling	HEIS	Sample	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Neptunium-237			Nickel-63			Plutonium-238		
17	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
18	A1	J01C52	3/29/2004	2.01E-01	U	3.1E-01	2.52E+00	U	5.6E+00	9.94E-01		1.3E-01	1.2E-01	U	1.2E-01	2.68E-01	U	2.7E-01	3.4E-01	U	3.4E-01	2.3E-01	U	2.3E-01	2.5E-02	U	3.8E-02	3.09E+00	U	5.9E+00	0	U	2.5E-01
19	Duplicate of J01C52	J01C55	3/29/2004	0	U	2.4E-01	1.10E+00	U	6.1E+00	8.75E-01		7.2E-02	9.6E-02	U	9.6E-02	2.8E-01	U	2.8E-01	2.4E-01	U	2.4E-01	2.1E-01	U	2.1E-01	5.2E-02		4.5E-02	6.81E+00		5.1E+00	0	U	2.7E-01
20	Split of J01C52	J01C57	3/29/2004	2.09E-01		6.30E-02	-4.25E-03	U	3.13E-01	9.42E-01		1.74E-02	2.66E-02	U	2.19E-02	3.10E-01		4.62E-02	2.82E-02	U	6.02E-02	2.07E-02	U	4.30E-02	1.79E-02	U	1.34E-01	6.01E+00	U	7.57E+00	0	U	5.12E-02
21		TDL		1			5			0.1			0.05			0.1			0.1			0.1			1			30			1		
22	Duplicate Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
23		Both > 5xTDL?								**Yes (calc RPD)**																							
24		RPD								13%																							
25	Split Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
26		Both > 5xTDL?								**Yes (calc RPD)**																							
27		RPD								5.4%																							
28																																	

29	Sampling	HEIS	Sample	Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230			Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
30	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
31	A1	J01C52	3/29/2004	2.89E-01		2.5E-01	1.27E+00		2.0E-01	5.98E-01		3.3E-01	5.95E-01		3.3E-01	6.38E-01		3.3E-01	-1.21E-01	U	6.3E-01	2.56E-01		2.4E-01	1.16E-01	U	3.0E-01	7.68E-01		2.4E-01
32	Duplicate of J01C52	J01C55	3/29/2004	3.20E-01		2.7E-01	6.55E-01		2.0E-01	6.05E-01		3.1E-01	2.01E-01	U	3.1E-01	6.03E-01		3.1E-01	-2.46E-01	U	7.2E-01	6.97E-01		2.3E-01	1.10E-01	U	2.8E-01	5.76E-01		2.3E-01
33	Split of J01C52	J01C57	3/29/2004	2.08E-01		5.12E-02	1.01E+00		1.13E-01	5.78E-01		6.27E-02	1.04E+00		6.27E-02	1.10E+00		1.39E-01	1.28E+01		8.76E+00	6.85E-01		1.06E-01	-2.23E-03	U	9.30E-02	7.54E-01		9.30E-02
34		TDL		1			1			1			1			1			10			1			0.5			1		
35	Duplicate Analysis	Both > MDA?		**Yes (continue)**			**Yes (continue)**			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**		
36		Both > 5xTDL?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)		
37		RPD																												
38	Split Analysis	Both > MDA?		**Yes (continue)**			**Yes (continue)**			**Yes (continue)**			**Yes (continue)**			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**		
39		Both > 5xTDL?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)		
40		RPD																												

41 HEIS = Hanford Environmental Information System
42 J = estimated
43 MDA = minimum detectable activity
44 PQL = practical quantitation limit

Q = qualifier
RPD = relative percent difference
TDL = target detection limit
U = undetected

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron **Date** 2/23/06 **Calc. No.** 0100H-CA-V0085 **Rev. No.** 0
Project Reactor Interim Safe Storage **Job No.** 14655 **Checked** T. M. Blakley **Date** 2/28/06
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations **Sheet No.** 13 of 21

1 **Fuel Storage Basin Underlying Soils 0-1' bgs (Deep Zone)**

2	Sampling	HEIS	Sample	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248			Aroclor-1254			Aroclor-1260		
3	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	A1-1	J018B9	3/22/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
5	Duplicate of J018B9	J018F5	3/22/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	2.E-02	UC	2.E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02
6	A1-2	J018C1	3/22/2004	2.0E-01	U	2.0E-01	2.5E+00	U	2.5E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
7	A2-1	J018C3	3/22/2004	2.2E-01		2.0E-01	1.24E+01		1.9E+00	1.E-02	UC	1.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
8	A2-2	J018C5	3/22/2004	2.0E-01	U	2.0E-01	2.3E+00	U	2.3E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
9	A2-3	J018C7	3/22/2004	2.1E-01	U	2.1E-01	1.92E+01		2.4E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
10	A3-1	J018C9	3/22/2004	2.1E-01	U	2.1E-01	3.48E+01		2.6E+00	1.E-02	UC	1.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	J	1.4E-02	1.4E-02	UJ	1.4E-02
11	A3-2	J018D1	3/22/2004	2.1E-01	U	2.1E-01	1.64E+01		2.5E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	2.4E-02	J	1.4E-02	1.4E-02	UJ	1.4E-02
12	A4-1	J018D3	3/22/2004	2.1E-01	U	2.1E-01	2.04E+01		2.5E+00	1.E-02	UC	1.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
13	A4-2	J018D5	3/22/2004	4.4E-01		2.1E-01	8.7E+00		2.0E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
14	A4-3	J018D7	3/22/2004	9.4E-01		2.0E-01	1.15E+01		2.2E+00	1.E-02	UC	1.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02

15 **Statistical Computation Input Data**

16	Sampling	HEIS	Sample	Hexavalent Chromium	Lead	Mercury	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
17	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
18	A1-1	J018B9/J018F5	3/22/2004	1.0E-01	1.2E+00	1.E-02	6.8E-03	6.8E-03	6.8E-03	6.8E-03	6.8E-03	6.8E-03	6.8E-03
19	A1-2	J018C1	3/22/2004	1.0E-01	1.3E+00	1.E-02	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
20	A2-1	J018C3	3/22/2004	2.2E-01	1.24E+01	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
21	A2-2	J018C5	3/22/2004	1.0E-01	1.2E+00	1.E-02	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
22	A2-3	J018C7	3/22/2004	1.1E-01	1.92E+01	1.E-02	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
23	A3-1	J018C9	3/22/2004	1.1E-01	3.48E+01	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	1.4E-02	7.0E-03
24	A3-2	J018D1	3/22/2004	1.1E-01	1.64E+01	1.E-02	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	2.4E-02	7.0E-03
25	A4-1	J018D3	3/22/2004	1.1E-01	2.04E+01	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
26	A4-2	J018D5	3/22/2004	4.4E-01	8.7E+00	1.E-02	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
27	A4-3	J018D7	3/22/2004	9.4E-01	1.15E+01	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03

28 **Statistical Computations**

29		Hexavalent Chromium	Lead	Mercury	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
30	95% UCL value based on	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Large data set (n ≥10), use MTCAStat normal distribution.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.
31	N	10	10	10	10	10	10	10	10	10	10
32	% < Detection limit	70%	30%	100%	100%	100%	100%	100%	100%	80%	100%
33	mean	2.3E-01	1.27E+01	8.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	9.E-03	7.0E-03
34	st. dev.	2.7E-01	1.06E+01	3.E-03	8.E-05	8.E-05	8.E-05	8.E-05	8.E-05	6.E-03	8.E-05
35	95% UCL on mean	NA	1.89E+01	NA	NA	NA	NA	NA	NA	NA	NA
36	max value	9.4E-01	3.48E+01	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	2.4E-02	1.4E-02 U
37	Statistical value	9.4E-01	1.89E+01	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	2.4E-02	1.4E-02 U
38	Background	NA	1.02E+01	3.3E-01	NA	NA	NA	NA	NA	NA	NA
39	Statistical value above background	9.4E-01	1.89E+01	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	2.4E-02	1.4E-02 U
40	**Most Stringent Cleanup Limit for nonradionuclide and RAG type**	2 River Protection	10.2 BG/GW/River Protection	0.33 BG/GW/River Protection	0.017 RDL/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection
41	**WAC 173-340 3-PART Test**										
42	Statistical value > Cleanup Limit?	NO	YES	NO	NO	NO	NO	NO	NO	YES	NO
43	> 10% above Cleanup Limit?	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO
44	Any sample > 2X Cleanup Limit?	NO	YES	NO	NO	NO	NO	NO	NO	NO	NO

45 BG = background
46 bgs = below ground surface
47 C = blank contamination
48 GW = groundwater
49 HEIS = Hanford Environmental Information System
50 J = estimated
51 NA = not applicable

PQL = practical quantitation limit
Q = qualifier
RAG = remedial action goal
RDL = required detection limit
U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley

Rev. No. 0
Date 2/28/06
Sheet No. 14 of 21

1 **Fuel Storage Basin Underlying Soils 0-1' bgs (Deep Zone) (continued)**

2	Sampling	HEIS	Sample	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Neptunium-237			Nickel-63			Plutonium-238		
3	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	A1-1	J018B9	3/22/2004	2.3E-02	U	1.8E-01	1.20E+00	UJ	4.7E+00	9.1E-02	U	9.1E-02	8.5E-02	U	8.5E-02	1.9E-01	U	1.9E-01	2.8E-01	U	2.8E-01	2.8E-01	U	2.8E-01	9.E-03	UJ	8.5E-02	4.86E+00		4.7E+00	4.E-03	U	3.0E-02
5	Duplicate of J018B9	J018F5	3/22/2004	2.7E-02	U	2.0E-01	1.07E+00	UJ	4.9E+00	7.7E-02	U	7.7E-02	7.4E-02	U	7.4E-02	1.7E-01	U	1.7E-01	3.0E-01	U	3.0E-01	1.8E-01	U	1.8E-01	1.4E-02	UJ	6.8E-02	-7.21E-01	U	4.7E+00	0	U	2.2E-01
6	A1-2	J018C1	3/22/2004	1.93E-01	U	2.5E-01	-7.8E-02	UJ	5.7E+00	9.9E-02		6.1E-02	5.4E-02	U	5.4E-02	1.1E-01	U	1.1E-01	1.4E-01	U	1.4E-01	9.4E-02	U	9.4E-02	1.1E-02	UJ	4.3E-02	2.32E+00	U	4.6E+00	0	U	2.1E-01
7	A2-1	J018C3	3/22/2004	5.11E-01		2.0E-01	1.01E+00	UJ	6.2E+00	4.28E+00		1.0E-01	1.79E-01		6.3E-02	1.25E+00		2.2E-01	2.22E-01		1.9E-01	2.2E-01	U	2.2E-01	1.9E-02	UJ	4.9E-02	2.17E+01		4.5E+00	6.1E-02	U	2.3E-01
8	A2-2	J018C5	3/22/2004	1.37E-01	U	1.7E-01	-9.87E-01	UJ	5.6E+00	1.27E+00		9.1E-02	2.10E-01		7.7E-02	2.5E-01	U	2.5E-01	2.3E-01	U	2.3E-01	1.9E-01	U	1.9E-01	4.8E-02	J	1.6E-02	5.17E+00		4.5E+00	2.7E-02	U	2.1E-01
9	A2-3	J018C7	3/22/2004	0	U	1.7E-01	6.69E-01	UJ	6.2E+00	3.56E-01		6.6E-02	6.3E-02	U	6.3E-02	2.0E-01	U	2.0E-01	2.0E-01	U	2.0E-01	1.5E-01	U	1.5E-01	1.4E-02	UJ	6.6E-02	1.27E+00	U	4.6E+00	0	U	2.2E-01
10	A3-1	J018C9	3/22/2004	8.4E-02	U	1.6E-01	1.95E+00	UJ	6.0E+00	2.24E+00		1.4E-01	1.8E-01	U	1.8E-01	1.04E+00		2.7E-01	3.2E-01	U	3.2E-01	2.5E-01	U	2.5E-01	2.9E-02	J	2.8E-02	1.33E+01		4.7E+00	2.7E-02	U	2.1E-01
11	A3-2	J018D1	3/22/2004	2.09E-01		1.8E-01	2.04E+00	UJ	6.0E+00	2.90E+01		1.2E-01	1.00E-01		5.0E-02	8.69E-01		4.5E-01	2.18E-01		1.6E-01	2.9E-01	U	2.9E-01	2.1E-02	UJ	4.1E-02	8.34E+00		4.6E+00	2.6E-02	U	2.0E-01
12	A4-1	J018D3	3/22/2004	2.6E-02	U	2.0E-01	5.54E-01	UJ	5.1E+00	6.59E-01		7.9E-02	7.8E-02	U	7.8E-02	1.64E-01	U	1.9E-01	2.3E-01	U	2.3E-01	1.9E-01	U	1.9E-01	2.3E-02	UJ	7.3E-02	5.69E+00		4.8E+00	0	U	2.1E-01
13	A4-2	J018D5	3/22/2004	7.65E-01		2.0E-01	3.34E+00	UJ	5.6E+00	1.60E+01		1.5E-01	3.74E-01		5.8E-02	5.30E+00		5.4E-01	3.9E-01	U	3.9E-01	3.9E-01	U	3.9E-01	4.2E-02	UJ	5.3E-02	5.75E+01		4.7E+00	5.2E-02	U	2.0E-01
14	A4-3	J018D7	3/22/2004	4.27E-01		2.2E-01	2.54E+01	J	5.3E+00	9.82E+00		2.2E-01	2.80E-01		1.2E-01	6.42E+00		4.0E-01	8.93E-01		3.2E-01	4.0E-01	U	4.0E-01	1.4E-02	UJ	5.3E-02	4.19E+01		4.6E+00	9.1E-02	U	2.3E-01

15 Note: Radiological analytical methods use statistically-determined floating calibration curves that are not forced through the origin; therefore, negative values are routinely reported for undetected analytes. This does not diminish the usability of the data.

16 **Statistical Computation Input Data**

17	Sampling	HEIS	Sample	Americium-241	Carbon-14	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Neptunium-237	Nickel-63	Plutonium-238
18	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
19	A1-1	J018B9/J018F5	3/22/2004	2.5E-02	1.14E+00	4.2E-02	4.0E-02	9.0E-02	1.5E-01	1.2E-01	1.2E-02	2.07E+00	2.E-03
20	A1-2	J018C1	3/22/2004	1.93E-01	-7.8E-02	9.9E-02	2.7E-02	5.5E-02	7.0E-02	4.7E-02	1.1E-02	2.32E+00	0
21	A2-1	J018C3	3/22/2004	5.11E-01	1.01E+00	4.28E+00	1.79E-01	1.25E+00	2.22E-01	1.1E-01	1.9E-02	2.17E+01	6.1E-02
22	A2-2	J018C5	3/22/2004	1.37E-01	-9.87E-01	1.27E+00	2.10E-01	1.3E-01	1.2E-01	9.5E-02	4.8E-02	5.17E+00	2.7E-02
23	A2-3	J018C7	3/22/2004	0	6.69E-01	3.56E-01	3.2E-02	1.0E-01	1.0E-01	7.5E-02	1.4E-02	1.27E+00	0
24	A3-1	J018C9	3/22/2004	8.4E-02	1.95E+00	2.24E+00	9.0E-02	1.04E+00	1.6E-01	1.3E-01	2.9E-02	1.33E+01	2.7E-02
25	A3-2	J018D1	3/22/2004	2.09E-01	2.04E+00	2.90E+01	1.00E-01	8.69E-01	2.18E-01	1.5E-01	2.1E-02	8.34E+00	2.6E-02
26	A4-1	J018D3	3/22/2004	2.6E-02	5.54E-01	6.59E-01	3.9E-02	1.64E-01	1.2E-01	9.5E-02	2.3E-02	5.69E+00	0
27	A4-2	J018D5	3/22/2004	7.65E-01	3.34E+00	1.60E+01	3.74E-01	5.30E+00	2.0E-01	2.0E-01	4.2E-02	5.75E+01	5.2E-02
28	A4-3	J018D7	3/22/2004	4.27E-01	2.54E+01	9.82E+00	2.80E-01	6.42E+00	8.93E-01	2.0E-01	1.4E-02	4.19E+01	9.1E-02

29 **Statistical Computations**

30		Americium-241		Carbon-14		Cesium-137		Cobalt-60		Europium-152		Europium-154		Europium-155		Neptunium-237		Nickel-63		Plutonium-238	
31	95% UCL value based on	Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.	
32	N	10		10		10		10		10		10		10		10		10		10	
33	% < Detection limit	60%		90%		10%		50%		50%		70%		100%		80%		20%		100%	
34	mean	2.38E-01		3.5E+00		6.4E+00		1.37E-01		1.54E+00		2.2E-01		1.2E-01		2.3E-02		1.59E+01		2.9E-02	
35	st. dev.	2.52E-01		7.8E+00		9.5E+00		1.20E-01		2.33E+00		2.4E-01		5.E-02		1.3E-02		1.92E+01		3.1E-02	
36	Z-statistic	1.645		1.645		1.645		1.645		1.645		1.645		1.645		1.645		1.645		1.645	
37	95% UCL on mean	3.69E-01		7.6E+00		1.13E+01		1.99E-01		2.76E+00		3.5E-01		1.5E-01		3.0E-02		2.59E+01		4.5E-02	
38	max value	7.65E-01		2.54E+01		2.90E+01		3.74E-01		6.42E+00		8.9E-01		4.0E-01	U	4.8E-02		5.75E+01		9.1E-02	U
39	Statistical value	3.69E-01		7.6E+00		1.13E+01		1.99E-01		2.76E+00		3.5E-01		1.5E-01	U	3.0E-02		2.59E+01		4.5E-02	U
40	Background	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
41	Statistical value above background	3.69E-01		7.6E+00		1.13E+01		1.99E-01		2.76E+00		3.5E-01		1.5E-01	U	3.0E-02		2.59E+01		4.5E-02	U

42 bgs = below ground surface
43 HEIS = Hanford Environmental Information System
44 J = estimated
45 MDA = minimum detectable activity

NA = not applicable
Q = qualifier
U = undetected
UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 15 of 21

1 **Fuel Storage Basin Underlying Soils 0-1' bgs (Deep Zone) (continued)**

2	Sampling	HEIS	Sample	Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230			Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
3	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	A1-1	J018B9	3/22/2004	4.E-03	U	3.0E-02	1.2E-02	U	2.0E-01	7.52E-01	J	2.7E-01	1.07E-01	U	2.7E-01	4.29E-01	J	2.7E-01	5.0E-02	U	2.5E-01	4.50E-01		3.6E-02	2.0E-02	U	3.0E-02	4.20E-01		2.5E-02
5	Duplicate of J018B9	J018F5	3/22/2004	0	U	2.2E-01	9.1E-02	U	2.4E-01	8.48E-01	J	6.7E-02	6.60E-01		2.2E-01	6.73E-01	J	5.3E-02	1.37E-01	U	4.9E-01	5.27E-01		3.0E-02	4.2E-02		2.9E-02	5.11E-01		3.0E-02
6	A1-2	J018C1	3/22/2004	8.3E-02	U	2.1E-01	1.22E-01	U	2.0E-01	4.17E-01	J	2.9E-01	1.51E-01	U	2.9E-01	5.30E-01	J	2.9E-01	9.0E-02	U	2.3E-01	4.86E-01		2.8E-02	9.E-03	U	3.4E-02	4.20E-01		2.8E-02
7	A2-1	J018C3	3/22/2004	1.65E+00		2.3E-01	1.26E+01		2.0E-01	4.52E-01	J	2.5E-01	6.13E-01		2.5E-01	5.48E-01	J	2.5E-01	2.47E-01		2.3E-01	4.59E-01		3.2E-02	2.8E-02		2.7E-02	5.57E-01		2.2E-02
8	A2-2	J018C5	3/22/2004	3.78E-01		2.1E-01	3.08E+00		1.8E-01	4.88E-01	J	2.9E-01	6.00E-01		2.9E-01	6.00E-01	J	2.9E-01	-4.3E-02	U	2.1E-01	5.20E-01		2.8E-02	2.2E-02	U	3.4E-02	5.53E-01		2.8E-02
9	A2-3	J018C7	3/22/2004	2.9E-02	U	2.2E-01	1.27E-01	U	2.1E-01	4.50E-01	J	2.9E-01	2.25E-01	U	2.9E-01	6.37E-01	J	2.9E-01	1.4E-02	U	5.2E-01	4.57E-01		3.6E-02	3.2E-02		3.0E-02	4.86E-01		3.1E-02
10	A3-1	J018C9	3/22/2004	3.82E-01		2.1E-01	1.85E+00		1.9E-01	8.94E-01	J	3.1E-01	6.49E-01		3.1E-01	3.65E-01	J	3.1E-01	-1.40E-01	U	5.1E-01	4.91E-01		3.0E-02	3.4E-02		2.9E-02	4.67E-01		3.0E-02
11	A3-2	J018D1	3/22/2004	4.38E-01		2.0E-01	3.49E+00		2.2E-01	8.99E-01	J	2.9E-01	4.12E-01		2.9E-01	4.49E-01	J	2.9E-01	-8.1E-02	U	5.7E-01	5.02E-01		4.1E-02	2.7E-02	U	3.4E-02	4.16E-01		3.6E-02
12	A4-1	J018D3	3/22/2004	1.66E-01	U	2.1E-01	8.68E-01		2.2E-01	5.71E-01	J	2.9E-01	6.46E-01		2.9E-01	8.37E-01	J	2.9E-01	-7.5E-02	U	5.2E-01	5.29E-01		3.9E-02	4.7E-02		3.3E-02	4.90E-01		2.7E-02
13	A4-2	J018D5	3/22/2004	1.64E+00		2.0E-01	8.90E+00		2.1E-01	5.54E-01	J	3.3E-01	1.06E+00		3.3E-01	5.95E-01	J	3.3E-01	2.20E-01	U	5.0E-01	6.65E-01		3.0E-02	3.4E-02		2.9E-02	6.65E-01		2.4E-02
14	A4-3	J018D7	3/22/2004	9.74E-01		2.3E-01	5.90E+00		2.3E-01	8.46E-01	J	3.2E-01	3.38E-01	U	3.2E-01	7.19E-01	J	3.2E-01	-1.24E-01	U	5.1E-01	4.92E-01		2.5E-02	2.0E-02	U	3.0E-02	5.11E-01		2.5E-02

15 Note: Radiological analytical methods use statistically-determined floating calibration curves that are not forced through the origin; therefore, negative values are routinely reported for undetected analytes. This does not diminish the usability of the data.

16 **Statistical Computation Input Data**

17	Sampling	HEIS	Sample	Plutonium-239/240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Tritium	Uranium-233/234	Uranium-235	Uranium-238
18	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
19	A1-1	J018B9/J018F5	3/22/2004	2.E-03	5.2E-02	8.00E-01	3.84E-01	5.51E-01	9.4E-02	4.89E-01	3.1E-02	4.66E-01
20	A1-2	J018C1	3/22/2004	8.3E-02	1.22E-01	4.17E-01	1.51E-01	5.30E-01	9.0E-02	4.86E-01	9.E-03	4.20E-01
21	A2-1	J018C3	3/22/2004	1.65E+00	1.26E+01	4.52E-01	6.13E-01	5.48E-01	2.47E-01	4.59E-01	2.8E-02	5.57E-01
22	A2-2	J018C5	3/22/2004	3.78E-01	3.08E+00	4.88E-01	6.00E-01	6.00E-01	-4.3E-02	5.20E-01	2.2E-02	5.53E-01
23	A2-3	J018C7	3/22/2004	2.9E-02	1.27E-01	4.50E-01	2.25E-01	6.37E-01	1.4E-02	4.57E-01	3.2E-02	4.86E-01
24	A3-1	J018C9	3/22/2004	3.82E-01	1.85E+00	8.94E-01	6.49E-01	3.65E-01	-1.40E-01	4.91E-01	3.4E-02	4.67E-01
25	A3-2	J018D1	3/22/2004	4.38E-01	3.49E+00	8.99E-01	4.12E-01	4.49E-01	-8.1E-02	5.02E-01	2.7E-02	4.16E-01
26	A4-1	J018D3	3/22/2004	1.66E-01	8.68E-01	5.71E-01	6.46E-01	8.37E-01	-7.5E-02	5.29E-01	4.7E-02	4.90E-01
27	A4-2	J018D5	3/22/2004	1.64E+00	8.90E+00	5.54E-01	1.06E+00	5.95E-01	2.20E-01	6.65E-01	3.4E-02	6.65E-01
28	A4-3	J018D7	3/22/2004	9.74E-01	5.90E+00	8.46E-01	3.38E-01	7.19E-01	-1.24E-01	4.92E-01	2.0E-02	5.11E-01

29 **Statistical Computations**

30		Plutonium-239/240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Tritium	Uranium-233/234	Uranium-235	Uranium-238
31	95% UCL value based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
32	N	10	10	10	10	10	10	10	10	10
33	% < Detection limit	40%	30%	0%	30%	0%	90%	0%	40%	0%
34	mean	5.7E-01	3.7E+00	6.37E-01	5.1E-01	5.83E-01	2.0E-02	5.09E-01	2.8E-02	5.03E-01
35	st. dev.	6.3E-01	4.2E+00	1.99E-01	2.6E-01	1.32E-01	1.38E-01	5.9E-02	1.0E-02	7.4E-02
36	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
37	95% UCL on mean	9.0E-01	5.9E+00	7.41E-01	6.4E-01	6.52E-01	9.2E-02	5.40E-01	3.4E-02	5.42E-01
38	max value	1.65E+00	1.26E+01	8.99E-01	1.06E+00	8.37E-01	2.47E-01	6.65E-01	4.7E-02	6.65E-01
39	Statistical value	9.0E-01	5.9E+00	7.41E-01	6.4E-01	6.52E-01	9.2E-02	5.40E-01	3.4E-02	5.42E-01
40	Background	NA	NA	1.32E+00	NA	1.32E+00	NA	1.1E+00	1.1E-01	1.1E+00
41	Statistical value above background	9.0E-01	5.9E+00	0 (<BG)	6.4E-01	0 (<BG)	9.2E-02	0 (<BG)	0 (<BG)	0 (<BG)

42 BG = background
43 bgs = below ground surface
44 HEIS = Hanford Environmental Information System
45 J = estimated
46 MDA = minimum detectable activity

NA = not applicable
Q = qualifier
U = undetected
UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 16 of 21

Fuel Storage Basin Underlying Soils 0-1' bgs (Deep Zone) (continued)

Split-Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium mg/kg	Q	PQL	Lead mg/kg	Q	PQL	Mercury mg/kg	Q	PQL	Aroclor-1016 mg/kg	Q	PQL	Aroclor-1221 mg/kg	Q	PQL	Aroclor-1232 mg/kg	Q	PQL	Aroclor-1242 mg/kg	Q	PQL	Aroclor-1248 mg/kg	Q	PQL	Aroclor-1254 mg/kg	Q	PQL	Aroclor-1260 mg/kg	Q	PQL
A1-1	J018B9	3/22/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
Duplicate of J018B9	J018F5	3/22/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	2.E-02	UC	2.E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02	1.3E-02	UJ	1.3E-02
Split of J018B9	J01BC6	3/22/2004	1.53E-02	U	7.09E-02	1.85E-01	U	3.12E-01	5.84E-03	U	1.85E-02	-1.90E-03	U	1.82E-02	-1.67E-02	U	4.14E-02	-1.07E-02	U	6.12E-02	3.70E-02	U	4.10E-02	-4.12E-03	U	9.86E-02	1.86E+00	U	6.13E+00	0.00E+00	U	1.20E-01
TDL			1			5			0.1			0.05			0.1			0.1			0.1			1			30			1		
Duplicate Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																															
	RPD																															
Split Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																															
	RPD																															

Sampling Area	HEIS Number	Sample Date	Americium-241 pCi/g	Q	MDA	Carbon-14 pCi/g	Q	MDA	Cesium-137 pCi/g	Q	MDA	Cobalt-60 pCi/g	Q	MDA	Europium-152 pCi/g	Q	MDA	Europium-154 pCi/g	Q	MDA	Europium-155 pCi/g	Q	MDA	Neptunium-237 pCi/g	Q	MDA	Nickel-63 pCi/g	Q	MDA	Plutonium-238 pCi/g	Q	MDA
A1-1	J018B9	3/22/2004	2.3E-02	U	1.8E-01	1.20E+00	UJ	4.7E+00	9.1E-02	U	9.1E-02	8.5E-02	U	8.5E-02	1.9E-01	U	1.9E-01	2.8E-01	U	2.8E-01	2.8E-01	U	2.8E-01	9.E-03	UJ	8.5E-02	4.86E+00		4.7E+00	4.E-03	U	3.0E-02
Duplicate of J018B9	J018F5	3/22/2004	2.7E-02	U	2.0E-01	1.07E+00	UJ	4.9E+00	7.7E-02	U	7.7E-02	7.4E-02	U	7.4E-02	1.7E-01	U	1.7E-01	3.0E-01	U	3.0E-01	1.8E-01	U	1.8E-01	1.4E-02	UJ	6.8E-02	-7.21E-01	U	4.7E+00	0	U	2.2E-01
Split of J018B9	J01BC6	3/22/2004	1.53E-02	U	7.09E-02	1.85E-01	U	3.12E-01	5.84E-03	U	1.85E-02	-1.90E-03	U	1.82E-02	-1.67E-02	U	4.14E-02	-1.07E-02	U	6.12E-02	3.70E-02	U	4.10E-02	-4.12E-03	U	9.86E-02	1.86E+00	U	6.13E+00	0.00E+00	U	1.20E-01
TDL			1			5			0.1			0.05			0.1			0.1			0.1			1			30			1		
Duplicate Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																															
	RPD																															
Split Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																															
	RPD																															

Sampling Area	HEIS Number	Sample Date	Plutonium-239/240 pCi/g	Q	MDA	Strontium-90 pCi/g	Q	MDA	Thorium-228 pCi/g	Q	MDA	Thorium-230 pCi/g	Q	MDA	Thorium-232 pCi/g	Q	MDA	Tritium pCi/g	Q	MDA	Uranium-233/234 pCi/g	Q	MDA	Uranium-235 pCi/g	Q	MDA	Uranium-238 pCi/g	Q	MDA
A1-1	J018B9	3/22/2004	4.E-03	U	3.0E-02	1.2E-02	U	2.0E-01	7.52E-01	J	2.7E-01	1.07E-01	U	2.7E-01	4.29E-01	J	2.7E-01	5.0E-02	U	2.5E-01	4.50E-01		3.6E-02	2.0E-02	U	3.0E-02	4.20E-01		2.5E-02
Duplicate of J018B9	J018F5	3/22/2004	0	U	2.2E-01	9.1E-02	U	2.4E-01	8.48E-01	J	6.7E-02	6.60E-01		2.2E-01	6.73E-01	J	5.3E-02	1.37E-01	U	4.9E-01	5.27E-01		3.0E-02	4.2E-02		2.9E-02	5.11E-01		3.0E-02
Split of J018B9	J01BC6	3/22/2004	7.55E-02	U	2.33E-01	-1.41E-02	U	1.37E-01	6.75E-01		9.57E-02	4.82E-01		9.00E-02	6.04E-01		8.68E-02	9.40E-02		3.18E-02	3.94E-01		1.05E-01	1.58E-02	U	7.32E-02	3.80E-01		9.21E-02
TDL			1			1			1			1			1			10			1			0.5			1		
Duplicate Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**		
	Both > 5xTDL?								No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)		
	RPD																												
Split Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**		
	Both > 5xTDL?								No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)		
	RPD																												

bgs = below ground surface
C = blank contamination
HEIS = Hanford Environmental Information System
J = estimated
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
RPD = relative percent difference
TDL = target detection limit
U = undetected

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 17 of 21

1 **Fuel Storage Basin Underlying Soils 8-10' bgs (Deep Zone)**

2	Sampling	HEIS	Sample	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248			Aroclor-1254			Aroclor-1260		
3	Area	Number	Date	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
4	A1-1	J018C0	3/24/2004	2.0E-01	U	2.0E-01	2.5E+00	U	2.5E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
5	Duplicate of J018C0	J018F6	3/24/2004	2.1E-01	U	2.1E-01	2.3E+00	U	2.3E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
6	A1-2	J018C2	3/24/2004	2.1E-01	U	2.1E-01	2.6E+00	U	2.6E+00	2.E-02	UC	2.E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
7	A2-1	J018C4	3/25/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
8	A2-2	J018C6	3/25/2004	2.1E-01	U	2.1E-01	2.5E+00	U	2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
9	A2-3	J018C8	3/25/2004	2.1E-01	U	2.1E-01	2.5E+00	U	2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
10	A3-1	J018D0	3/25/2004	2.1E-01	U	2.1E-01	2.5E+00	U	2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
11	A3-2	J018D2	3/25/2004	2.0E-01	U	2.0E-01	2.4E+00	U	2.4E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
12	A4-1	J018D4	3/25/2004	2.1E-01	U	2.1E-01	2.5E+00	U	2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
13	A4-2	J018D6	3/25/2004	2.1E-01	U	2.1E-01	2.5E+00	U	2.5E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02
14	A4-3	J018D8	3/25/2004	2.1E-01	U	2.1E-01	2.3E+00	U	2.3E+00	1.E-02	U	1.E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02	1.4E-02	U	1.4E-02

15 **Statistical Computation Input Data**

16	Sampling	HEIS	Sample	Hexavalent Chromium	Lead	Mercury	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
17	Area	Number	Date	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg	mg/kg
18	A1-1	J018C0/J018F6	3/24/2004	1.0E-01	1.2E+00	1.E-02	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
19	A1-2	J018C2	3/24/2004	1.1E-01	1.3E+00	1.E-02	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
20	A2-1	J018C4	3/25/2004	1.0E-01	1.2E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
21	A2-2	J018C6	3/25/2004	1.1E-01	1.3E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
22	A2-3	J018C8	3/25/2004	1.1E-01	1.3E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
23	A3-1	J018D0	3/25/2004	1.1E-01	1.3E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
24	A3-2	J018D2	3/25/2004	1.0E-01	1.2E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
25	A4-1	J018D4	3/25/2004	1.1E-01	1.3E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
26	A4-2	J018D6	3/25/2004	1.1E-01	1.3E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03
27	A4-3	J018D8	3/25/2004	1.1E-01	1.2E+00	5.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03

28 **Statistical Computations**

29		Hexavalent Chromium	Lead	Mercury	Aroclor-1016	Aroclor-1221	Aroclor-1232	Aroclor-1242	Aroclor-1248	Aroclor-1254	Aroclor-1260
30	95% UCL value based on	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.	Nonradionuclide data set >50% censored. 95% UCL value not calculated.
31	N	10	10	10	10	10	10	10	10	10	10
32	% < Detection limit	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%
33	mean	1.0E-01	1.2E+00	6.E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.0E-03	7.E-03	7.0E-03
34	st. dev.	2.E-03	4.2E-02	2.E-03	0	0	0	0	0	0	0
35	95% UCL on mean	NA	NA	NA	NA	NA	NA	NA	NA	NA	NA
36	max value	2.1E-01 U	2.6E+00 U	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U
37	Statistical value	2.1E-01 U	2.6E+00 U	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U
38	Background	NA	1.02E+01	3.3E-01	NA	NA	NA	NA	NA	NA	NA
39	Statistical value above background	2.1E-01 U	2.6E+00 U	2.E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U	1.4E-02 U
40	**Most Stringent Cleanup Limit for nonradionuclide and RAG type**	2 River Protection	10.2 BG/GW/River Protection	0.33 BG/GW/River Protection	0.017 RDL/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection	0.017 RDL/GW/River Protection
41	**WAC 173-340 3-PART Test**										
42	Statistical value > Cleanup Limit?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
43	> 10% above Cleanup Limit?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO
44	Any sample > 2X Cleanup Limit?	NO	NO	NO	NO	NO	NO	NO	NO	NO	NO

45 BG = background
46 bgs = below ground surface
47 C = blank contamination
48 GW = groundwater
49 HEIS = Hanford Environmental Information System
50 J = estimated
51 NA = not applicable

PQL = practical quantitation limit
Q = qualifier
RAG = remedial action goal
RDL = required detection limit
U = undetected
UCL = upper confidence limit
WAC = Washington Administrative Code

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 18 of 21

1 **Fuel Storage Basin Underlying Soils 8-10' bgs (Deep Zone) (continued)**

2	Sampling	HEIS	Sample	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Neptunium-237			Nickel-63			Plutonium-238		
3	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	A1-1	J018C0	3/24/2004	0	U	1.8E-01	5.88E-01	UJ	6.2E+00	4.5E-02	U	4.5E-02	4.3E-02	U	4.3E-02	1.1E-01	U	1.1E-01	1.8E-01	U	1.8E-01	8.9E-02	U	8.9E-02	0	UJ	4.0E-02	3.62E+00	U	4.6E+00	0	U	2.1E-01
5	Duplicate of J018C0	J018F6	3/24/2004	1.20E-01	U	2.3E-01	6.73E-01	UJ	5.5E+00	5.6E-02	U	5.6E-02	6.6E-02	U	6.6E-02	1.5E-01	U	1.5E-01	1.8E-01	U	1.8E-01	1.5E-01	U	1.5E-01	2.1E-02	UJ	5.4E-02	1.00E+00	U	4.5E+00	0	U	2.6E-01
6	A1-2	J018C2	3/24/2004	4.8E-02	U	1.8E-01	-3.20E-01	UJ	5.9E+00	4.9E-02	U	4.9E-02	5.7E-02	U	5.7E-02	1.3E-01	U	1.3E-01	1.9E-01	U	1.9E-01	1.3E-01	U	1.3E-01	-6.E-03	UJ	6.1E-02	3.56E+00	U	4.6E+00	0	U	2.2E-01
7	A2-1	J018C4	3/25/2004	6.5E-02	U	2.5E-01	2.05E+00	U	4.9E+00	3.0E-02	U	3.0E-02	2.6E-02	U	2.6E-02	6.6E-02	U	6.6E-02	9.4E-02	U	9.4E-02	6.3E-02	U	6.3E-02	-5.E-03	U	5.2E-02	1.77E+00	U	4.9E+00	0	U	3.2E-01
8	A2-2	J018C6	3/25/2004	6.3E-02	U	2.4E-01	3.00E+00	U	5.6E+00	1.75E-01		2.3E-02	2.2E-02	U	2.2E-02	6.5E-02	U	6.5E-02	6.6E-02	U	6.6E-02	5.5E-02	U	5.5E-02	0	U	5.7E-02	-5.37E-01	U	5.1E+00	0	U	2.4E-01
9	A2-3	J018C8	3/25/2004	1.43E-01	U	2.7E-01	6.43E-01	U	5.2E+00	9.5E-02	U	9.5E-02	1.1E-01	U	1.1E-01	2.1E-01	U	2.1E-01	3.1E-01	U	3.1E-01	1.9E-01	U	1.9E-01	5.E-03	U	5.2E-02	7.48E-01	U	5.0E+00	3.4E-02	U	2.6E-01
10	A3-1	J018D0	3/25/2004	3.6E-02	U	2.8E-01	-1.61E+00	U	4.7E+00	1.6E-01	U	1.6E-01	5.7E-02	U	5.7E-02	1.3E-01	U	1.3E-01	1.6E-01	U	1.6E-01	1.0E-01	U	1.0E-01	1.4E-02	U	5.2E-02	1.62E+00	U	5.4E+00	0	U	2.3E-01
11	A3-2	J018D2	3/25/2004	7.9E-02	U	3.0E-01	1.25E+00	U	4.8E+00	1.65E-01		7.6E-02	7.0E-02	U	7.0E-02	1.7E-01	U	1.7E-01	2.4E-01	U	2.4E-01	1.7E-01	U	1.7E-01	0	U	6.4E-02	-1.09E+00	U	5.2E+00	3.6E-02	U	2.8E-01
12	A4-1	J018D4	3/25/2004	6.5E-02	U	2.5E-01	-5.80E-01	U	6.0E+00	3.87E-01		7.2E-02	7.7E-02	U	7.7E-02	2.1E-01	U	2.1E-01	2.1E-01	U	2.1E-01	1.8E-01	U	1.8E-01	7.E-03	U	2.0E-02	2.61E+00	U	5.3E+00	3.6E-02	U	2.8E-01
13	A4-2	J018D6	3/25/2004	0	U	2.4E-01	1.62E+00	U	5.6E+00	4.22E-01		1.0E-01	8.2E-02	U	8.2E-02	2.3E-01	U	2.3E-01	2.9E-01	U	2.9E-01	1.9E-01	U	1.9E-01	-5.E-03	U	4.9E-02	-1.11E+00	U	5.3E+00	0	U	2.6E-01
14	A4-3	J018D8	3/25/2004	0	U	2.9E-01	1.96E+00	U	4.7E+00	4.7E-02	U	4.7E-02	5.8E-02	U	5.8E-02	1.1E-01	U	1.1E-01	1.6E-01	U	1.6E-01	1.1E-01	U	1.1E-01	2.7E-02	U	6.5E-02	-9.62E-01	U	4.9E+00	0	U	2.9E-01

15 Note: Radiological analytical methods use statistically-determined floating calibration curves that are not forced through the origin; therefore, negative values are routinely reported for undetected analytes. This does not diminish the usability of the data.

16 **Statistical Computation Input Data**

17	Sampling	HEIS	Sample	Americium-241	Carbon-14	Cesium-137	Cobalt-60	Europium-152	Europium-154	Europium-155	Neptunium-237	Nickel-63	Plutonium-238
18	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
19	A1-1	J018C0/J018F6	3/24/2004	6.00E-02	6.31E-01	2.5E-02	2.7E-02	6.5E-02	9.0E-02	6.0E-02	1.1E-02	2.31E+00	0
20	A1-2	J018C2	3/24/2004	4.8E-02	-3.20E-01	2.5E-02	2.9E-02	6.5E-02	9.5E-02	6.5E-02	-6.E-03	3.56E+00	0
21	A2-1	J018C4	3/25/2004	6.5E-02	2.05E+00	1.5E-02	1.3E-02	3.3E-02	4.7E-02	3.2E-02	-5.E-03	1.77E+00	0
22	A2-2	J018C6	3/25/2004	6.3E-02	3.00E+00	1.75E-01	1.1E-02	3.3E-02	3.3E-02	2.8E-02	0	-5.37E-01	0
23	A2-3	J018C8	3/25/2004	1.43E-01	6.43E-01	4.8E-02	5.5E-02	1.1E-01	1.6E-01	9.5E-02	5.E-03	7.48E-01	3.4E-02
24	A3-1	J018D0	3/25/2004	3.6E-02	-1.61E+00	8.0E-02	2.9E-02	6.5E-02	8.0E-02	5.0E-02	1.4E-02	1.62E+00	0
25	A3-2	J018D2	3/25/2004	7.9E-02	1.25E+00	1.65E-01	3.5E-02	8.5E-02	1.2E-01	8.5E-02	0	-1.09E+00	3.6E-02
26	A4-1	J018D4	3/25/2004	6.5E-02	-5.80E-01	3.87E-01	3.9E-02	1.1E-01	1.1E-01	9.0E-02	7.E-03	2.61E+00	3.6E-02
27	A4-2	J018D6	3/25/2004	0	1.62E+00	4.22E-01	4.1E-02	1.2E-01	1.5E-01	9.5E-02	-5.E-03	-1.11E+00	0
28	A4-3	J018D8	3/25/2004	0	1.96E+00	2.4E-02	2.9E-02	5.5E-02	8.0E-02	5.5E-02	2.7E-02	-9.62E-01	0

29 **Statistical Computations**

30		Americium-241		Carbon-14		Cesium-137		Cobalt-60		Europium-152		Europium-154		Europium-155		Neptunium-237		Nickel-63		Plutonium-238	
31	95% UCL value based on	Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.		Radionuclide data set. Use nonparametric z-statistic.	
32	N	10		10		10		10		10		10		10		10		10		10	
33	% < Detection limit	100%		100%		60%		100%		100%		100%		100%		100%		100%		100%	
34	mean	5.6E-02		8.6E-01		1.36E-01		3.1E-02		7.3E-02		9.5E-02		6.5E-02		5.E-03		8.9E-01		1.1E-02	
35	st. dev.	4.1E-02		1.40E+00		1.53E-01		1.3E-02		2.9E-02		3.9E-02		2.5E-02		1.0E-02		1.73E+00		1.7E-02	
36	Z-statistic	1.645		1.645		1.645		1.645		1.645		1.645		1.645		1.645		1.645		1.645	
37	95% UCL on mean	7.7E-02		1.59E+00		2.16E-01		3.7E-02		8.8E-02		1.2E-01		7.8E-02		1.0E-02		1.79E+00		1.9E-02	
38	max value	1.43E-01	U	3.00E+00	U	4.22E-01		1.1E-01	U	2.3E-01	U	3.1E-01	U	1.9E-01	U	2.7E-02	U	3.62E+00	U	3.6E-02	U
39	Statistical value	7.7E-02	U	1.59E+00	U	2.16E-01		3.7E-02	U	8.8E-02	U	1.2E-01	U	7.8E-02	U	1.0E-02	U	1.79E+00	U	1.9E-02	U
40	Background	NA		NA		NA		NA		NA		NA		NA		NA		NA		NA	
41	Statistical value above background	7.7E-02	U	1.59E+00	U	2.16E-01		3.7E-02	U	8.8E-02	U	1.2E-01	U	7.8E-02	U	1.0E-02	U	1.79E+00	U	1.9E-02	U

42 bgs = below ground surface
43 HEIS = Hanford Environmental Information System
44 J = estimated
45 MDA = minimum detectable activity

NA = not applicable
Q = qualifier
U = undetected
UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 19 of 21

1 **Fuel Storage Basin Underlying Soils 8-10' bgs (Deep Zone) (continued)**

2	Sampling	HEIS	Sample	Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230			Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
3	Area	Number	Date	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
4	A1-1	J018C0	3/24/2004	0	U	2.1E-01	-2.7E-02	U	1.9E-01	3.40E-01	J	2.9E-01	3.78E-01		2.9E-01	4.53E-01	J	2.9E-01	1.53E-01	U	5.0E-01	3.28E-01		3.3E-02	2.1E-02	U	3.2E-02	4.50E-01		2.7E-02
5	Duplicate of J018C0	J018F6	3/24/2004	0	U	2.6E-01	-1.5E-02	U	2.4E-01	4.23E-01	J	9.0E-02	5.03E-01		1.9E-01	4.16E-01	J	7.0E-02	2.70E-01	U	5.8E-01	3.52E-01		3.2E-02	2.0E-02	U	3.1E-02	3.82E-01		2.5E-02
6	A1-2	J018C2	3/24/2004	0	U	2.2E-01	-5.0E-02	U	2.1E-01	2.33E-01	UJ	3.0E-01	8.13E-01		3.0E-01	4.26E-01	J	3.0E-01	3.98E-01	U	4.9E-01	3.62E-01		4.3E-02	2.1E-02	U	3.2E-02	2.96E-01		3.3E-02
7	A2-1	J018C4	3/25/2004	0	U	3.2E-01	-3.4E-02	U	2.4E-01	3.92E-01		2.7E-01	4.27E-01		2.7E-01	4.27E-01		2.7E-01	3.74E-01	U	5.0E-01	4.19E-01		2.0E-01	9.5E-02	U	2.4E-01	5.50E-01		2.0E-01
8	A2-2	J018C6	3/25/2004	9.6E-02	U	2.4E-01	9.2E-02	U	2.1E-01	2.76E-01	U	4.2E-01	2.20E-01	U	4.2E-01	3.31E-01	U	4.2E-01	2.7E-02	U	5.2E-01	3.46E-01		2.0E-01	3.2E-02	U	2.5E-01	2.93E-01		2.0E-01
9	A2-3	J018C8	3/25/2004	3.4E-02	U	2.6E-01	-7.8E-02	U	2.3E-01	3.23E-01	U	6.2E-01	3.23E-01	U	6.2E-01	8.88E-01		6.2E-01	-7.2E-02	U	4.7E-01	4.31E-01		2.1E-01	6.5E-02	U	2.5E-01	3.23E-01		2.1E-01
10	A3-1	J018D0	3/25/2004	3.0E-02	U	2.3E-01	1.63E-01	U	2.0E-01	4.91E-01		3.4E-01	8.92E-01		3.4E-01	5.80E-01		3.4E-01	2.13E-01	U	5.2E-01	2.66E-01		2.3E-01	0	U	2.7E-01	4.72E-01		2.3E-01
11	A3-2	J018D2	3/25/2004	7.2E-02	U	2.8E-01	1.07E-01	U	2.4E-01	4.39E-01		3.1E-01	3.98E-01		3.0E-01	1.99E-01	U	3.0E-01	3.56E-01	U	4.6E-01	3.28E-01		2.1E-01	0	U	2.5E-01	4.38E-01		2.1E-01
12	A4-1	J018D4	3/25/2004	1.82E-01	U	2.8E-01	5.70E-01		2.0E-01	5.07E-01		3.0E-01	6.62E-01		3.0E-01	5.06E-01		3.0E-01	8.2E-02	U	4.6E-01	3.45E-01		2.2E-01	0	U	2.7E-01	4.60E-01		2.2E-01
13	A4-2	J018D6	3/25/2004	0	U	2.6E-01	-5.0E-02	U	2.6E-01	3.60E-01		3.1E-01	2.79E-01	U	3.1E-01	4.0E-02	U	3.1E-01	5.68E-01		4.3E-01	4.29E-01		2.2E-01	3.5E-02	U	2.6E-01	4.57E-01		2.2E-01
14	A4-3	J018D8	3/25/2004	0	U	2.9E-01	4.7E-02	U	2.3E-01	4.50E-01		2.9E-01	1.12E-01	U	2.9E-01	1.50E-01	U	2.9E-01	1.45E-01	U	4.7E-01	4.28E-01		2.0E-01	3.2E-02	U	2.5E-01	4.55E-01		2.0E-01

15 Note: Radiological analytical methods use statistically-determined floating calibration curves that are not forced through the origin; therefore, negative values are routinely reported for undetected analytes. This does not diminish the usability of the data.

16 **Statistical Computation Input Data**

17	Sampling	HEIS	Sample	Plutonium-239/240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Tritium	Uranium-233/234	Uranium-235	Uranium-238
18	Area	Number	Date	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g	pCi/g
19	A1-1	J018C0/J018F6	3/24/2004	0	-2.1E-02	3.82E-01	4.41E-01	4.35E-01	2.12E-01	3.40E-01	2.1E-02	4.16E-01
20	A1-2	J018C2	3/24/2004	0	-5.0E-02	2.33E-01	8.13E-01	4.26E-01	3.98E-01	3.62E-01	2.1E-02	2.96E-01
21	A2-1	J018C4	3/25/2004	0	-3.4E-02	3.92E-01	4.27E-01	4.27E-01	3.74E-01	4.19E-01	9.5E-02	5.50E-01
22	A2-2	J018C6	3/25/2004	9.6E-02	9.2E-02	2.76E-01	2.20E-01	3.31E-01	2.7E-02	3.46E-01	3.2E-02	2.93E-01
23	A2-3	J018C8	3/25/2004	3.4E-02	-7.8E-02	3.23E-01	3.23E-01	8.88E-01	-7.2E-02	4.31E-01	6.5E-02	3.23E-01
24	A3-1	J018D0	3/25/2004	3.0E-02	1.63E-01	4.91E-01	8.92E-01	5.80E-01	2.13E-01	2.66E-01	0	4.72E-01
25	A3-2	J018D2	3/25/2004	7.2E-02	1.07E-01	4.39E-01	3.98E-01	1.99E-01	3.56E-01	3.28E-01	0	4.38E-01
26	A4-1	J018D4	3/25/2004	1.82E-01	5.70E-01	5.07E-01	6.62E-01	5.06E-01	8.2E-02	3.45E-01	0	4.60E-01
27	A4-2	J018D6	3/25/2004	0	-5.0E-02	3.60E-01	2.79E-01	4.0E-02	5.68E-01	4.29E-01	3.5E-02	4.57E-01
28	A4-3	J018D8	3/25/2004	0	4.7E-02	4.50E-01	1.12E-01	1.50E-01	1.45E-01	4.28E-01	3.2E-02	4.55E-01

29 **Statistical Computations**

30		Plutonium-239/240	Strontium-90	Thorium-228	Thorium-230	Thorium-232	Tritium	Uranium-233/234	Uranium-235	Uranium-238
31	95% UCL value based on	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.	Radionuclide data set. Use nonparametric z-statistic.
32	N	10	10	10	10	10	10	10	10	10
33	% < Detection limit	100%	90%	30%	40%	40%	90%	0%	100%	0%
34	mean	4.1E-02	7.5E-02	3.85E-01	4.57E-01	3.98E-01	2.30E-01	3.69E-01	3.0E-02	4.16E-01
35	st. dev.	6.0E-02	1.92E-01	9.0E-02	2.55E-01	2.41E-01	1.95E-01	5.5E-02	3.0E-02	8.5E-02
36	Z-statistic	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645	1.645
37	95% UCL on mean	7.3E-02	1.74E-01	4.32E-01	5.90E-01	5.23E-01	3.32E-01	3.98E-01	4.6E-02	4.60E-01
38	max value	1.82E-01 U	5.70E-01	5.07E-01	8.92E-01	8.88E-01	5.68E-01	4.31E-01	9.5E-02 U	5.50E-01
39	Statistical value	7.3E-02 U	1.74E-01	4.32E-01	5.90E-01	5.23E-01	3.32E-01	3.98E-01	4.6E-02 U	4.60E-01
40	Background	NA	NA	1.32E+00	NA	1.32E+00	NA	1.1E+00	1.1E-01	1.1E+00
41	Statistical value above background	7.3E-02 U	1.74E-01	0 (<BG)	5.90E-01	0 (<BG)	3.32E-01	0 (<BG)	0 (<BG) U	0 (<BG)

42 BG = background
43 bgs = below ground surface
44 HEIS = Hanford Environmental Information System
45 J = estimated
46 MDA = minimum detectable activity

NA = not applicable
Q = qualifier
U = undetected
UCL = upper confidence limit

CALCULATION SHEET

Washington Closure Hanford

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 2/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 20 of 21

Fuel Storage Basin Underlying Soils 8-10' bgs (Deep Zone) (continued)

Split-Duplicate Analysis

Sampling Area	HEIS Number	Sample Date	Hexavalent Chromium			Lead			Mercury			Aroclor-1016			Aroclor-1221			Aroclor-1232			Aroclor-1242			Aroclor-1248			Aroclor-1254			Aroclor-1260		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
A1-1	J018C0	3/24/2004	2.0E-01	U	2.0E-01	2.5E+00	U	2.5E+00	2.0E-02	UC	2.0E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
Duplicate of J018C0	J018F6	3/24/2004	2.1E-01	U	2.1E-01	2.3E+00	U	2.3E+00	2.0E-02	UC	2.0E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02	1.4E-02	UJ	1.4E-02
Split of J018C0	J01BC7	3/24/2004	-3.17E-03	U	7.58E-02	8.11E-02	U	3.12E-01	-3.59E-03	U	1.41E-02	1.23E-03	U	1.60E-02	-2.29E-02	U	3.59E-02	-2.47E-02	U	4.65E-02	1.82E-02	U	3.75E-02	0.00E+00	U	5.46E-02	1.08E+00	U	6.20E+00	-2.79E-03	U	1.17E-01
TDL			1			5			0.1			0.05			0.1			0.1			0.1			1			30			1		
Duplicate Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																															
	RPD																															
Split Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																															
	RPD																															

Sampling Area	HEIS Number	Sample Date	Americium-241			Carbon-14			Cesium-137			Cobalt-60			Europium-152			Europium-154			Europium-155			Neptunium-237			Nickel-63			Plutonium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1-1	J018C0	3/24/2004	0	U	1.8E-01	5.88E-01	UJ	6.2E+00	4.5E-02	U	4.5E-02	4.3E-02	U	4.3E-02	1.1E-01	U	1.1E-01	1.8E-01	U	1.8E-01	8.9E-02	U	8.9E-02	0	UJ	4.0E-02	3.62E+00	U	4.6E+00	0	U	2.1E-01
Duplicate of J018C0	J018F6	3/24/2004	1.20E-01	U	2.3E-01	6.73E-01	UJ	5.5E+00	5.6E-02	U	5.6E-02	6.6E-02	U	6.6E-02	1.5E-01	U	1.5E-01	1.8E-01	U	1.8E-01	1.5E-01	U	1.5E-01	2.1E-02	UJ	5.4E-02	1.00E+00	U	4.5E+00	0	U	2.6E-01
Split of J018C0	J01BC7	3/24/2004	-3.17E-03	U	7.58E-02	8.11E-02	U	3.12E-01	-3.59E-03	U	1.41E-02	1.23E-03	U	1.60E-02	-2.29E-02	U	3.59E-02	-2.47E-02	U	4.65E-02	1.82E-02	U	3.75E-02	0.00E+00	U	5.46E-02	1.08E+00	U	6.20E+00	-2.79E-03	U	1.17E-01
TDL			1			5			0.1			0.05			0.1			0.1			0.1			1			30			1		
Duplicate Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																															
	RPD																															
Split Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																															
	RPD																															

Sampling Area	HEIS Number	Sample Date	Plutonium-239/240			Strontium-90			Thorium-228			Thorium-230			Thorium-232			Tritium			Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
A1-1	J018C0	3/24/2004	0	U	2.1E-01	-2.7E-02	U	1.9E-01	3.40E-01	J	2.9E-01	3.78E-01		2.9E-01	4.53E-01	J	2.9E-01	1.53E-01	U	5.0E-01	3.28E-01		3.3E-02	2.1E-02	U	3.2E-02	4.50E-01		2.7E-02
Duplicate of J018C0	J018F6	3/24/2004	0	U	2.6E-01	-1.5E-02	U	2.4E-01	4.23E-01	J	9.0E-02	5.03E-01		1.9E-01	4.16E-01	J	7.0E-02	2.70E-01	U	5.8E-01	3.52E-01		3.2E-02	2.0E-02	U	3.1E-02	3.82E-01		2.5E-02
Split of J018C0	J01BC7	3/24/2004	2.79E-02	U	7.55E-02	2.79E-02	U	7.55E-02	2.79E-02	U	7.55E-02	2.79E-02	U	7.55E-02	2.79E-02	U	7.55E-02	2.79E-02	U	7.55E-02	2.79E-02	U	7.55E-02	2.79E-02	U	7.55E-02	2.79E-02	U	7.55E-02
TDL			1			1			1			1			1			10			1			0.5			1		
Duplicate Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			**Yes (continue)**			**Yes (continue)**			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**			No-Stop (acceptable)			**Yes (continue)**		
	Both > 5xTDL?								No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)						No-Stop (acceptable)						No-Stop (acceptable)		
	RPD																												
Split Analysis	Both > MDA?		No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)			No-Stop (acceptable)		
	Both > 5xTDL?																												
	RPD																												

bgs = below ground surface
C = blank contamination
HEIS = Hanford Environmental Information System
J = estimated
MDA = minimum detectable activity
PQL = practical quantitation limit
Q = qualifier
RPD = relative percent difference
TDL = target detection limit
U = undetected

Washington Closure Hanford

CALCULATION SHEET

Originator J. M. Capron JMC
Project Reactor Interim Safe Storage
Subject 105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification 95% UCL Calculations

Date 02/23/06
Job No. 14655

Calc. No. 0100H-CA-V0085
Checked T. M. Blakley TMB

Rev. No. 0
Date 2/28/06
Sheet No. 21 of 21

Ecology Software (MTCAStat) Results

Underlying Soils (0-1') Lead 95% UCL Calculation

DATA	ID
1.2E+00	J018B9/J018F5
1.3E+00	J018C1
1.24E+01	J018C3
1.2E+00	J018C5
1.92E+01	J018C7
3.48E+01	J018C9
1.64E+01	J018D1
2.04E+01	J018D3
8.7E+00	J018D5
1.15E+01	J018D7

Number of samples	
Uncensored	10
Censored	
Detection limit or PQL	
Method detection limit	
TOTAL	10

Uncensored values	
Mean	12.7
Lognormal mean	17.4
Std. devn.	10.6
Median	12.0
Min.	1.2
Max.	34.8

Lognormal distribution?
r-squared is: 0.841

Normal distribution?
r-squared is: 0.914

Recommendations:
Use normal distribution.

UCL (based on t-statistic) is 18.9

The 105-H Reactor Fuel Storage Basin Comparison to Drinking Water Standards (MCL)

(This calculation brief only pertains to the 105-H Fuel Storage Basin Soils [118-H-6:3] and Deep Zone Side-Slope Soils [118-H-6:6])

CALCULATION COVER SHEET

Project Title:	105-H Reactor Interim Safe Storage	**Job No.**	14655
Area	100-H Area		
Discipline	Environmental	***Calc. No.**	0100H-CA-V0087
Subject	105-H Reactor Building Fuel Storage Basin Comparison to Drinking Water Standards (MCL)		
Computer Program	Excel	**Program No.**	Excel 2003

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

Committed Calculatio X **Preliminary** **Superseded** **Voided**

Rev.	Sheet Numbers	Originator	Checker	Reviewer	Approval	Date
0	Cover - 1 Calculations - 3 Total - 4	S. W. Clark S.W. Clark 3/13/2006	J. M. Capron J.M. Capron 3/13/06	D. W. Shea DWShea 3/22/06	E. G. Ison ERSC G. Ison	03/22/06

SUMMARY OF REVISIONS

*Obtain Calc. No. from DIS
DE01-437.03 (12/09/2004)

Washington Closure Hanford **CALCULATION SHEET**

Originator	S. W. Clark	**Date** 3/13/06	**Calc. No.** 0100H-CA-V0087	**Rev. No.**	0
Project	105-H Reactor Interim Safe Storage	**Job No.** 14655	**Checked** J. M. Capron	**Date**	3/13/06
Subject	105-H Reactor Building Fuel Storage Basin Comparison to Drinking Water Standards (MCL)			**Sheet No.**	1 of 3

Purpose:
Compare RESRAD derived groundwater radionuclide concentrations to remedial action goals and maximum contaminant levels (MCLs) for groundwater. Compare beta/gamma emitter dose contributions to the maximum allowable dose of 4 mrem/yr. Compare alpha emitter dose contributions to the maximum allowable gross particle activity of 15 pCi/L or 1/25th of the derived concentration guide (DCG).

Table of Contents:

Given/References:
1) RESRAD derived groundwater radionuclide concentrations from Calculation 0100H-CA-V0086, *105-H Reactor Building (118-H-6) Fuel Storage Basin Cleanup Verification RESRAD Calculation Brief*.

2) Remedial action goals for groundwater and MCLs summarized in Table 2-3 of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP), DOE/RL-96-17, Rev. 4, U.S. Department of Energy, Richland Operations office, Richland, WA.

3) Maximum allowable dose of 4 mrem/yr for beta/gamma emitters and maximum allowable gross particle activity of 15 pCi/L for alpha emitters from: 40 CFR 141, "National Primary Drinking Water Regulation," *Code of Federal Regulations*, as amended (40 CFR Part 141, Subpart G, 141.66).

4) 1/25th of the derived concentration guide values from *Radiation Protection of the Public and Environment,* DOE Order 5400.5, U.S. Department of Energy, Washington D.C.

5) Individual organ-dose caclulation methodology for beta/gamma emitter dose contribution to the maximum allowable dose of 4 mrem/yr from: *Maximum Permissible Body Burdens and Maximum Permissible Concetrations of Radionuclides in Air or Water for Occupational Exposure*, National Bureau of Standards (NBS) Handbook 69, as amended, U.S. Department of Commerce, Washington D.C., and National Primary Drinking Water Regulations, EPA-570/9-76-003, U.S. Environmental Protection Agency, Office of Water Supply, Washington D.C.

Solution:
1. The site data for the calculation are the groundwater concentrations for the contaminants of concern (COCs) (daughter products are not considered) over time from the RESRAD groundwater concentration file.

2. If the site conceptual model breaks the contamination into multiple layers with differing concentrations, then the groundwater concentrations from the various model runs are added (for each time interval) to provide the concentration data for comparison to the individual remedial action goals and MCLs and the dose calculation for the beta and gamma emitters.

3. Compare the summed concentrations for each radionuclide to the groundwater remedial action goal and MCL given in the RDR/RAWP, Table 2-3.

4. The cumulative dose for each organ for all beta and gamma emitting COCs (C-14, Co-60, Cs-137, Eu-152, Eu-154, Eu-155, H-3, Ni-63, and Sr-90) at time t is calculated separately using the concentration corresponding to 4 mrem/year dose (C4) and the sum of fractions equation shown below (from EPA-570/9-76-003). The organs for which doses need to be computed are total body, bone, liver and gastrointestinal tract [lower large intestine] (GI(LLI)). The individual organ doses are compared to 4 mrem/yr.

Doseorgan x (t) = [ConcA(t)/C4A(x) + ConcB(t)/C4B(x) + ...] x (4 mrem/yr)

where:
Doseorgan x (t) is the total dose to organ x in mrem/yr
ConcA(t) is the concentration of isotope A at time t in pCi/L
C4A(x) is the 4 mrem/yr dose equivalent concentration for organ x of isotope A at time t in pCi/L
If the dose for organ x < 4 mrem/yr, then the standard is met.

Conclusions:
1. The summed concentrations for each radionuclide COC are less than the groundwater remedial action goal and MCL given in the RDR/RAWP, Table 2-3.

2. The cumulative dose for each total body, bone, liver and gastrointestinal tract for all beta and gamma emitting COCs is less than 4 mrem/yr

3. RESRAD modeling indicates that the alpha emitting COCs (Am-241, Pu-238, Pu-239, Pu-240, Th-228, and Th-232) will not impact groundwater. Therefore, concentrations for the alpha emitting COCs are less than the maximum allowable gross particle activity of 15 pCi/L and the 1/25th of the DCG.

4. The total uranium COCs (U-233/234, U-235, and U-238) are present at concentrations less than natural background.

Washington Closure Hanford

CALCULATION SHEET

Originator	S. W. Clark	**Date** 3/13/06	**Calc. No.** 0100H-CA-V0087	**Rev. No.**	0
Project	105-H Reactor Interim Safe Storage	**Job** 14655	**Checked** J. M. Capron	**Date**	3/13/06
Subject	105-H Reactor Building Fuel Storage Basin Comparison to Drinking Water Standards (MCL)			**Sheet No.**	2 of 3

Comparison of the summed concentrations for each radionuclide to the GW MCL
Data derived from RESRAD modelling, units are pCi/L.

Radionuclide	Time (years) 0	1	3	7.5	12	20.8	42	137	1000	MCL	Exceeds MCL?	Peak Conc.	Year of Peak Conc.
C-14	0	0	0	0	0	0	0	0	0	2,000	No	0	0
Cs-137	0	5.39E-04	1.55E-03	3.50E-03	5.05E-03	7.14E-03	8.83E-03	3.19E-03	0	60	No	0	42
Co-60	0	0	0	0	0	0	0	0	0	100	No	0	0
Eu-152	0	0	0	0	0	0	0	0	0	200	No	0	0
Eu-154	0	0	0	0	0	0	0	0	0	60	No	0	0
Eu-155	0	0	0	0	0	0	0	0	0	600	No	0	0
H-3	0	1.70E+02	2.32E+02	1.61E+02	7.09E+01	1.45E+01	3.39E-01	2.75E-08	0	20000	No	232	3
Ni-63	0	0	0	0	0	0	0	0	0	50	No	0	0
Sr-90	0	3.18E-03	9.12E-03	2.05E-02	2.94E-02	4.13E-02	5.01E-02	1.67E-02	2.91E-11	8	No	0.0501	42

Washington Closure Hanford

CALCULATION SHEET

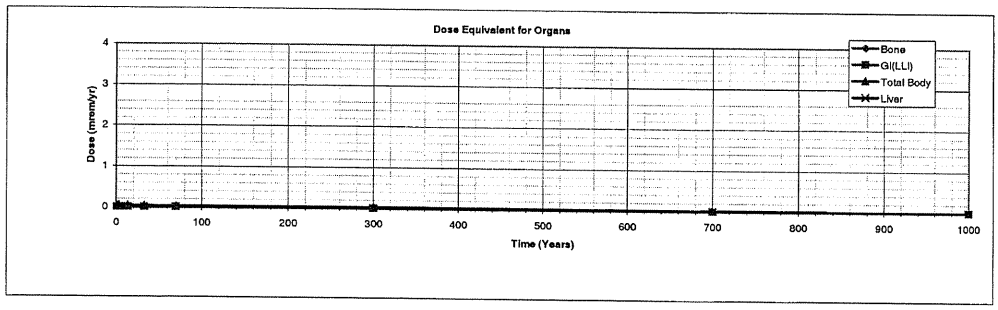
Originator	S. W. Clark	**Date** 3/13/06	**Calc. No.** 0100H-CA-V0087	**Rev. No.**	0
Project	105-H Reactor Interim Safe Storage	**Job** 14655	**Checked** J. M. Capron	**Date**	3/13/06
Subject	105-H Reactor Building Fuel Storage Basin Comparison to Drinking Water Standards (MCL)			**Sheet No.**	3 of 3

Comparison of the summed concentrations for each radionuclide to the groundwater maximum contaminant levels (MCL)
Data derived from RESRAD modelling, units are pCi/L.

Radionuclide	Time (years) 0	1	3	7.5	12	20.8	42	137	1000	Organ	C_4	Exceeds 4 mrem/yr?	Peak Conc.	Year of Peak Conc.
C-14	0	0	0	0	0	0	0	0	0	Total Body	9,000	No	0	0
										Bone	2,000	No		
										Fat	2,000	No		
Cs-137	0	5.39E-04	1.55E-03	3.50E-03	5.05E-03	7.14E-03	8.83E-03	3.19E-03	0	Bone	80	No	8.83E-03	42
										GI(LLI)	2,000	No		
										Total Body	200	No		
										Liver	60	No		
Co-60	0	0	0	0	0	0	0	0	0	GI(LLI)	100	No	0	0
										Total Body	900	No		
										Liver	3,000	No		
Eu-152	0	0	0	0	0	0	0	0	0	Bone	30,000	No	0	0
										GI(LLI)	200	No		
										Total Body	200,000	No		
										Liver	100,000	No		
Eu-154	0	0	0	0	0	0	0	0	0	Bone	5,000	No	0	0
										GI(LLI)	60	No		
										Total Body	70,000	No		
										Liver	60,000	No		
Eu-155	0	0	0	0	0	0	0	0	0	Bone	100,000	No	0	0
										GI(LLI)	600	No		
										Total Body	900,000	No		
										Liver	600,000	No		
H-3	0	1.70E+02	2.32E+02	1.61E+02	7.09E+01	1.45E+01	3.39E-01	2.75E-08	0	Total Body	20,000	No	2.32E+02	3
Ni-63	0	0	0	0	0	0	0	0	0	Bone	50	No	0	0
										GI(LLI)	3,000	No		
										Total Body	2,000	No		
										Liver	600	No		
Sr-90	0	3.18E-03	9.12E-03	2.05E-02	2.94E-02	4.13E-02	5.01E-02	1.67E-02	2.91E-11	Bone	8	No	5.01E-02	42
										GI(LLI)	100	No		
										Total Body	8	No		

Cumulative dose for each organ (with time)

Organ	Time (years) 0	1	3	13	32.6	70.0	300	700	1000	Exceeds 4 mrem/yr?	Peak Conc.	Year of Peak Conc.
Bone	0	1.62E-03	4.64E-03	1.04E-02	1.50E-02	2.10E-02	2.55E-02	8.51E-03	1.46E-11	No	2.55E-02	300
GI(LLI)	0	1.28E-04	3.68E-04	8.27E-04	1.19E-03	1.67E-03	2.02E-03	6.74E-04	1.16E-12	No	2.02E-03	300
Total Body	0	3.56E-02	5.10E-02	4.25E-02	2.90E-02	2.37E-02	2.53E-02	8.41E-03	1.46E-11	No	5.10E-02	3
Liver	0	3.59E-05	1.03E-04	2.33E-04	3.37E-04	4.76E-04	5.89E-04	2.13E-04	0.00E+00	No	5.89E-04	300



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