0070693

## Waste Site Reclassification Form

| | | |
|---|---|---|
| **Date Submitted:** 08/01/06<br><br>**Originator:** L. M. Dittmer<br><br>**Phone:** 372-9664 | **Operable Unit(s):** 100-HR-1<br><br>**Waste Site ID:** 132-H-2<br><br>**Type of Reclassification Action:**<br>Rejected ☐<br>Closed Out ☐<br>Interim Closed Out ☒<br>No Action ☐ | **Control Number:** 2006-049<br><br>**Lead Agency:** Ecology<br><br>RECEIVED<br>AUG 30 2006<br>EDMC |

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 132-H-2 site (117-H Filter Building) and associated below-grade ductwork were decommissioned and demolished in 1984, with a portion of the rubble left in situ beneath clean fill at least 1 m (3.3 ft) thick. Decommissioning included removal of contaminated air filters. Radiological characterization was performed prior to final decommissioning, including the collection of paint and concrete samples to support dose assessment calculations prepared in accordance with *Allowable Residual Contamination Levels for Decommissioning Facilities in the 100 Areas of the Hanford Site* (Kennedy and Napier 1983). The allowable residual contamination level calculations indicated that the potential dose to the maximally exposed individual in 1984 would contribute less than 1 mrem/yr. A RESidual RADioactivity (RESRAD) evaluation was performed in 2006 using the 1984 sampling results (after accounting for radioactive decay) to support the interim closed-out decision. This evaluation predicts that the maximum dose rate is 0.232 mrem/yr above background over 1,000 years. RESRAD also showed that of the contaminants detected, only tritium is predicted to reach groundwater within 1,000 years. The maximum tritium concentration in groundwater is predicted to be less than the remedial action goal (20,000 pCi/L). Therefore, the dose limits for the rural-residential (15 mrem/yr) and groundwater (4 mrem/yr) pathways will not be exceeded.

**Basis for reclassification:**

The site achieves the remedial action objectives and the corresponding remedial action goals established in the *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, and 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*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington. Residual concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario and pose no threat to groundwater or the Columbia River based on RESRAD modeling. However, the acceptability of unrestricted direct exposure to below-grade structure surfaces in the deep zone has not been demonstrated; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are required. The basis for reclassification to interim closed out is described in detail in the *Remaining Site Verification Package for 132-H-2, 117-H Filter Building* (attached). The data used for this evaluation were not obtained from environmental media and are not intended to be incorporated into the River Corridor Baseline Risk Assessment. Waste site-specific evaluations will be performed to determine which data are appropriate for ecological risk assessment and/or to assess the risk these sites present to ecological receptors.

| | | |
|---|---|---|
| K. Bazzell<br>DOE-RL Project Manager | Signature | 8/1/2006<br>Date |
| J. Price<br>Ecology Project Manager | Signature | 8/1/2006<br>Date |
| NA<br>EPA Project Manager | Signature | Date |

# REMAINING SITES VERIFICATION PACKAGE FOR 132-H-2, 117-H FILTER BUILDING

**Attachment to Waste Site Reclassification Form 2006-049**

**August 2006**

# REMAINING SITES VERIFICATION PACKAGE FOR 132-H-2, 117-H FILTER BUILDING

## EXECUTIVE SUMMARY

The 117-H Filter Building was built in 1960, approximately 12 years after the startup of the 105-H Reactor, to filter the exhaust air from the reactor building before it was routed to the 116-H Reactor Exhaust Stack. The exhaust air was routed to the 117-H Filter Building via an underground concrete inlet duct, filtered through particulate (high-efficiency particulate air) and halogen (activated charcoal) filters, and then routed to the stack via an underground concrete exhaust duct. In 1965, the reactor and associated facilities, including the 117-H Filter Building, were shut down. The 117-H Filter Building, including below-grade ductwork, was decommissioned and demolished in 1984. Dust was vacuumed from the walls and floors to prevent spread of loose contamination. Filter equipment was removed with the contaminated filters packaged and shipped to the Hanford Site 200 West Area burial grounds for disposal.

As part of decommissioning activities, extensive radiological surveying and sampling activities were performed to characterize residual radiological contamination on the accessible internal surface areas of the 117-H Filter Building. Characterization results indicated that residual contamination was confined to the 1-mm (0.04-in.) vinyl paint layer. An evaluation of the concrete beneath the paint showed that the contamination did not penetrate the paint or absorb into the concrete.

The 117-H Filter Building was released for unrestricted use based on the *ARCL Calculations for Decommissioning the 117-H Filter Building* (UNI 1984). The allowable residual contamination level calculation indicated that the demolished facility would contribute less than 1 mrem/yr dose to a hypothetical, maximally-exposed site resident if the site was released for unrestricted use after the demolition and burial in situ of the facility. Consequently, demolition and site grading were performed in 1984 using conventional heavy equipment. The rubble was buried under at least 1 m (3.3 ft) of clean fill, and the site was graded to blend with the natural terrain. The demolished 117-H Filter Building is identified as the 132-H-2 site in the Waste Information Data System (Appendix A).

Using the maximum radiological activities from the pre-demolition characterization data to represent residual contamination levels over 100% of the paint and concrete surface of the former building, RESidual RADioactivity (RESRAD) modeling was performed in 2006 to support the previous decision to demolish and bury the building in place. The RESRAD modeling accounts for radioactive decay from 1984 (year of sampling) to 2006 and predicts that the site achieves the dose limits and risk objectives for rural residential land use with institutional controls, groundwater protection, and river protection. Results of the RESRAD evaluation are summarized in Table ES-1.

**Table ES-1. Summary of Remedial Action Goals for the 132-H-2 Site.**

| Regulatory Requirement | Remedial Action Goals | Results | Remedial Action Objectives Attained? |
|---|---|---|---|
| Direct Exposure – Radionuclides | Attain 15-mrem/yr dose rate above background over 1,000 years. | 0.232 mrem/yr is the highest dose rate above background predicted over 1,000 years. | Yes |
| Groundwater/River Protection – Radionuclides | Attain single COC groundwater and river protection RAGs. | Tritium is the only radionuclide that is predicted to reach groundwater, but its maximum concentration will not exceed the remedial action goal based on RESRAD modeling. | Yes |
| | Attain national primary drinking water standards:[a] 4 mrem/yr (beta/gamma) dose rate to target receptor/organs. | | |
| | Meet drinking water standards for alpha emitters: the most stringent of 15 pCi/L MCL or 1/25th of the derived concentration guides from DOE Order 5400.5.[b] | | |

[a] "National Primary Drinking Water Regulations" (40 *Code of Federal Regulations* 141).
[b] *Radiation Protection of the Public and the Environment* (DOE Order 5400.5).
COC = contaminant of concern
MCL = maximum contaminant level
RAG = remedial action goal
RESRAD = RESidual RADioactivity (dose model)

In accordance with this evaluation, the 1984 sampling results support a reclassification of the 132-H-2 site to interim closed out. The current site conditions achieve the remedial action objectives and the corresponding remedial action goals established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005) and 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* (ROD) (EPA 1999). These results show that the site and contaminant levels remaining in the soil will be protective of direct exposure, groundwater, and the Columbia River. However, the acceptability of unrestricted direct exposure to below-grade structure surfaces in the deep zone has not been demonstrated; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are required.

Soil cleanup levels were established in the interim action ROD based on a limited ecological risk assessment. 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 closeout decision for this site.

# REMAINING SITES VERIFICATION PACKAGE FOR 132-H-2; 117-H FILTER BUILDING

## STATEMENT OF PROTECTIVENESS

This report demonstrates that the 132-H-2 site meets the objectives for interim closed out as established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2005) and 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* (EPA 1999). These results show that the site and contaminant levels remaining in the soil will be protective of direct exposure, groundwater, and the Columbia River.

## GENERAL SITE INFORMATION

The 117-H Filter Building was built in 1960, approximately 12 years after the startup of the 105-H Reactor, to filter the exhaust air from the reactor building before it was routed to the 116-H Reactor Exhaust Stack. The air was filtered through particulate (high-efficiency particulate air [HEPA]) and halogen (activated charcoal) filters and then routed to the stack via an underground concrete exhaust duct. In 1965, the reactor and associated facilities, including the 117-H Filter Building, were shut down.

The 117-H Filter Building, located approximately 24.4 m (80 ft) southwest of the 105-H Reactor Building (Figure 1), was a reinforced concrete structure 18 m (59 ft) long, 11.9 m (39 ft) wide, and 10.7 m (35 ft) high, of which only 1.1 m (3.5 ft) was above grade. The concrete walls and floors were generally 38.1 cm (15 in.) thick (UNI 1986).

The 117-H Filter Building received exhaust air from the 105-H Reactor Building exhaust air system via an underground concrete duct that ran from the 105-H Reactor Building exhaust fan discharge to the 117-H Building filter cells (Figure 2). A discharge duct conveyed the filtered air from the 117-H filter cells to the 116-H stack. The ducts were made of reinforced concrete no more than 38.1 cm (15 in.) thick. Both ducts had inside dimensions of 1.5 m (5 ft) wide by 3.5 m (11.6 ft) high. The inlet duct was 23.2 m (76 ft) long, and the exhaust duct was 30.8 m (101 ft) long. The duct roofs were typically 2.4 m (8 ft) below grade. Turning vanes, installed in the inlet and exhaust ducts, reduced turbulence in the air flow in and out of the filter cells.

The 117-H Filter Building contained two identical filter cells (A and B) separated by a two-story gallery area. The operating gallery contained a small amount of piping and electrical gear. The floor was metal grating. Eight doors on this level provided access to the A and B filter cells. Two doors, one on either end, provided access to the inlet and the exhaust ducts. Fresh air supply manifolds and air flow and radiation level instruments were located on this level.

**Figure 1. 132-H-2 Site Location Map.**

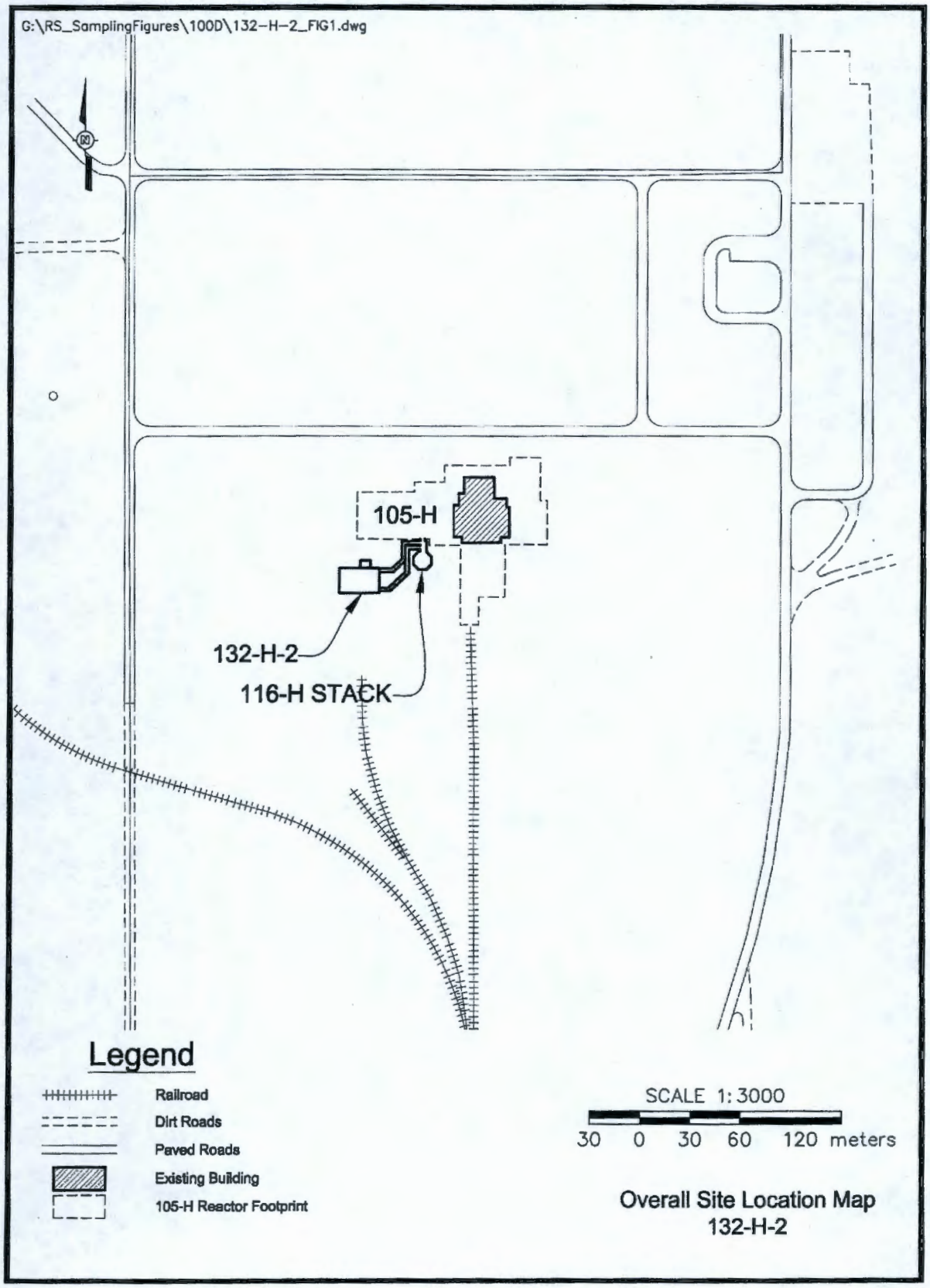
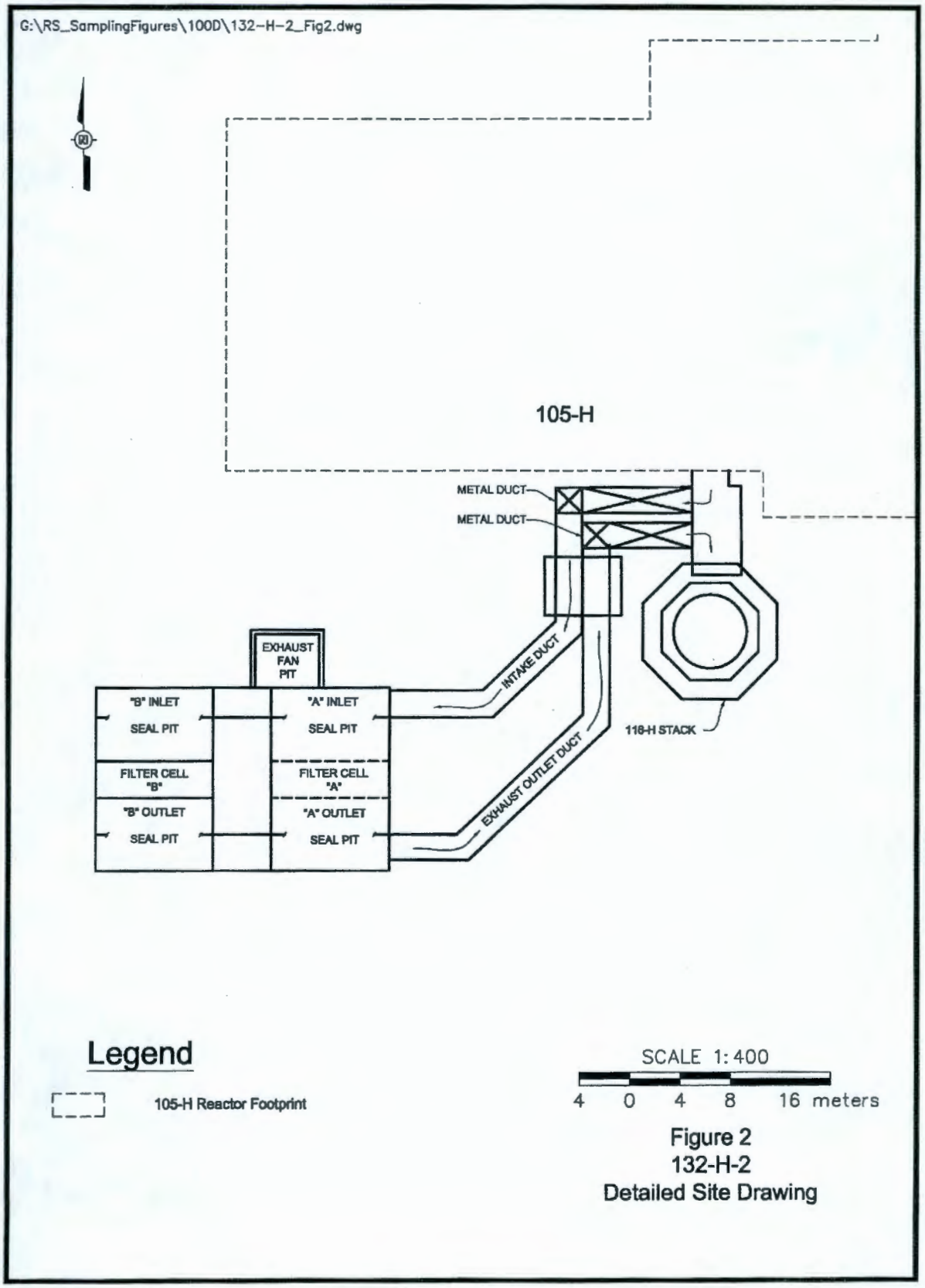


**Figure 2. 132-H-2 Detailed Site Plan View.**



The equipment gallery, located directly below the operating gallery, contained the majority of the piping and valves, including water lines, drain lines, air lines, sump pump, and the exhaust fan system lines.

Each filter cell had six berths, arranged in three banks with two berths per bank. Each filter berth contained 1 aluminum filter frame that held 24 HEPA or halogen filters, each of which was 61 by 61 by 30.5 cm (24 by 24 by 12 in.) (UNI 1986).

## DECONTAMINATION AND DECOMMISSIONING BACKGROUND

The 117-H Filter Building in situ decommissioning involved decontaminating the interior of the building, removing the equipment that could not be satisfactorily decontaminated, demolishing the building to below-grade level, and then grading the site to blend with the surrounding environment. Prior to demolition and site grading, radiation surveys and isotopic analyses of concrete and paint were made (UNI 1986).

The first step in the decommissioning project was to thoroughly survey the 117-H Filter Building and the inlet and outlet ducts. In 1983, radiation surveys were performed on 100% of the internal accessible surface areas of the facility for alpha and beta/gamma radiation. All inside surfaces of the inlet and outlet ducts were wiped clean of loose dust and marked off in 2- by 2-m (6.6- by 6.6-ft) grids for surveying. Surface smears and paint samples were collected in each grid, then labeled and analyzed for radioactive contamination (UNI 1986). These samples were collected to evaluate the potential radiological dose to a hypothetical maximally-exposed site resident if the site was released for unrestricted use after the demolition and burial in situ of the facility.

Decontamination activities consisted mainly of using Masslinn® cloth to wipe the vinyl base paint coating covering all surfaces exposed to air flow through the filter building (UNI 1984). Prior to demolition, dust was vacuumed from the walls and floors to prevent spread of loose contamination, and all remaining filters were removed and bagged. The filters were classified as low-level radioactive waste, packaged, and shipped to the Hanford Site 200 West Area burial grounds for disposal. All noncontaminated piping, electrical gear, filter frames, grating, and other equipment were either left in place or relocated within the filter building facility prior to demolition.

All interior surfaces of the inlet duct, filter cells, seal pits, and exhaust duct had been painted with a coating of vinyl-based paint. Paint samples were collected by removing approximately 150 $cm^2$ (23.3 $in^2$) of paint. Concrete samples were collected from beneath the paint in the inlet and outlet ducts to establish the depth of penetration of contamination. The concrete samples from the inlet duct were used to represent the concrete beneath the paint in all areas of the structure upstream of the filters. The concrete samples from the outlet duct were used represent the concrete from beneath the paint in all areas of the filter building downstream of the filters.

® Masslinn is a registered trademark of PGI, Inc.

Paint and concrete samples were analyzed using a multi-channel analyzer with a germanium (lithium) detector for gamma energy identification. The isotopes cobalt-60, cesium-137, europium-152, and europium-154 were identified by this method. Paint samples were sent to the U.S. Testing Company for gross alpha, tritium, carbon-14, and strontium-90 analysis. The samples exhibiting the highest radiological activity were collected from paint.

No sampling was performed for nonradionuclides. However, the *117-H Filter Building Decommissioning Individual Facility Report* (UNI 1986) states that no asbestos, mercury, or any other nonradioactive hazardous materials were found in the 117-H Filter Building.

The sample results were used to support calculation of the residual dose contribution for the demolished 117-H Filter Building in accordance with U.S. Department of Energy guidelines and *Allowable Residual Contamination Levels for Decommissioning Facilities in the 100 Areas of the Hanford Site* (Kennedy and Napier 1983). The allowable residual contamination level (ARCL) calculation indicated that the demolished facility would contribute less than 1 mrem/yr dose to a hypothetical, maximally-exposed site resident, if the site was released for unrestricted use after the demolition and burial in situ of the facility.

Demolition and site grading were completed in October 1984 using conventional heavy equipment, including a crane with a "wrecking ball," earth-moving bulldozer, and trucks. Prior to demolition, the building roof covers and selected metal floor gratings were surveyed and found to be free of contamination. They were then removed and the 117-H Building floors were perforated to allow for drainage. The ground above the ducts was excavated, then the exposed duct roofs were demolished. The ducts and the 117-H Building were filled to grade level with the demolished concrete and clean fill from nearby sources on the Hanford Site. Demolition rubble was buried under at least 1 m (3.3 ft) of clean fill, with rubble from the seal pits buried under at least 5 m (16 ft) of clean fill, and the site graded to blend with the surrounding terrain. Additional information is provided in the associated characterization and closeout reports (UNI 1984, 1986).

## BASIS FOR INTERIM CLOSED OUT

### Allowable Residual Contamination Level Methodology

The ARCL calculation methodology was used in 1984 to determine if further decontamination or remedial action was needed prior to demolition and in situ burial (UNI 1984). The calculation scenario was designed to represent unrestricted-use conditions for a hypothetical, maximally-exposed individual to receive a dose not exceeding 25 mrem/yr to the whole body or any organ. The ARCL methodology may either be applied to the entire building structure or various parts of the structure. In the case of the 117-H Building, the methodology was applied to the individually contaminated sections that included the inlet and outlet ducts, the inlet and outlet seal pits, and the filter cells (UNI 1984). The radionuclide inventories for the facility were determined from the sampling results and used the following general assumptions:

- The highest activity sample for each isotope was used to calculate the ARCL value for each section of the 117-H Building.

- All alpha activity remaining in the 117-H Building was attributed to plutonium-239.

- The depth of clean fill over the rubble was assumed to be 1 to 4 m (3.3 to 13 ft) deep, except for the seal pits, where a depth greater than 5 m (16 ft) was used.

The ARCL calculations were prepared in accordance with *Allowable Residual Contamination Levels for Decommissioning Facilities in the 100 Areas of the Hanford Site* (Kennedy and Napier 1983). According to the ARCL methodology used at the time, the final dose assessment was required to be based on the source term contained within the surrounding hectare for comparison with the 25 mrem/yr threshold. At the time the 117-H Filter Building was decommissioned, the ARCL calculation determined that the site would contribute less than 1 mrem/yr to an overall hectare dose rate, and, therefore, no further decontamination to reduce the source term was necessary and the facility could be buried in situ. Additional information is provided in the decommissioning and ARCL calculation reports (UNI 1984, 1986).

**RESidual RADioactivity Modeling Methodology**

In 2006, RESidual RADioactivity (RESRAD) modeling was performed in accordance with the RDR/RAWP (DOE-RL 2005) to support the interim closed out decision (Appendix C). The maximum concentrations of radionuclides, determined from the paint samples, were used to model the residual concentrations present in the buried concrete, assuming that the entire mass of concrete was contaminated. The waste site was modeled considering the entire thickness of contaminated materials and all pathways (direct exposure to gamma radiation; dust inhalation; soil ingestion; and ingestion of plants, meat, milk, aquatic foods, and drinking water) in the RESRAD evaluation. Contaminated concrete was buried in a demolished facility that extended 9.6 m (31.5 ft) below grade and was covered with 1 m (3.3 ft) of soil. The RESRAD evaluation used the 1984 sampling data adjusted for decay from 1984 to 2006. For each radionuclide identified in the samples that were collected, the highest value reported was conservatively used in the RESRAD modeling.

Table 1 provides a summary of the maximum radionuclide results from the samples collected in 1984 with the associated correction for decay as determined by RESRAD modeling (Appendix C). The corrected results for the maximum activities were used to represent uniform residual radiological contaminant concentrations over 100% of the rubble layer. Although the contamination was present in the vinyl paint layer coating the concrete on the inner building surfaces, soil distribution coefficients ($K_d$ values) were used in the modeling as conservative inputs to predict future potential groundwater impacts. The RESRAD input parameters are presented in Appendix B.

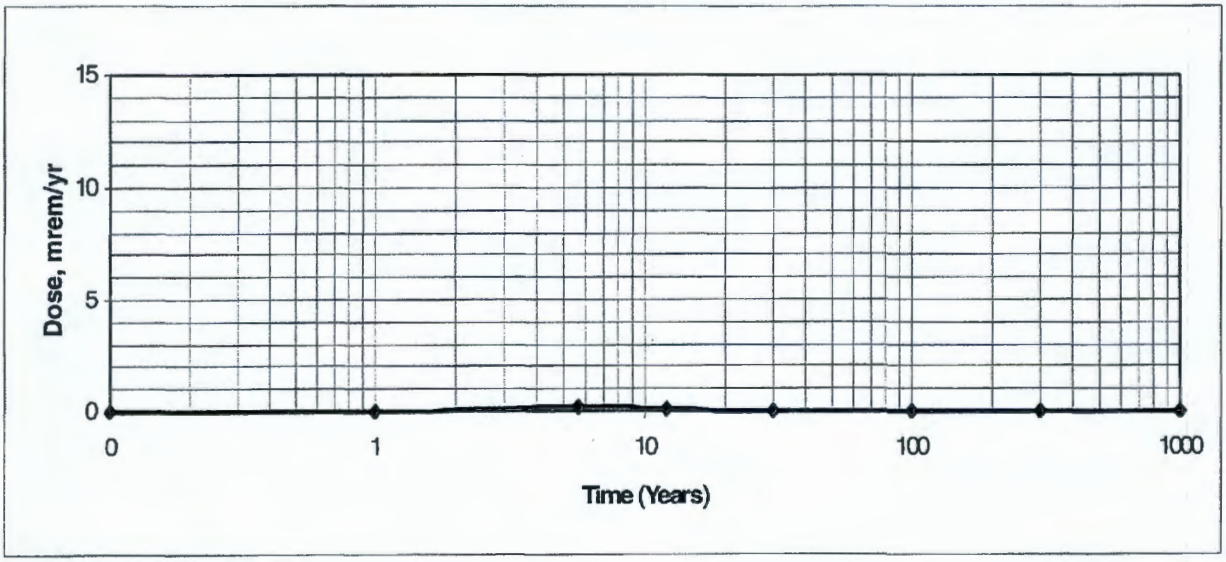
**Table 1. Radionuclide Activity.**

| Radionuclides | Maximum Activities from June 1984 [a] (pCi/g) | Activities Decayed to June 2006 (pCi/g) |
|---|---|---|
| Carbon-14 | 7.0 | 6.98 |
| Cesium-137 | 104 | 62.7 |
| Cobalt-60 | 56 | 3.1 |
| Europium-152 | 63 | 20.1 |
| Europium-154 | 19 | 3.36 |
| Tritium (H-3) | 41 | 11.9 |
| Plutonium-239 | 40 | 39.9 |
| Strontium-90 | 53 | 31.4 |

[a] *ARCL Calculations for Decommissioning the 117-H Filter Building* (UNI 1984)

The evaluation predicts that the dose limits will not be exceeded for either the rural-residential scenario (15 mrem/yr) or the groundwater pathway (4 mrem/yr) (Appendix C). Maximum potential dose to a receptor in the rural-residential scenario is predicted to be 0.232 mrem/yr, which is less than the guideline of 15 mrem/yr above background. This dose rate occurs 5.64 years after June 2006 as shown in Figure 3.

**Figure 3. Radionuclide Dose Rate – All Pathways for the 132-H-2 Site.**




RESRAD showed that of the contaminants detected, only tritium is predicted to reach groundwater within 1,000 years. The maximum tritium concentration in groundwater is

predicted to be less than the remedial action goal (20,000 pCi/L) at 4,780 pCi/L. Results are summarized in Table 2.

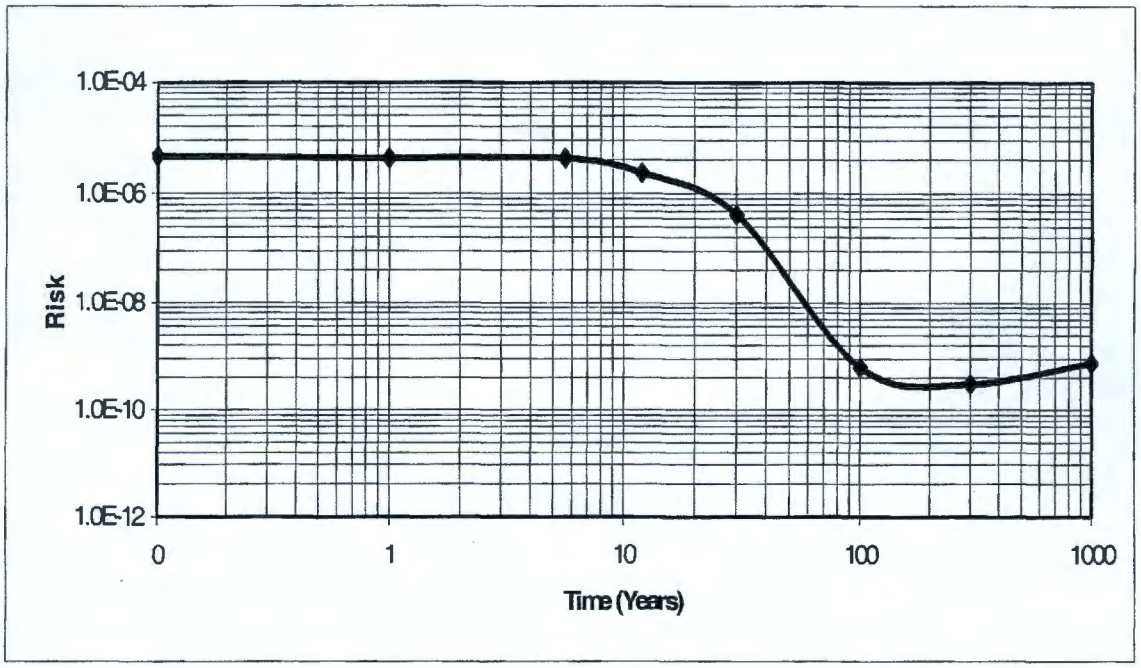
**Table 2. Summary of Attainment of Dose Limits for Radiological Contaminants of Concern for the 117-H Filter Building Using Soil Distribution Coefficient Values.**

| Scenario | Dose Limit (mrem/yr) | Dose Predicted by RESRAD (mrem/yr) | Is Dose > Dose Limit? |
|---|---|---|---|
| Rural residential | 15 | 0.232 | No |
| Groundwater protection | 4 | 0.232 | No |
| | **MCL [a] (pCi/L)** | **Concentration Predicted by RESRAD (pCi/L)** | **Is Concentration > Maximum Contaminant Level?** |
| Carbon-14 in groundwater | 2,000 | 0 | No |
| Cesium-137 in groundwater | 60 | 0 | No |
| Cobalt-60 in groundwater | 100 | 0 | No |
| Europium-152 in groundwater | 200 | 0 | No |
| Europium-154 in groundwater | 60 | 0 | No |
| Tritium (H-3) in groundwater | 20,000 | 4,780 | No |
| Plutonium-239 in groundwater | 15 | 0 | No |
| Strontium-90 in groundwater | 8 | 0 | No |

[a] Maximum contaminant levels from Table 2-3 of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005).
MCL = maximum contaminant level
RESRAD = RESidual RADioactivity (dose model)

The RESRAD model also estimates the excess lifetime cancer risk associated with the radiation dose rates using the U.S. Environmental Protection Agency's Health Effects Assessment Summary Tables. The "National Oil and Hazardous Substances Pollution Contingency Plan" (40 *Code of Federal Regulations* 300) presents a target range for residual risk of $10^{-4}$ to $10^{-6}$. The radionuclide excess lifetime cancer risk results are shown in Figure 4. The maximum excess lifetime cancer risk is $4.64 \times 10^{-6}$ occurs at year 0 (2006). Additional information for the RESRAD modeling is presented in Appendices B and C.

**Figure 4. Estimated Radionuclide Cancer Risk for the 132-H-2 Site.**




### Nonradionuclides

No detailed analysis was performed for nonradionuclides at the 117-H Filter Building. However, the *117-H Filter Building Decommissioning Individual Facility Report* (UNI 1986) states that no asbestos, mercury, or any other nonradioactive hazardous materials were found in the 117-H Filter Building.

## SUMMARY FOR INTERIM CLOSED OUT

The 132-H-2 site residual contaminant levels are protective of direct exposure, groundwater, and the Columbia River. However, the acceptability of unrestricted direct exposure to below-grade structure surfaces in the deep zone has not been demonstrated; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone are required. This decision is supported based on reviews of the facility information, historical data, and RESRAD modeling results as summarized below.

1. During decommissioning activities, contaminated materials were removed from the building and transported to the Hanford Site 200 Area for disposal.

2. The residual contamination exists in a thin layer of paint on the surface of the concrete walls and floor of the 117-H Filter Building.

3. Using conservative inputs (e.g., highest activity sample results and assuming uniform contamination levels on the paint and the entire mass of residual concrete), the RESRAD

outputs indicate that residual contamination levels do not present unacceptable risk to the maximally-exposed individual.

4. Excavation of the site to collect more information (i.e., samples) is not likely to result in a change to the interim closed out decision for the 132-H-2 site because the residual contamination occurred within a thin surface layer of paint on the interior surfaces of the building and would unlikely be detected in the deep zone rubble resulting from demolition of the building.

## REFERENCES

40 CFR 141, "National Primary Drinking Water Regulations," *Code of Federal Regulations,* as amended.

40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*, as amended.

DOE Order 5400.5, *Radiation Protection of the Public and the Environment*, as amended, U.S. Department of Energy, Washington, D.C.

DOE-RL, 2005, *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, 1999, *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*, U.S. Environmental Protection Agency, Region 10, Seattle, Washington.

Kennedy, W. E., Jr. and B. A. Napier, 1983, *Allowable Residual Contamination Levels for Decommissioning Facilities in the 100 Areas of the Hanford Site*, PNL-4722/UNI-2522, Pacific Northwest Laboratory, Richland, Washington.

UNI, 1984, *ARCL Calculations for Decommissioning the 117-H Filter Building*, UNI-3001, UNC Nuclear Industries, Richland, Washington.

UNI, 1986, *117-H Filter Building Decommissioning Individual Facility Report*, UNI-2752, UNC Nuclear Industries, Richland, Washington.

# APPENDIX A

# WASTE INFORMATION DATA SYSTEM GENERAL SUMMARY REPORT

# Waste Information Data System
# General Summary Report

*4/17/2003*

**Site Code:** 132-H-2 **Site Classification:** Accepted 

**Site Names:** 132-H-2, 117-H Filter Building Site

**Site Type:** Burial Ground **Start Date:** 1961

**Status:** Inactive **End Date:** 1965

**Operable Unit:** 100-HR-2 **Coordinates:**

**Hanford Area:** 100H (E) 577709.375

(N) 152487.109

Washington State Plane

**Site Description:** The unit was a reinforced concrete structure, 10.7 meters (35 feet) high and 90% below grade. The maximum thickness of the walls and floors was 0.6 meter (2 feet), with the majority being 38 centimeters (15 inches) thick. The ducts were made in reinforced concrete with a maximum wall thickness of 46 centimeters (18 inches). The inlet duct was 23.2 meters (76 feet) long and the exhaust duct was 30.8 meters (101 feet) long. The structure has been demolished in-situ and the site now resembles a gravel parking lot.

**Location Description:** The unit is located southwest of the 105-H Reactor Building.

**Associated Structures:** The building received exhaust fan discharge through an inlet duct from the 105-H and discharged the filtered air through a discharge duct and out the 116-H Stack.

**Site Comment:** The site was decommissioned using Allowable Residual Contamination Level (ARCL) methodology. The demolition and site grading were performed in September and October 1984. The building and ducts were excavated and demolished in-situ. The contaminated rubble was buried at least 1 meter (3.3 feet) deep except for rubble from the seal pits, which was buried under a minimum of 5 meters (16 feet) of clean earth.

**References:**

1. K. M. Harmon, et al, 8/75, Resource Book - Decommissioning of Contaminated Facilities at Hanford (Waste Management Facilities) App. XI (Draft), PNL-MA-588.
2. Scott Kitts, 8/26/91, Wids Site Addition, 132-H-2.
3. E. W. Powers, 9/16/86, 117-H Filter Building Decommissioning Individual Facility Report, UNI-2752.
4. General Electric, 8/14/64, PLAN COVER SLAB & DETAILS FILTER BUILDING, H-1-19836, Rev 4.
5. 1959, Plot Plan 117-H Filter Building, H-1-19805, Rev 3.

## Waste Information:

**Type:** Demolition and Inert Waste

**Category:** Radioactive

**Physical State:** Solid

**Description:** Total radionuclide inventory in the 117-H Building is estimated to be 0.41 millicuries. The radionuclides comprising this figure are tritium, carbon-14, cobalt-60, cesium-137, strontium-90, europium-154, europium-152, and plutonium-239/240. Of these radionuclides, strontium-90 is the most restrictive in the Allowable Residual Contamination Level (ARCL) calculations.

**References:**

1. Scott Kitts, 8/26/91, Wds Site Addition, 132-H-2.
2. E. W. Powers, 9/16/86, 117-H Filter Building Decommissioning Individual Facility Report, UNI-2752.

## Dimensions:

| | | |
|---|---|---|
| **Length:** | 16.86 Meters | 55.33 Feet |
| **Width:** | 7.01 Meters | 23.00 Feet |

**Comment:** The width increases to 12.09 meters (39.67 feet) if the ducts are included.

**References:**

1. General Electric, 8/14/64, PLAN COVER SLAB & DETAILS FILTER BUILDING, H-1-19836, Rev 4.

**Site Code: 132-H-2** **Site Classification: Accepted** Page 2

## Regulatory Information:

### Programmatic Responsibility

**DOE Program:** EM-40 **Confirmed By Program:** Yes
**DOE Division:** ERD - Environmental Restoration Division
**Responsible Contractor/Subcontractor:** BHI. Bechtel Hanford, Inc.

### Site Evaluation

**Solid Waste Management Unit:** Yes
**TPA Waste Management Unit Type:**

### Permitting

**RCRA Part A Permit:** No **Closure Plan:** No
**RCRA Part B Permit:** No **TSD Number:**
**RCRA Permit Status:**

**Septic Permit:** No **216/218 Permit:** No
**Inert Landfill:** No **NPDES:** No
**Air Operating Permit:** No **State Waste Discharge Permit:** No

**Air Operating Permit Number(s):**

### Tri-Party Agreement

**Lead Regulatory Agency:** Ecology
**Unit Category:** RCRA Past Practice (RPP)
**TPA Appendix:** C

### Remediation and Closure

**Decision Document:** Interim Action Record of Decision, 100 Area Remaining Sites (1999)
**Decision Document Status:** Final
**Remediation Design Group:** Group 5
**Closure Document:**
**Closure Type:**

**Post Closure Requirements:**

**Residual Waste:**

# APPENDIX B

# RESRAD INPUT PARAMETERS FOR THE 117-H FILTER BUILDING

1RESRAD, Version 6.30 T« Limit = 0.5 year 06/12/2006 07:04 Page 1
Summary : 132-H-2 / 117-H Filter Building RESRAD Evaluation of Rubblized Concrete
File : 132-H-2_Shallow_Zone.RAD

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File : 132-H-2_Shallow_Zone.RAD

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

| 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 | C-14 | 2.090E-06 | 2.090E-06 | DCF2( 2) |
| B-1 | Co-60 | 2.190E-04 | 2.190E-04 | DCF2( 3) |
| B-1 | Cs-137+D | 3.190E-05 | 3.190E-05 | DCF2( 4) |
| B-1 | Eu-152 | 2.210E-04 | 2.210E-04 | DCF2( 5) |
| B-1 | Eu-154 | 2.860E-04 | 2.860E-04 | DCF2( 7) |
| B-1 | Gd-152 | 2.430E-01 | 2.430E-01 | DCF2( 8) |
| B-1 | H-3 | 6.400E-08 | 6.400E-08 | DCF2( 9) |
| B-1 | Pa-231 | 1.280E+00 | 1.280E+00 | DCF2(10) |
| B-1 | Pu-239 | 4.290E-01 | 4.290E-01 | DCF2(11) |
| B-1 | Sr-90+D | 1.310E-03 | 1.310E-03 | DCF2(12) |
| B-1 | U-235+D | 1.230E-01 | 1.230E-01 | DCF2(13) |
| D-1 | Dose conversion factors for ingestion, mrem/pCi: | | | |
| D-1 | Ac-227+D | 1.480E-02 | 1.480E-02 | DCF3( 1) |
| D-1 | C-14 | 2.090E-06 | 2.090E-06 | DCF3( 2) |
| D-1 | Co-60 | 2.690E-05 | 2.690E-05 | DCF3( 3) |
| D-1 | Cs-137+D | 5.000E-05 | 5.000E-05 | DCF3( 4) |
| D-1 | Eu-152 | 6.480E-06 | 6.480E-06 | DCF3( 5) |
| D-1 | Eu-154 | 9.550E-06 | 9.550E-06 | DCF3( 7) |
| D-1 | Gd-152 | 1.610E-04 | 1.610E-04 | DCF3( 8) |
| D-1 | H-3 | 6.400E-08 | 6.400E-08 | DCF3( 9) |
| D-1 | Pa-231 | 1.060E-02 | 1.060E-02 | DCF3(10) |
| D-1 | Pu-239 | 3.540E-03 | 3.540E-03 | DCF3(11) |
| D-1 | Sr-90+D | 1.530E-04 | 1.530E-04 | DCF3(12) |
| D-1 | U-235+D | 2.670E-04 | 2.670E-04 | DCF3(13) |
| 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 | C-14 , plant/soil concentration ratio, dimensionless | 5.500E+00 | 5.500E+00 | RTF( 2,1) |
| D-34 | C-14 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) | 3.100E-02 | 3.100E-02 | RTF( 2,2) |
| D-34 | C-14 , milk/livestock-intake ratio, (pCi/L)/(pCi/d) | 1.200E-02 | 1.200E-02 | RTF( 2,3) |
| D-34 | | | | |
| D-34 | Co-60 , plant/soil concentration ratio, dimensionless | 8.000E-02 | 8.000E-02 | RTF( 3,1) |
| D-34 | Co-60 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) | 2.000E-02 | 2.000E-02 | RTF( 3,2) |
| D-34 | Co-60 , milk/livestock-intake ratio, (pCi/L)/(pCi/d) | 2.000E-03 | 2.000E-03 | RTF( 3,3) |
| D-34 | | | | |
| D-34 | Cs-137+D , plant/soil concentration ratio, dimensionless | 4.000E-02 | 4.000E-02 | RTF( 4,1) |
| D-34 | Cs-137+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) | 3.000E-02 | 3.000E-02 | RTF( 4,2) |
| D-34 | Cs-137+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d) | 8.000E-03 | 8.000E-03 | RTF( 4,3) |
| D-34 | | | | |
| D-34 | Eu-152 , plant/soil concentration ratio, dimensionless | 2.500E-03 | 2.500E-03 | RTF( 5,1) |
| D-34 | Eu-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) | 2.000E-03 | 2.000E-03 | RTF( 5,2) |
| D-34 | Eu-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d) | 2.000E-05 | 2.000E-05 | RTF( 5,3) |
| D-34 | | | | |

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Summary : 132-H-2 / 117-H Filter Building RESRAD Evaluation of Rubblized Concrete
File : 132-H-2_Shallow_Zone.RAD

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

| Menu | Parameter | Current Value | Default | Parameter Name |
|---|---|---|---|---|
| D-34 | Eu-154 , plant/soil concentration ratio, dimensionless | 2.500E-03 | 2.500E-03 | RTF( 7,1) |
| D-34 | Eu-154 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) | 2.000E-03 | 2.000E-03 | RTF( 7,2) |
| D-34 | Eu-154 , milk/livestock-intake ratio, (pCi/L)/(pCi/d) | 2.000E-05 | 2.000E-05 | RTF( 7,3) |
| D-34 | | | | |
| D-34 | Gd-152 , plant/soil concentration ratio, dimensionless | 2.500E-03 | 2.500E-03 | RTF( 8,1) |
| D-34 | Gd-152 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) | 2.000E-03 | 2.000E-03 | RTF( 8,2) |
| D-34 | Gd-152 , milk/livestock-intake ratio, (pCi/L)/(pCi/d) | 2.000E-05 | 2.000E-05 | RTF( 8,3) |
| D-34 | | | | |
| D-34 | H-3 , plant/soil concentration ratio, dimensionless | 4.800E+00 | 4.800E+00 | RTF( 9,1) |
| D-34 | H-3 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) | 1.200E-02 | 1.200E-02 | RTF( 9,2) |
| D-34 | H-3 , milk/livestock-intake ratio, (pCi/L)/(pCi/d) | 1.000E-02 | 1.000E-02 | RTF( 9,3) |
| D-34 | | | | |
| D-34 | Pa-231 , plant/soil concentration ratio, dimensionless | 1.000E-02 | 1.000E-02 | RTF(10,1) |
| D-34 | Pa-231 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) | 5.000E-03 | 5.000E-03 | RTF(10,2) |
| D-34 | Pa-231 , milk/livestock-intake ratio, (pCi/L)/(pCi/d) | 5.000E-06 | 5.000E-06 | RTF(10,3) |
| D-34 | | | | |
| D-34 | Pu-239 , plant/soil concentration ratio, dimensionless | 1.000E-03 | 1.000E-03 | RTF(11,1) |
| D-34 | Pu-239 , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) | 1.000E-04 | 1.000E-04 | RTF(11,2) |
| D-34 | Pu-239 , milk/livestock-intake ratio, (pCi/L)/(pCi/d) | 1.000E-06 | 1.000E-06 | RTF(11,3) |
| D-34 | | | | |
| D-34 | Sr-90+D , plant/soil concentration ratio, dimensionless | 3.000E-01 | 3.000E-01 | RTF(12,1) |
| D-34 | Sr-90+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) | 8.000E-03 | 8.000E-03 | RTF(12,2) |
| D-34 | Sr-90+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d) | 2.000E-03 | 2.000E-03 | RTF(12,3) |
| D-34 | | | | |
| D-34 | U-235+D , plant/soil concentration ratio, dimensionless | 2.500E-03 | 2.500E-03 | RTF(13,1) |
| D-34 | U-235+D , beef/livestock-intake ratio, (pCi/kg)/(pCi/d) | 3.400E-04 | 3.400E-04 | RTF(13,2) |
| D-34 | U-235+D , milk/livestock-intake ratio, (pCi/L)/(pCi/d) | 6.000E-04 | 6.000E-04 | RTF(13,3) |
| | | | | |
| 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 | C-14 , fish | 5.000E+04 | 5.000E+04 | BIOFAC( 2,1) |
| D-5 | C-14 , crustacea and mollusks | 9.100E+03 | 9.100E+03 | BIOFAC( 2,2) |
| D-5 | | | | |
| D-5 | Co-60 , fish | 3.000E+02 | 3.000E+02 | BIOFAC( 3,1) |
| D-5 | Co-60 , crustacea and mollusks | 2.000E+02 | 2.000E+02 | BIOFAC( 3,2) |
| D-5 | | | | |
| D-5 | Cs-137+D , fish | 2.000E+03 | 2.000E+03 | BIOFAC( 4,1) |
| D-5 | Cs-137+D , crustacea and mollusks | 1.000E+02 | 1.000E+02 | BIOFAC( 4,2) |
| D-5 | | | | |
| D-5 | Eu-152 , fish | 5.000E+01 | 5.000E+01 | BIOFAC( 5,1) |
| D-5 | Eu-152 , crustacea and mollusks | 1.000E+03 | 1.000E+03 | BIOFAC( 5,2) |
| D-5 | | | | |
| D-5 | Eu-154 , fish | 5.000E+01 | 5.000E+01 | BIOFAC( 7,1) |
| D-5 | Eu-154 , crustacea and mollusks | 1.000E+03 | 1.000E+03 | BIOFAC( 7,2) |
| D-5 | | | | |
| D-5 | Gd-152 , fish | 2.500E+01 | 2.500E+01 | BIOFAC( 8,1) |
| D-5 | Gd-152 , crustacea and mollusks | 1.000E+03 | 1.000E+03 | BIOFAC( 8,2) |
| D-5 | | | | |

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lRESRAD, Version 6.30     T« Limit = 0.5 year        06/12/2006  07:04  Page   4
 Summary : 132-H-2 / 117-H Filter Building RESRAD Evaluation of Rubblized Concrete
 File    : 132-H-2_Shallow_Zone.RAD

                  Dose Conversion Factor (and Related) Parameter Summary (continued)
                                File: HEAST 2001 Morbidity
0    ³                                                          ³  Current  ³           ³  Parameter
 Menu ³                        Parameter                        ³   Value   ³  Default  ³    Name
 ÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÅÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄÄ
 D-5  ³ H-3      , fish                                        ³ 1.000E+00 ³ 1.000E+00 ³ BIOFAC( 9,1)
 D-5  ³ H-3      , crustacea and mollusks                      ³ 1.000E+00 ³ 1.000E+00 ³ BIOFAC( 9,2)
 D-5  ³                                                       ³           ³           ³
 D-5  ³ Pa-231   , fish                                       ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC(10,1)
 D-5  ³ Pa-231   , crustacea and mollusks                     ³ 1.100E+02 ³ 1.100E+02 ³ BIOFAC(10,2)
 D-5  ³                                                       ³           ³           ³
 D-5  ³ Pu-239   , fish                                       ³ 3.000E+01 ³ 3.000E+01 ³ BIOFAC(11,1)
 D-5  ³ Pu-239   , crustacea and mollusks                     ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(11,2)
 D-5  ³                                                       ³           ³           ³
 D-5  ³ Sr-90+D  , fish                                       ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC(12,1)
 D-5  ³ Sr-90+D  , crustacea and mollusks                     ³ 1.000E+02 ³ 1.000E+02 ³ BIOFAC(12,2)
 D-5  ³                                                       ³           ³           ³
 D-5  ³ U-235+D  , fish                                       ³ 1.000E+01 ³ 1.000E+01 ³ BIOFAC(13,1)
 D-5  ³ U-235+D  , crustacea and mollusks                     ³ 6.000E+01 ³ 6.000E+01 ³ BIOFAC(13,2)
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1RESRAD, Version 6.30 T« Limit = 0.5 year 06/12/2006 07:04 Page 5
Summary : 132-H-2 / 117-H Filter Building RESRAD Evaluation of Rubblized Concrete
File : 132-H-2_Shallow_Zone.RAD

Site-Specific Parameter Summary

| Menu | Parameter | | User Input | Default | Used by RESRAD (If different from user input) | Parameter Name |
|---|---|---|---|---|---|---|
| R011 | Area of contaminated zone (m**2) | | 2.142E+02 | 1.000E+04 | --- | AREA |
| R011 | Thickness of contaminated zone (m) | | 8.600E+00 | 2.000E+00 | --- | THICK0 |
| R011 | Length parallel to aquifer flow (m) | | 2.200E+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) | | 5.640E+00 | 3.000E+00 | --- | T( 3) |
| R011 | Times for calculations (yr) | | 1.200E+01 | 1.000E+01 | --- | T( 4) |
| R011 | Times for calculations (yr) | | 3.000E+01 | 3.000E+01 | --- | T( 5) |
| R011 | Times for calculations (yr) | | 1.000E+02 | 1.000E+02 | --- | T( 6) |
| R011 | Times for calculations (yr) | | 3.000E+02 | 3.000E+02 | --- | T( 7) |
| R011 | Times for calculations (yr) | | 1.000E+03 | 1.000E+03 | --- | T( 8) |
| R011 | Times for calculations (yr) | | not used | 0.000E+00 | --- | T( 9) |
| R011 | Times for calculations (yr) | | not used | 0.000E+00 | --- | T(10) |
| R012 | Initial principal radionuclide (pCi/g): | C-14 | 6.980E+00 | 0.000E+00 | --- | S1( 2) |
| R012 | Initial principal radionuclide (pCi/g): | Co-60 | 3.100E+00 | 0.000E+00 | --- | S1( 3) |
| R012 | Initial principal radionuclide (pCi/g): | Cs-137 | 6.270E+01 | 0.000E+00 | --- | S1( 4) |
| R012 | Initial principal radionuclide (pCi/g): | Eu-152 | 2.010E+01 | 0.000E+00 | --- | S1( 5) |
| R012 | Initial principal radionuclide (pCi/g): | Eu-154 | 3.360E+00 | 0.000E+00 | --- | S1( 7) |
| R012 | Initial principal radionuclide (pCi/g): | H-3 | 1.190E+01 | 0.000E+00 | --- | S1( 9) |
| R012 | Initial principal radionuclide (pCi/g): | Pu-239 | 3.990E+01 | 0.000E+00 | --- | S1(11) |

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1RESRAD, Version 6.30     T« Limit = 0.5 year        06/12/2006  07:04  Page   6
 Summary : 132-H-2 / 117-H Filter Building RESRAD Evaluation of Rubblized Concrete
 File    : 132-H-2_Shallow_Zone.RAD
```

Site-Specific Parameter Summary (continued)

| 0 Menu | Parameter | User Input | Default | Used by RESRAD (If different from user input) | Parameter Name |
|---|---|---|---|---|---|
| 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) | 3.200E+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 C-14 | | | | |
| R016 | Contaminated zone (cm**3/g) | 2.000E+02 | 0.000E+00 | --- | DCNUCC( 2) |
| R016 | Unsaturated zone 1 (cm**3/g) | 2.000E+02 | 0.000E+00 | --- | DCNUCU( 2,1) |
| R016 | Saturated zone (cm**3/g) | 2.000E+02 | 0.000E+00 | --- | DCNUCS( 2) |
| R016 | Leach rate (/yr) | 0.000E+00 | 0.000E+00 | 1.937E-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( 3) |
| R016 | Unsaturated zone 1 (cm**3/g) | 5.000E+01 | 1.000E+03 | --- | DCNUCU( 3,1) |
| R016 | Saturated zone (cm**3/g) | 5.000E+01 | 1.000E+03 | --- | DCNUCS( 3) |
| R016 | Leach rate (/yr) | 0.000E+00 | 0.000E+00 | 7.736E-05 | ALEACH( 3) |
| R016 | Solubility constant | 0.000E+00 | 0.000E+00 | not used | SOLUBK( 3) |
| R016 | Distribution coefficients for Cs-137 | | | | |
| 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 | 7.736E-05 | ALEACH( 4) |
| R016 | Solubility constant | 0.000E+00 | 0.000E+00 | not used | SOLUBK( 4) |
| R016 | Distribution coefficients for Eu-152 | | | | |
| R016 | Contaminated zone (cm**3/g) | 2.000E+02 | -1.000E+00 | --- | DCNUCC( 5) |
| R016 | Unsaturated zone 1 (cm**3/g) | 2.000E+02 | -1.000E+00 | --- | DCNUCU( 5,1) |
| R016 | Saturated zone (cm**3/g) | 2.000E+02 | -1.000E+00 | --- | DCNUCS( 5) |
| R016 | Leach rate (/yr) | 0.000E+00 | 0.000E+00 | 1.937E-05 | ALEACH( 5) |
| R016 | Solubility constant | 0.000E+00 | 0.000E+00 | not used | SOLUBK( 5) |

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1RESRAD, Version 6.30     Tα Limit = 0.5 year        06/12/2006  07:04  Page   7
 Summary : 132-H-2 / 117-H Filter Building RESRAD Evaluation of Rubblized Concrete
 File    : 132-H-2_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-154 | | | | |
| R016 | Contaminated zone (cm**3/g) | 2.000E+02 | -1.000E+00 | --- | DCNUCC( 7) |
| R016 | Unsaturated zone 1 (cm**3/g) | 2.000E+02 | -1.000E+00 | --- | DCNUCU( 7,1) |
| R016 | Saturated zone (cm**3/g) | 2.000E+02 | -1.000E+00 | --- | DCNUCS( 7) |
| R016 | Leach rate (/yr) | 0.000E+00 | 0.000E+00 | 1.937E-05 | ALEACH( 7) |
| R016 | Solubility constant | 0.000E+00 | 0.000E+00 | not used | SOLUBK( 7) |
| R016 | Distribution coefficients for H-3 | | | | |
| R016 | Contaminated zone (cm**3/g) | 0.000E+00 | 0.000E+00 | --- | DCNUCC( 9) |
| R016 | Unsaturated zone 1 (cm**3/g) | 0.000E+00 | 0.000E+00 | --- | DCNUCU( 9,1) |
| R016 | Saturated zone (cm**3/g) | 0.000E+00 | 0.000E+00 | --- | DCNUCS( 9) |
| R016 | Leach rate (/yr) | 0.000E+00 | 0.000E+00 | 3.949E-02 | ALEACH( 9) |
| R016 | Solubility constant | 0.000E+00 | 0.000E+00 | not used | SOLUBK( 9) |
| R016 | Distribution coefficients for Pu-239 | | | | |
| R016 | Contaminated zone (cm**3/g) | 2.000E+02 | 2.000E+03 | --- | DCNUCC(11) |
| R016 | Unsaturated zone 1 (cm**3/g) | 2.000E+02 | 2.000E+03 | --- | DCNUCU(11,1) |
| R016 | Saturated zone (cm**3/g) | 2.000E+02 | 2.000E+03 | --- | DCNUCS(11) |
| R016 | Leach rate (/yr) | 0.000E+00 | 0.000E+00 | 1.937E-05 | ALEACH(11) |
| R016 | Solubility constant | 0.000E+00 | 0.000E+00 | not used | SOLUBK(11) |
| R016 | Distribution coefficients for Sr-90 | | | | |
| R016 | Contaminated zone (cm**3/g) | 2.500E+01 | 3.000E+01 | --- | DCNUCC(12) |
| R016 | Unsaturated zone 1 (cm**3/g) | 2.500E+01 | 3.000E+01 | --- | DCNUCU(12,1) |
| R016 | Saturated zone (cm**3/g) | 2.500E+01 | 3.000E+01 | --- | DCNUCS(12) |
| R016 | Leach rate (/yr) | 0.000E+00 | 0.000E+00 | 1.544E-04 | ALEACH(12) |
| R016 | Solubility constant | 0.000E+00 | 0.000E+00 | not used | SOLUBK(12) |
| 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) | 2.000E+01 | 2.000E+01 | --- | DCNUCS( 1) |
| R016 | Leach rate (/yr) | 0.000E+00 | 0.000E+00 | 1.928E-04 | 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+00 | -1.000E+00 | 8.249E+02 | DCNUCC( 8) |
| R016 | Unsaturated zone 1 (cm**3/g) | -1.000E+00 | -1.000E+00 | 8.249E+02 | DCNUCU( 8,1) |
| R016 | Saturated zone (cm**3/g) | -1.000E+00 | -1.000E+00 | 8.249E+02 | DCNUCS( 8) |
| R016 | Leach rate (/yr) | 0.000E+00 | 0.000E+00 | 4.698E-06 | ALEACH( 8) |
| R016 | Solubility constant | 0.000E+00 | 0.000E+00 | not used | SOLUBK( 8) |
| R016 | Distribution coefficients for daughter Pa-231 | | | | |
| R016 | Contaminated zone (cm**3/g) | 5.000E+01 | 5.000E+01 | --- | DCNUCC(10) |
| R016 | Unsaturated zone 1 (cm**3/g) | 5.000E+01 | 5.000E+01 | --- | DCNUCU(10,1) |
| R016 | Saturated zone (cm**3/g) | 5.000E+01 | 5.000E+01 | --- | DCNUCS(10) |
| R016 | Leach rate (/yr) | 0.000E+00 | 0.000E+00 | 7.736E-05 | ALEACH(10) |
| R016 | Solubility constant | 0.000E+00 | 0.000E+00 | not used | SOLUBK(10) |

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Summary : 132-H-2 / 117-H Filter Building RESRAD Evaluation of Rubblized Concrete
File : 132-H-2_Shallow_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 U-235 | | | | |
| R016 | Contaminated zone (cm**3/g) | 2.000E+00 | 5.000E+01 | --- | DCNUCC(13) |
| R016 | Unsaturated zone 1 (cm**3/g) | 2.000E+00 | 5.000E+01 | --- | DCNUCU(13,1) |
| R016 | Saturated zone (cm**3/g) | 2.000E+00 | 5.000E+01 | --- | DCNUCS(13) |
| R016 | Leach rate (/yr) | 0.000E+00 | 0.000E+00 | 1.847E-03 | ALEACH(13) |
| R016 | Solubility constant | 0.000E+00 | 0.000E+00 | not used | SOLUBK(13) |
| 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) |
| 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 |

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Summary : 132-H-2 / 117-H Filter Building RESRAD Evaluation of Rubblized Concrete
File : 132-H-2_Shallow_Zone.RAD

Site-Specific Parameter Summary (continued)

| Menu | Parameter | User Input | Default | Used by RESRAD (If different from user input) | Parameter Name |
|---|---|---|---|---|---|
| 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 | 0.107E+00 | FPLANT |
| R018 | Contamination fraction of meat | -1 | -1 | 0.107E-01 | FMEAT |
| R018 | Contamination fraction of milk | -1 | -1 | 0.107E-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) |
| 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 |

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Summary : 132-H-2 / 117-H Filter Building RESRAD Evaluation of Rubblized Concrete
File : 132-H-2_Shallow_Zone.RAD

Site-Specific Parameter Summary (continued)

| Menu | Parameter | User Input | Default | Used by RESRAD (If different from user input) | Parameter Name |
|---|---|---|---|---|---|
| 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) |
| TITL | Number of graphical time points | 32 | --- | --- | 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 |

# CALCULATION COVER SHEET

**Project Title** 100-H Area Field Remediation **Job No.** 14655
**Area** 100-H
**Discipline** Environmental ***Calc. No.** 0100H-CA-V0083
**Subject** 132-H-2 / 117-H Filter Building Site RESRAD Evaluation
**Computer Program** RESRAD **Program No.** Version 6.30

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

**Committed Calculation** ☒ **Preliminary** ☐ **Superseded** ☐ **Voided** ☐

| Rev. | Sheet Numbers | Originator | Checker | Reviewer | Approval | Date |
|---|---|---|---|---|---|---|
| 0 | Cover – 1 pg<br>Summary – 5 pg<br>Attm. 1 - 1 pg<br>Attm. 2 - 24 pg<br>Attm. 3 - 27 pg<br>Attm. 4 - 17 pg<br>Total – 75 pages | S. W. Clark<br>S W Clark<br>6/12/06 | M. W. Perrott<br>M.W. Perrott<br>6/12/06 | T. M. Blakley<br>T.M. Blakley<br>6/15/06 | R. A. Carlson<br>RA Carlson | 6/15/06 |
| | | | | | | |
| | | | | | | |

**SUMMARY OF REVISION**

| | |
|---|---|
| | |
| | |

WCH-DE-018 (4/14/06) *Obtain Calc. No. from R&DC and Form from Intranet

**Washington Closure Hanford** CALCULATION SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Originator: | S. W. Clark SWC | Date: | 5/12/06 | Calc. No.: | 0100H-CA-V0083 | Rev.: | 0 |
| Project: | 100-H Field Remediation | Job No: | 14655 | Checked: | M. W. Perrott MWP | Date: | 5/12/06 |
| Subject: | 132-H-2 / 117-H Filter Building Site RESRAD Evaluation | | | | | Sheet No. | 1 of 5 |

## PURPOSE:

Evaluate the potential dose and risk to a receptor in a rural residential scenario from contaminants in concrete rubble at 132-H-2, the former 117-H Filter Building site, and determine if contamination is predicted to reach groundwater within 1,000 years. Use data available from samples taken in June of 1984 for an Allowable Residual Contamination Level (ARCL) method evaluation of the decommissioned building site.

## GIVEN/REFERENCES:

1) Decommissioning information, sample data, and dates from *ARCL Calculations for Decommissioning the 117-H Filter Building*, UNI-3001, December 27, 1984, UNC Nuclear Industries, Richland, Washington.
2) Facility description from *H Area Technical Baseline Report*, BHI-00127, Rev. 00, 1995, Bechtel Hanford Inc., Richland, Washington.
3) *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.
4) For the purpose of these RESRAD calculations, there are no nonradionuclide contaminants of concern. Prior to demolition, all filters, fixtures and other equipment were removed from the facility.
5) RESidual RADioactivity (RESRAD) computer code, version 6.30, to calculate compliance with residual radioactivity guidelines, developed for the U.S. Department of Energy by the Environmental Assessment Division of Argonne National Laboratory, Argonne, Illinois.

## BACKGROUND:

The 132-H-2 / 117-H Filter Building operated from 1961 until the 105-H Reactor was shut down in 1965 to filter reactor building air before releasing it through the 132-H-1 116-H Reactor Exhaust Stack to the atmosphere. Most of the reinforced concrete structure (9.6 m [31.5 ft]) was below grade and 2.4 m (8 ft) was above grade. The facility was decommissioned in 1984. All filters, fixtures, and other equipment from the facility were disposed of in the 200 Area burial grounds and the remaining structure was decontaminated and sampled (in 1984). The facility was demolished to 1 m (3.3 ft) below grade and covered with 1 m (3.3 ft) of clean fill. Samples were taken from marked grids on the decontaminated painted concrete surfaces to determine if ARCL criteria for decommissioning were met. Sampling showed the contamination was confined to the 0.0016 m (1/16 inch) of paint on the surface of the 0.2 m (8 inch) thick concrete of the walls and the floor of the facility. However, the RESRAD evaluation used the maximum concentrations of radionuclides from the paint on the surface of the concrete to conservatively model the residual concrete as if the entire mass of the concrete was contaminated. This was the conceptual model for evaluations of dose, risk, and groundwater protection.

**Washington Closure Hanford** CALCULATION SHEET

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Originator: | S. W. Clark | Date: | 6/12/06 | Calc. No.: | 0100H-CA-V0083 | Rev.: | 0 |
| Project: | 100-H Field Remediation | Job No: | 14655 | Checked: | M. W. Perrott | Date: | 6/12/06 |
| Subject: | 132-H-2 / 117-H Filter Building Site RESRAD Evaluation | | | | | Sheet No. | 2 of 5 |

## SOLUTION:

1) Table 1 shows the waste site parameters used for RESRAD modeling. The model for the RESRAD runs assumes that the residual contamination levels from the data set in the *ARCL Calculations for Decommissioning the 117-H Filter Building* is representative of the entire mass of the concrete from decommissioning of the building.

2) Radionuclide activities were decayed from June 1984 to the present date (June 2006; 22 years) as shown in Table 2. Input factors for each RESRAD run are shown in the "Summary" section of the RESRAD "Mixture Sums and Single Radionuclide Guidelines," which are included as printouts in the Attachments to this Calculation Summary.

3) The year where the peak dose (or groundwater concentration) occurs from each individual radionuclide was determined by a preliminary run. 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 radionuclides. For the water pathways (i.e., drinking water and food ingestion) the peak year was year 5.64 for tritium. Only tritium was predicted to reach groundwater within 1,000 years. The 5.64-year time periods were included in all of the RESRAD runs.

**Table 1. Waste Site Dimensions for RESRAD Modeling**

| Parameter | Units | Value | Comments |
|---|---|---|---|
| Cover Depth | m | 1 | Minimum cover for conservative evaluation |
| Area of Contaminated Zone | $m^2$ | 214.2 | Based on site area including building and ducts[a] |
| Length Parallel to Aquifer Flow | m | 22 | Based on groundwater flow direction |
| Elevation: Surface | m | 128.8 | NAVD88 |
| Elevation: Bottom of waste | m | 119.2 | Bottom of structure 7.0 m (23 ft) below grade. |
| Elevation: Groundwater | m | 116.0 | NAVD88 |
| Thickness: Contaminated Zone | m | 8.6 | Based on 1 m cover[a] |
| Thickness: Unsaturated Zone | m | 3.2 | From foundation bottom to groundwater |

[a] *ARCL Calculations for Decommissioning the 117-H Filter Building*, UNI-3001, December 27, 1984, UNC Nuclear Industries, Richland, Washington.

## METHODOLOGY:

1) Runs of RESRAD version 6.30 were completed for the deep zone using the radionuclide concentrations decayed to June 2006 shown in Table 2. RESRAD numerical output reports for dose, risk, and concentration for the deep zone are presented in the Attachments to this calculation summary.

Ms. Jane Hedges, Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton Boulevard
Richland, Washington 99354

Dear Ms. Hedges:

TRANSMITTAL OF APPROVED WASTE SITE RECLASSIFICATION FORM AND SUPPORTING DOCUMENTATION FOR THE 132-H-2 SITE

Enclosed for your use are the approved Waste Site Reclassification Form No. 2006-049 and supporting *Remaining Sites Verification Package for 132-H-2, 117-H Filter Building*, Rev. 0. If you have any questions, please contact Mr. K. R. Westover of my staff on 376-3967.

Sincerely,

J. R. Franco, Assistant Manager
for the River Corridor

XXX:xx

Enclosures

cc w/ encl:
Administrative Record
J. Price, Ecology

cc w/o encl:
K. D. Bazzell, RL
C. Whalen, Ecology
R. A. Carlson, WCH
L. M. Dittmer, WCH
K. R. Westover, RL