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Waste Site Reclassification Form

Date Submitted: 5/10/2004 **Originator:** R. A. Carlson **Phone:** 372-9632	**Operable Unit(s):** 100-BC-2 **Waste Site ID:** 100-C-9:4 **Type of Reclassification Action:** Rejected ☐ Closed Out ☐ Interim Closed Out ☐ No Action ☒	**Control Number:** 2004-015 **Lead Agency:** EPA

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:

Sampling and evaluation of this site have been performed in accordance with remedial action objectives and goals established by the *Interim Action Record of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington* (Remaining Sites ROD). The selected action involved (1) sampling of the site, (2) demonstration through a combination of field screening and confirmational sampling that cleanup goals have been met, and (3) proposal of no further action.

Basis for reclassification:

The Cooling Water Pipe Tunnels Site (100-C-9:4) meets the Remedial Action Objectives specified in the Remaining Sites ROD, U.S. Environmental Protection Agency, Region 10, Seattle, Washington. The results show that the site and contaminant levels remaining in the soil will be protective of groundwater and the Columbia River. It should be noted that, with the maximum residual concentration of hexavalent chromium in the pipe, institutional controls are required to prevent an inhalation exposure pathway. The basis for reclassification is described in detail in the *Remaining Sites Verification Package for 100-C-9:4 Cooling Water Pipe Tunnels Site* (attached).

H. E. Bilson DOE-RL Assistant Manager	Signature	5/14/04 Date
NA Ecology Project Manager	Signature	Date
D. A. Faulk EPA Project Manager	Signature	6-3-04 Date

REMAINING SITES VERIFICATION PACKAGE FOR 100-C-9:4 COOLING WATER PIPE TUNNELS SITE

Attachment to Waste Site Reclassification Form 2004-015

May 2004

REMAINING SITES VERIFICATION PACKAGE FOR 100-C-9:4 COOLING WATER PIPE TUNNELS SITE

EXECUTIVE SUMMARY

The 100-C-9:4 site is located within the 100-BC-2 Operable Unit in the 100-B/C Area of the Hanford Site. The 100-C-9 site includes underground process piping within tunnels associated with the 100-C Area prereactor cooling water. For the confirmatory sampling and evaluation effort, the 100-C-9 site was divided into four subunits (Waste Information Data System [WIDS] subsites) based upon the documented historical use of each system, expected sources of contamination, and potentially different remedial actions. The 100-C-9:4 cooling water pipe tunnels is one of the subsites associated with 100-C-9, and is the only subsite discussed in this report. Other subsites are addressed in separate reports. The 100-C-9:4 cooling water pipe tunnels consist of the 105-C Reactor feedwater and steam process pipelines within concrete tunnels. The feedwater pipes were used to transport filtered and treated cooling water from the 100-C Reactor cooling water treatment facilities to the 105-C Reactor.

The scope of the confirmatory sampling effort consisted of the cooling water pipes and tunnels to the reactor. Sampling efforts were conducted only on the pipes. Previous sampling and survey data associated with decontamination and decommissioning (D&D) activities at the 105-C cooling water pipe tunnels was used to evaluate the tunnels and soil. This D&D data, as well as a focused sampling approach at the analogous 100-B-14:4 site, were used to confirm current site conditions. The analogous, focused sampling data, previous tunnel sampling and survey data, and previous soil sampling beneath the tunnels was used to make decisions for reclassifying the site in accordance with the TPA-MP-14 (RL-TPA-90-0001) (DOE-RL 1998) process.

Confirmatory sampling was conducted at the analogous 100-B-14:4 site in November 2003. The sampling approach consisted of collecting one composite sample of scale material from 14 valves in the 105-B valve pit. The sampled valves were associated with the feed cooling water for the 105-B Reactor. The 100-B-14:4 cooling water lines feeding into the 105-B Reactor building were used as an analogous site because their construction and use were identical to those at the 105-C Reactor, which were not accessible for sample collection, due to previous remedial action. The valve pit scale sample represents a worst-case sample location for the cooling water pipelines. A summary of the results and data evaluation with respect to the applicable remedial action goals (RAGs) is presented in Table ES-1.

Radiological surveys and sample collection were performed for the 105-C cooling water pipe tunnels during and after D&D activities at the 100-C Reactor area in order to assess the residual radioactivity associated with the concrete tunnel floor (BHI 1997a). During April and May of 1997 the soil beneath the 105-C cooling water pipe tunnels was sampled to assess the potential for contamination in the soil underlying these tunnel structures (BHI 1997b).

In accordance with this evaluation, the confirmatory sampling results for pipe scale at an analogous site, previous sampling and surveying data associated with the concrete floor of the tunnels, and previous soil sampling from beneath the tunnels, support a no action reclassification

of the 100-C-9:4 site. The current site conditions achieve the remedial action objectives and the corresponding RAGs established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2002) 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* (commonly called the Remaining Sites Record of Decision) (EPA 1999). The basis for this reclassification is summarized in Table ES-1. These results show that the site and contaminant levels remaining in the soil will be protective of groundwater and the Columbia River. It should be noted, however, that with the maximum residual concentration of hexavalent chromium in the pipes, institutional controls are required to prevent an inhalation exposure pathway.

Table ES-1. Summary of Remedial Action Objectives for the 100-C-9:4 Site.

Regulatory Requirement	Remedial Action Goals	Results	Remedial Action Objectives Attained?
Direct Exposure – Radionuclides and Nonradionuclides	Attain individual RAGs.	Maximum detected results for all COPCs are below the direct exposure RAG, except for hexavalent chromium, which is above the direct exposure RAG.	Yes, with institutional controls
Meet Nonradionuclide Risk Requirements	Attain a hazard quotient of <1 for noncarcinogens	All hazard quotients are below 1.	Yes, with institutional controls
	Attain a cumulative hazard quotient of <1 for noncarcinogens.	Cumulative hazard quotient (0.38) is less than 1.	
	Attain an excess cancer risk of $<1 \times 10^{-6}$ for individual carcinogens.	Excess cancer risk for individual carcinogens are all less than 1×10^{-6}, except for hexavalent chromium, which is 1.48×10^{-6}.	
	Attain a total excess cancer risk of $<1 \times 10^{-5}$ for carcinogens.	Total excess cancer risk (1.95×10^{-6}) is below 1×10^{-5}.	
Groundwater/River Protection – Radionuclides	Attain single-COPC groundwater and river protection RAGs.	All single-COPC groundwater and river RAGs have been attained.	Yes
	Attain National Primary Drinking Water Standards[a]: 4 mrem/yr (beta/gamma) dose rate to target receptor/organs.	Contaminants are not predicted to reach groundwater within 1,000 years.	
	Meet drinking water standards for alpha emitters: the more stringent of 15 pCi/L MCL or 1/25th of the derived concentration guide from DOE Order 5400.5[b].	Maximum activity of detected alpha emitters in residual soil is less than Hanford Site background value.	
	Meet total uranium standard of 21.2 pCi/L[c].	Uranium concentrations are less than the Hanford Site background value.	
Groundwater/River Protection – Nonradionuclides	Attain individual nonradionuclide groundwater and river cleanup requirements.	Maximum detected results for all COPCs are below groundwater and river RAGs.	Yes

[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).

[c] Based on the isotopic distribution of uranium in the 100 Areas, the 30 µg/L MCL corresponds to 21.2 pCi/L. Concentration-to-activity calculations are documented in *Calculation of Total Uranium Activity Corresponding to a Maximum Contaminant Level for Total Uranium of 30 Micrograms per Liter in Groundwater*, 0100X-CA-V0038 (BHI 2001).

COPC = contaminant of potential concern
DOE = U.S. Department of Energy
NA = not applicable
MCL = maximum contaminant level

REMAINING SITES VERIFICATION PACKAGE FOR 100-C-9:4 COOLING WATER PIPE TUNNELS SITE

STATEMENT OF PROTECTIVENESS

The 100-C-9:4 Cooling Water Pipe Tunnels Site (referred to as the 100-C-9:4 site) sample results and supporting documentation demonstrate that the site meets the objectives established in the *Remedial Design Report/Remedial Action Work Plan for the 100 Area* (RDR/RAWP) (DOE-RL 2002) 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* (commonly called the Remaining sites Record of Decision) (EPA 1999). These results show that the site and contaminant levels remaining in the soil will be protective of groundwater and the Columbia River. It should be noted, however, that with the maximum residual concentration of hexavalent chromium in the pipes, institutional controls are required to prevent an inhalation exposure pathway.

GENERAL SITE INFORMATION AND BACKGROUND

The 100-C-9:4 site is located within the 100-BC-2 Operable Unit in the 100-B/C Area of the Hanford Site. The 100-C-9:4 subsite includes underground process piping associated with the 100-C Area prereactor cooling water within two concrete tunnels. Three 0.6-m (2-ft)-diameter pipelines within each tunnel carried treated water from the 190-C Pump House building to the 105-C Reactor building and one 0.2-m (8-in.)-diameter steam line, which also ran between the buildings (BHI 1997a and BHI 1997b).

The western end of the tunnels was removed from the 190-C Pump House to within approximately 18 m (60 ft) of the tunnel ventilation structures during pump house demolition activities in 1996 and 1997 (BHI 1998b). All of the water pipes in the remaining tunnel structures were cut and capped, and the western tunnel end was sealed with wood beams, railroad ties, angle iron, and foam sealant. During the 1996 through 1998 105-C Reactor interim safe storage activities, the eastern-most end of the tunnels was removed from the reactor building to approximately 3 m (10 ft) from the west edge of the reactor building (BHI 1998a) and backfilled with clean soil. Approximately 121 m (400 ft) of open tunnel and piping remain in place.

The dimensions of the concrete tunnels vary slightly, but generally measure 3.3 m (10 ft) in width by 3.6 m (12 ft) in height. Each of the two tunnels are sloped up from the ventilation structures to the reactor building, gaining approximately 3.6 m (12 ft) in elevation. The floor of the concrete tunnel is positioned approximately 4.6 m (15 ft) below grade at its eastern-most end of the remaining tunnel structure near the 105-C Reactor building, and approximately 7.6 m (25 ft) below grade at its western-most end of the existing structure near the ventilation structure. At the ventilation structure, which extends above the existing ground surface, the floor of the tunnel is approximately 4.6 m (15 ft) below grade. The ventilation structure extends above the ground surface.

The water pipes are positioned vertically along the concrete walls of the tunnels, and the uppermost pipe varies in depth from approximately 2.1 m (7 ft) below the ground surface at the eastern end of the remaining tunnel structure to approximately 5.5 m (18 ft) below the ground surface at the western-most end to the remaining tunnel structure near the ventilation structure. Within the ventilation structure at the western end of the tunnel, the uppermost pipe is situated approximately 2.1 m (7 ft) below the ground structure. Portions of the pipes and tunnel walls are in the shallow zone (less than 4.6 m [15 ft] below ground surface).

Additional waste site information is provided in Appendix A.

CONFIRMATORY SAMPLING ACTIVITIES

Contaminants of Potential Concern

The contaminants of potential concern (COPCs) for the feedwater pipes were identified based on existing analytical data, historical process information, and historical uses and practices associated with the 183-C Filter Building, the 190-C Process Pump House, and the associated feedwater pipelines. The COPCs included inductively coupled plasma (ICP) metals, mercury, hexavalent chromium, and polychlorinated biphenyls (PCBs).

Historical information did not indicate radiological constituents as contaminants of potential concern within the pipes; however, radionuclides were analyzed as a COPC because the sample results from the decontamination and decommissioning (D&D) activities indicated a dose from residual radionuclides.

Confirmatory Sample Design

Sample collection at the 105-C Reactor valve pit or within the cooling water pipe tunnels was not possible because the existing structures were not readily accessible; these facilities had been sealed to prevent entry following previous D&D activities. Therefore, confirmatory sampling of the pipe contents was conducted at the analogous 100-B-14:4 pipes in November 2003.
A focused sampling approach, biased toward worst-case accessible sample locations, was selected for this site. The sampling approach consisted of collecting one composite sample of pipe scale material from the feedwater valves in the 105-B valve pit.

Samples were collected by scraping pipe scale material from within each of the 14 feedwater valves in the 105-B valve pit. The inside of the valve bodies were accessed through the valve bonnets, which had been removed from each of the valves. Approximately equal volumes of scale material were removed from each of the valves, and the scale material was placed in a new clean polyethylene bag. After scale from each of the valves was collected, the sample material was mixed to homogenize the media and then packaged in sample containers.

Samples were not collected from either the concrete floor of the feedwater tunnels at the 105-C Reactor or from the soil beneath the tunnels, because an evaluation of these media had already

been performed during previous D&D activities associated with the 190-C Pump House and the interim safe storage of the 105-C Reactor facility (BHI 1997a, BHI 1997b). Conclusions from these reported activities were used to support reclassification decisions related to the 105-C cooling water pipe tunnels.

The maximum detected results from the scale samples were used to support site reclassification. Table 1 provides a sample summary.

Table 1. Sample Summary Table[a].

Sample Location	Location Description	Sampling Access	Sample Location	Sample Media	HEIS Sample Number	Sample Analyses
105-B valve pit (composite)	Scale from within feedwater valves	Sampled through valve bonnet	Composite of scale from the following valves: No. 1 Annex, No 1 Turbine No. 1 Annex, No 2 Turbine No. 2 Annex, No. 3 Turbine No. 2 Annex, No 4 Turbine No. 3 Annex, turbine unknown No. 4 Annex, No. 5 Turbine No. 4 Annex, No 6 Turbine No. 5 Annex, No. 7 Turbine No. 5 Annex, No. 8 Turbine No. 6 Annex, turbine unknown No. 7 Annex, No. 9 Turbine No. 7 Annex, No. 10 Turbine No. 8 Annex, No. 11 Turbine No. 8 Annex, No. 12 Turbine	Pipe scale from within each of the 14 feedwater valves at the 105-B valve pit	J012K1 J012K2	ICP metals, mercury, hexavalent chromium, PCBs, GEA, gross alpha[b], gross beta[c], isotopic uranium
Equipment Blank	N/A	N/A	N/A	Silica Sand	J012K3	ICP metals, mercury, hexavalent chromium, PCBs, GEA, gross alpha[b], gross beta[c]

[a] Logbook 1578-1, pages 58 and 59 (BHI 2003c)
[b] If gross alpha is detected above background, then GEA data will be evaluated to determine if further alpha-specific analyses are needed.
[c] If gross beta is detected above background, then strontium analyses will be performed.
HEIS = Hanford Environmental Information System

Confirmatory Sample Results

Using U.S. Environmental Protection Agency (EPA)-approved analytical methods, offsite contract laboratories analyzed the samples collected to evaluate this site. A data quality assessment review was performed to compare the sampling approach and resulting analytical data with the sampling and data quality requirements specified by the project objectives and performance specifications. The results of this review are reported in the Data Quality Assessment Section. The sample results are stored in the Hanford Environmental Information System and are summarized in the data summary tables (Appendix B).

Previous radiological survey data, sampling results, and modeling results performed during D&D activities at the 100-C-9:4 site were used to evaluate the concrete tunnel and soils beneath the tunnel. This data was evaluated against the RAGs and cleanup objectives for the 100-C-9:4 site.

Process knowledge, historical information, and field observations were used to identify the 105-B Reactor feedwater valves, as an appropriate analogous location with the greatest potential for residual contamination, to verify the contaminant concentrations in the pipelines at the 100-C-9:4 site. In accordance with the focused sampling approach and *Washington Administrative Code* (WAC) 173-340-740(7)(d)(iii), a direct comparison of the cleanup verification sample results with the RAGs is an acceptable method to evaluate compliance with cleanup objectives for the 100-C-9:4 site.

Table 2 compares the maximum detected results that were identified for the 100-C-9:4 site with cleanup levels identified in the RDR/RAWP (DOE-RL 2002). Of the ICP metals analyzed, aluminum, calcium, iron, magnesium, potassium, silicon, and sodium are not evaluated in the Cleanup Levels and Risk Calculations table under WAC 173-340-740(3), and thus, are not considered COPCs. However, data results for these constituents are presented in Appendix B. Contaminants that were not detected above the practical quantification limits or minimum detectable activities are excluded from Table 2. Evaluation of the pipe scale consisted of a tiered approach that was approved by the regulators at the December 4, 2003 Unit Managers Meeting Minutes (EPA et al. 2004). When the soil data from the underlying/surrounding pipelines meet the cleanup criteria, but the scale from inside the pipeline is contaminated, the analysis of the contamination is determined based upon the analyses of scale scrapings inside the pipelines relative to the entire matrix of the material making up the pipeline. When the soil contamination surrounding the pipeline does not meet the cleanup criteria, the pipeline would be remediated with the soil. Complete sample results are provided in Appendix B.

Sampling, radiological surveys, and subsequent RESRAD Build modeling was performed for the concrete floor in the 105-C tunnels during 1997 D&D activities associated with the 190-C trenches and 105-C tunnels (BHI 1997a). Reported conclusions based on these activities indicate the dose from residual radionuclides is significantly below the 15 mrem/yr RAG and within the CERCLA risk range of 10^{-4} to 10^{-6}.

Soil samples collected from beneath and along the entire length of the concrete tunnels during a 1997 verification-sampling event were analyzed for hexavalent chromium (BHI 1997b). A total of 12 samples were collected and submitted for laboratory analysis. The results of the laboratory

analysis indicate that the maximum concentration of hexavalent chromium observed in these soil samples was 0.180 mg/kg. The reported conclusions from this soil sampling event indicate that the hexavalent chromium concentrations are below the applicable RAGs.

In evaluating the pipeline scale data collected at the analogous 100-B-14:4 site, all inorganic COPCs except cadmium, total chromium, hexavalent chromium, copper, lead, mercury, molybdenum, nickel, and zinc are less than background or the applicable RAGs. All these contaminants are not predicted to migrate into groundwater within a 1,000-year assessment period based on a site-specific RESRAD model (BHI 2004a). All organic COPCs, with the exception of arorclor-1248 and arorclor-1254, are less than the applicable RAGs. These organic contaminants are also predicted to not reach groundwater within a 1,000-year assessment period based on a site-specific RESRAD model (BHI 2004a). When modeling the scale data from the pipelines, the option in the RESRAD model for noncircular shapes is used instead of a circular shape because the contaminated area (i.e., pipelines) is long and narrow.

Nonradionuclide risk requirements include an individual site hazard quotient of less than 1.0, a cumulative hazard quotient of less than 1.0, an individual contaminant carcinogenic risk of less than $1x10^{-6}$, and a cumulative carcinogenic risk of less than $1x10^{-5}$ for the 100-C-9:4 site. These risk values were not calculated for constituents that were either not detected or were detected at concentrations below Hanford site or Washington State background. All individual hazard quotients for noncarcinogenic constituents were less than 1.0. The cumulative hazard quotient for these noncarcinogenic constituents above background or detection levels is 0.38. The carcinogenic risk values for carcinogenic constituents above background or detection levels are all below 1×10^{-6}. The cumulative carcinogenic risk value for this constituents is 1.95×10^{-6}, which is below 1×10^{-5}. Because a portion of the feedwater pipes are within the shallow zone (less than 4.5 m [15 ft] below the ground surface) the pipe scale data was compared against the direct exposure lookup values. The maximum concentrations of all COPCs, except hexavalent chromium, are less than the direct exposure lookup values. The matrixed hexavalent chromium concentration was reported at 3.11 mg/kg, which slightly exceeds the carcinogenic direct exposure lookup value of 2.1 mg/kg. However, because hexavalent chromium is considered a carcinogenic inhalation hazard and because this contaminant is contained within sealed pipes, the exposure pathway does not exist unless the pipes are breached. Therefore, it is reasonable to conclude that the site meets the standards for direct exposure with institutional controls in place.

A focused sampling approach was selected for this site; therefore, the WAC 173-340-740(7)(e), which is an equivalent for statistically based soil cleanup assessment, is not applied.

Table 2. Comparison of Maximum Values to Action Levels (Cooling Water Pipe Tunnels, 100-C-9:4). (2 Pages)

COPC	Maximum Result (mg/kg)[a]	Remedial Action Goals (pCi/g)			Does the Maximum Result Exceed Lookup Value?	Matrix Results		Does the Maximum Soil and Pipe Result Pass RESRAD Modeling?
	Pipe Scale	Direct Exposure	Soil Standards for Groundwater Protection	Soil Standards for River Protection	Pipe Scale	Pipe Matrix Value[b]	Does the Matrix Value Exceed Lookup Value?	
Radionuclides (pCi/g)								
Cs-137	0.053 (<BG)	6.2	1,460[c]	1,460[c]	No	--	--	--
U-233/234 (isotopic)	3.03	1.1	1.1	1.1	Yes	0.245 (<BG)	No	--
U-235 (isotopic)	0.109 (<BG)	1	1	1	No	--	--	--
U-238 (isotopic)	2.15	1.1	1.1	1.1	Yes	0.174 (<BG)	No	--
COPC	**Maximum Result (mg/kg)**	**Remedial Action Goals (mg/kg)**			**Does the Maximum Result Exceed Lookup Value?**	**Matrix Results**		**Does the Maximum Soil and Pipe Result Pass RESRAD Modeling?**
	Pipe Scale	**Direct Exposure**	**Soil Standards for Groundwater Protection**	**Soil Standards for River Protection**	**Pipe Scale**	**Pipe Matrix Value[b]**	**Does the Matrix Value Exceed Lookup Value?**	
Nonradionuclides (mg/kg)								
Antimony[d]	10.2	32	5.0[e]	5.0[e]	Yes	0.825 (<BG)	No	--
Arsenic[f]	91.1	20[e]	20[e]	20[e]	Yes	7.371 (<BG)	No	--
Barium	139	5,600	132[e]	224	Yes	11.25 (<BG)	No	--
Boron[g]	5.4	7,200	144	--[h]	No	--	--	--
Cadmium[d]	14.1	13.9	0.81[e]	0.81[e]	Yes	1.14	Yes	Yes[i]
Chromium, total	9,670	80,000	18.5[e]	18.5[e]	Yes	782	Yes	Yes[i]
Chromium VI[g]	38.4	400[j] 2.1[k]	8	2	Yes	3.11	Yes	Yes[i]
Cobalt	34.1	1,600	32	--[h]	Yes	2.76 (<BG)	No	--
Copper	677	2,960	59.2	22.0[e]	Yes	54.8	Yes	Yes[i]
Lead	501	353[l]	10.2[e]	10.2[e]	Yes	40.5	Yes	Yes[i]
Manganese	2,060	11,200	512[e]	512[e]	Yes	166.7 (<BG)	No	--

Table 2. Comparison of Maximum Values to Action Levels (Cooling Water Pipe Tunnels, 100-C-9:4). (2 Pages)

COPC	Maximum Result (mg/kg)	Remedial Action Goals (mg/kg)			Does the Maximum Result Exceed Lookup Value?	Matrix Results		Does the Maximum Soil and Pipe Result Pass RESRAD Modeling?
	Pipe Scale	Direct Exposure	Soil Standards for Groundwater Protection	Soil Standards for River Protection	Pipe Scale	Pipe Matrix Value[b]	Does the Matrix Value Exceed Lookup Value?	
Mercury	16.5	24	0.33[e]	0.33[e]	Yes	1.34	Yes	Yes[i]
Molybdenum[g]	244	400	8	--[h]	Yes	19.7	Yes	Yes[i]
Nickel	612	1,600	32	27.4	Yes	49.4	Yes	Yes[i]
Selenium	2.4	400	5	1	Yes	0.19 (<BG)	No	--
Silver	5.8	400	8	0.73[e]	Yes	0.47 (<BG)	No	--
Vanadium	132	560	85.1	--[h]	Yes	10.7 (<BG)	No	--
Zinc	755	24,000	480	67.8[m]	Yes	60.93 (<BG)	No	--
Aroclor-1248	0.9	0.5	0.017[m]	0.017[m]	No	0.073	Yes	Yes[i]
Aroclor-1254	1.5	0.5	0.017[m]	0.017[m]	No	0.12	Yes	Yes[i]

[a] Background values are from the 90% upper confidence limit table in DOE-RL (1995).
[b] The pipe matrix value is found in the *Pipe and Contamination Matrix Reduction Calculations* (BHI 2004b). The pipe matrix factor for 2-feet (0.6-meter) steel pipe is 12.36. The pipe matrix value is equal to contaminant concentration divided by pipe matrix factor.
[c] Calculated by RESRAD, Version 6.21, using the 100 Area generic site groundwater model and assuming the entire deep zone to be contaminated.
[d] Hanford Site specific background not available. Background value is from Ecology (1994).
[e] Where cleanup levels are less than background, cleanup levels default to background (WAC 173-340-706[1][a]).
[f] The Washington state arsenic background value of 20 mg/kg (Table 2 of WAC 173-340-740) has been adopted for the 100 Area.
[g] There is no Washington state or Hanford Site background value.
[h] A river protection value cannot be calculated, because there are no published water quality criteria.
[i] *100-C-9:3 Clearwells RESRAD* calculation (BHI 2004a).
[j] Noncarcinogenic cleanup limit from WAC 173-340-740(3).
[k] Carcinogenic cleanup limit per WAC 173-340-750(3), Method B. Based on the *Calculation of Hexavalent Chromium Carcinogenic Risk* (BHI 2000).
[l] WAC 173-340-740(3) value for lead is not available. Cleanup value calculated using EPA's *Guidance Manual for the Integrated Exposure Uptake Biokinetic Model for Lead in Children*, Version D.99D (EPA 1994).
[m] Where cleanup levels are less than RDLs, cleanup levels default to RDLs (WAC 173-340-707[2]).

-- = not applicable
BG = background
RDL = required detection limit
RESRAD = RESidual RADioactivity

DATA QUALITY ASSESSMENT FOR CONFIRMATORY SAMPLING

A data quality assessment (DQA) review was performed to compare the confirmatory sampling approach and resulting analytical data with the sampling and data requirements specified by the project objectives and performance specifications. Because of the availability of analogous data for most of the areas at this site, there was no published sample design for this site. The DQA review for this site involved the evaluation of the data taken from the one sample event at 100-B-14:4 site to determine if they are of the right type, quality, and quantity to support there intended use (i.e., closeout decisions [EPA 2000]). The assessment review completes the data life cycle (i.e., planning, implementation, and assessment) that was initiated by the data process.

This DQA review was performed in accordance with BHI-EE-01, *Environmental Investigations Procedures.* Specific data quality objectives for the site are found in the *100 Area Remedial Action Sampling and Analysis Plan* (SAP) (DOE-RL 2001). The data quality requirements in the 100 Area SAP are used for assessing data from statistical sampling and do not specifically apply to the data sets resulting from the focused sampling performed for the remaining sites. However to ensure quality data sets, the 100 Area SAP data assurance requirements, as well as the validation procedures detailed in BHI-01435 (BHI 2000a) and BHI-01433 (BHI 2000b) for chemical and radiochemical analysis, are followed where appropriate.

The data quality assessment review for the 100-C-9:4 site concludes that the data are of the right type, quality, and quantity to support the intended use. Detection limits, precision, accuracy, and SDG completeness were assessed to determine if any analytical results should be rejected as a result of quality assurance and quality control deficiencies. The DQA review found the results to be accurate within the standard errors associated with the methods, including sampling and sample handling.

The confirmatory sample analytical data are stored in the Environmental Restoration (ENRE) Project Specific Database prior to archiving in HEIS and are summarized in Appendix B.

SUMMARY FOR NO ACTION

The no action decision for the 100-C-9:4 site is supported based on reviews of site history, field observations and characterization results from an analogous site, and previous investigations performed at the site during D&D activities. The maximum detected results from pipe scale at analogous locations suspected of having the greatest potential for residual contamination levels were shown to meet the cleanup objectives for direct exposure, groundwater protection, and river protection. It should be noted, however, that given the demonstrated maximum residual concentration of hexavalent chromium in the feedwater pipes, institutional controls are required to prevent an inhalation exposure pathway.

REFERENCES

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

BHI-EE-01, *Environmental Investigation Procedures*, Bechtel Hanford, Inc., Richland, Washington.

BHI, 1997a, *Application for Approval of Derived Authorized Limits for the Release of the 190-C Trenches and 105-C Process Water Tunnels at the Hanford Site: Volume 1 – Dose Assessment and Results*, BHI-00844, Rev. 1, Vol. 1, Bechtel Hanford, Inc., Richland, Washington.

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APPENDIX A

WASTE INFORMATION DATA SYSTEM GENERAL SUMMARY REPORT

Waste Information Data System

03/03/2004

General Summary Report

Site Names:	100-C-9, 100-C Area Process and Sanitary Sewer Underground Pipelines, see subsites		
Site Type:	Process Sewer	**Start Date:**	1952
Status:	Inactive	**End Date:**	1969
Operable Unit:	100-BC-2	**Coordinates:**	
Hanford Area:	100C	(E)	0.000
		(N)	0.000
		Washington State Plane	

Site Description: This site includes the underground process sewers associated with the 105-C Reactor operations. It also includes the feed pipelines to several septic systems (1607-B8, 1607-B9, 1607-B10) and the treated water pipelines from the 190-C Pump House to the 105-C Reactor.

The large twin-box process sewer pipeline is constructed of reinforced concrete with two portals measuring 6 ft tall by 4 ft wide. Approximately 3,000 meters of pipeline are associated with the 100-C-9 site; this includes miscellaneous piping that supports the 6-foot (1.8 meter) line. Approximately 2 meters of soil cover the pipeline.

Location Description The pipelines come from the 183-C Head House, Sedimentation/Filter Building, and Clearwells, and 190-C Pump House and join to form the 2,143-meter (7,032-foot) long concrete flume. The flume contains two side-by-side 4 foot by 6 foot (1.2 meter by 1.8 meter) c process sewers that eventually drained at the 132-C-2 Outfall Structure.

Process Description These pipelines carried a variety of non-radioactive waste fluids, treated cooling water (pre-reactor), and septage. This site does not include the clean water pipes, pipes otherwise identified with septic systems, or the main reactor effluent pipelines (100-C-6).

Associated Structures The buildings that discharged to the process and septic sewers are the 183-C Facilities and 190-C Pump House discharged to 1607-B8; the 105-C Reactor discharged to the 1607-B9 Septic system pipeline, and the 190-C Pump House connected to the 105-C Reactor through the treated cooling water pipelines.

Site Comment These pipelines were separated from 100-C-5 in March 2001 to allow Rejection of the clean water pipes (100-C-5) through the TPA-MP-14 process.

According to historical documentation, *Summary of 100-B/C Reactor Operations and Result wastes, Hanford Site*, WHC-SD-EN-RPT-004, Rev. 0, there was an unplanned sodium dichromate release in September 1966. A transfer pump was left running for 2 days, allowing 140,000 lbs. of sodium dichromate solution to escape through the large concrete twin box process sewer pipeline into the Columbia River. A sample of scale from the concrete flume showed 3,090 parts per million (ppm) of hexavalent chromium.

Cleanup Activities During remediation of the 116-C-1 influent/effluent pipelines, a 100-meter (110-yard) section of the concrete double-sewer flume was crushed and removed. The remedial action group plugged the open ends of the pipe with plywood. A scale sample from inside the pipe was taken and analyzed for radionuclides and chromium; the results are included in the field work section.

References:

1. J. J. Sharpe, J. K. Linville, 1/2/01 100-B/C Reactor Area Underground Pipeline Historical Information Summary, BHI-01453.
2. U.S. Atomic Energy Commission, 10/20/19 Piping- Schematic Underground Sewer and Water Lines, H-1-13050, Rev 1.
3. Dean Strom, 3/1/02 72 Inch Twin Box Process Sewer Line (100-C-9).

SubSites:

SubSite Code: 100-C-9:1

SubSite Names: 100-C-9:1, 100-C Main Process Sewer Collection Line

Classification: Accepted

Description: This sub-unit includes the process sewers servicing pre-reactor water treatment and management facilities which emptied into a 1.2 meter by 1.8 meter twin box main collection sewer that connected to the 132-C-2 Outfall structure at the river. This main collection line is approximately 1875 meter (6150 feet) in length, and includes the line from the junction with the 1607-B11 sewer pipeline east and north to the outfall. The part of the main line from the 1607-B11 junction and west will be addressed as part of 100-C-7.

SubSite Code: 100-C-9:2

SubSite Names: 100-C-9:2, 100-C Sanitary Sewer Lines

Classification: Accepted

Description: This sub-unit includes feeder pipes for the 1607-B8 and 1607-B9 septic systems (NOTE: 1607-B10 and 1607-B11 pipelines will be moved to 100-C-7 and addressed with Chromium-VI remediation). The septic tanks and associated drain fields for these systems have been remediated by excavating suspected contaminated material. As of August 2003, the ends of the feeder pipes are exposed in the side slopes of the septic tank excavations. The subsite includes al the remaining lines from the excavation to the outside walls of the originating building.

SubSite Code: 100-C-9:3

SubSite Names: 100-C-9:3, 183-C Clearwell Pipelines

Classification: Accepted

Description: This sub-unit includes the process sewer pipes surrounding the 183-C Clearwells (demolished) to the point of junction with the main process sewer collection line. The clearwells were used to store treated cooling water for the 105-C reactor. Chromium was added to the treated water at concentrations between 2-4 ppm (parts per million) as a corrosion inhibitor. The primary contaminant of concern is hexavalent chromium.

SubSite Code: 100-C-9:4

SubSite Names: 100-C-9:4, 100-C Cooling Water Transfer Pipelines and Tunnels

Classification: Accepted

Description: This sub-unit includes the Cooling Water transfer lines located in tunnels between the 190-C Pump House and the 105-C Reactor building. Six 0.6 meter (24 inch) steel pipes located in two tunnels transferred treated cooling water from the 190-C Pump House to the 105-C Reactor. The portions of the tunnels from the 190-C building to just west of the Ventilation house of each tunnel were removed with D&D of the 190-C Building. A newly discovered 30-inch- pipeline (not in a tunnel) from the 183-C to the 183-B building is also included in this subsite.
Hexavalent chromium is the primary contaminant of concern inside the pipes.
The floor of the tunnels may be radiologically contaminated with reactor fission and activation products from previous releases of reactor effluent. Radiological contamination may also exist as contaminated biological waste products (i.e. bat guano).

Waste Information:

Type: Equipment

Category: Unknown

Physical State: Solid

Waste Obscured: Soil Overburden

Description: The site is the non-radioactively contaminated process and septic sewer pipelines associated with the 105-C Reactor operations. The 1607-B9 septic system serviced the 105-C Reactor and thus may be radioactively contaminated. Any contamination still associated with these pipelines is expected to be in residual amounts.

Chemical additives to the reactor cooling water included aluminum sulfate (alum) with excess hydrated calcium oxide, sulfuric acid, chlorine, and sodium dichromate. Water pH was maintained at about 7.5, the free chlorine residual was approximately 0.2 milligrams/liter, and sodium dichromate was added at a rate of about 2 milligrams/liter. (NOTE: Reference: *WHC-SD-EN-TI-169 is for 100-F,* and applies equally to 100-C).

References:

1. D. H. DeFord, 07/06/93, *100-F Reactor Site Technical Baseline Report Including Operable Units 100-FR-1 and 100-FR-2*, WHC-SD-EN-TI-169, Rev 0.
2. J. J. Sharpe, J. K. Linville, 1/2/01, *100-B/C Reactor Area Underground Pipeline Historical Information Summary*, BHI-01453.

Field Work:

Type: Analytical Sampling

Begin Date: 01/16/2002

End Date: 01/16/2002 **Data Repository:** HEIS

Purpose: Characterize pipe for future remediation

Comment: Samples B13Y04 and B13Y02-A were taken of scale from inside the pipe.
The results are (in picoCuries per gram except as noted):
Am-241: 1.1 (undetected)
Co-60: 1.25
Cs-137: 4.75
Eu-152: 7.68
Eu-154: 1.3 (undetected)
Eu-155 : 0.31 (undetected)
Pu-238: 1.2 (undetected)
Pu-239/240: 1.2 (undetected)
Sr-90: 0.69 (undetected)
U-235: 0.128 (undetected)
U-233/234: 1.06 (undetected)
U-235: 0.128 (undetected)
U-238: 1.59
hexavalent chromium: 3,090 parts per million.

Based on the sample results, the analytes of concern are Eu-152, U-238, and hexavalent chromium.

References:

1. Dean Strom, 3/1/02 72 Inch Twin Box Process Sewer Line (100-C-9).

Regulatory Information:

Programmatic Responsibility

DOE Program: **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: Inactive Contaminated Structure

This site was consolidated with:

Reason:

Permitting

RCRA Part B Permit: No

TSD Number:

RCRA Part A Permit: No

Closure Plan: No

RCRA PermitStatus:

Septic Permit: No

216/218 Permit: No

Inert LandFill: No

NPDES: No

State Waste Discharge Permit: No

Air Operating Permit: No

Tri-Party Agreement

Lead Regulatory Agency: EPA

Unit Category: CERCLA Past Practice (CPP)

TPA Appendix: C

Remediation and Closure

Decision Document:

Decision Document Status:

Remediation Design Group:

Closure Document:

Closure Type:

Post Closure Requirements:

Residual Waste:

APPENDIX B

100-C-9:4 DATA SUMMARY TABLES

105-B Reactor Valve Pit Radionuclide Data Summary (100-C-9:4)

Sample Area	HEIS Number	Sample Date	Americium-241			Americium-241 GEA			Cesium-137			Cobalt-60			Europium-152			Europium-154		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Main	J012K1	11/04/03	0.034	U	0.056	0.072	U	0.072	0.053		0.02	0.02	U	0.02	0.053	U	0.053	0.058	U	0.058
Equipment Blank	J012K3	11/04/03	0.052	U	0.4	0.016	U	0.016	0.011	U	0.011	0.012	U	0.012	0.027	U	0.027	0.035	U	0.035

Sample Area	HEIS Number	Sample Date	Europium-155			Gross alpha			Gross beta			Potassium-40*			Radium-226*			Radium-228*		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Main	J012K1	11/04/03	0.054	U	0.054	4.6		4.1	2.69	U	5.5	0.27	U	0.27	0.226		0.039	0.13	U	0.13
Equipment Blank	J012K3	11/04/03	0.024	U	0.024	0.516	U	2.2	5.75		5	3.21		0.11	0.118		0.021	0.158		0.057

Sample Area	HEIS Number	Sample Date	Thorium-228 GEA*			Thorium-232 GEA*			Uranium-235 GEA			Uranium-238 GEA		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Main	J012K1	11/04/03	0.044		0.021	0.13	U	0.13	0.093		0.082	2.65		2.5
Equipment Blank	J012K3	11/04/03	0.16		0.013	0.158		0.057	0.04	U	0.04	1.5	U	1.5

Sample Area	HEIS Number	Sample Date	Uranium-233/234			Uranium-235			Uranium-238		
			pCi/g	Q	MDA	pCi/g	Q	MDA	pCi/g	Q	MDA
Main	J012K1	11/04/03	3.03		0.14	0.109		0.17	2.15		0.14

Note:
*Potasium-40, Radium-226, Radium-208, Thorium 228, and Thorium-232 are not evaluated based on environmental fate decay rates and analogous site information (BHI 2003c).

Acronyms

B	=	blank contamination
C	=	low-level detect
D	=	diluted
GEA	=	gamma energy analysis
HEIS	=	Hanford Environmental Information System
I	=	interference during analysis
J	=	estimate
MDA	=	minimum detectable activity
OS	=	other solids
PQL	=	practical quantitation limit
Q	=	qualifier
SVOA	=	semivolatile organic analyses
TCLP	=	toxicity characteristic leachate procedure
U	=	undetected

105-B Reactor Valve Pit Inorganics Data Summary (100-C-9:4)

Sample Area	HEIS Number	Sample Date	Aluminum			Antimony			Arsenic			Barium			Beryllium			Boron		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Main	J012K1	11/04/03	11600		26.2	10.2		1.6	91.1		2.4	139		0.11	0.22	U	0.22	5.4		1.2
Equipment Blank	J012K3	11/04/03	59		4.5	0.28	U	0.28	0.4	U	0.4	0.98		0.02	0.04	U	0.04	0.21	U	0.21

Sample Area	HEIS Number	Sample Date	Cadmium			Calcium			Chromium			Cobalt			Copper			Hexavalent Chromium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Main	J012K1	11/04/03	14.1		0.22	446		17.4	9670		0.56	34.1		0.67	677		0.67			
Main	J012K2	11/04/03																38.4		0.35
Equipment Blank	J012K3	11/04/03	0.04	U	0.04	21.8		3	0.48		0.1	0.12	U	0.12	0.15		0.12	0.4	U	0.4

Sample Area	HEIS Number	Sample Date	Iron			Lead			Magnesium			Manganese			Mercury			Molybdenum		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Main	J012K1	11/04/03	548000		88.9	501		1.1	116		3.9	2060		0.17	16.5		0.35	244		1.1
Equipment Blank	J012K3	11/04/03	124		1.9	0.38		0.18	8.3		0.67	3.2		0.03	0.02	U	0.02	0.18	U	0.18

Sample Area	HEIS Number	Sample Date	Nickel			Potassium			Selenium			Silicon			Silver			Sodium		
			mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL	mg/kg	Q	PQL
Main	J012K1	11/04/03	612		1.1	26.4		13.2	2.4		1.6	1780		3	5.8		0.45	19.4		4
Equipment Blank	J012K3	11/04/03	1.1		0.19	28.5		2.3	0.28	U	0.28	56.8		0.52	0.08	U	0.08	9		0.68

Sample Area	HEIS Number	Sample Date	Vanadium			Zinc		
			mg/kg	Q	PQL	mg/kg	Q	PQL
Main	J012K1	11/04/03	132		0.5	755		1.5
Equipment Blank	J012K3	11/04/03	0.09	U	0.09	1.1		0.25

105-B Reactor Valve Pit Organics Data Summary (100-C-9:4)

Constituent	J012K1 Sample Area Main Sample Date 11/4/03			J012K3 Equipment Blank Sample Date 11/4/03		
	µg/kg	Q	PQL	µg/kg	Q	PQL
PCB Data						
Aroclo-1016	140	U	140	13	U	13
Aroclor-1221	140	U	140	13	U	13
Aroclor-1232	140	U	140	13	U	13
Aroclor-1242	140	U	140	13	U	13
Aroclor-1248	900		140	13	U	13
Aroclor-1254	1500		140	13	U	13
Aroclor-1260	140	U	140	13	U	13

PCB = polychlorinated biphenyl