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Waste Site Reclassification Form

Date Submitted: 8/23/05 **Originator:** R. A. Carlson **Phone:** 373-1440	**Operable Unit(s):** 100-DR-1 **Waste Site ID:** 132-DR-1 **Type of Reclassification Action:** Rejected ☐ Closed Out ☐ Interim Closed Out ☒ No Action ☐	**Control Number:** 2005-035 **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:

Radiological characterization, decommissioning and demolition of the 132-DR-1 site, 1608-DR Effluent Pumping Station was performed in 1987. Decommissioning included removal of equipment and water for disposal as radioactive waste. Sludge in the sump areas was removed and disposed as mixed waste. The at- and below-grade structure (floor slab, foundation walls, sump walls, and piping) was demolished to at least 5 m (16.4 ft) below grade with the resulting rubble buried in situ. The area was backfilled to grade with 5 m (16.4 ft) of clean fill to blend with the natural terrain. Samples of concrete and pipe scale/rust were taken prior to decommissioning and used to support dose assessment calculations that were prepared in accordance with *Allowable Residual Contamination Levels (ARCL) for Decommissioning Facilities in the 100 Areas of the Hanford Site* (Kennedy and Napier 1983). The ARCL calculations indicated that the "worst case" potential dose to the maximally exposed individual in 1987 would be 5.2×10^{-2} mrem/yr. A RESidual RADioactivity (RESRAD) evaluation was performed in 2005 using the 1987 sampling results to support the interim closure decision. The evaluation accounts for radioactive decay from 1987 (the year of building demolition) to 2005 and predicts the maximum dose rate is 1.93×10^{-2} mrem/yr above background over 1,000 years. The RESRAD evaluation 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 (RAOs) and the corresponding remedial action goals (RAGs) 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 attached *Remaining Site Verification Package for 132-DR-1, 1608-D Effluent Pumping Station*, Bechtel Hanford Inc., Richland, Washington.

Kevin Bazzell, DOE Project Manager	Signature	Date 9/22/05
John Price, Ecology Project Manager	Signature	Date 9/22/2005
NA EPA Project Manager	Signature	Date

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REMAINING SITES VERIFICATION PACKAGE FOR 132-DR-1, 1608-DR EFFLUENT PUMPING STATION

Attachment to Waste Site Reclassification Form 2005-035

September 2005

REMAINING SITES VERIFICATION PACKAGE FOR 132-DR-1, 1608-DR EFFLUENT PUMPING STATION

EXECUTIVE SUMMARY

The 132-DR-1, 1608-DR Effluent Pumping Station site was constructed in 1950 and was located adjacent to the northeast corner of the 105-DR Reactor Building within the 105-D/DR Exclusion Area Fence. The facility functioned as a sump to collect radioactively contaminated liquid wastes from the 105-DR Reactor Building. The liquid wastes were collected in the sumps for final disposal by pumping to the 107-D/DR Retention Basin via a 41-cm (16-in.)-diameter pipe. The 1608-DR Effluent Pumping Station consisted of (1) an above-grade structure consisting of concrete block walls, a reinforced concrete floor, and a roof constructed of reinforced concrete deck with composition surface; and (2) a below-grade structure of reinforced concrete. The facility extended 3.7 m (12 ft) above grade and 9.8 m (32 ft) below grade and was 11 m (36 ft) in length and 10.4 m (34 ft) in width.

The 1608-DR Effluent Pumping Station was decommissioned and demolished in 1987. Initial decommissioning activities consisted of removing and disposing of all asbestos and equipment within the building and removing residual water and sludge from the sumps. Contaminated equipment was packaged and shipped to the Hanford Site 200 West Area burial grounds for disposal. Contaminated water was transferred to the 1325-N Liquid Waste Disposal Facility. Sludge from the sumps was shipped to the 200 West Area for disposal.

Decommissioning activities continued with extensive radiological surveying and sampling of concrete surfaces and piping scale/rust to characterize residual radiological contamination for the 1608-DR Effluent Pumping Station. Characterization results indicated that residual contamination was confined to the surface of the concrete and to the rust/scale from piping and metal gates within the facility.

The 1608-DR Effluent Pumping Station was released for unrestricted use based on the post-decontamination characterization results and the *Dose Assessment of In Situ Burial of the 1608-DR Lift Station* (WHC 1988). Consequently, demolition and site grading were performed in 1987 using conventional heavy equipment. The structure was reduced to 5 m (16.4 ft) below grade using a wrecking ball, the rubble was buried under 5 m (16.4 ft) of clean fill, and the site was graded to blend with the natural terrain. The demolished 1608-DR Effluent Pumping Station is identified as the 132-DR-1 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 through all the residual concrete of the former building, RESidual RADioactivity (RESRAD) modeling was performed in 2005 to support the previous decision to demolish and bury the building in place. The RESRAD modeling accounts for radioactive decay from 1987 (year of sampling) to 2005 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-DR-1 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.	1.93×10^{-2} mrem/yr is the highest dose rate above background 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 RAG 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 1987 sampling results support a reclassification of the 132-DR-1 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* (EPA 1999). These results show that the site and contaminant levels remaining 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.

REMAINING SITES VERIFICATION PACKAGE FOR 132-DR-1, 1608-DR EFFLUENT PUMPING STATION

STATEMENT OF PROTECTIVENESS

This report demonstrates that the 132-DR-1 site meets the objectives for interim closure 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 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.

GENERAL SITE INFORMATION AND BACKGROUND

The 132-DR-1, 1608-DR Effluent Pumping Station site was constructed in 1950 and was located adjacent to the northeast corner of the 105-DR Reactor Building within the 105-D/DR Exclusion Area Fence (Figure 1). The facility contained three sumps to collect radioactively contaminated liquid wastes from the 105-DR Reactor Building. The liquid wastes were collected in the sumps for final disposal by pumping to the 107-D/DR Retention Basin via a 41-cm (16-in.)-diameter pipe. The 1608-DR Effluent Pumping Station consisted of (1) an above-grade structure with concrete block walls, a reinforced concrete floor, and a roof constructed of reinforced concrete deck with composition surface; and (2) a below-grade structure of reinforced concrete. The facility extended 3.7 m (12 ft) above grade and 9.8 m (32 ft) below grade and was 11 m (36 ft) in length and 10.4 m (34 ft) in width. Figures 2 and 3 provide schematics of the floor plan and the elevation view for the 1608-DR Effluent Pumping Station, respectively.

The operating level was 1.5 m (5 ft) below grade and contained the pumping equipment located above the discharge sump chambers. A large accumulation inlet chamber was located in the northern section of the building and fed the three discharge sump chambers by use of sluice gates that were manually controlled from the electrical switchgear floor level. The maximum thickness of concrete in the structure was 0.6 m (2 ft), which occurred at the base of the sump walls, the floor over the sump inlet chamber, and the floor over the sump chamber.

The major equipment contained within the effluent water pumping station consisted of two 7,571-L/min (2,000-gal/min) vertical submerged sump pumps, their associated controls and electrical switch gear, and their respective driving motors. One pump was driven by an electrical motor and the other by a steam turbine. The building also contained a 1,893-L/min (500-gal/min) pump with its electric driving motor (WHC 1987, 1988).

Figure 1. 132-DR-1 Site Location Map.

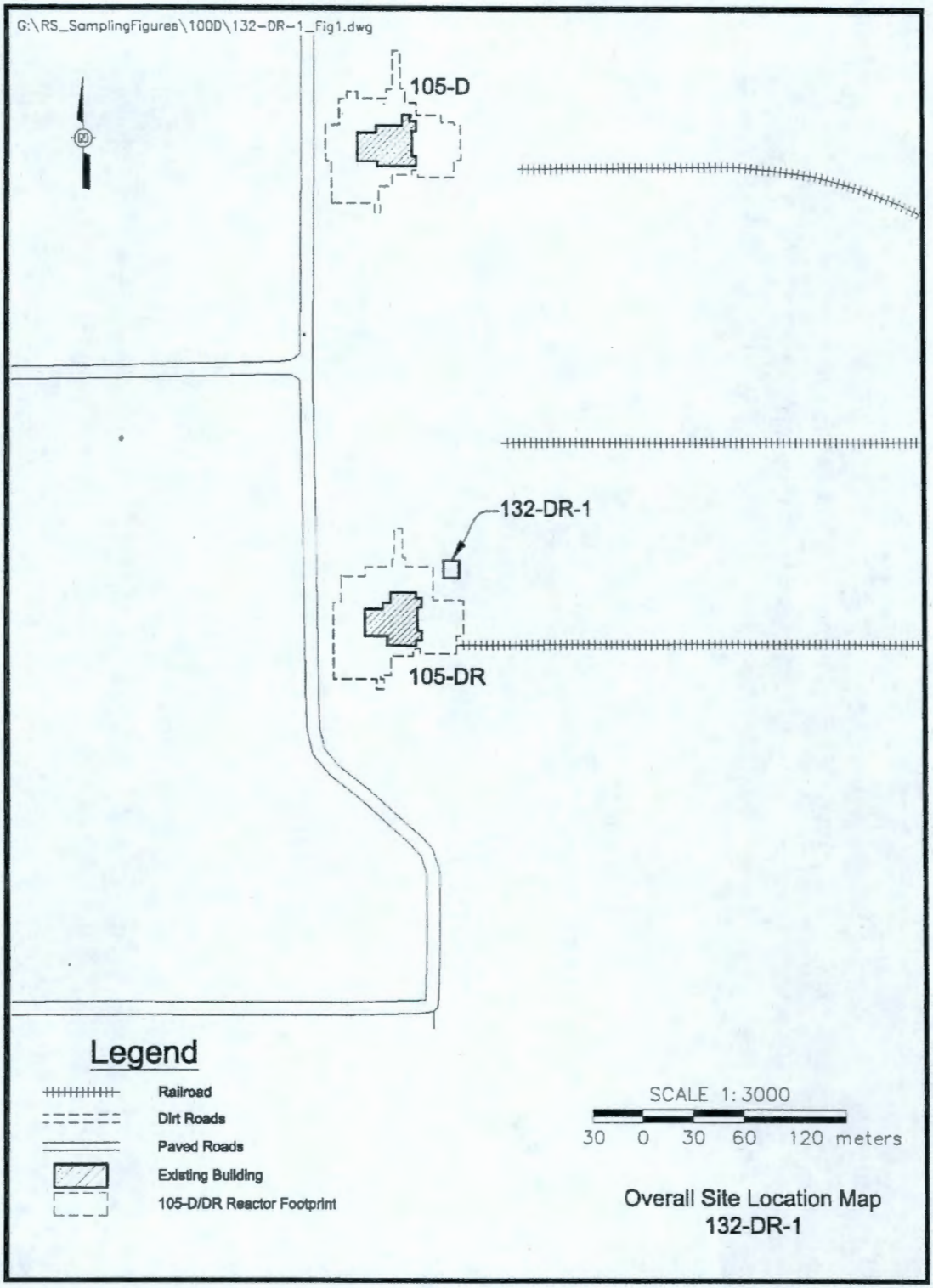
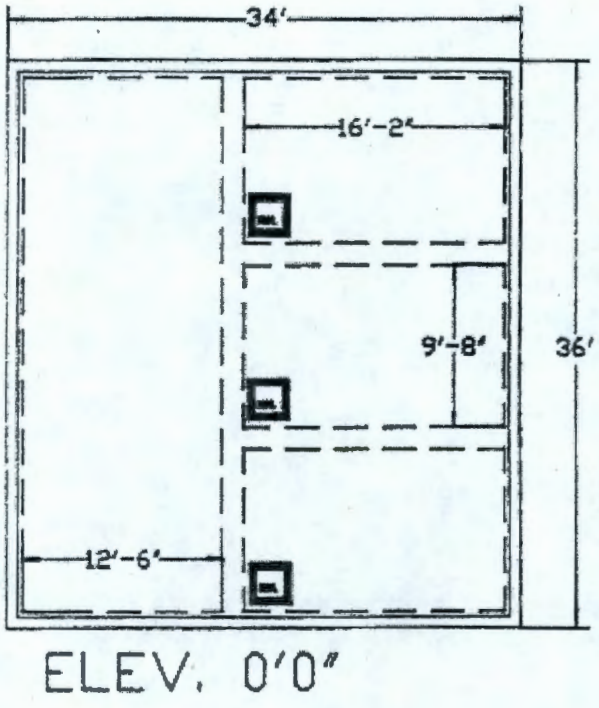


Figure 2. 1608-DR Effluent Pumping Station Floor Plan.



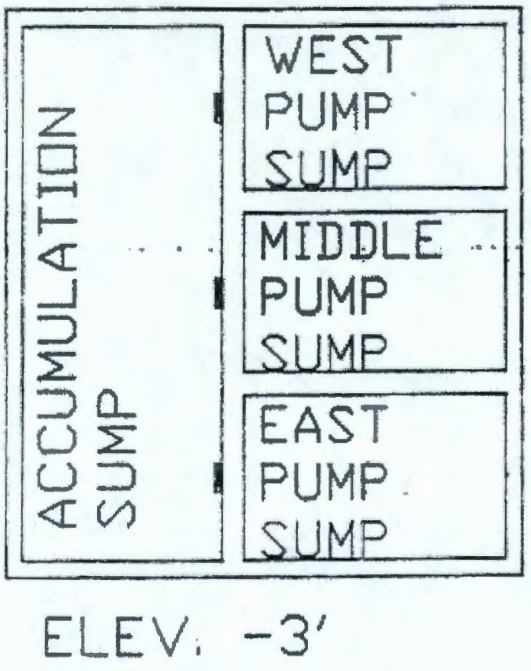
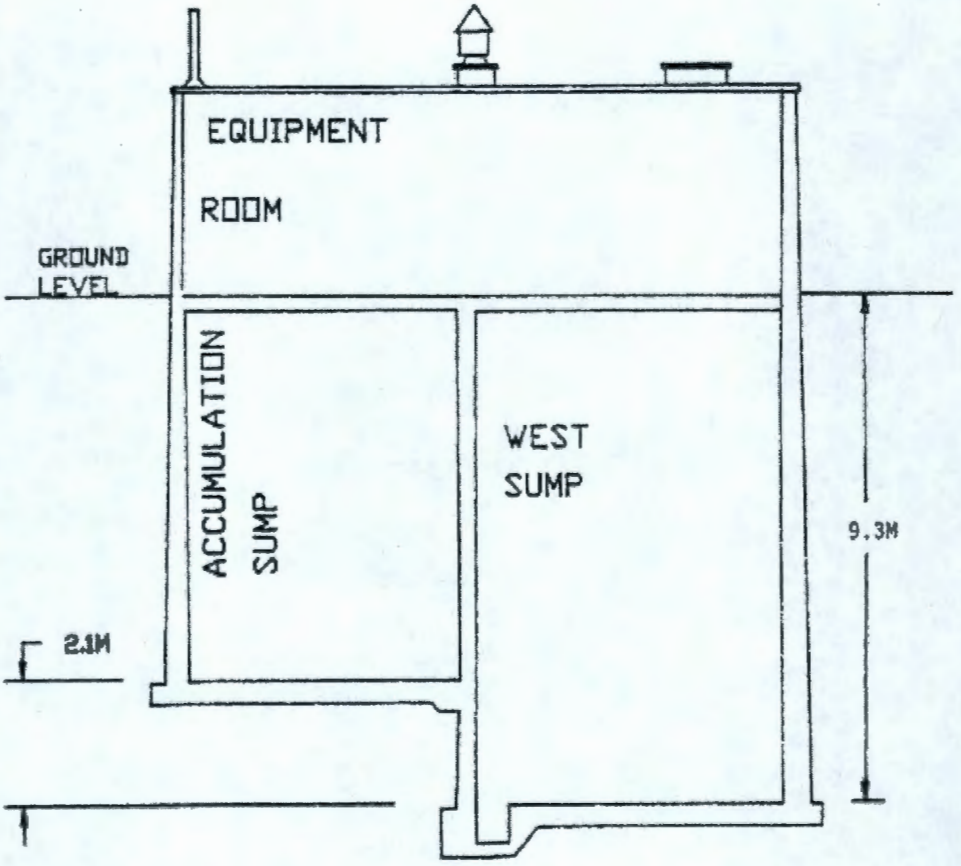


Figure 3. 1608-DR Effluent Pumping Station Elevation View.



DECONTAMINATION AND DECOMMISSIONING BACKGROUND

The 1608-DR Effluent Pumping Station was decommissioned in 1987. The selected method for decommissioning was to demolish the facility and bury the resulting rubble in situ.

Decommissioning work included the following:

- Removing and disposing of all asbestos within the building
- Removing and disposing of lead wool caulking between piping and pipe sleeves
- Removing and disposing of pump assemblies
- Removing the water from the sumps and transferring it to the 1325-N Liquid Waste Disposal Facility

- Removing the sludge from the sumps

- Sampling and characterizing the structure, piping, components, switch gear, equipment, and the sediment in the sumps.

Samples of sludge from the sumps were taken and sent to the Pacific Northwest National Laboratory for analysis. The sludge was designated based on the equivalent concentration of various possible toxic compounds in the sludge. Equivalent concentrations were derived by making "worst-case" assumptions about the form of the various cations in the waste. The sludge did not designate as a hazardous waste. However, the concentrations of lead and phosphate were used to calculate a concentration of lead phosphate (7,300 ppm) that resulted in designating the sludge as a state-only toxic dangerous waste (i.e., extremely hazardous waste) according to Washington State regulations (WAC 173-303). The sludge was also radioactive, giving it the classification of radioactive mixed waste.

After removal of equipment, water, and sludge from the 1608-DR Effluent Pumping Station, extensive radiological surveys of the floors, ceilings, and walls of the equipment room and sump areas and of the piping left in the facility were performed. Contamination levels in the equipment room were found to be less than 200 cpm direct beta-gamma contamination. The highest contamination levels found on the floor of the sump and accumulation sump areas ranged from 30,000 to 60,000 cpm beta gamma. Radiological surveys of the sump walls indicated the high water level to be approximately 1.5 m (5 ft) below grade based on radiological contamination levels of 4,000 to 8,000 cpm beta gamma below the water line and 200 to 800 cpm above the water line. Radiological surveys of below water line metal surfaces (i.e., distribution gates, pipes) indicated rust/scale on surfaces of 5,000 to 20,000 cpm beta gamma. These survey results were then used to identify five strata corresponding to the different contamination levels found in the 1608-DR Effluent Pumping Station. Samples of concrete and pipe scale were collected from each of these five strata. The following list describes the five strata and the samples taken from each. All concrete samples were taken to a depth of 1 cm (0.4 in.).

- Sump floors: This stratum includes the three pump sumps and the accumulation sump floors. A total of eight concrete samples were taken from the floor surfaces.

- Sump walls below water line: This stratum includes the below-water-line walls of the three pump sumps and the accumulation sump. A total of 24 concrete samples were taken from this stratum.

- Sump ceilings and walls above water line: This stratum includes the above-water-line walls and ceilings of the three pump sumps and the accumulation sump. A total of 12 concrete samples were taken from this stratum. All samples were taken from the sump walls for convenience.

- Equipment room floor, walls, and ceiling: This stratum includes all of the floor, wall, and ceiling concrete surfaces in the main floor equipment room. No surface contamination was detected on these surfaces. The mechanism for contamination spread on these surfaces would have been by leaking pipe flanges, etc. Therefore, it was assumed that any contamination present would most likely be present on the floor surfaces, and that the activity levels of floor samples would represent a conservative estimate of the activity levels present on the superstructure walls and ceilings. As a result, a total of nine concrete samples were taken from the equipment room floor.

- Rust scale on below water line metal surfaces: This stratum includes the three metal distribution gates located in the accumulation sump and the miscellaneous overflow/vent piping located between the accumulation and pump sumps. A total of eight rust scale samples were collected from the inside surfaces of the overflow/vent piping and the outside surfaces of the distribution gates. All samples were collected by scraping all of the scale from a 103-cm^2 (16-$in.^2$) area.

The concrete and rust/scale samples were analyzed at the Decommissioning Health Physics Laboratory in the 183-KE Building and by the Pacific Northwest National Laboratory in the Hanford 300 Area. Samples were analyzed for carbon-14, cesium-137, cobalt-60, europium-152, europium-154, tritium, strontium-90, and gross alpha activity. The gross alpha results were assumed to represent plutonium-239.

The sample results were used to support calculation of the residual dose contribution for the demolished 1608-DR Effluent Pumping Station in accordance with U.S. Department of Energy guidelines and *Allowable Residual Contamination Levels for Decommissioning Facilities on 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 (WHC 1988).

Demolition activities began in July 1987 when excavation around the periphery of the north and east sides of the structure extended to a depth of 5 m (16.4 ft) below grade. All pipes entering the structure were isolated and plugged to prevent the potential for water draining into the facility after demolition.

Actual demolition of the structure was initiated in September 1987. A wrecking ball was used to break the bottom of each sump for drainage before any walls were demolished. The structure was then demolished to 5 m (16.4 ft) below grade. The voids were backfilled with soil. Dampening the soil, backfilling, and compacting continued until the excavation was covered with soil. Fill dirt was hauled to the site to allow grading to conform to the surrounding terrain.

BASIS FOR INTERIM CLOSURE

Allowable Residual Contamination Level Methodology

The ARCL calculation methodology was used in 1987 to determine if further decontamination or remedial action was needed prior to demolition and in situ burial (WHC 1988). The calculation scenario was designed to represent unrestricted use conditions for a hypothetical, maximally exposed individual to receipt of a dose not exceeding 25 mrem/yr to the whole body or any organ. At the time of decommissioning of the 1608-DR facility, 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 characterization and closeout reports (WHC 1987, 1988).

RESidual RADioactivity Modeling Methodology

In 2005, RESidual RADioactivity (RESRAD) modeling was performed in accordance with the RDR/RAWP (DOE-RL 2005) to support the interim closure decision. The waste site was conservatively modeled with all exposure pathways (direct exposure to gamma radiation; dust inhalation; soil ingestion; and ingestion of plants, meat, milk, aquatic foods, and drinking water) evaluated in RESRAD. Contaminated concrete was buried in a demolished facility that extended 9.8 m (32 ft) below grade and was covered with 5 m (16.4 ft) of soil. The RESRAD evaluation used the 1987 sampling data adjusted for decay from 1987 to 2005. The highest decayed value for each radionuclide was conservatively used in the RESRAD modeling, regardless of whether the sample was of concrete or pipe scale/rust. Table 1 provides a summary of the maximum radionuclide results from the 53 samples collected in 1987 with the associated correction for decay. The decayed results for the maximum activities were used to represent uniform residual radiological contaminant concentrations over 100% of the 4.3-m (14.1-ft)-thick rubble layer. Although the contamination was present in 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. 1987 Sample Results with Correction for Decay to 2005.

Radionuclides	Sample Type and Location	1987 Activities (pCi/g)	Activities decayed to 2005 (pCi/g)
Carbon-14	Concrete (sump floor)	9.28	9.26
Cesium-137	Concrete (sump floor)	6,090	4,016
Cobalt-60	Pipe scale (sump area)	1,120	105
Europium-152	Pipe scale (sump area)	4,160	1,631
Europium-154	Pipe scale (sump area)	805	195
Tritium (H-3)	Concrete (sump floor)	35.1	10.24
Plutonium-239	Pipe scale (sump area)	198.4	198.3
Strontium-90	Concrete (sump floor)	4,966	3,233

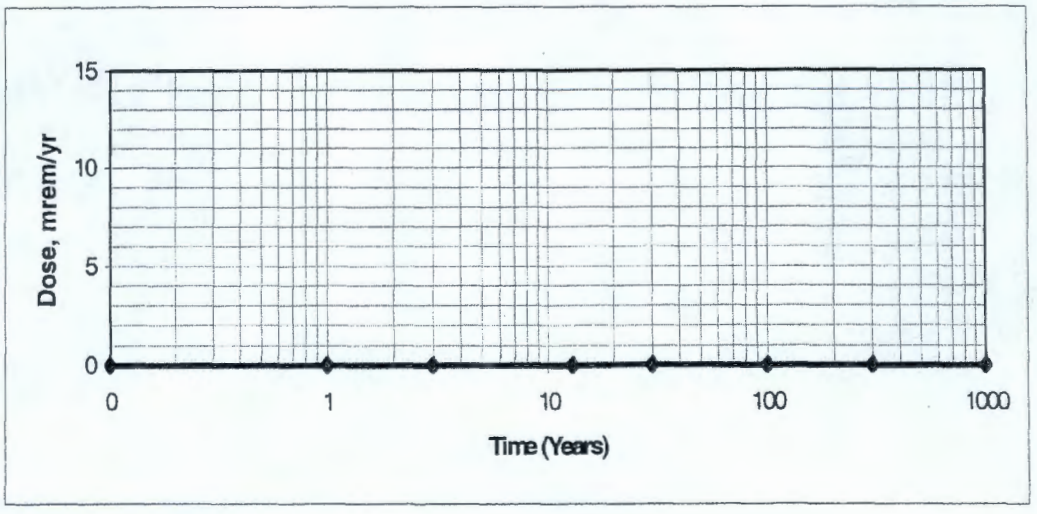
The evaluation predicts that the dose limits will not be exceeded for either the rural-residential scenario (15 mrem/yr) or the groundwater pathway (4 mrem/yr) (Appendix C). Maximum potential dose to a receptor in the rural-residential scenario is predicted to be 1.93×10^{-2} mrem/yr, which is less than the guideline of 15 mrem/yr above background. 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 (RAG) (20,000 pCi/L). Results are summarized in Table 2 and Figure 3.

Table 2. Summary of Attainment of Dose Limits for Radiological Contaminants of Concern for the 1608-DR Effluent Pumping Station Using Soil Distribution Coefficient Values.

Scenario	Dose Limit (mrem/yr)	Dose Predicted by RESRAD (mrem/yr)	Is Dose > Dose Limit?
Rural-residential	15	1.93×10^{-2}	No
Groundwater protection	4	1.85×10^{-2}	No
Radionuclide	**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
Tritium (H-3) in groundwater	20,000	424	No
Strontium-90 in groundwater	8	0	No

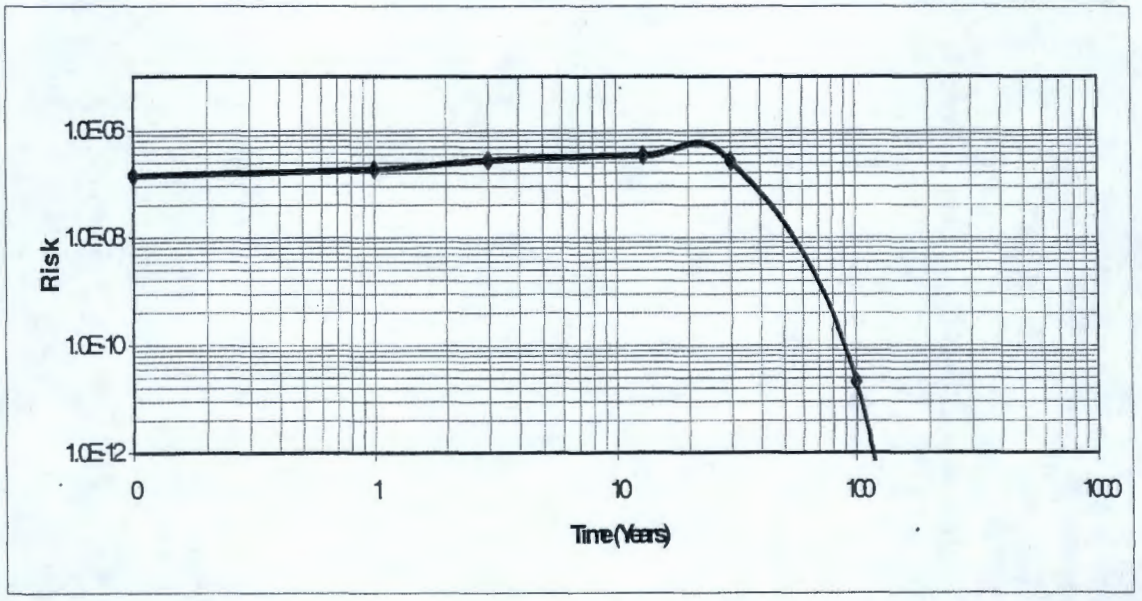
[a] Maximum contaminant levels from Table 2-3 of the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (DOE-RL 2005).
MCL = maximum contaminant level
RESRAD = RESidual RADioactivity (dose model)

Figure 3. Radionuclide Dose Rate – All Pathways for the 132-DR-1 Site.



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 3.38×10^{-7} and occurs at year 13 (2018). Summary information for the RESRAD modeling (BHI 2005) is presented in Appendix C.

Figure 4. Estimated Radionuclide Cancer Risk for the 132-DR-1 Site.



Nonradionuclides

No detailed analyses were performed for nonradionuclides at the 1608-DR Effluent Pumping Station. Analogous facilities at the 190-DR Process Water Pump House (Waste Information Data System site [WIDS] 100-D-68) were sampled for a series of nonradionuclide contaminants of concern (hexavalent chromium, lead, mercury, plus other metals, semivolatile organic compounds, pesticides, and polychlorinated biphenyls) and were closed as "no action" sites with remaining concrete structures reduced to 1 m (3.3 ft) below grade. The 190-DR and 1608-DR facilities pumped liquids containing approximately the same concentrations of nonradionuclides, but liquids from 1608-DR also contained radionuclides. All residual contaminant levels from sampling at worst-case locations at the 190-DR facility were found to be below the RAGs for direct exposure and groundwater/river protection. By analogy, residual nonradionuclide contamination at 1608-DR is also believed to meet the RAGs for direct exposure and groundwater/river protection.

Additionally, the samples of sludge collected from the sumps designated as a state-only dangerous waste due to the presence of lead and phosphate. The designation process therefore would indicate that no other chemical constituents were present in the sludge that resulted in the application of additional waste codes. Since this sludge was removed and represents the worst-case location and waste media for assessing chemicals within the facility, it is reasonable to expect that no residual chemical constituents are present within the demolished facility at concentrations that would exceed the RAGs for direct exposure and groundwater/river protection.

SUMMARY FOR INTERIM CLOSURE

The 132-DR-1 site residual contaminant levels 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. 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 material and equipment were removed from the building and transported to the Hanford Site 200 Area for disposal.

2. The residual contamination exists in a thin layer on concrete surfaces and in rust scale from piping and metal gates of the 1608-DR Effluent Pumping Station.

3. Using conservative inputs (e.g., highest activity sample results, uniform contamination levels throughout the entire mass of residual concrete, and modeling of all exposure pathways), the ARCL and RESRAD outputs indicate that residual contamination levels do not present unacceptable risk to the maximally exposed individual.

4. Additional excavation of the site to collect more information (i.e., samples) is not likely to result in a change of the interim decision for the 132-DR-1 site because the residual contamination occurred as a thin surface layer on the interior surfaces of the building sump and would be impossible to detect 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.

BHI, 2005, *132-DR-1 / 1608-DR Lift Station RESRAD Evaluation,* Calculation No. 0100D-CA-V0264, Bechtel Hanford, Inc., Richland, Washington.

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 on the Hanford Site*, PNL-4722/UNI-2522, Pacific Northwest Laboratory, Richland, Washington.

WAC 173-303, 2004, "Dangerous Waste Regulations," *Washington Administrative Code*.

WHC, 1987, *1608-DR Effluent Water Pumping Station Facility Decommissioning Report*, WHC-SD-DD-TI-024, Westinghouse Hanford Company, Richland, Washington.

WHC, 1988, *Dose Assessment of In Situ Burial of the 1608-DR Lift Station*, WHC-SD-DD-TI-019, Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

WASTE INFORMATION DATA SYSTEM GENERAL SUMMARY REPORT

Waste Information Data System
General Summary Report

07/27/2005

Site Code: 132-DR-1 **Site Classification: Accepted** Page 1

Site Names: 132-DR-1, 1608-DR Waste Water Pumping Station, 1608-DR Effluent Pumping Station
Site Type: Pump Station
Status: Inactive
Operable Unit: 100-DR-2
Hanford Area: 100D

Start Date: 1950
End Date: 1964
Coordinates:
(E) 573804.188
(N) 151319.969
Washington State Plane

Site Description: The unit consisted of: 1) an above ground section constructed with concrete block walls, a reinforced concrete floor, and a reinforced concrete roof with a composition surface; and 2) below grade section constructed of reinforced concrete. The facility contained an operating level, which consisted of pumping equipment, and an accumulation inlet chamber, which fed three discharge sump chambers. The accumulation chamber was located in the northern section of the facility.

Location Description: The unit is located adjacent to the northeast corner of the 105-DR Reactor Building within the 105-D/DR Exclusion Area Fence.

Site Comment: Decommissioning consisted of: 1) Removal/disposal of about 3.85 cubic meters (136 cubic feet) of asbestos, 2) removal/disposal of pump equipment and related piping, 3) removal/disposal of 4.8E+05 liters (1.27E+05 gallons) of sump water, 4) removal/disposal of fifteen 208-liter (55-gallon) drums of sludge from the sumps, and 5) demolition and site grading. All decommissioning activities were completed on September 30, 1987.

Environmental Monitoring Description: The site is radiologically surveyed monthly.

References:
1. K. H. Cramer, Hanford Site Waste Management Units Report, May 1987.
2. 2/89 Preliminary Operable Units Designation Project, WHC-EP-0216.
3. Scott Kitts to Nancy Homan, 4/17/90 100N updates for WIDS, DSI.

Waste Information:

Type: Water
Category: Mixed
Physical Status: Liquid
Description: This site received water from reactor building drains containing trace amounts of low-level radionuclides and decontamination chemicals. Radionuclides were primarily miscellaneous fission and activation products. The decontamination chemicals consisted of sodium fluoride, oxalic acid, and citric acid. Water was pumped from the reactor collection pits into the reactor effluent lines near the reactor building and became part of the 107-DR effluent that was discharged to the Columbia River.
References:
1. K. H. Cramer, Hanford Site Waste Management Units Report, May 1987.

Waste Information Data System
General Summary Report

07/27/2005

Site Code: 132-DR-1 **Site Classification: Accepted** Page 2

Dimensions:

Length:	10.97	Meters	36.00	Feet
Width:	10.36	Meters	34.00	Feet
Depth/Height:	8.53	Meters	28.00	Feet
Sq. Area:	113.71	sqMeters	1,224.00	sqFeet

References:
1. Scott Kitts to Nancy Homan, 4/17/90 100N updates for WIDS, DSI.
2. 1608 DR Building: Plan & Section For Pump House, H-1-8650DR.

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.

Responsible Project:

Site Evaluation

Solid Waste Management Unit: Yes
TPA Waste Management Unit Type: Waste Disposal Unit
This site was consolidated with:

Reason:

Permitting

RCRA Part B Permit:	No	**TSD Number:**	
RCRA Part A Permit:	No	**Closure Plan:**	No
RCRA Permit Status:			
Septic Permit:	No	**216/218 Permit:**	No
Inert Landfill:	No	**NPDES:**	No
Air Operating Permit:	No	**State Waste Discharge Permit**	No

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

1608-DR EFFLUENT PUMPING STATION (LIFT STATION) RESRAD INPUT PARAMETERS

RESRAD Input Parameters for 132-DR-1/1608-DR Lift Station. (3 Pages)

Parameter	Units	Rural Residential Scenario Input Parameter Values[a]
Exposure pathways		
External gamma		Yes
Inhalation of dust		Yes
Plant ingestion		Yes
Meat ingestion		Yes
Milk ingestion		Yes
Aquatic foods		Yes
Drinking water		Yes
Soil ingestion		Yes
Radon		No
Cover		Soil
Cover depth	m	5
Density of cover material	g/cm^3	1.6
Cover erosion rate	m/yr	0.001
Contaminated zone		
Area of contaminated zone	m^2	114.4
Thickness of contaminated zone	m	4.3
Length parallel to aquifer flow	m	11
Density	g/cm^3	2.4 (concrete[b])
Erosion rate	m/yr	0
Total porosity	--	0.3 (concrete)
Field capacity	--	0.16 (concrete)
Hydraulic conductivity	m/yr	41 (concrete)
Soil-specific b parameter	--	11.4 (concrete)
Hydrogeologic data		
Evapotranspiration coefficient	--	0.91
Wind Speed	m/sec	3.4
Precipitation	m/yr	0.161
Irrigation	m/yr	0.76
Irrigation mode	--	Overhead
Runoff coefficient	--	0.2
Watershed area (nearby)	cm^2	1E+06
Accuracy for soil/water computations	--	0.001
Saturated zone		Soil
Density	g/cm^3	1.6
Total porosity	--	0.4
Effective porosity	--	0.25
Field capacity	--	0.15
Hydraulic conductivity	m/yr	5530
Hydraulic gradient	--	0.00125
Soil-specific b parameter	--	4.05
Water table drop rate	m/yr	0.001
Well pump intake depth (below water table)	m	4.6
Nondispersion (ND) or mass balance (MB)	--	ND
Well pumping rate	m^3/yr	250
Unsaturated zone		
Unsaturated zone strata		Soil
Thickness	m	8
Density	g/cm^3	1.6

RESRAD Input Parameters for 132-DR-1/1608-DR Lift Station. (3 Pages)

Parameter	Units	Rural Residential Scenario Input Parameter Values[a]
Total porosity	--	0.4
Effective porosity	--	0.25
Field capacity	--	0.15
Hydraulic conductivity	m/yr	250
Soil-specific b parameter	--	4.05
Distribution coefficients[c]		Soil
Carbon-14	cm^3/g	200
Cobalt-60	cm^3/g	50
Cesium-137	cm^3/g	50
Europium-152	cm^3/g	200
Europium-154	cm^3/g	200
Tritium (H-3)	cm^3/g	0
Plutonium-239	cm^3/g	200
Strontium-90	cm^3/g	25
Time since material placement	yrs	17.2
Radionuclide Concentrations		
Carbon-14	pCi/g	9.26
Cobalt-60	pCi/g	105
Cesium-137	pCi/g	4016
Europium-152	pCi/g	1631
Europium-154	pCi/g	195
Tritium (H-3)	pCi/g	10.24
Plutonium-239	pCi/g	198.3
Strontium-90	pCi/g	3233
Occupancy and Inhalation Data		
Inhalation rate	m^3/yr	7300
Mass loading for inhalation	g/cm^3	0.0001
Exposure duration	yr	30
Shielding factor, inhalation	--	0.4
Shielding factor, external gamma	--	0.8
Fraction of time indoors	--	0.6
Fraction of time outdoors	--	0.2
Food consumption		
Fruits, vegetables, and grain	Kg/yr	110
Leafy vegetables	Kg/yr	2.7
Milk	L/yr	100
Meat	Kg/yr	36
Fish	Kg/yr	19.7
Other aquatic food	Kg/yr	0.9
Soil ingestion	g/yr	73
Drinking water intake	L/yr	730
Contaminated fraction of food and water		
Drinking water	--	1
Household water	--	1
Livestock water	--	1
Irrigation water	--	1
Aquatic food	--	1
Plant food	--	1
Meat	--	1
Milk	--	1

RESRAD Input Parameters for 132-DR-1/1608-DR Lift Station. (3 Pages)

Parameter	Units	Rural Residential Scenario Input Parameter Values[a]
Ingestion parameters, nondietary		
Livestock fodder intake for meat	Kg/d	68
Livestock fodder intake for milk	Kg/d	55
Livestock water intake for meat	L/d	50
Livestock water intake for milk	L/d	160
Livestock soil intake	Kg/d	0.5
Mass loading for foliar deposition	g/cm^3	0.0001
Depth of soil mixing layer	M	0
Depth of roots	M	0.9
Groundwater fractional usage		
Drinking water	--	1
Household water	--	1
Livestock water	--	1
Irrigation	--	1
Storage times of contaminated foodstuffs		Not used
Radon emanation data		Not used

[a] All general 100 Area input parameters (non-site-specific) are from Appendix B of 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.

[b] Input parameters for concrete are from Appendix B of 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.

[c] Distribution coefficients for soil are from Appendix E of the RDR/RAWP, DOE/RL-96-17, Rev. 5, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

APPENDIX C

SUMMARY OF THE 1608-DR EFFLUENT PUMPING STATION (LIFT STATION) RESRAD EVALUATION

CALCULATION COVER SHEET

Project Title 100-D/DR Remedial Action **Job No.** 22192
Area 100-D Area
Discipline Environmental ***Calc. No.** 0100D-CA-V0264
Subject 132-DR-1 / 1608-DR Lift Station RESRAD Evaluation
Computer Program RESRAD **Program No.** Version 6.22

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 – 6 pg Attm. 1 - 1 pg Attm. 2 - 24 pg Attm. 3 - 27 pg Attm. 4 - 17 pg Total – 76 pages	S. W. Clark S.W. Clark 7/12/05	T. M. Blakley T.M. Blakley 7/15/05	K. E. Cook K.E. Cook 7/19/05	R. A. Carlson RA Carlson	7/22/05

SUMMARY OF REVISION

*Obtain Calc. No. from DIS

DE01-437.03 (12/09/2004)

Bechtel Hanford, Inc. CALCULATION SHEET

Originator:	S. W. Clark	Date:	7/12/05	Calc. No.:	0100D-CA-V0264	Rev.:	0
Project:	100-D/DR Remedial Action	Job No:	22192	Checked:	T. M. Blakley	Date:	7/15/05
Subject:	132-DR-1 / 1608-DR Lift Station RESRAD Evaluation					Sheet No.	1 of 6

PURPOSE:

Evaluate the potential dose and risk to a receptor in a rural residential scenario from contaminants in concrete rubble at 132-DR-1, the former 1608-DR Lift Station site, and predict if contamination would reach groundwater within 1,000 years. Use data available from samples that were taken in June of 1987 for an Allowable Residual Contamination Level (ARCL) method evaluation of the decommissioned site.

GIVEN/REFERENCES:

1) Sample data and dates from *Dose Assessment of In Situ Burial of the 1608-DR Lift Station*, WHC-SD-DD-TI-019, Rev. 0, Westinghouse Hanford Company, Richland, Washington.
2) Decommissioning information from *1608-DR Effluent Water Pumping Station Facility Decommissioning Report*, WHC-SD-DD-TI-024, Rev. 0, Westinghouse Hanford Company, 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.
5) RESidual RADioactivity (RESRAD) computer code, version 6.22, 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-DR-1 / 1608-DR Lift Station operated from 1950 until the 105-DR Reactor was shut down in 1964 to collect water from reactor building drains and pump it to the 116-DR-9 (107-DR) Retention Basin for discharge to the river. Most of the reinforced concrete structure (9.3 m [30.5 ft]) was below grade and only 2.44 m (8 ft) was above grade. The facility was decommissioned in 1987. Residual sump water was disposed in the 1325-N Liquid Waste Disposal Facility. All equipment and sludge from the facility sumps was disposed in the 200 Area and the remaining structure was decontaminated.

A total of 53 samples were taken from the decontaminated concrete surfaces to determine if ARCL criteria for decommissioning were met. Residual contamination was confined to the concrete on the surface of the walls and the floor of the facility sumps. Sampling showed the contamination was confined to a 0.013 m (0.5 inch) surface layer of the concrete. However, the RESRAD evaluation used the maximum concentrations of radionuclides from the surface concrete to conservatively model the residual concrete as if the entire mass of the concrete was contaminated. This was the conceptual model for

Bechtel Hanford, Inc. CALCULATION SHEET

Originator:	S. W. Clark SWC	Date:	7/12/05	Calc. No.:	0100D-CA-V0264	Rev.:	0
Project:	100-D/DR Remedial Action	Job No:	22192	Checked:	T. M. Blakley TMB	Date:	7/15/05
Subject:	132-DR-1 / 1608-DR Lift Station RESRAD Evaluation					Sheet No.	4 of 6

Table 3. All Pathway Dose Rate (mrem/yr)

Vadose Zone Horizon	"All Pathways" Dose Contributions in mrem/yr at each time slice (yr)							
	0	1	3	13	30	100	300	1000
Deep Zone Total Dose	7.04E-25	6.29E-25	5.04E-25	1.73E-25	1.93E-02	1.52E-06	2.85E-18	0.00E+00

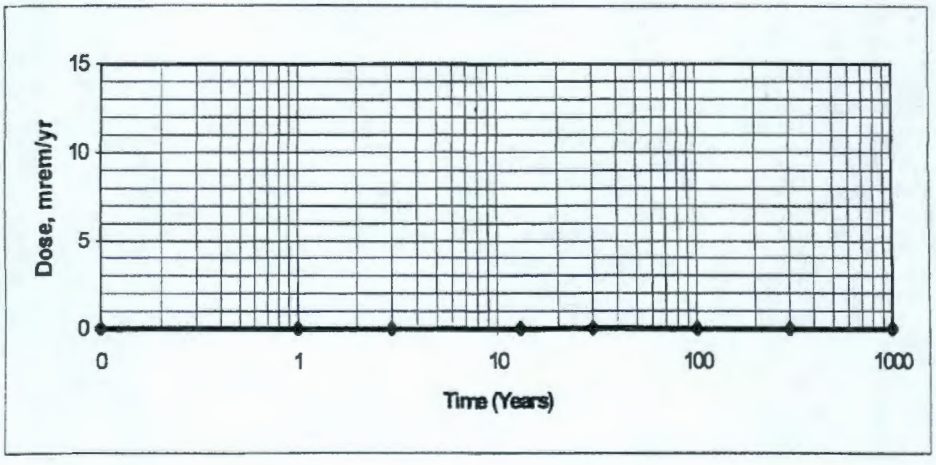
2) Radionuclide Excess Cancer Risk: The radionuclide excess lifetime cancer risk results are shown in Table 4. The maximum excess lifetime cancer risk (3.38×10^{-7}) occurs at year 13 (2018).

Table 4. Radionuclide Excess Lifetime Cancer Risk

Vadose Zone Horizon	Excess Cancer Risk at Each Time Slice (yr)							
	0	1	3	13	30	100	300	1000
Deep Zone Total Excess Cancer Risk	1.41E-07	1.89E-07	2.75E-07	3.38E-07	2.66E-07	2.10E-11	3.93E-23	0.00E+00

3) Figures 1 and 2 show the all pathways dose rate and radionuclide excess cancer risk for the rural residential scenario.

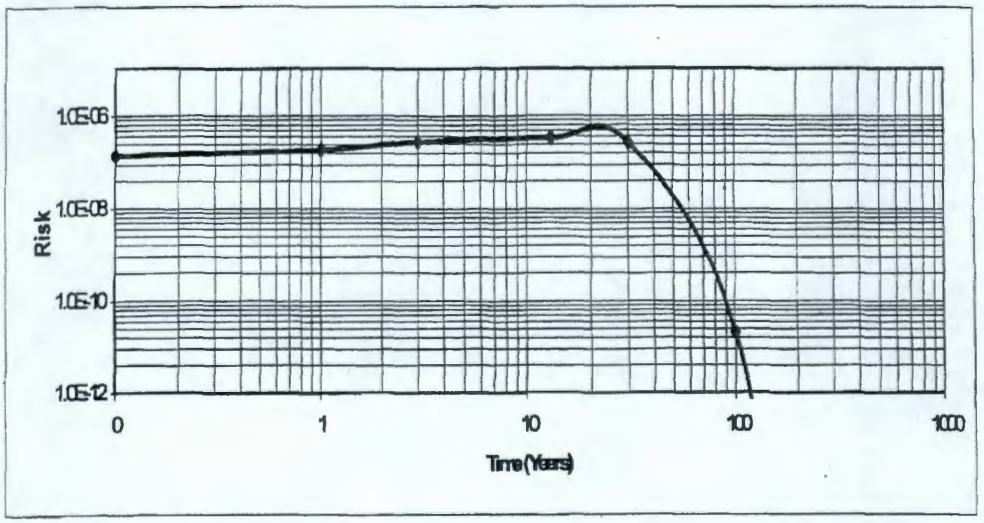
Figure 1. RESRAD Analysis – All Pathways Dose Rate



Bechtel Hanford, Inc. CALCULATION SHEET

Originator:	S. W. Clark	Date:	7/13/05	Calc. No.:	0100D-CA-V0264	Rev.:	0
Project:	100-D/DR Remedial Action	Job No:	22192	Checked:	T. M. Blakley	Date:	7/15/05
Subject:	132-DR-1 / 1608-DR Lift Station RESRAD Evaluation					Sheet No.	5 of 6

Figure 2. RESRAD Analysis – Radionuclide Risk, All Pathways.



4) Radionuclide Groundwater Protection: The radionuclide concentrations in groundwater calculated by the RESRAD model are summarized in Table 5. Only tritium was predicted to reach groundwater within 1,000 years.

Table 5. RESRAD Predicted Radionuclide Groundwater (Well Water) Concentrations

Radio-nuclides	Vadose Zone Horizon	Groundwater Concentrations in pCi/L at Each Time Slice (yr)								RAGs From RDR
		0	1	3	13	30	100	300	1000	
C-14	Total	0	0	0	0	0	0	0	0	2,000
Co-60	Total	0	0	0	0	0	0	0	0	100
Cs-137	Total	0	0	0	0	0	0	0	0	60
Eu-152	Total	0	0	0	0	0	0	0	0	200
Eu-154	Total	0	0	0	0	0	0	0	0	60
H-3	Total	0	0	0	0	4.24E+02	3.33E-02	6.26E-14	0	20,000
Pu-239	Total	0	0	0	0	0	0	0	0	1.2
Sr-90	Total	0	0	0	0	0	0	0	0	8

Bechtel Hanford, Inc. CALCULATION SHEET

Originator:	S. W. Clark SWC	Date:	7/12/05	Calc. No.:	0100D-CA-V0264	Rev.:	0
Project:	100-D/DR Remedial Action	Job No:	22192	Checked:	T. M. Blakley TMB	Date:	7/15/05
Subject:	132-DR-1 / 1608-DR Lift Station RESRAD Evaluation					Sheet No.	6 of 6

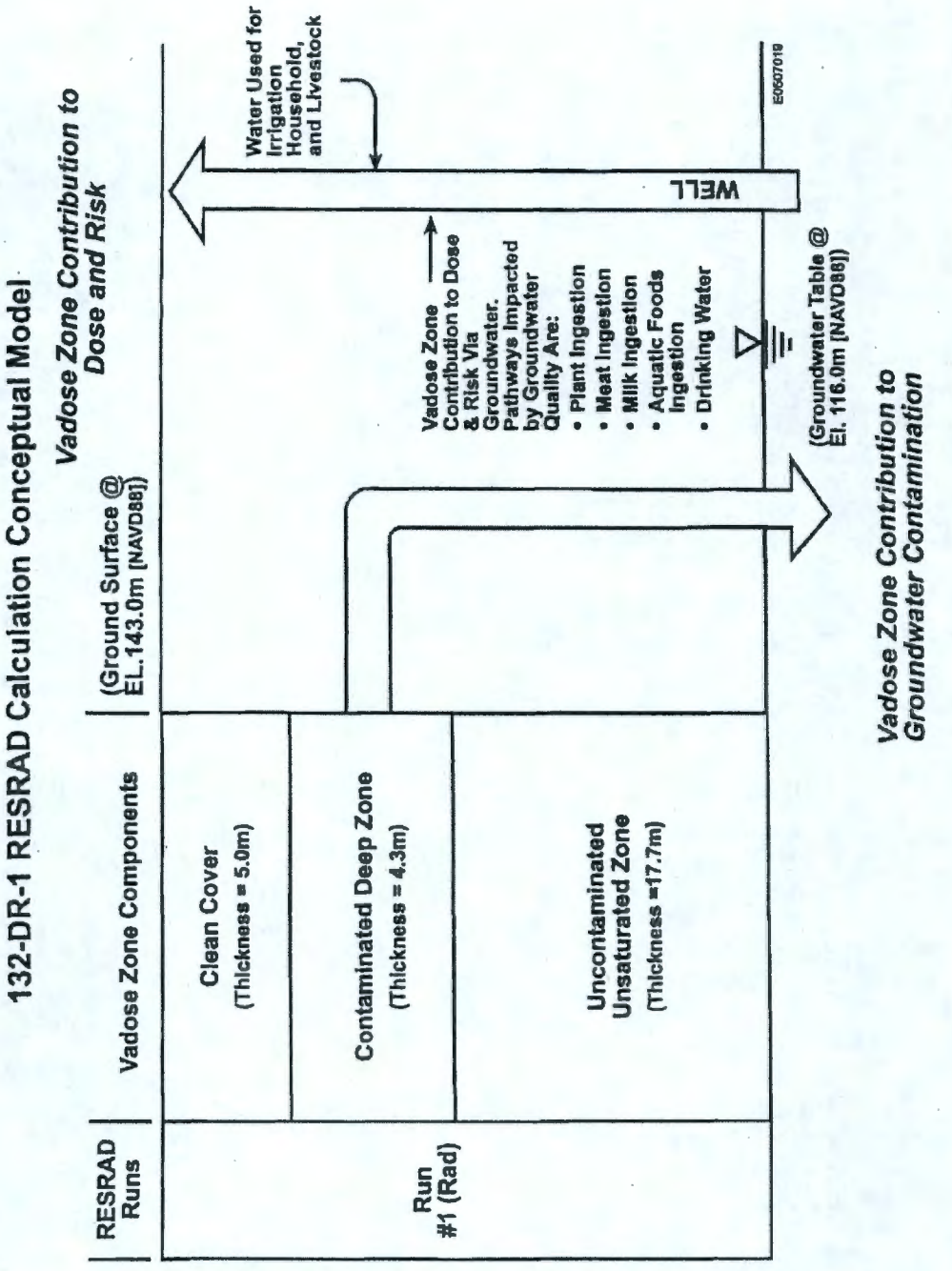
CONCLUSIONS:

- The maximum all-pathways dose rate for the 132-DR-1 deep zone is 1.93×10^{-2} mrem/yr which occurs at year 30 (2035).
- The dominant pathway for the dose rate is drinking water ingestion.
- The primary radionuclide contributing to the drinking water ingestion pathway is tritium (H-3).
- None of the 132-DR-1 site radionuclides are projected to exceed remedial action goals (RAGs).
- The maximum excess lifetime cancer risk (3.38×10^{-7}) occurs at year 13 (2018).
- Only tritium was predicted to reach groundwater within 1,000 years.

ATTACHMENTS:

1. Graphic showing 132-DR-1 RESRAD Evaluation Model (1 page)
2. RESRAD Output: 132-DR-1 Deep Zone Radionuclides, Mixture Sums and Single Radionuclide Guidelines (24 pages)
3. RESRAD Output: 132-DR-1 Deep Zone Radionuclides, Intake Quantities and Health Risk Factors (27 pages)
4. RESRAD Output: 132-DR-1 Deep Zone Radionuclides, Concentration of Radionuclides, (17 pages)

ATTACHMENT 1



Attachment 1 Sheet No. 1 of 1
Originator S. W. Clark Date 7/12/05
Chk'd By T. M. Blakley Date 9/15/05
Calc. No. 0100D-CA-V0264 Rev. No. 0