Appendix J

Alternative Development Supporting Documentation

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J.1 Waste Site Descriptions

This appendix provides description of the 100-D/H waste sites identified for further action (through either interim actions or remaining for remedial action under the Record of Decision [ROD]). Risk drivers associated with the waste sites have been determined based on knowledge of the process that was performed at the sites and remediation results at similar sites in the River Corridor. Table J-1 provides descriptions of the waste sites identified for further, and identifies the contaminants and basis for action (where there are risks) associated with the waste sites remediated under interim actions. Table J-2 is a subset of Table J-1 that shows those sites that have groundwater/surface water protection as a basis for action.

A total of 59 waste sites are currently or anticipated to be remediated under *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 (100 Area Remaining Sites)*(EPA/ROD/R10-99/039), or are anticipated to be in progress by the time the ROD is signed. For the protection of human health, preliminary remediation goals (PRG) were developed based on direct contact as well as groundwater and surface water protection. The direct contact PRGs were set as the lower of the interim action cleanup values or the risk-based calculations. Site-specific data have been used to develop PRGs for groundwater and surface water protection. For protection of ecological receptors, PRGs were developed in *River Corridor Baseline Risk Assessment, Volume I: Ecological Risk Assessment* (DOE/RL-2007-21) and presented in Table 8-2. It is expected that interim actions will achieve the required clean-up levels and that no additional actions will be required

There are 52 waste sites expected to be remediated after the ROD is issued. These sites are evaluated for remedial alternatives in the FS. Risk drivers have been determined based on knowledge of the process that was performed at the sites and remediation results at similar sites in the River Corridor (Table J-1). Table J-3 provides additional information for each waste site evaluated in the development of alternatives and summarizes the remedial approaches for the major risk drivers developed for each alternative.

Details regarding the development of cost estimates are presented in *100-DH Cost Estimate Scoping Forms for Feasibility Study Alternative Costing* (ECF-100DR1-12-0022) and *Environmental Cost Estimate for 100 D/H Vadose Zone and Groundwater RI/FS* (ECE-100HR311-00004).

J.2 References

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Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
Waste Sites to be Remediated under Interim Actions						
100-D-100	Unplanned release	This site is contaminated soil near the former sodium dichromate acid railcar and truck unloading station (100-D-12). The waste is hexavalent chromium-contaminated soil.	X	X	X	Cr(VI) and total Cr.
100-D-104	Unplanned release	The site consists of stained soils near the former external sodium dichromate storage tank and acid French drain outside of the 185-D facility.	X	X	X	Cr(VI) and total Cr.
100-D-14	Septic Tank	The site is a concrete tank with drain field that received sanitary sewage from the 105-DR Reactor construction badgehouse before relocation. The site appears as a vegetation-covered field. A small depression may indicate the presence of the tank. A 10 cm (4-in.) cement pipe is likely to be a vent pipe to the drain field. The site is adjacent to a small soil pile.	X	X		Nitrate.
100-D-30	Unplanned Release	Sodium dichromate contamination was discovered in the soil along the entire length of the 185-D Sodium Dichromate Trench. Contamination existed in the soil and concrete rubble remaining after demolition of the 185-D Building. The 185-D Building contained sodium dichromate mixing tanks and a pipe trench that were used to prepare and convey sodium dichromate solutions to be added to the process water in the large 190-D Building storage tanks.	X	X	X	Cr(VI).
100-D-31:11	Process Sewer	The 100-D-31:11, 182-D and 183-D process and sanitary sewer pipelines, transported effluents from the east side of the 182-D building and the west side of the 183-D Building. The 100-D-31:11 pipelines transported the wastewater to the 100-D-31:8 pipelines.	X	X		Metals (barium, copper, cadmium, Cr (total), lead, nickel, zinc, and mercury) and PAHs (benzo(a)pyrene, dibenz(a,h)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, and chrysene) assumed based on similar process and sanitary sewers.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-D-31:12	Process Sewer Pipelines	The 100-D-31:12 process sewer pipelines serviced the west side of the 183-D Building and discharged to the 100-D-31:11 process sewer pipelines.	X	X		Metals (barium, copper, cadmium, Cr (total), lead, nickel, zinc, and mercury) and PAHs (benzo(a)pyrene, dibenz(a,h)anthracene, benzo(b)fluoranthene, benzo(k)fluoranthene, indeno(1,2,3-cd)pyrene, and chrysene) assumed based on similar process and sanitary sewers.
100-D-50:1	Process Sewer	Abandoned underground pipelines carried treated and untreated wastewater from the 183-DR Building, the 183-DR Clearwells, the 190-DR facility, and the 105-DR Reactor to the 100-D-8 Outfall.	X	X	X	Metals, Cr(VI), cobalt-60, cesium-137, europium-152, europium-154, europium-155, strontium-90, carbon-14, tritium, Ni-63, PAHs, PCBs.
100-D-50:4	Process Sewer	This subsite consists of steel gas recirculation piping between the 115-D/DR facility and the 105-DR Reactor. The piping was located in tunnels that have since been demolished, but the disposition of the piping was not well documented.	X	X	X	cobalt-60, cesium-137, europium-152, europium-154, strontium-90, lead, metals, PCBs, PAHs, carbon-14, tritium, europium-155.
100-D-50:6	Process Sewer	This subsite includes the 183-DR clearwell pads and three functional groups of piping at the 183-DR Clearwells: 1) process piping used to deliver water from the filter building to the clearwells, 2) process piping used to deliver water from the clearwells to 190-DR Pumphouse, and 3) drain piping servicing the clearwells and pumphouse floor drains and discharging to the 100-D-50:1 Emergency Discharge Pipeline.	X	X	X	Metals (including mercury and Cr(VI)) and PCBs.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-D-50:7	Process Sewer	This subsite includes the pipelines that provided drainage for the 183-DR Coagulation Basins, floor drains, and catch basins at the 183-DR Head House, and mixing tanks in the vicinity of the 186-D Waste Acid Reservoir. These pipelines ultimately discharged to the 100-D Area process sewer systems.	X	X	X	Metals (including Cr(VI)), pesticides, and PCBs.
100-D-50:8	Process Sewer	This subsite is an asbestos-cement pipeline that connected the 117-DR HEPA Filter Building to the 116-DR-8 Seal Pit Crib.	X	X	X	Metals and Cr(VI).
100-D-50:9	Process Sewer	The 100-D-50:9 subsite encompasses two functional inter-connected pipeline groups: (1) an overflow drain line for the high tower and (2) residual sanitary sewer lines. Both pipeline functional groups discharged into the 100-D-13 septic tank.	X	X		PAHs.
100-D-62	Septic Tank	Site includes a septic tank with a capacity of 2,271 L (600 gal), a drain field, and related piping. 100-D-62 serviced the 183-DR Building.	X	X		Chromium, mercury, lead, anions, SVOCs, pesticides, PCBs.
100-D-65	Outfall	The site is the concrete spillway (also referred to as a flume) that led from the 116-D-5 Outfall Structure and terminated at the river shoreline.	X	X	X	MFP.
100-D-66	Outfall	The site is the concrete spillway (also referred to as a flume) that led from the 116-DR-5 Outfall Structure and terminated at the river shoreline.	X	X	X	MFP.
100-D-69	Unplanned Release	This site consists of suspect sodium dichromate-contaminated concrete on a foundation. The soil is also potentially contaminated. The source of contamination is unknown.	X	X	X	To be determined based on confirmatory evaluation. Potential Cr(VI) contamination in soil assumed to be limited to shallow soil.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-D-71	Laboratory	The site consists of subsurface components of the 195-D Vertical Safety Rod Tower (tower was demolished in 1995). It is unknown if the related components remain in the ground. The site had a 1.2 m (4 ft) diameter by 2.2 m (7 ft) deep concrete drywell, a below grade pit approximately 30.5 cm (12 in.) square, and a 7.6 cm (3 in.) diameter underground cast iron pipe.	X	X		Mercury, metals, PCBs, TPH, PAHs.
100-D-72	Process Unit Plant	The waste site consists of multiple components on the south side of the 183-D Head House. All activities associated with the waste site are related to the unloading, storage, and use of acid to support water treatment in the 183-D Facility.	X	X		To be determined based on confirmatory evaluation. Potential remediation assumed to include residual physical structures and shallow underlying soil.
100-D-73	Process Unit/ Plant	The site consist of soil and the remaining demolition footprint for the former 108-D Building. This building was used to store and mix sodium dichromate.	X	X	X	Cr(VI) (suspected)
100-D-75:2	Electrical Substation	Subsite consists of the 152-E1-D substation near the 181-D Pumphouse.	X	X		To be determined based on confirmatory evaluation. Potential PCB contamination assumed to be limited to surficial soils.
100-D-76	Crib	The waste site is either a French drain or crib, representing an alternate possible location for the 116-D-3 site. Historical documentation, a construction drawing, and ground-penetrating radar results indicate this crib may remains near the southeast corner of the 108-D Building. This site may have received 0.08 Ci of Cs-134 and 30,000 L of effluent.	X	X	X	Cr(VI) (collocated with the 100-D-73 waste site).

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-D-77	Process Unit/ Plant	The waste site consists of the 183-DR Acid Facility, 183-DR Head House, the six 183-DR Flocculation Basins, the six 183-DR Sedimentation Basins, and the 183-DR Filter Building, all of which were components of the cooling water treatment system that supported the 105-DR Reactor. These components are of interest because they stored, mixed, or processed liquid contaminants of concern, especially sodium dichromate and sulfuric acid.	X	X	X	Mercury and Cr(VI) (suspected).
100-D-78	Dumping Area	The site consists of four areas of yellow-stained soils between the 183-D and 186-D Buildings. The staining is near the acid trench and waste acid reservoir.	X	X		Solid hazardous wastes, elevated metals concentrations (arsenic, beryllium, cadmium, cobalt, chromium, copper, mercury, manganese, nickel, lead, vanadium, zinc) and low pH levels.
100-D-8	Outfall	The outfall was constructed in 1949 as a spillway for the 100-D-50:1 pipeline. The pipe discharged into a concrete box flume at a headwall that spilled onto a grouted riprap surface and extended about 13 m beyond the low water level of the Columbia River. The headwall and upper portion of the spillway were demolished and covered in 1978.	X	X		carbon-14, cobalt-60, cesium-137, europium-152, europium-154, europium-155, tritium, strontium-90, metals, PCBs, PAHs, pesticides.
100-D-80:2	Dumping Area	This subsite consists of a suspect valve box with possible asbestos insulation.	X	X		Asbestos.
100-D-81	Dumping Area	This site consists of eight areas that contain burned areas, stained soil, scattered concrete, oil staining, and/or quartz sand.	X	X		PAHs, TPH, PCBs.
100-D-83:1	Product Piping	Pipeline segments associated with the former 183-DR acid treatment facility.	X	X		Lead, mercury, sulfate.
100-D-83:2	Product Piping	Pipeline segments associated with the 100-D-50:7 subsite that were not included in that subsite.	X	X	X	Metals, Cr(VI), PCBs.
100-D-83:3	Product Piping	Pipeline segments associated with the 108-D acid addition facility, including a sulfuric acid pipeline and process sewer connection.	X	X		Lead, mercury, sulfate.

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Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-D-83:5	Product Piping	Pipeline segments not previously addressed with other sites. Includes treated water pipelines associated with the 186-D facility and cooling water pipelines in tunnels between the 190-D and 105-D buildings.	X	X		Lead, mercury, sulfate.
100-D-84:2	Sanitary Sewer	Subsite includes two separate pipelines: 1) inlet sewer from the 181-D Pumphouse to the 1607-D5 septic system and 2) the former sewer between the 1607-D2 septic tank (1607-D2:4) and the original drain field (1607-D2:1).	X	X		Lead, pesticides, PAHs, PCBs, PAHs.
100-D-85:2	Radioactive Process Sewer	Subsite consists of suspect radioactive liquid effluent sewer segments around the 105-DR Fuel Storage Basin not previously addressed by the 100-D-49 site.	X	X		MFP, Cr(VI), lead, mercury, PCBs.
100-D-86:1	Process Sewer	This subsite consists of steel gas recirculation piping between the 115-D/DR facility and the 105-D Reactor. The piping was located in tunnels that have since been demolished, but the disposition of the piping was not well documented.	X	X		cobalt-60, cesium-137, europium-152, europium-154, strontium-90, lead, metals, PCBs, PAHs, carbon-14, tritium, europium-155.
100-D-86:3	Process Sewer	This subsite consists of process sewer pipeline segments on the western side of the former 105-DR fan room and Large Sodium Fire Facility.	X	X	X	Cr(VI), anions.
100-D-97	Storage Tank	This site consists of the underlying soil, a potential fuel UST, and associated fuel oil supply and fuel oil return piping (1.27 cm [1.5-in.] diameter). It is believed that these items were removed in 1985/1986 as part of the 100-D/DR general demolition efforts. It now appears as a cobble-covered field with vegetation on the surface.	X	X		PAHs, TPH, VOCs, PCBs, lead.
100-D-99	Septic Tank	The site is a possible septic system and the underlying soils.	X	X		To be determined based on confirmatory evaluation. Site is believed to be water valves only, but remediation of a possible sanitary sewer system has been considered.

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Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-H-28:2	Process Sewer	The 100-H-28:2 subsite consists of vitrified clay, reinforced concrete, and cast iron process sewer lines formerly servicing parts of the 105-H Reactor Building, 190-H Pumphouse, 183-H clearwells and pumphouse, and miscellaneous 1700-series buildings east of the 190-H Pumphouse. These process sewers formerly discharged to the 1906-H lift station, which then pumped wastes to the 116-H-5, 1904-H Outfall.	X	X	X	MFP, carbon-14, metals, PAHs, & PCBs.
100-H-28:3	Process Sewer	The 100-H-28:3 subsite consists of vitrified clay, reinforced concrete, and cast iron process sewer lines formerly servicing the 184-H Power House, 182-H Reservoir, and the northern part of the 183-H facility. These process sewers formerly discharged to the 100-H-28:2 sewer.	X	X	X	Cr(VI), metals, PAHs, sulfate, PCBs.
100-H-28:4	Process Sewer	The 100-H-28:4 subsite consists of those vitrified clay pipelines that formerly carried sanitary wastes to the 1607-H1 septic system. These sewers formerly serviced the 105-H Reactor Building, 190-H Pumphouse, and 151-H Electrical Substation.	X	X	X	Metals, PAHs, PCBs, pesticides.
100-H-28:5	Process Sewer	The 100-H-28:5 subsite consists of those vitrified clay pipelines that formerly carried sanitary wastes to the 1607-H2 septic system. These sewers formerly serviced the 182-H Reservoir pumphouse, 183-H Filter Plant, 184-H Power House, 190-H Pumphouse, and 1700-series buildings east of the 190-H Pumphouse.	X	X	X	Metals, PCBs, pesticides, PAHs.
100-H-42	Pump Station	The site consists of the former 1906-H lift station, including the underground reinforced-concrete flume/reservoir filled with building rubble and clean soil, as well as associated piping not included in other pipeline sites. The concrete structure may be in contact with surrounding soil contaminated by past leaks from the structure. This site also includes potential residual piping between the former 1908-H facility and the 116-H-5 Outfall site.	X	X		MFP, carbon-14, metals, PAHs, PCBs.
100-H-43	Foundation	This site consists of the belowgrade remnants of the 1716-H Maintenance Garage following its demolition and site leveling in 1974. The facility was used to service the area vehicles.	X	X	X	Metals, PCBs, SVOCs, TPH, PAHs.

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Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-H-44	Process Unit/ Plant	This site consists of residual features and potentially contaminated soil associated with the 183-H Neutralization Pit. The Neutralization Pit received sulfuric acid from two storage tanks and one acid head tank and lime slurry from the 183-H Head House.	X	X	X	Lead and mercury.
100-H-46	Process Unit/ Plant	This site consists of potentially contaminated soils, concrete structures, and drainpipes that were beneath the sodium dichromate process equipment, piping, unloading dock, and railroad spur. This site is within the footprint of the 190-H Pumphouse, which was demolished and removed to 1 m (3 ft) below grade in 1977.	X	X		Cr(VI), chromium, lead, mercury.
100-H-48	Product Piping	The site consists of potentially remaining fuel oil piping that was associated with two former fuel oil USTs that supported the 184-HA Boilerhouse Building. Potentially, fuel oil piping and contaminated underlying soil could be remaining.	X	X		TPH, PAHs, PCBs.
100-H-49:1	French Drain	This subsite consists of four French drains around the former 184-H and 1717-H facilities.	X	X	X	Metals, mercury, Cr(VI), PAHs, PCBs, pesticides, TPH.
100-H-51:1	Process Sewer	The 100-H-51:1 subsite consists of a VCP sanitary sewer segment. The line connected the 1703-H building with the 100-H-28:5 sanitary sewer.	X	X		Metals, pesticides, SVOCs, anions, PAHs, PCBs.
100-H-51:2	Process Sewer	The 100-H-51:2 subsite consists of a cement asbestos feed line that ran from the 117-H Air Filter Building to the 116-H-9 seal pit crib.	X	X		MFP, metals, Cr(VI), PCBs.
100-H-51:3	Process Sewer	The 100-H-51:3 subsite consists of two parallel pipelines: a steel brine discharge line and a steel filtered water line that ran from the 184-H Power House Building to the 184-H Salt Dissolving Pit and Brine Pump House. Filtered water was piped from the 184-H Power House to the 184-H Salt Dissolving Pit and Brine Pump House where sodium chloride was added and the brine was pumped back to the 184-H Power House for further use.	X	X		Metals, sulfate, nitrate, PAHs.
100-H-52	Septic Tank	The site consists of a drain field and associated piping that supported the 184-HA Boiler Annex. The waste is remaining pipelines and any potentially contaminated soil.	X	X		PAHs, PCBs, TPH, metals.

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Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
116-DR-3	Trench	The site consists of a trench that received water and sludge pumped from the fuel storage basin via an over ground pipeline.	X	X	X	MFP, Cr(VI).
118-D-2:1	Burial Ground	This site contained several trenches that trend east to west and five pairs of disposal pits. The site was the primary burial ground for the disposal of 105-D Reactor operations waste, including irradiated dummies, splines, rods, thimbles, and gun barrels. The metallic waste disposed of in the waste site consists of 16,329 kg (35,924 lb) of aluminum tubes, 36,287 kg (79,831 lb) of aluminum spacers, 89,040 kg (195,888 lb) of lead poison slugs, 3,719 kg (8,182 lb) of cadmium poison slugs, 54 kg (119 lb) of graphite, 14 kg (31 lb) of desiccant, 5,987 kg (2,721 lb) of aluminum poison slugs, 816 kg (371 lb) of boron poison splines, 58,966 kg (26,803 lb) of lead, and 16,329 kg (7,422 lb) of miscellaneous metallic waste. Large volumes of water were required to extinguish a fire at this site in 1960.	X	X		MFP, metals, PAHs.
118-D-2:2	Burial Ground	This site contained several trenches that trend east to west and five pairs of disposal pits. The site was the primary burial ground for the disposal of 105-D Reactor operations waste, including irradiated dummies, splines, rods, thimbles, and gun barrels. The metallic waste disposed of in the waste site consists of 16,329 kg (35,924 lb) of aluminum tubes, 36,287 kg (79,831 lb) of aluminum spacers, 89,040 kg (195,888 lb) of lead poison slugs, 3,719 kg (8,182 lb) of cadmium poison slugs, 54 kg (119 lb) of graphite, 14 kg (31 lb) of desiccant, 5,987 kg (2,721 lb) of aluminum poison slugs, 816 kg (371 lb) of boron poison splines, 58,966 kg (26,803 lb) of lead, and 16,329 kg (7,422 lb) of miscellaneous metallic waste. Large volumes of water were required to extinguish a fire at this site in 1960.	X	X		MFP, metals, PAHs.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
118-D-3:1	Burial Ground	The 118-D-3:1 subsite consists of the primary burial ground. This site contains multiple trenches oriented east and west. The burial ground was the primary disposal site for 105-DR Reactor operations waste, including irradiated dummies, splines, rods, thimbles, and gun barrels. The site also contained a burning pit used to dispose of low-level radioactive combustible materials. The eastern boundary was used for the disposal of 100-N Area solid wastes. The waste site received 23.8 tons of lead, 97 tons of aluminum, 137.7 tons of lead/cadmium, 1 ton of boron, and 0.06 ton of graphite.	X	X		MFP, metals, PAHs.
118-D-3:2	Burial Ground	The 118-D-3:2 subsite consists of anomaly staging areas and a suspect spent nuclear fuel bunker area used during remediation of the 118-D-3:1 subsite.	X	X		MFP, metals, PAHs.
126-DR-1	Dumping Area	The site location originally contained four 1.42E+07 L (3.75E+06 gal) steel water tanks that have been removed. After removal of the metal tanks, the site was used as a dumping area for demolition and inert waste from demolished facilities, including rubble from released portions of the 115-D/DR facility, and some rubble from the 183-DR facility.	X	X		Metals, Cr(VI), PCBs, and asbestos.
126-H-2	Dumping Area	Former water storage clearwell for the 183-H facility. The eastern clearwell was later used for disposal of demolition debris.	X	X		MFP, technetium-99, Cr(VI).
132-H-3	Pump Station	This site was the 1608-H pump station, which received water from reactor building drains and the fuel storage basin. Water was then pumped to either the 116-H-2 Disposal Trench or the 116-H-7 retention basin. Site was decontaminated, decommissioned, and demolished partly in-place in 1987.	X	X	X	MFP.
1607-D2:5	Septic Tank	The 1607-D2:5 subsite consists of a pipeline segment that was not previously included in other subsites, extending from the end of the 1607-D2:3 pipeline (approximately at the perimeter road) north to the 1607-D2:2 subsite.	X	X		Metals.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
Waste Sites Remaining for Remedial Action						
100-D-10	Depression/Pit (nonspecific)	This site is a former outfall in the river embankment upstream of the 100-D-8, 1907-DR outfall.	X	X		To be determined based on confirmatory evaluation.
100-D-101	Sump	The site consists of four chemical storage tanks, an acid neutralization pit/sump, a sodium silicate sump, two sets of pumps, and a car spot. All located to the west of the 108-D building. Two chemicals were stored near 108-D, sulfuric acid and sodium silicate, which each had its own set of two large storage tanks.	X	X	X	To be determined based on confirmatory evaluation. Potential leakage and/or spillage of acid and sodium dichromate to soils assumed to be limited to relatively small volumes of shallow soil.
100-D-102	Unplanned release	Suspect effluent leak adjacent to 107-DR basin.	X	X		To be determined based on confirmatory evaluation. Potential cesium-137, cobalt-60, europium-152, europium-154, strontium-90, and Cr(VI) contamination in soil.
100-D-103	French Drain	Suspected trench and French drain from 116-D-8 cask pad.	X	X		To be determined based on confirmatory evaluation. Potential cesium-137, cobalt-60, europium-152, europium-154, strontium-90, and metals contamination expected to be limited to former trench and French drain and immediately underlying soil.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-D-25	Unplanned Release	Site is located beneath the 107-DR Retention Basin. Release is the result of retention basin leaks. The effluent volume release is unknown.	X			This site is carrying forward based on the RI risk evaluation on verification samples identifying the shallow decision unit containing cesium-137, and the deep decision unit containing cesium-137 and europium-152, at concentrations greater than the residential RBSL.
100-D-50:2	Process Sewer	This subsite consists of steel piping used to deliver treated cooling water from the 183-DR clearwells to the 190-DR Pumphouse and from the pumphouse to the 105-DR Reactor.	X	X		Metals and Cr(VI).
100-D-52	French Drain	Designed to receive condensate or cooling water leakage from the concrete enclosure for the 105-D Downcomer. Volume and inventory are not documented.	X	X	X	Site is being considered for potential residual Cr(VI) contamination only.
100-D-59	French Drain	This French drain received overflow sulfuric acid from railroad car transfer operations. Any waste acid was assumed to be neutralized in the Hanford Site's alkaline soil. Therefore, the site was previously rejected as a waste site, but is being reconsidered for potential mercury cross-contamination of sulfuric acid.	X	X		To be determined based on confirmatory evaluation. Site is being reconsidered for potential mercury contamination in former sulfuric acid disposal; contamination assumed to be limited to former French drain and underlying soil.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-D-63	Product Piping	The site encompasses the clean water pipelines upstream of the 100-D and 100-DR Reactors, including underground pipelines used to transport raw, fire, export, and sanitary water from the river pumphouse, to the water treatment facilities and to 100-D facilities and fire hydrants. Site does not include pipelines that carried water treated with hexavalent chromium. Site also includes pipelines associated with the PFE. The PFE project, a light-water reactor test facility, was cancelled prior to construction. The design of the PFE-related facilities included an aboveground oil pipeline and a process sewer extension. These pipelines are shown on design drawings but were never built. They are included with the 100-D-63 service water pipelines site in order to document that they were never constructed and require no action.	X	X		To be determined based on confirmatory evaluation. Potential contaminants expected to be limited to metals in pipe scale.
100-D-75:1	Electrical Substation	Subsite is the 151-D Primary Electrical Substation.	X	X		Assumed PCB contamination in shallow soils.
100-D-96	French Drain	The site consists of seven French drains, one dry well location, and their underlying soil. Each of the facilities with which the French drains are associated were nonradioactive buildings.	X	X		To be determined based on confirmatory evaluation. Potential PAH and metals contamination assumed to be limited to French drain and underlying soils.
100-D-98:1	Electrical Substation	This site consists of two active (C4-S17 and 152-D1-D) electrical substations and underlying soil.	X	X		To be determined based on confirmatory evaluation. Potential PCB contamination assumed to be limited to surficial soils.
100-H-28:7	Process Sewer	The 100-H-28:7 subsite consists of filtered/treated water supply lines originating at the 183-H Filter Plant, connecting to the 105-H, 182-H, 184-H, 187-H, and 190-H facilities.	X	X		To be determined based on confirmatory evaluation. Potential contaminants expected to be limited to metals in pipe scale.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-H-36	Outfall	The site is an underground concrete emergency overflow spillway (also referred to as a flume) that led from the 116-H-5 Outfall Structure to the river shoreline. The spillway could have received reactor coolant effluent when the 100-H-34 River Pipelines were blocked, damaged, or undergoing maintenance.	X	X	X	Potential mixed fission products (cesium-137, cobalt-60, europium-152, europium-154, and strontium-90), metals (lead, mercury, and Cr (total)), and Cr(VI) in exposed concrete.
100-H-38	Burial Ground	The site consists of an area approximately 3 acres in size and is marked by ground scars resembling trenches and pits. The site is situated along a natural depression on the western boundary of the 100-H Area perimeter fence.	X	X		To be determined based on confirmatory evaluation. Potential for solid hazardous waste with corresponding soil metals and PAH contamination in a large area.
100-H-5	Burial Ground	Site contained unknown amount of sludge removed from the 116-H-7 Retention Basin in 1953.	X	X	X	Site is being considered for potential residual Cr(VI) contamination only.
100-H-57	Foundation	This site encompasses the former underground piping, valves, and sumps at the bases of the two elevated water towers for the 105-H Reactor.	X	X		To be determined based on confirmatory evaluation. Potential Cr(VI) contamination assumed to be limited to shallow soil in footprint of former water towers.
100-H-58	Contamination Migration	This site consists of contaminated mud dauber wasp nests on power poles. Contamination is associated with sediment from the 105-H Fuel Storage Basin.	X			Potential cesium-137, cobalt-60, europium-152, europium-154, strontium-90 in wasp nests on (presently active) power poles.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
116-D-8	Storage	Concrete pad with two drains that stored shipping and handling casks and is covered with grey grout.	X	X		MFP, chromium, Cr(VI), lead, mercury, PCBs.
116-DR-9	Retention Basin	Site was an open concrete basin that retained cooling water effluent from the 118-DR-2 (105-DR Reactor) for radioactive decay and thermal cooling before release to the Columbia River. Also received ruptured fuel element waste after 1954. Total radionuclide inventory in the vicinity ranged from 5 to 400 Ci.	X			This site is carrying forward based on the RI risk evaluation on verification samples identifying the shallow decision unit containing cesium-137, and the deep decision unit containing cesium-137 and europium-152, at concentrations greater than the residential RBSL.
118-DR-2:2	Reactor	This subsite includes the 105-DR Reactor belowgrade structures and underlying soils. It was divided into five zones and the ISS decon areas. Zone 1 consists of the 400 Fuel Storage Basin, 410 Storage and Transfer Area, 412 Storage Area, the 413 Transfer Bay, and the soils underlying the fuel storage basin. Zone 2 consists of the valve pit that received wastewater from the reactor. Zone 3 consisted of the 228c solids feed area, the north water tunnel, and the trench under the accumulator room. Zone 4 consisted of the 105 Gas Tunnel, 316 Exhaust Plenum, 103 Gas Recirculation Tunnel, and the 104 Instrument Room. Zone 5 consisted of the side slope soils around the fuel storage basin, the south effluent pipelines, and the soil under the 224b Slab.	X			This site is carrying forward based on the RI risk evaluation on verification samples identifying the shallow decision unit containing technetium-99, and the deep decision unit containing cesium-137 and europium-152, at concentrations greater than the residential RBSL.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-D-98:2	Electrical Substation	This waste site consists of 19 historical locations of electrical substations (secondary and distribution) and underlying soil (see (HAN-10970, Volume 3 pp. 653, 716 and 718). Most were an open, wooden pole structure surrounded by a picket fence and contained transformers at or near ground level, set on concrete pads. All substations and all but one concrete pad were removed and demolished with the associated building. Following excavations of these sites, clean soil, non-hazardous debris, and potential asbestos containing material (ACM) were backfilled. This potential ACM would have been buried deeper than 6 inches and covered with compacted non-asbestos containing material.	X	X		To be determined based on confirmatory evaluation. Potential PCB contamination assumed to be limited to surficial soils.
100-D-105	Product Piping	The site consists of all the D/DR-Area Pipelines discovered during remediation but that were not associated with an existing waste site. Additional pipeline segments were assigned to this grouping following a spatial analysis of the pipeline geographic information system (GIS) assignments with those contained in regulator approved work instructions and closure documents. Some of these pipeline segments were either not assigned to a waste site or incorrectly assigned to a waste site when compared to the documents.	X			To be determined based on confirmatory evaluation. Potential contaminants expected to be limited to metals in pipe scale.
100-D-106	Sanitary Sewer	The site consists of the sanitary sewer pipelines that connected the service buildings at the 100-D main gate to the 1607-D1 septic tank. It also includes a french drain approximately 21 m (70 ft) north of the 1709-D building (H-1-701).	X			Lead, PAHs, and PCBs.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-H-56	Product Piping	The site consists of all the 100-H Area miscellaneous pipelines not associated with an existing waste site. These pipeline segments were discovered during a spatial analysis of the pipeline geographic information system (GIS) assignments with those contained in regulator approved work instructions and closure documents. Some of these pipeline segments were either not assigned to waste sites or incorrectly assigned to a waste site when compared to the documents. Additional pipeline segments were discovered in the field during field remediation activities.	X			To be determined based on confirmatory evaluation. Potential contaminants expected to be limited to metals in pipe scale.
100-H-59	Unplanned Release	The site consists of contaminated soil discovered during the removal of the rail at the 100-H project. A 213 meter (700 foot) long trench of contaminated railroad bed, including 39 rails, 700 ties, and scattered debris in 25 piles, remains. The contaminated area is about 3,250 square meters (35,000 square feet). The railroad berm tapers from 2.6 meters (8.5 feet) to 0.3 meters (1 foot) above original grade.	X			Cesium-137
100-H-51:6	Product Piping	The 100-H-51:6 waste site is a section of 25-cm (10-in) pipe that starts approximately 70-m (231-ft) south of the 100-H-51:5 waste site and ends near the 1713-H Building. This particular section of carbon steel pipe is thought to have connected to the southern side of a temporary wooden water tank and ended near the 1713-H Building. This pipeline and water tank is suspected to be part of an extensive temporary water system for construction of the 100-H Area in 1948 (HW-24800-2). This section of pipe (that is currently named 100-H-51:6) used to be part of 100-H-51:5 and 100 -H-53 waste site until confirmatory sample results exceeded direct exposure cleanup levels and was forced to be removed, treated, and disposed (RTD).	X			To be determined based on confirmatory evaluation. Potential contaminants expected to be limited to metals in pipe scale.
600-380	Dumping Area	The site consists of an unknown cylinder located 20 m (64 ft) from a maintained gravel road.	X			Lead, mercury, and PAHs.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
600-381	Depression/Pit (nonspecific)	This site consists of two wooden air vents covered with screening protruding from the ground. This feature is a discovery site because of the possibility of a void underground space of unknown size.	X			To be determined based on confirmatory evaluation.
600-382:1	Unplanned Release	This subsite consists of two oil filters surrounded by soil devoid of vegetation.	X	X		Lead and PAHs.
600-382:2	Unplanned Release	This subsite consists of three oil filters and a small area of soil devoid of vegetation.	X	X		Lead and PAHs.
600-382:3	Unplanned Release	This subsite consists of an oil filter surrounded by soil devoid of vegetation.	X	X		Lead and PAHs.
600-382:4	Unplanned Release	This subsite consists of a 3 square meter (37 square feet) area devoid of vegetation containing discarded oil filters.	X	X		Lead and PAHs.
600-382:5	Unplanned Release	This subsite consists of three oil filters surrounded by soil devoid of vegetation.	X	X		Lead and PAHs.
600-383:1	Dumping Area	This subsite consists of a 4 m (13 feet) diameter area of discarded batteries.	X	X		Chromium, lead, mercury, and zinc.
600-383:2	Dumping Area	This subsite consists of twelve discarded dry cell batteries.	X	X		Chromium, lead, mercury, and zinc.
600-383:3	Dumping Area	This subsite consists of a twenty-two discarded dry cell batteries.	X	X		Chromium, lead, mercury, and zinc.
600-383:4	Dumping Area	This subsite consists of a dry cell battery pack.	X	X		Chromium, lead, mercury, and zinc.
600-383:5	Dumping Area	This subsite consists of two areas of discarded dry cell batteries that are devoid of vegetation.	X	X		Chromium, lead, mercury, and zinc.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
600-383:6	Dumping Area	This subsite consists of a 1 m (3 feet) diameter area of discarded dry cell batteries.	X	X		Chromium, lead, mercury, and zinc.
600-383:7	Dumping Area	This subsite consists of a wet cell car battery.	X	X		Chromium, lead, mercury, and zinc.
600-383:8	Dumping Area	This subsite consists of six dry cell batteries.	X	X		Chromium, lead, mercury, and zinc.
600-383:9	Dumping Area	This subsite consists of a 5 m (16 feet) diameter area of discarded dry cell batteries.	X	X		Chromium, lead, mercury, and zinc.
600-383:10	Dumping Area	This subsite consists of a 2 m (7 feet) diameter area of discarded batteries.	X	X		Chromium, lead, mercury, and zinc.
600-384:1	Unplanned Release	This subsite consists of a 4 m (13 ft) diameter area of yellow and white powder.	X			Metals
600-384:2	Unplanned Release	This subsite consists of a 15 m (49 ft) diameter area of yellow and white powder.	X			Metals
600-384:3	Unplanned Release	This subsite consists of two locations that have stained soil.	X			Metals
600-384:4	Unplanned Release	This subsite consists of a 4 m (13 ft) diameter area of stained soil.	X			Metals
600-384:5	Unplanned Release	This subsite consists of a 1.5 m (5 ft) diameter area of stained soil.	X			Metals
600-385	Dumping Area	The site consists of a 5334 square m (1.3 acres) area with scattered transite, concrete, and metal debris.	X	X		Metals and solid hazardous debris.

Table J-1. Basis for Action: Waste Sites Remediated under Interim Actions or Remaining for Remedial Action

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-D-107	Unplanned Release	The site consists of the soil beneath and surrounding the demolished 1713-DA Essential Materials Warehouse. The 1713-DA Essential Materials Warehouse is analogous in operation to 1713-BA. The sodium dichromate contamination at 1713-BA (100-B-27) was directly related to operations in the 1713-BA Building. It is unknown whether or not there are any releases at 1713-DA from the operations involving sodium dichromate. The building was a wood frame structure with post and girder construction and wooden floors, and was divided into sixteen large storage bays. It measured 80 ft wide, 208 ft long and 12 ft high. A railroad spur ran along one side of the building. The facility had wooden unloading platforms along each side of the warehouse Historical photographs suggest that the building was demolished in the late 1950s.	X	X	X	To be determined based on confirmatory evaluation. Potential hexavalent chromium contamination.
100-H-54	Unplanned Release	On June 3, 2004, a radiological field survey of the 100-H Shoreline was conducted. The system used to collect the data was a man-carried back pack with walking stick system called the Global Positioning Environmental Radiological Surveyor (GPERS). The survey was performed as part of the risk assessment work performed by Bechtel Hanford, Inc. (BHI).	X			To be determined based on confirmatory evaluation. Potential radiological contamination.

Cr(VI) = hexavalent chromium
Eco = ecological risk
GWP/SWP = groundwater protection/surface water protection
HH = human health risk
MFP = mixed fission product
OHWM = ordinary high water mark
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PFE = Plenum Filling Experiment
RBSL = risk-based screening level
SVOC = semivolatile organic compound
TPH = total petroleum hydrocarbons
VCP = vitrified clay pipe
VOC = volatile organic compound

Table J-2. Waste Sites Where Basis for Action Includes Groundwater or Surface Water Protection

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
Waste Sites to be Remediated under Interim Actions						
100-D-100	Unplanned release	This site is contaminated soil near the former sodium dichromate acid railcar and truck unloading station (100-D-12). The waste is contaminated soil. The waste consists of hexavalent-contaminated soil.	X	X	X	Cr(VI) and total C
100-D-104	Unplanned release	The site consists of stained soils near the former external sodium dichromate storage tank and acid French drain outside of the 185-D facility.	X	X	X	Cr(VI) and total Cr.
100-D-30	Unplanned Release	Sodium dichromate contamination was discovered in the soil along the entire length of the 185-D Sodium Dichromate Trench. Contamination existed in the soil and concrete rubble remaining after demolition of the 185-D Building. The 185-D Building contained sodium dichromate mixing tanks and a pipe trench that were used to prepare and convey sodium dichromate solutions to be added to the process water in the large 190-D Building storage tanks.	X	X	X	Cr(VI).
100-D-50:1	Process Sewer	Abandoned underground pipelines that carried treated and untreated wastewater from the 183-DR Building, the 183-DR Clearwells, the 190-DR facility, and the 105-DR Reactor to the 100-D-8 Outfall.	X	X	X	Metals, Cr(VI), cobalt-60, cesium-137, europium-152, europium-154, europium-155, strontium-90, carbon-14, tritium, Ni-63, PAHs, PCBs.
100-D-50:4	Process Sewer	This subsite consists of steel gas recirculation piping between the 115-D/DR facility and the 105-DR Reactor. The piping was located in tunnels that have since been demolished, but the disposition of the piping was not well documented.	X	X	X	Cobalt-60, cesium-137, europium-152, europium-154, strontium-90, lead, metals, PCBs, PAHs, carbon-14, tritium, europium-155.

Table J-2. Waste Sites Where Basis for Action Includes Groundwater or Surface Water Protection

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-D-50:6	Process Sewer	This subsite includes the 183-DR clearwell pads and three functional groups of piping at the 183-DR Clearwells: 1) process piping used to deliver water from the filter building to the clearwells, 2) process piping used to deliver water from the clearwells to 190-DR Pumphouse, and 3) drain piping servicing the clearwells and pumphouse floor drains and discharging to the 100-D-50:1 Emergency Discharge Pipeline.	X	X	X	Metals (including mercury and Cr(VI)) and PCBs.
100-D-50:7	Process Sewer	This subsite includes the pipelines that provided drainage for the 183-DR Coagulation Basins, floor drains and catch basins at the 183-DR Head House, and mixing tanks in the vicinity of the 186-D Waste Acid Reservoir. These pipelines ultimately discharged to the 100-D Area process sewer systems.	X	X	X	Metals (including Cr(VI)), pesticides, and PCBs.
100-D-50:8	Process Sewer	This subsite is an asbestos-cement pipeline that connected the 117-DR HEPA Filter Building to the 116-DR-8 Seal Pit Crib.	X	X	X	Metals and Cr(VI).
100-D-65	Outfall	The site is the concrete spillway (also referred to as a flume) that led from the 116-D-5 Outfall Structure and terminated at the river shoreline.	X	X	X	MFP.
100-D-66	Outfall	The site is the concrete spillway (also referred to as a flume) that led from the 116-DR-5 Outfall Structure and terminated at the river shoreline.	X	X	X	MFP.
100-D-73	Process Unit/ Plant	Soil and remaining demolition footprint for the former 108-D Building. This building was used to store and mix sodium dichromate.	X	X	X	Cr(VI) (suspected).
100-D-76	Crib	The waste site is either a French drain or crib, representing an alternate possible location for the 116-D-3 site. Historical documentation, a construction drawing, and ground-penetrating radar results indicate this crib may remains near the southeast corner of the 108-D Building. This site may have received 0.08 Ci of Cs-134 and 30,000 L of effluent.	X	X	X	Cr(VI) (collocated with the 100-D-73 waste site).

Table J-2. Waste Sites Where Basis for Action Includes Groundwater or Surface Water Protection

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-D-77	Process Unit/ Plant	The waste site consists of the 183-DR Acid Facility, 183-DR Head House, the six 183-DR Flocculation Basins, the six 183-DR Sedimentation Basins, and the 183-DR Filter Building, all of which were components of the cooling water treatment system that supported the 105-DR Reactor. These components are of interest because they stored, mixed, or processed liquid contaminants of concern, especially sodium dichromate and sulfuric acid.	X	X	X	Mercury and Cr(VI) (suspected).
100-D-83:2	Product Piping	Pipeline segments associated with the 100-D-50:7 subsite that were not included in that subsite.	X	X	X	Metals, Cr(VI), PCBs.
100-D-86:3	Process Sewer	This subsite consists of process sewer pipeline segments on the western side of the former 105-DR fan room and Large Sodium Fire Facility.	X	X	X	Cr(VI), anions.
100-D-107	Unplanned Release	The site consists of the soil beneath and surrounding the demolished 1713-DA Essential Materials Warehouse. The 1713-DA Essential Materials Warehouse is analogous in operation to 1713-BA. The sodium dichromate contamination at 1713-BA (100-B-27) was directly related to operations in the 1713-BA Building. It is unknown whether or not there are any releases at 1713-DA from the operations involving sodium dichromate. The building was a wood frame structure with post and girder construction and wooden floors, and was divided into sixteen large storage bays. It measured 80 ft wide, 208 ft long and 12 ft high. A railroad spur ran along one side of the building. The facility had wooden unloading platforms along each side of the warehouse Historical photographs suggest that the building was demolished in the late 1950s.	X	X	X	To be determined based on confirmatory evaluation. Potential hexavalent chromium contamination.
100-H-28:2	Process Sewer	The 100-H-28:2 subsite consists of vitrified clay, reinforced concrete, and cast iron process sewer lines formerly servicing parts of the 105-H Reactor Building, 190-H Pumphouse, 183-H clearwells and pumphouse, and miscellaneous 1700-series buildings east of the 190-H Pumphouse. These process sewers formerly discharged to the 1906-H lift station, which then pumped wastes to the 116-H-5, 1904-H Outfall.	X	X	X	MFP, carbon-14, metals, PAHs, and PCBs.

Table J-2. Waste Sites Where Basis for Action Includes Groundwater or Surface Water Protection

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
100-H-28:3	Process Sewer	The 100-H-28:3 subsite consists of vitrified clay, reinforced concrete, and cast iron process sewer lines formerly servicing the 184-H Power House, 182-H Reservoir, and the northern part of the 183-H facility. These process sewers formerly discharged to the 100-H-28:2 sewer.	X	X	X	Cr(VI), metals, PAHs, sulfate, PCBs.
100-H-28:4	Process Sewer	The 100-H-28:4 subsite consists of those vitrified clay pipelines that formerly carried sanitary wastes to the 1607-H1 septic system. These sewers formerly serviced the 105-H Reactor Building, 190-H Pumphouse, and 151-H Electrical Substation.	X	X	X	Metals, PAHs, PCBs, pesticides.
100-H-28:5	Process Sewer	The 100-H-28:5 subsite consists of those vitrified clay pipelines that formerly carried sanitary wastes to the 1607-H2 septic system. These sewers formerly serviced the 182-H Reservoir pumphouse, 183-H Filter Plant, 184-H Power House, 190-H Pumphouse, and 1700-series buildings east of the 190-H Pumphouse.	X	X	X	Metals, PCBs, pesticides, and PAHs.
100-H-43	Foundation	This site consists of the belowgrade remnants of the 1716-H Maintenance Garage following its demolition and site leveling in 1974. The facility was used to service the area vehicles.	X	X	X	Metals, PCBs, SVOCs, TPH, PAHs.
100-H-44	Process Unit/ Plant	This site consists of residual features and potentially contaminated soil associated with the 183-H Neutralization Pit. The Neutralization Pit received sulfuric acid from two storage tanks and one acid head tank and lime slurry from the 183-H Head House.	X	X	X	Lead and mercury.
100-H-49:1	French Drain	This subsite consists of four French drains around the former 184-H and 1717-H facilities.	X	X	X	Metals, mercury, Cr(VI), PAHs, PCBs, pesticides, TPH.
116-DR-3	Trench	Site consists of a trench that received water and sludge pumped from the fuel storage basin via an over ground pipeline.	X	X	X	MFP, Cr(VI).

Table J-2. Waste Sites Where Basis for Action Includes Groundwater or Surface Water Protection

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	
132-H-3	Pump Station	This site was the 1608-H pump station, which received water from reactor building drains and the fuel storage basin. Water was then pumped to either the 116-H-2 Disposal Trench or the 116-H-7 retention basin. Site was decontaminated, decommissioned, and demolished partly in-place in 1987.	X	X	X	MFP.
Waste Sites Remaining for Remedial Action						
100-D-101	Sump	The site consists of four chemical storage tanks, an acid neutralization pit/sump, a sodium silicate sump, two sets of pumps, and a car spot. All located to the west of the 108-D building. Two chemicals were stored near 108-D, sulfuric acid and sodium silicate, which each had its own set of two large storage tanks.	X	X	X	To be determined based on confirmatory evaluation. Potential leakage and/or spillage of acid and sodium dichromate to soils assumed to be limited to relatively small volumes of shallow soil.
100-D-52	French Drain	Designed to receive condensate or cooling water leakage from the concrete enclosure for the 105-D Downcomer. Volume and inventory are not documented.	X	X	X	Site is being considered for potential residual Cr(VI) contamination only.
100-H-36	Outfall	The site is an underground concrete emergency overflow spillway (also referred to as a flume) that led from the 116-H-5 Outfall Structure to the river shoreline. The spillway could have received reactor coolant effluent when the 100-H-34 River Pipelines were blocked, damaged, or undergoing maintenance.	X	X	X	Potential mixed fission products (cesium-137, cobalt-60, europium-152, europium-154, and strontium-90), metals (lead, mercury, and Cr (total)), and Cr(VI) in exposed concrete.
100-H-5	Burial Ground	Site contained unknown amount of sludge removed from the 116-H-7 Retention Basin in 1953.	X	X	X	Site is being considered for potential residual Cr(VI) contamination only.

Table J-2. Waste Sites Where Basis for Action Includes Groundwater or Surface Water Protection

Waste Site	WIDS Site Type	Site History	Basis for Action			Known or Suspected Contaminants
			HH	Eco	GWP/SWP	

Cr(VI) = hexavalent chromium
Eco = ecological risk
GWP/SWP = groundwater protection/surface water protection
HH = human health risk
MFP = mixed fission product
OHWM = ordinary high water mark
PAH = polycyclic aromatic hydrocarbon
PCB = polychlorinated biphenyl
PFE = Plenum Filling Experiment
RBSL = risk-based screening level
SVOC = semivolatile organic compound
TPH = total petroleum hydrocarbons
VCP = vitrified clay pipe
VOC = volatile organic compound

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	Site Description	Applicable Previous Decision Documents	Type of Exceedance (assumed for Post ROD To Go Sites)	Physical Constraints (for Post ROD To Go Sites)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS (see Table 8-1)[b]	Alternative 2	Alternative 3	Alternative 4
100-D-10	This site is a former outfall in the river embankment upstream of the 100-D-8, 1907-DR outfall.	N/A	Candidate site; Potential Human Health Impact (Shallow)	To be determined following confirmation sampling of candidate site.	See alternatives for assumed footprint area	See alternatives for assumed depth	To be determined based on confirmatory evaluation.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 251.43 m^2 (2,705 ft^2) x 6 m (19.7 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 251.43 m^2 (2,705 ft^2) x 6 m (19.7 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 251.43 m^2 (2,705 ft^2) x 6 m (19.7 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-D-101	The site consists of four chemical storage tanks, an acid neutralization pit/sump, a sodium silicate sump, two sets of pumps, and a car spot. All located to the west of the 108-D building. Two chemicals were stored near 108-D, sulfuric acid and sodium silicate; each had its own set of two large storage tanks.	RSR plug-in	Candidate site; Potential Human Health (shallow) and Groundwater/Surface Water Protection Impacts	To be determined following confirmation sampling of candidate site.	See alternatives for footprint area	See alternatives for assumed depth	To be determined based on confirmatory evaluation. Potential leakage and/or spillage of acid and sodium dichromate to soils assumed to be limited to relatively small volumes of shallow soil.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 618.1 m^2 (6,650 ft^2) x 2.5 m (8.2 ft) excavation depth 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 618.1 m^2 (6,650 ft^2) x 2.5 m (8.2 ft) excavation depth 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 618.1 m^2 (6,650 ft^2) x 2.5 m (8.2 ft) excavation depth 3) Disposal of excavated soil at ERDF
100-D-102	Suspect effluent leak adjacent to 107-DR basin.	RSR plug-in	Candidate site; Potential Human Health Impact (Shallow)	To be determined following confirmation sampling of candidate site.	See alternatives for footprint area	See alternatives for assumed depth	To be determined based on confirmatory evaluation. Potential Cs-137, Co-60, Eu-152, Eu-154, Sr-90, & Cr(VI) contamination in soil.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 1,285 m^2 (13,825 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 1,285 m^2 (13,825 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 1,285 m^2 (13,825 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	**Site Description**	**Applicable Previous Decision Documents**	**Type of Exceedance (assumed for Post ROD To Go Sites)**	**Physical Constraints (for Post ROD To Go Sites)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS (see Table 8-1)[b]**	**Alternative 2**	**Alternative 3**	**Alternative 4**
100-D-103	Suspected trench and French drain from 116-D-8 cask pad.	RSR plug-in	Candidate site; Potential Human Health Impact (Shallow)	To be determined following confirmation sampling of candidate site.	See alternatives for footprint area	See alternatives for assumed depth	To be determined based on confirmatory evaluation. Potential Cs-137, Co-60, Eu-152, Eu-154, Sr-90, and metals contamination expected to be limited to former trench and French drain and immediately underlying soil	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 46 m^2 (495 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 46 m^2 (495 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 46 m^2 (495 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-D-25	Site is located beneath the 107-DR Retention Basin. Release is the result of retention basin leaks. The effluent volume release is unknown.	100-BC-1/DR-1/HR-1 OU IROD (proximity site)	Potential Human Health Impact (Shallow)	See 116-DR-9	See 116-DR-9	See 116-DR-9	This site is carrying forward based on the RI risk evaluation on verification samples identifying the shallow decision unit containing Cs-137, and the deep decision unit containing Cs-137 and Eu-152, at concentrations greater than the residential RBSL.	Encompassed with remediation of 116-DR-9	Encompassed with remediation of 116-DR-9	Encompassed with remediation of 116-DR-9
100-D-50:2	This subsite consists of steel piping used to deliver treated cooling water from the 183-DR clearwells to the 190-DR Pumphouse and from the pumphouse to the 105-DR Reactor.	*Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision*	Potential Human Health Impact	Potential ecological issues with bats inhabiting pipeline tunnels	819 m^2 (106,965 ft^2)	7.3 m (24.0 ft)	Metals and Cr(VI)	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) Place cap over end of pipeline 3) Entry and excavation restriction ICs	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) Place cap over end of pipeline 3) Entry and excavation restriction ICs	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 819 m^2 (106,965 ft^2) x 7.3 m (24.0 ft) below ground surface 3) Disposal of excavated soil at ERDF

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	**Site Description**	**Applicable Previous Decision Documents**	**Type of Exceedance (assumed for Post ROD To Go Sites)**	**Physical Constraints (for Post ROD To Go Sites)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS (see Table 8-1)[b]**	**Alternative 2**	**Alternative 3**	**Alternative 4**
100-D-52	Designed to receive condensate or cooling water leakage from the concrete enclosure for the 105-D Downcomer. Volume and inventory are not documented.	100-BC-1/DR-1/HR-1 OU IROD (proximity site)	Candidate site; Potential Groundwater and Surface Water Protection Impact	To be determined following confirmation sampling of candidate site.	See alternatives for footprint area	See alternatives for assumed depth	Site is being considered for potential residual Cr(VI) contamination only.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 1 m (3.3 ft) x 6.7 m (22 ft) x 7.6 m (25 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 1 m (3.3 ft) x 6.7 m (22 ft) x 7.6 m (25 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 1 m (3.3 ft) x 6.7 m (22 ft) x 7.6 m (25 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-D-59	This French drain received overflow sulfuric acid from railroad car transfer operations. Any waste acid was assumed to be neutralized in the Hanford Site's alkaline soil. Therefore, the site was previously rejected as a waste site, but is being reconsidered for potential mercury cross-contamination of sulfuric acid.	N/A	Candidate site; Potential Human Health Impact (Shallow)	To be determined following confirmation sampling of candidate site.	See alternatives for footprint area	See alternatives for assumed depth	To be determined based on confirmatory evaluation. Site is being reconsidered for potential Hg contamination in former sulfuric acid disposal; contamination assumed to be limited to former French drain and underlying soil.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 0.16 m^2 (1.70 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 0.16 m^2 (1.70 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 0.16 m^2 (1.70 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-D-63	The site encompasses the clean water pipelines upstream of the 100-D and 100-DR Reactors, including underground pipelines used to transport raw, fire, export, and sanitary water from the river pumphouse, to the water treatment facilities and to 100-D facilities and fire hydrants. Site does not include pipelines that carried water treated with hexavalent chromium. Site also includes pipelines associated with the PFE. The PFE project, a light-water reactor test facility, was cancelled prior to construction. The design of the PFE-related facilities included an above-ground oil pipeline and a process sewer extension. These pipelines are shown on design drawings but were never built. They are included with the 100-D-63 service water pipelines site in order to document that they were never constructed and require no action.	*Explanation of Significant Differences for the 100 Area Remaining Sites Interim Remedial Action Record of Decision: Hanford Site Benton County, Washington* (Table 2)	Candidate site; Potential Human Health Impact (Shallow)	Site associated with active 182-D River Pump House Facility	10,000 m (32,800 ft) of linear pipe lengthlength	4.6 mm (15 ft)	To be determined based on confirmatory evaluation. Potential contaminants expected to be limited to metals in pipe scale.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 10,000 m (32,800 ft) of linear pipe length x 4.6 m excavation depth 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 10,000 m (32,800 ft) of linear pipe length x 4.6 m excavation depth 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 10,000 m (32,800 ft) of linear pipe length x 4.6 m excavation depth 3) Disposal of excavated soil at ERDF

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	Site Description	Applicable Previous Decision Documents	Type of Exceedance (assumed for Post ROD To Go Sites)	Physical Constraints (for Post ROD To Go Sites)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS (see Table 8-1)[b]	Alternative 2	Alternative 3	Alternative 4
100-D-75:1	Subsite is the 151-D Primary Electrical Substation.	RSR ESD 2009 (Table 2)	Potential Human Health Impact (Shallow)	Assume that site will not be addressed while in active use. Concrete structural features would remain following cessation of use.	12,600 m^2 (135,625 ft^2)	0 - 0.5 m (0 - 1.6 ft)	Assumed PCB contamination in shallow soils.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 12,600 m^2 (135,625 ft^2) to 1 m (3 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 12,600 m^2 (135,625 ft^2) to 1 m (3 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 12,600 m^2 (135,625 ft^2) to 1 m (3 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-D-96	The site consists of seven French drains, one dry well location, and their underlying soil. Each of the facilities with which the French drains are associated was a nonradioactive building.	RSR ESD 2009 (Table 2)	Candidate site; Potential Human Health Impact (Shallow)	To be determined following confirmation sampling of candidate site.	See alternatives for footprint area	See alternatives for assumed depth	To be determined based on confirmatory evaluation. Potential PAH and metals contamination assumed to be limited to French drain and underlying soils.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 8 French drains totaling 2.78 m^2 (29.9 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 8 French drains totaling 2.78 m^2 (29.9 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 8 French drains totaling 2.78 m^2 (29.9 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-D-98:1	This site consists of two active (C4-S17 and 152-D1-D) electrical substations and underlying soil.	RSR ESD 2009 (Table 2)	Candidate site; Potential Human Health Impact (Shallow)	Location includes active and inactive substations located near the 181-D, 182-D, 184-D, 186-D, 185/189-D, 190-D, and 105-D facilities.	See alternatives for footprint areaarea	See alternatives for assumed depthdepth	To be determined based on confirmatory evaluation. Potential PCB contamination assumed to be limited to surficial soils.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 13 Concrete pads totaling 718.5 m^2 (7,729.9 ft^2) x 1 m (3.28 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 13 Concrete pads totaling 718.5 m^2 (7,729.9 ft^2) x 1 m (3.28 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 13 Concrete pads totaling 718.5 m^2 (7,729.9 ft^2) x 1 m (3.28 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-H-28:7	The 100-H-28:7 subsite consists of filtered/treated water supply lines originating at the 183-H Filter Plant, connecting to the 105-H, 182-H, 184-H, 187-H, and 190-H facilities.	RSR ESD 2004	Candidate site; Potential Human Health Impact (Shallow)	To be determined following confirmation sampling of candidate site.	See alternatives for footprint area	See alternatives for assumed depth	To be determined based on confirmatory evaluation. Potential contaminants expected to be limited to metals in pipe scale.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 1957 linear m (6,420 ft) x 1.5 m (5 ft) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 1957 linear m (6,420 ft) x 1.5 m (5 ft) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 1957 linear m (6,420 ft) x 1.5 m (5 ft) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	**Site Description**	**Applicable Previous Decision Documents**	**Type of Exceedance (assumed for Post ROD To Go Sites)**	**Physical Constraints (for Post ROD To Go Sites)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS (see Table 8-1)[b]**	**Alternative 2**	**Alternative 3**	**Alternative 4**
100-H-36	The site is an underground concrete emergency overflow spillway (also referred to as a flume) that led from the 116-H-5 Outfall Structure to the river shoreline. The spillway could have received reactor coolant effluent when the 100-H-34 River Pipelines were blocked, damaged, or undergoing maintenance.	RSR ESD 2009 (Table 2)	Potential Human Health (Shallow) and Surface Water Protection Impact	Site is a large existing concrete structure within an armored river embankment. This spillway is a subgrade box flume from the former 116-H-5 outfall structure, down to the OHWM, where it discharges to a concrete spillway pad that extends approximately to the LWM. There is a large quantity of (presumably clean) concrete underneath the box flume. River embankment armoring consists of grouted rip rap.	Remaining box flume footprint: approximately 300 m^2 (3,229 ft^2). Spillway pad below box flume (also below OHWM): approximately 1150 m^2 (12,379 ft^2)	Box flume structure is approximately 2 m (7 ft) tall, underlain by up to 5 m (16 ft) of concrete foundation. Runoff pad is a thin (<0.3 m [1 ft]) poured pad. Associated soil/sediment volume assumed to be small relative to overall concrete volume.	Potential mixed fission products (Cs-137, Co-60, Eu-152, Eu-154, & Sr-90), metals (Pb, Hg, and Cr (total)), & Cr(VI) in exposed concrete	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) Grout void fill of remaining box flume (3 side by side channels 2.3 m^2 (24.2 ft^2) x 40 m (130 ft) length) 3) RTD of Spillway Pad below box flume (1,150 m^2 (12,379 ft^2) x 0.3 m (1 ft) thickness) 4) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) Grout void fill of remaining box flume (3 side by side channels 2.3 m^2 (24.2 ft^2) x 40 m (130 ft) length) 3) RTD of Spillway Pad below box flume (1,150 m^2 (12,379 ft^2) x 0.3 m (1 ft) thickness) 4) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of (building demolition) of two structures, o Remaining box flume (300 m^2 [3,229 ft^2]) x 2 m (6.6 ft) tall with 5 m (16.4 ft) concrete foundation o Spillway Pad below box flume (1,150 m^2 (12,379 ft^2) x 0.3 m (1 ft) thickness) 3) Disposal of excavated soil at ERDF

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	Site Description	Applicable Previous Decision Documents	Type of Exceedance (assumed for Post ROD To Go Sites)	Physical Constraints (for Post ROD To Go Sites)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS (see Table 8-1)[b]	Alternative 2	Alternative 3	Alternative 4
100-H-38	The site consists of an area approximately 3 acres in size and is marked by ground scars resembling trenches and pits. The site is situated along a natural depression on the western boundary of the 100-H Area perimeter fence.	TBD (RSR plug-in)	Candidate site; Potential Human Health Impact (Shallow)	To be determined following confirmation sampling of candidate site.	See alternatives for footprint area	See alternatives for assumed depth	To be determined based on confirmatory evaluation. Potential for solid hazardous waste with corresponding soil metals and PAH contamination in a large area.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 3 acres (WIDS description) (130,680 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 3 acres (WIDS description) (130,680 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 3 acres (WIDS description) (130,680 ft^2) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-H-5	Site contained unknown amount of sludge removed from the 116-H-7 Retention Basin in 1953. Site has been remediated, backfilled, and revegetated.	*Interim Remedial Action Record of Decision for the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, Hanford Site, Benton County, Washington*	Candidate site; Potential Groundwater and Surface Water Protection Impact	To be determined following confirmation sampling of candidate site.	See alternatives for footprint area	See alternatives for assumed depth	Site is being considered for potential residual Cr(VI) contamination only.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 100 m x 15 m x 7.6 m (328 ft x 49.2 ft x 24.9 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 100 m x 15 m x 7.6 m (328 ft x 49.2 ft x 24.9 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 100 m x 15 m x 7.6 m (328 ft x 49.2 ft x 24.9 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-H-57	This site encompasses the former underground piping, valves, and sumps at the bases of the two elevated water towers for the 105-H Reactor.	TBD (RSR plug-in)	Human Health Impact (Shallow)	To be determined following confirmation sampling of candidate site.	See alternatives for footprint area	See alternatives for assumed depth	To be determined based on confirmatory evaluation. Potential Cr(VI) contamination assumed to be limited to shallow soil in footprint of former water towers.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 231.88 m^2 (est) (2,495.9 ft) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 231.88 m^2 (est) (2,495.9 ft) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 231.88 m^2 (est) (2,495.9 ft) x 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-H-58	This site consists of contaminated mud dauber wasp nests on power poles. Contamination is associated with sediment from the 105-H Fuel Storage Basin.	TBD (RSR plug-in)	Above Grade Contaminated Nests	To be determined following confirmation sampling of candidate site.	See alternatives for footprint area	See alternatives for assumed depth	Potential Cs-137, Co-60, Eu-152, Eu-154, Sr-90 in wasp nests on (presently active) power poles.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of estimate 1 cubic meter for RTD of x N/A 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of estimate 1 cubic meter for RTD of x N/A 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of estimate 1 cubic meter for RTD of x N/A 3) Disposal of excavated soil at ERDF

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	**Site Description**	**Applicable Previous Decision Documents**	**Type of Exceedance (assumed for Post ROD To Go Sites)**	**Physical Constraints (for Post ROD To Go Sites)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS (see Table 8-1)[b]**	**Alternative 2**	**Alternative 3**	**Alternative 4**
116-D-8	Concrete pad with two drains that stored shipping and handling casks and is covered with grey grout.	RSR (A-1)	Human Health Impact (Shallow)	None significant	See 100-D-50:2	See 100-D-50:2	This site is carrying forward based on the RI risk evaluation on verification samples identifying the shallow decision unit containing Cs-137 at concentrations greater than the residential RBSL.	MNA and Institutional controls through 2035 years	MNA and Institutional controls through 2035 years	Encompassed with remediation 100-D-50:2
116-DR-9	Site was an open concrete basin that retained cooling water effluent from the 118-DR-2 (105-DR Reactor) for radioactive decay and thermal cooling before release to the Columbia River. Also received ruptured fuel element waste after 1954. Total radionuclide inventory in the vicinity ranged from 5 to 400 Ci. Site has been remediated, backfilled, and revegetated. Site was selected for investigation under the RI to evaluate CSM at a high volume liquid site. Previous LFI boring was also performed at the site.	100-BC-1/DR-1/HR-1 OU IROD	Human Health Impact (Shallow)	None significant	541 m^2 (5823 ft^2)	Area represents a former corner slope (nominally 1.5:1) between 0 and 4.6 m (15 ft) below present grade. Assume 1 additional m removal below this slope, but not to exceed 4.6 m bgs, and overlain by clean fill material.	This site is carrying forward based on the RI risk evaluation on verification samples identifying the shallow decision unit containing Cs-137, and the deep decision unit containing Cs-137 and Eu-152, at concentrations greater than the residential RBSL.	MNA and Institutional controls through 2035 years	MNA and Institutional controls through 2035 years	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 541 m^2 (5823 ft^2) to 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	**Site Description**	**Applicable Previous Decision Documents**	**Type of Exceedance (assumed for Post ROD To Go Sites)**	**Physical Constraints (for Post ROD To Go Sites)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS (see Table 8-1)[b]**	**Alternative 2**	**Alternative 3**	**Alternative 4**
118-DR-2:2	This subsite includes the 105-DR Reactor below grade structures and underlying soils. It was divided into five zones and the ISS decon areas. Zone 1 consists of the 400 Fuel Storage Basin, 410 Storage and Transfer Area, 412 Storage Area, the 413 Transfer Bay, and the soils underlying the fuel storage basin. Zone 2 consists of the valve pit that received wastewater from the reactor. Zone 3 consisted of the 228c solids feed area, the north water tunnel, and the trench under the accumulator room. Zone 4 consisted of the 105 Gas Tunnel, 316 Exhaust Plenum, 103 Gas Recirculation Tunnel, and the 104 Instrument Room. Zone 5 consisted of the side slope soils around the fuel storage basin, the south effluent pipelines, and the soil under the 224b Slab.	*Action Memorandum: USDOE Hanford 100 Area National Priorities List, 105-F and 105-DR Reactor Buildings and Ancillary Facilities, Hanford Site, Benton County, Washington*	Human Health Impact (Shallow)	None significant for shallow removal in identified area.	272 m^2 (2,928 ft^2)	0 to 4.6 m (0 to 15 ft)	This site is carrying forward based on the RI risk evaluation on verification samples identifying the shallow decision unit containing Tc-99, and the deep decision unit containing Cs-137 and Eu-152, at concentrations greater than the residential RBSL.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 272 m^2 (2,926 ft^2) to 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 272 m^2 (2926 ft^2) to 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD of 272 m^2 (2926 ft^2) to 4.6 m (15 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-D-98:2	This waste site consisted of 19 historical locations of electrical substations (secondary and distribution) and underlying soil (see (HAN-10970, Volume 3 pp. 653, 716 and 718). Most were an open, wooden pole structure surrounded by a picket fence and contained transformers at or near ground level, set on concrete pads. All substations and all but one concrete pad were removed and demolished with the associated building. Following excavations of these sites, clean soil, non-hazardous debris, and potential asbestos containing material (ACM) were backfilled. This potential ACM would have been buried deeper than 6 inches and covered with compacted non-asbestos containing material.	RSR ESD 2009 (Table 2)	Candidate site; Potential Human Health Impact (Shallow)	Location includes active and inactive substations located near the 181-D, 182-D, 184-D, 186-D, 185/189-D, 190-D, and 105-D facilities.	Included in remediation of 100-D-98:1	Included in remediation of 100-D-98:1	See 100-D-98:1	Included in remediation of 100-D-98:1	Included in remediation of 100-D-98:1	Included in remediation of 100-D-98:1

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	Site Description	Applicable Previous Decision Documents	Type of Exceedance (assumed for Post ROD To Go Sites)	Physical Constraints (for Post ROD To Go Sites)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS (see Table 8-1)[b]	Alternative 2	Alternative 3	Alternative 4
100-D-105	The site consists of all the D/DR-Area Pipelines discovered during remediation but were not associated with an existing waste site. Additional pipeline segments were assigned to this grouping following a spatial analysis of the pipeline geographic information system (GIS) assignments with those contained in regulator approved work instructions and closure documents. Some of these pipeline segments were either not assigned to a waste site or incorrectly assigned to a waste site when compared to the documents.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on site conditions	To be determined based on site conditions	To be determined based on confirmatory evaluation. Potential contaminants expected to be limited to metals in pipe scale.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.646 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-D-106	The site consists of the sanitary sewer pipelines that connected the service buildings at the 100-D main gate to the 1607-D1 septic tank. It also includes a french drain approximately 21 m (70 ft) north of the 1709-D building (H-1-701).	Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Lead, PAHs, and PCBs.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-H-56	The site consists of all the 100-H Area miscellaneous pipelines not associated with an existing waste site. These pipeline segments were discovered during a spatial analysis of the pipeline geographic information system (GIS) assignments with those contained in regulator approved work instructions and closure documents. Some of these pipeline segments were either not assigned to waste sites or incorrectly assigned to a waste site when compared to the documents. Additional pipeline segments were discovered in the field during field remediation activities.	Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	To be determined based on confirmatory evaluation. Potential contaminants expected to be limited to metals in pipe scale.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	**Site Description**	**Applicable Previous Decision Documents**	**Type of Exceedance (assumed for Post ROD To Go Sites)**	**Physical Constraints (for Post ROD To Go Sites)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS (see Table 8-1)[b]**	**Alternative 2**	**Alternative 3**	**Alternative 4**
100-H-59	The site consists of contaminated soil discovered during the removal of the rail at the 100-H project. A 213 meter (700 foot) long trench of contaminated railroad bed, including 39 rails, 700 ties, and scattered debris in 25 piles, remains. The contaminated area is about 3,250 square meters (35,000 square feet). The railroad berm tapers from 2.6 meters (8.5 feet) to 0.3 meters (1 foot) above original grade.	Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Cesium-137	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-H-51:6	The 100-H-51:6 waste site is a section of 25-cm (10-in) pipe that starts approximately 70-m (231-ft) south of the 100-H-51:5 waste site and ends near the 1713-H Building. This particular section of carbon steel pipe is thought to have connected to the southern side of a temporary wooden water tank and ended near the 1713-H Building. This pipeline and water tank is suspected to be part of an extensive temporary water system for construction of the 100-H Area in 1948 (HW-24800-2). This section of pipe (that is currently named 100-H-51:6) used to be part of 100-H-51:5 and 100 - H-53 waste site until confirmatory sample results exceeded direct exposure cleanup levels and was forced to be removed, treated, and disposed (RTD).	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	To be determined based on confirmatory evaluation. Potential contaminants expected to be limited to metals in pipe scale.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-380	The site consists of an unknown cylinder located 20 m (64 ft) from a maintained gravel road.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Lead, mercury, and PAHs.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF

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General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	**Site Description**	**Applicable Previous Decision Documents**	**Type of Exceedance (assumed for Post ROD To Go Sites)**	**Physical Constraints (for Post ROD To Go Sites)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS (see Table 8-1)[b]**	**Alternative 2**	**Alternative 3**	**Alternative 4**
600-381	This site consists of two wooden air vents covered with screening protruding from the ground. This feature is a discovery site because of the possibility of a void underground space of unknown size.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	To be determined based on confirmatory evaluation.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-382:1	This subsite consists of two oil filters surrounded by soil devoid of vegetation.	Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Lead and PAHs.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-382:2	This subsite consists of three oil filters and a small area of soil devoid of vegetation.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Lead and PAHs.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-382:3	This subsite consists of an oil filter surrounded by soil devoid of vegetation.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Lead and PAHs.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF

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General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	Site Description	Applicable Previous Decision Documents	Type of Exceedance (assumed for Post ROD To Go Sites)	Physical Constraints (for Post ROD To Go Sites)	Assumed Areal Footprint Requiring Remediation	Assumed Depth of Contamination Requiring Remediation	COPCs Considered for the FS (see Table 8-1)[b]	Alternative 2	Alternative 3	Alternative 4
600-382:4	This subsite consists of a 3 square meter (37 square feet) area devoid of vegetation containing discarded oil filters.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Lead and PAHs.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-382:5	This subsite consists of three oil filters surrounded by soil devoid of vegetation.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Lead and PAHs.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-383:1	This subsite consists of a 4 m (13 feet) diameter area of discarded batteries.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Chromium, lead, mercury, and zinc.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-383:2	This subsite consists of twelve discarded dry cell batteries.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Chromium, lead, mercury, and zinc.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF

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Waste Site	**Site Description**	**Applicable Previous Decision Documents**	**Type of Exceedance (assumed for Post ROD To Go Sites)**	**Physical Constraints (for Post ROD To Go Sites)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS (see Table 8-1)[b]**	**Alternative 2**	**Alternative 3**	**Alternative 4**
600-383:3	This subsite consists of a twenty-two discarded dry cell batteries.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Chromium, lead, mercury, and zinc.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-383:4	This subsite consists of a dry cell battery pack.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Chromium, lead, mercury, and zinc.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-383:5	This subsite consists of two areas of discarded dry cell batteries that are devoid of vegetation.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Chromium, lead, mercury, and zinc.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-383:6	This subsite consists of a 1 m (3 feet) diameter area of discarded dry cell batteries.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Chromium, lead, mercury, and zinc.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF

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600-383:7	This subsite consists of a wet cell car battery.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Chromium, lead, mercury, and zinc.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-383:8	This subsite consists of six dry cell batteries.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Chromium, lead, mercury, and zinc.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-383:9	This subsite consists of a 5 m (16 feet) diameter area of discarded dry cell batteries.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Chromium, lead, mercury, and zinc.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-383:10	This subsite consists of a 2 m (7 feet) diameter area of discarded batteries.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Chromium, lead, mercury, and zinc.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF

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600-384:1	This subsite consists of a 4 m (13 ft) diameter area of yellow and white powder.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Metals	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-384:2	This subsite consists of a 15 m (49 ft) diameter area of yellow and white powder.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Metals	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-384:3	This subsite consists of two locations that have stained soil.	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Metals	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-384:4	This subsite consists of a 4 m (13 ft) diameter area of stained soil.	2009 ESD for the Remaining Sites ROD	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Metals	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	**Site Description**	**Applicable Previous Decision Documents**	**Type of Exceedance (assumed for Post ROD To Go Sites)**	**Physical Constraints (for Post ROD To Go Sites)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS (see Table 8-1)[b]**	**Alternative 2**	**Alternative 3**	**Alternative 4**
600-384:5	This subsite consists of a 1.5 m (5 ft) diameter area of stained soil.	2009 ESD for the Remaining Sites ROD	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Metals	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
600-385	The site consists of a 5334 square m (1.3 acres) area with scattered transite, concrete, and metal debris.	N/A	Candidate site; Potential Human Health Impact (Shallow)	Potential for Cultural Resource Review	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	Metals and solid hazardous debris.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF
100-D-107	The site consists of the soil beneath and surrounding the demolished 1713-DA Essential Materials Warehouse. The 1713-DA Essential Materials Warehouse is analogous in operation to 1713-BA. The sodium dichromate contamination at 1713-BA (100-B-27) was directly related to operations in the 1713-BA Building. It is unknown whether or not there are any releases at 1713-DA from the operations involving sodium dichromate. The building was a wood frame structure with post and girder construction and wooden floors, and was divided into sixteen large storage bays. It measured 80 ft wide, 208 ft long and 12 ft high. A railroad spur ran along one side of the building. The facility had wooden unloading platforms along each side of the warehouse Historical photographs suggest that the building was demolished in the late 1950s.	N/A	Candidate site; Potential Groundwater and Surface Water Protection Impact	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	To be determined based on confirmatory evaluation. Potential hexavalent chromium contamination.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF

Table J-3. Alternatives for Evaluated Waste Sites

General Waste Site Information		Information for Development of Alternatives[a]								
Waste Site	**Site Description**	**Applicable Previous Decision Documents**	**Type of Exceedance (assumed for Post ROD To Go Sites)**	**Physical Constraints (for Post ROD To Go Sites)**	**Assumed Areal Footprint Requiring Remediation**	**Assumed Depth of Contamination Requiring Remediation**	**COPCs Considered for the FS (see Table 8-1)[b]**	**Alternative 2**	**Alternative 3**	**Alternative 4**
100-H-54	On June 3, 2004, a radiological field survey of the 100-H Shoreline was conducted. The system used to collect the data was a man-carried back pack with walking stick system called the Global Positioning Environmental Radiological Surveyor (GPERS). The survey was performed as part of the risk assessment work performed by Bechtel Hanford, Inc. (BHI).	N/A	Candidate site; Potential Human Health Impact (Shallow)	None significant	To be determined based on confirmatory sampling	To be determined based on confirmatory sampling	To be determined based on confirmatory evaluation. Potential radiological contamination.	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF	1) Minimal Design Sampling, use rule of thumb for confirmation/verification sampling 2) RTD to 0 - 4.6 m (0 - 15 ft) below ground surface 3) Disposal of excavated soil at ERDF

a. The actions assumed in Appendix J were developed for cost estimating purposes for this FS. Additional information on components of the alternatives is presented in Chapter 9.

b. Table 8-1 presents a summary of waste site COPCs based on process knowledge.

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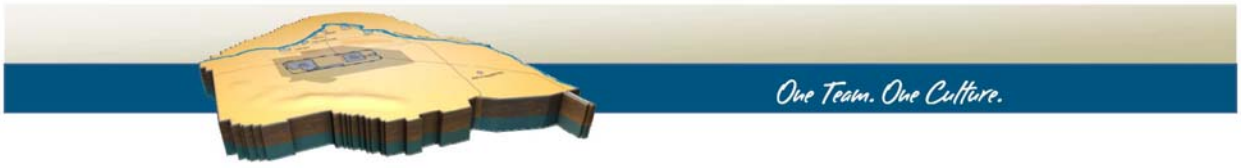

ENVIRONMENTAL COST ESTIMATE

ECE-100HR311-00004

Environmental Cost Estimate for 100 D/H Vadose Zone and Groundwater RI/FS

Revision 5

Date: April 7, 2014

Project: CH2M HILL Plateau Remediation Company

Topic: Cost Analysis

Administrative Use

CHPRC Environmental Cost Estimate Cover Page

Project: 100-D/H Vadose Zone and Groundwater RI/FS Date: 04/07/2014

Project Cost Estimator: S. Ferries

Cost Estimate Checker: B. Ostapkowicz

ER & QA Lead Cost Estimator: K. Klink

ECE Document Number: ECE-100HR311-00004 Revision: 5

Document Review & Approval Signatures of approval

Project Cost Estimator	S. Ferries, Sr. Cost Estimator	Date: 4/7/2014
Cost Estimate Checker:	B. Ostapkowicz, Engineer	Date. 4/7/2014
ER & QA Lead Cost Estimator:	K. Klink, Chemical Engineer	Date 4/7/2014
Senior Reviewer:	A. Lee	Date: 4/7/2014
Senior Reviewer:	K. Ivarson	Date: 4/8/2014
Project Manager:	J. Borghese	Date: 4/8/2014
Responsible Manager:	B. Brunke, Manager Environmental Integration	Date: 4/8/2014

Revision History:

Revision No.	Description	Date	Affected Pages
1	Entire document	07/05/2011	All
2	Section 3.1, 4.5, and 8	10/17/2011	7-8, 8-11, 11-14, and 28
3	Entire document	04/25/2012	All
4	Entire document	11/28/2012	All
5	Entire document	04/07/2014	All

Terms

AACE	Association for the Advancement of Cost Engineering International
CHPRC	CH2M HILL Plateau Remediation Company
DD	Direct Distributable
DOE	U.S. Department of Energy
ECE	Environmental Cost Estimate
ECF	Environmental Calculation File
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FICA	Federal Insurance Contributions Act
FP	Fixed-price
G&A	General and Administrative
GW	Groundwater
HSSA	Hanford Site Stabilization Agreement
MS Excel™	Microsoft Excel
O&M	Operation and Maintenance
OMB	Office of Management and Budget
OU	Operable Unit
PRC	Plateau Remediation Company
PW	Present Worth
RACER™	Remedial Action Cost Engineering and Requirements System (Cost Estimating Software)
RCTs	Radiological Control Technicians
TRACE	Tool for Response Action Cost Estimating
VZ	Vadose Zone

Contents

Figures

Tables

Appendix

1 Introduction

CHPRC has prepared this Environmental Cost Estimate (ECE) in support of Feasibility *Study for the 100-D/H (DOE/RL-2010-95)*. The following sections provide the basis of estimate.

The cost estimates for each waste site summarized in this ECE have been prepared for comparative response action evaluation(s) from the information available at the time of preparation. The cost estimates reflect specific response action approaches, and scope assumptions and exclusions as well as cost estimating methodologies. The response action cost estimates have expected ranges of accuracy described in the "Estimate Classification" section. The final costs of the selected response action will depend on actual labor and material costs, actual site conditions, productivity, competitive market conditions, final project scope, final project schedule, and other factors.

2 Purpose of Estimate

This ECE and cost estimate backup supports the response action alternatives analysis provided in *Feasibility Study for the 100-D/H* (DOE/RL-2010-95). It provides an overview of response action-specific cost inputs, methodology, and results. It also lists references that provide more detailed scope and cost estimate information used to prepare these estimates.

The purpose of this ECE is to:

- Describe the methodology applied in performing the cost estimates.
- Describe the general and response action-specific assumptions and cost inputs applied to the subject cost estimates.
- Summarize the response action alternative cost estimates.

This ECE also documents the references that provide additional scope and cost estimate information used to prepare these estimates.

3 General Project Description

In 1989, representatives from Washington State Department of Ecology (Ecology), U.S. Environmental Protection Agency (EPA), and U.S. Department of Energy (DOE) signed the Hanford Federal Facility Agreement and Consent Order (Tri-Party Agreement [Ecology et al., 1989a]). The agreement created a cohesive regulatory framework, schedule, and adjudication process to administer environmental remediation activities at the Hanford Site for both Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) response action and Resource Conservation and Recovery Act of 1976 (RCRA) corrective action activities.

For the purpose of remediation, the River Corridor was divided into different geographic areas: 100-BC, 100-K, 100-D, 100-H (managed as 100-D/H), 100-N, 100-F, 100-IU-2, 100-IU-6 (managed as 100 F/IU-2/IU-6), and the 300 Area. The Figure below shows these areas. The geographic areas include groundwater OUs, source OUs, and facilities that encompass the 100 Area National Priorities List sites.

The 100 Area sites and the groundwater are contaminated from releases and spills of radiological and/or chemical constituents, and historical solid waste disposal practices, and encompass the 100 Area sites that are on the National Priorities List (NPL), 40 CFR 300, *"National Oil and Hazardous Substances Pollution Contingency Plan (NCP)."*

The 100-D/H area encompasses 20 km^2 (7.8 mi^2) area in the northern portion of the Hanford Site in the 100 Area. 100-D/H includes two reactor areas (100-D and 100-H) and adjacent areas. Most of the waste sites associated with the investigation are in 100-D and 100-H. The Columbia River bounds about half of the site. The area between the reactor areas is commonly referred to as the "Horn." The Horn was used for agricultural purposes until 1943. A few isolated waste sites are located in the Horn, but the area is relatively undisturbed. 100-D/H contains source OU waste sites assigned to the 100-DR-1, 100-DR-2, 100-HR-1, and 100-HR-2 OUs, plus other waste sites located within its boundary. The 100-HR-3 groundwater OU and the adjacent aquifers are also within the 100-D/H boundary.

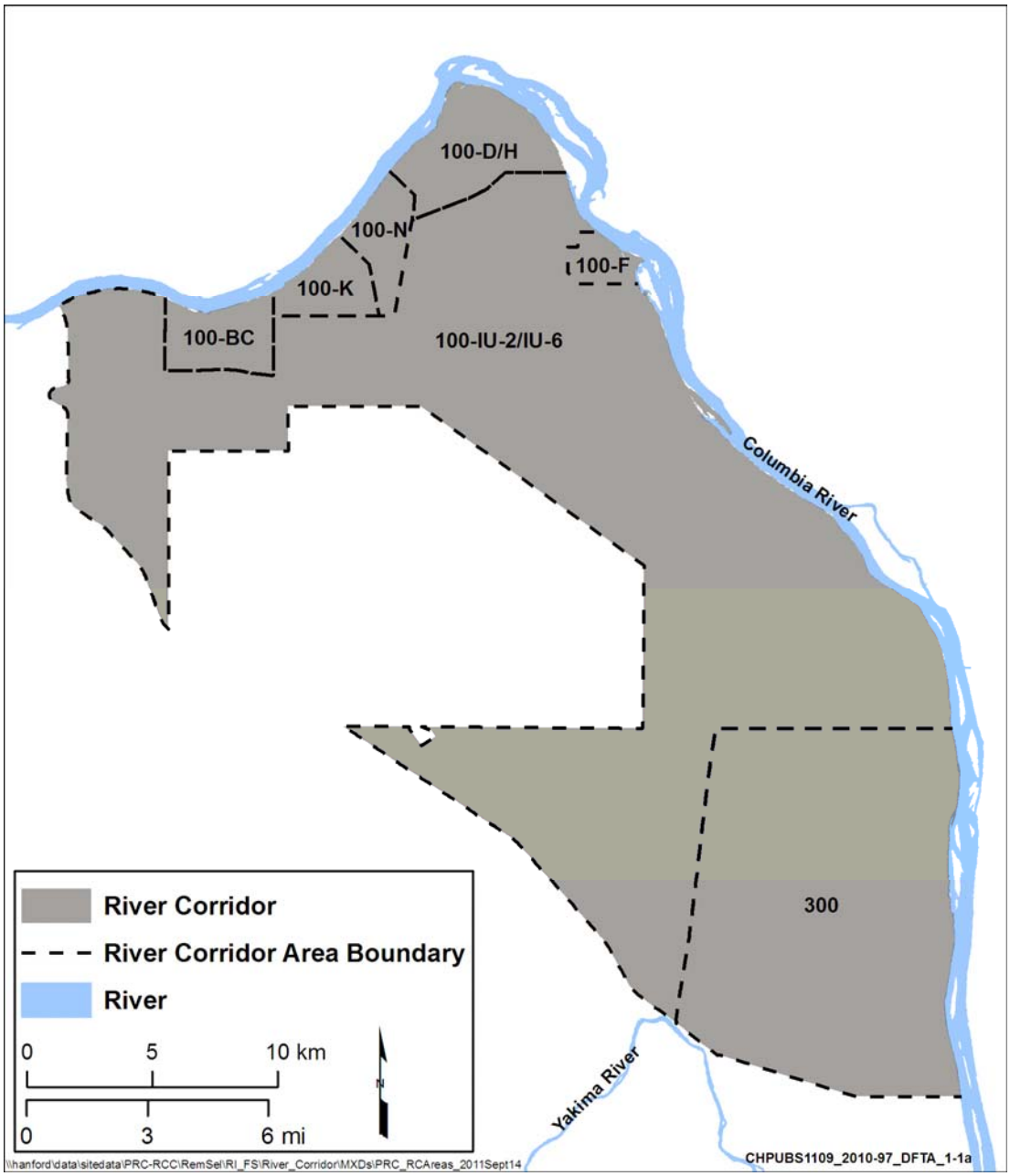

Figure 1. 100 Area Map

This cost estimate encompasses the cost of the four alternatives reviewed in the 100 D/H Feasibility Study. The four FS alternatives focus on the sites within the 100 D/H area shown in Table 1.

Table 1. List of Sites

118-DR-2:2	
100-D-101	100-H-5
100-D-102	100-H-57
100-D-103	100-H-58
100-D-50:2	116-D-8
100-D-52	116-DR-9 (Includes 100-D-25)
100-D-75:1	100-D-59
100-D-96	
100-H-36	100-H-28:7
100-D-10	Groundwater

4 Scope of Work

The cost estimate for the 100 D/H Feasibility Study project was developed in accordance with EPA/540/R-00/002, A Guide to Developing and Documenting Cost Estimates During the Feasibility Study, OSWER 9355.0-75 (EPA, 2000), and Hanford's internal cost estimating procedure for response action decision-making.

Quantities used in the creation of this estimate were based on the information provided by the technical project manager in the Environmental Calculation File (ECF) document, ECF-100DR1-12-0022, Rev 2 November, 2012 The ECF defines quantities for the following four response action alternatives:

Waste Site and Groundwater Alternatives

Alternative 1—No Action Alternative

No Further Action is taken to protect human health and the environment. Under this alternative, no remedial actions would be taken and all soil and groundwater interim actions would be discontinued. The NCP requires consideration of a No Action Alternative ("Remedial Investigation/Feasibility Study and Selection of Remedy" [40 CFR 300.430(e)(6)]).

Alternative 2—RTD and Grouting for Waste Site and Pump-and-Treat with Biological Treatment for Groundwater

Alternative 2 - Removal, treatment, and disposal (RTD) is used to excavate contaminated material from waste sites (shown in Table 2) until cleanup levels are achieved. Void fill grouting is used at one underground flume waste site (100-H-36) near the river where RTD would have a potential ecological impact. Monitored Natural Attenuation (MNA) with Institutional Controls (ICs) is used for two waste sites with shallow radioactive contamination that decays to cleanup levels within approximately 23 years. One pipeline waste site (100-D-50:2) that delivered treated cooling water to the reactor will be capped at

both ends and left in place. One site (100-H-58) will remove Mud Dauber nests from power poles. Institutional controls (ICs) to restrict excavation will be applied at individual waste sites with residual risks associated with contamination at depths greater than 4.6 m (15 ft) bgs after remediation, but there is no direct exposure pathway. Additional ICs to waste sites may be added through closure reclassifications. For groundwater, a pump-and-treat system and biological treatment of Cr(VI) will be used. Existing pump and treat systems will be expanded by installing approximately 35 new wells. Biological treatment is used in select areas to enhance treatment for Cr(VI). Nitrate and strontium-90 contaminated groundwater plumes are within the treatment footprint for the Cr(VI) plume and will be co-extracted by the extraction well network used for the Cr(VI) plume remediation. The groundwater treatment system effluent is not expected to exceed MCLs and no treatment is proposed for strontium 90 and nitrate. Specific treatment would be provided if the extracted groundwater in the pump-and-treat effluent stream exceeds the MCLs for the respective COCs prior to reinjection. MNA and institutional controls will be used for strontium 90. Groundwater monitoring will confirm effectiveness of MNA for strontium-90 and determine the impact of pump-and-treat on the persistence of the COC within the aquifer over time.

For cost estimate preparation, the scope of this alternative consisted of:

- RTD waste sites:

Table 2. Alternative 2 Waste Sites with RTD

100-D-75:1	100-D-96
118-DR-2:2	
100-D-101	100-H-5
100-D-102	100-H-57
100-D-103	
100-D-52	100-H-28:7
100-D-10	
100-D-59	

- Void fill grouting of pipeline (100-H-36)
- Capping pipeline (100-D-50:2)
- Removal of Mud Dauber nests (100-H-58)
- Institutional Controls for 116-D-8 and 116-DR-9/100-D-25
- Optimization and expansion of the existing pump and treat system with biological injection for hexavalent chromium in groundwater

Alternative 3—RTD and Grouting of Waste Site and Increased Capacity Groundwater Pump-and-Treat for Groundwater

Alternative 3 - Removal, treatment, and disposal (RTD) is used to excavate contaminated material from waste sites (shown in Table 3) until cleanup levels are achieved. Void fill grouting is used at one

underground flume waste site (100-H-36) near the river where RTD would have a potential ecological impact. Monitored Natural Attenuation (MNA) with Institutional Controls (ICs) is used for two waste sites with shallow radioactive contamination that decays to cleanup levels within approximately 23 years. One pipeline waste site (100-D-50:2) that delivered treated cooling water to the reactor will be capped at both ends and left in place. One site (100-H-58) will remove Mud Dauber nests from power poles. Institutional controls (ICs) to restrict excavation will be applied at individual waste sites with residual risks associated with contamination at depths greater than 4.6 m (15 ft) bgs after remediation, but there is no direct exposure pathway. Additional ICs to waste sites may be added through closure reclassifications.

For groundwater, an expanded pump-and-treat system for treatment of Cr(VI) will be used. The existing groundwater pump and treat system will be expanded by installing approximately 86 new wells. Nitrate and strontium-90 contaminated groundwater plumes are within the treatment footprint for the Cr(VI) plume and will be co-extracted by the extraction well network used for the Cr(VI) plume remediation. The groundwater treatment system effluent is not expected to exceed MCLs and no treatment is proposed for strontium 90 and nitrate. Specific treatment would be provided if the extracted groundwater in the pump-and-treat effluent stream exceeds the MCLs for the respective COCs prior to reinjection. MNA and institutional controls will be used for strontium 90. Groundwater monitoring will confirm effectiveness of MNA for strontium-90 and determine the impact of pump-and-treat on the persistence of the COC within the aquifer over time.

For cost estimate preparation, the scope of this alternative consisted of:

- RTD waste sites:

Table 3. Alternative 3 Waste Sites with RTD

100-D-75:1	100-D-96
118-DR-2:2	
100-D-101	100-H-5
100-D-102	100-H-57
100-D-103	
100-D-52	100-H-28:7
100-D-10	
100-D-59	

- Void fill grouting of pipeline (100-H-36)
- Capping pipeline (100-D-50:2)
- Removal of Mud Dauber nests (100-H-58)
- Institutional Controls for 116-D-8 and 116-DR-9/100-D-25
- Aggressive pump and treat for hexavalent chromium in groundwater

Alternative 4—RTD for Waste Sites and Pump-and-Treat for Groundwater

This alternative uses RTD for removal of contamination to clean up levels for waste sites (shown in Table 4). Institutional controls to restrict excavation will be applied at individual waste sites with residual risks associated with contamination at depths greater than 4.6 m (15 ft) bgs after remediation, but there is no direct exposure pathway.

For groundwater, pump-and-treat system for treatment of Cr(VI) will be used. The existing pump and treat systems will be expanded by installing approximately 39 new wells. Nitrate and strontium-90 contaminated groundwater plumes are within the treatment footprint for the Cr(VI) plume and will be co-extracted by the extraction well network used for the Cr(VI) plume remediation. The groundwater treatment system effluent is not expected to exceed MCLs and no treatment is proposed for strontium 90 and nitrate. Specific treatment would be provided if the extracted groundwater in the pump-and-treat effluent stream exceeds the MCLs for the respective COCs prior to reinjection. MNA and institutional controls will be used for strontium 90. Groundwater monitoring will confirm effectiveness of MNA for strontium-90 and determine the impact of pump-and-treat on the persistence of the COC within the aquifer over time.

For cost estimate preparation, the scope of this alternative consisted of:

- RTD waste sites:

Table 4. Alternative 4 Waste Sites with RTD

116-D-8	
100-D-75:1	100-H-58
100-H-36	100-H-5
116-DR-9 (includes 100-D-25)	100-H-57
118-DR-2:2	100-D-50:2
100-D-101	100-D-10
100-D-102	100-D-59
100-D-103	
100-D-52	100-H-28:7
100-D-96	

5 Overall Costs

Table 5 presents the combined costs of the waste sites and the groundwater areas. The table lists the capital, annual, periodic, non-discounted and discounted costs for Alternatives 2, 3 and 4.

Table 5. CH2M HILL PRC Overall Costs for Each Alternative

	Alternative VZ & GW-2	Alternative VZ & GW-3	Alternative VZ & GW-4
Subtotal Capital (Non-discounted)	$ 89,446,000	$ 188,104,000	$ 108,702,000
Subtotal Annual (Non-discounted)	$ 198,753,000	$ 119,237,000	$ 258,269,000
Subtotal Periodic (Non-discounted)	$ 144,427,000	$ 114,325,000	$ 252,145,000
Subtotal Non-discounted Cost	$ 432,624,000	$ 421,665,000	$ 619,115,000
Subtotal Discounted (Discounted)	**$ 333,877,000**	**$ 375,100,000**	**$ 433,437,000**
Note: Range of accuracy is expected to be +50%/-30%			

Table A-1 (in Appendix) presents site specific capital, annual, periodic, total non-discounted, and total discounted (present value) costs for each of the twenty vadose zone sites (Site 116-DR-9 includes 100-D-25 and is counted as two sites) and for the 100-DH groundwater zone with assumed integrated in situ soil treatment. The total cost for each alternative is shown at the bottom of the table. Table A-2 (in Appendix) presents the important quantities used in the creation of the estimates for the waste sites. .

Table A-3 (in Appendix) presents specific capital, annual, periodic, total non-discounted, and total discounted (present value) costs for the 100-DH groundwater areas. The total cost for each alternative is shown at the bottom of the table. Table A-4 (in Appendix) presents the important quantities used in the groundwater areas cost estimate.

6 Major Assumptions

There are two different types of assumptions and inputs for cost estimation; general and response activity specific.

6.1 General Assumptions and Inputs

General assumptions apply to all response action cost estimates. The general assumptions discussed in the sections below include direct and indirect cost assumptions and other general pricing assumptions.

6.1.1 General Direct Cost Assumptions

Direct costs include all costs that can be directly attributed to a particular construction activity or item of work required to accomplish the project. Typical direct cost items include: labor, material, equipment and subcontract items. Direct cost assumptions for this estimate include:

- Scope and Bid Contingencies, see Section 9.
- Project management, remedial design, and construction management capital costs, see Section 10.
- Construction labor is discussed in Section 16.

- Equipment used in the estimate based on standard commercial estimating resources and databases: R S Means ECHOS Environmental Remediation Cost Data and the Unit Price Book (within RACER 2011). The units may have been factored or adjusted by the estimator as appropriate to reflect influences by contract, work site, or other identified project or special conditions.

- Cost impacts for performing work under specific levels of worker health safety protection:

    - Work assumed to be performed under worker health and safety level D was assumed to be at the standard TRACE unit cost rates

6.1.2 General Indirect Cost Assumptions

Indirect costs are costs not directly attributable to the completion of an activity. Indirect costs are typically allocated or spread across all activities on a predetermined basis. Indirect costs items can include the following job-related overhead items: taxes; project-specific insurance; bonds; permits and licenses; general supervision; temporary office personnel; schedules; preparatory work and testing services; temporary project facilities; temporary utilities; operations and maintenance of temporary project-site facilities; project vehicles; personal protective equipment and OSHA requirements; quality controls; mobilization and demobilization; and site security.

General indirect cost assumptions for this estimate include:

- Markups are included for profit and G&A, see Section 8

- Mobilization/demobilization and bonding/insurance (MDBI) – the cost estimater can enter a certain percent of the total project to be applied for MDBI within the standard TRACE workbook (V3 and V4).

6.1.3 Other General Cost Assumptions

Quantities used in the cost estimate were provided by the technical team in the Environmental Calculation File, (ECF-100DR1-12-0022)100-D/H Cost Estimate Scoping Forms For Feasibility Study Alternative Costing. Any changes from the original quantities and any additional cost estimate basis assumptions are documented below in this section.

6.2 Response Activity-Specific Assumptions and Inputs

Assumptions specific to the proposed remedial activities for this cost estimate are described below. Important quantities used in the TRACE V3 and V4 cost estimating workbooks are summarized in Table A-2 for waste sites and Table A-4 for the groundwater estimate.

6.2.1 Summary of Cost by Site

The costs for the alternatives for 100 DH were calculated by alternative as a total cost, with itemized vadose zone site costs and itemized groundwater remediation costs combined into each alternative. Separate costs for each of the twenty vadose zone sites and for the groundwater remediation were split out and summarized from the alternative total costs by the following:

- Breaking out and summing each of the site-specific costs for each site

- Allocating a portion of the overall mobilization/demobilization/bonding/insurance, site preparation, and alternative markup costs to each specific site based on the site subtotal cost of the overall alternative cost

All quantity assumptions and inputs for the cost estimate are described in the 100 D/H ECF document.

6.2.2 Specific Assumptions

Groundwater Pump & Treat and monitoring

- Groundwater Monitoring Wells (all alts, where applicable for alternative duration)
    - Replace and abandon wells every 30 years
    - Replace pumps every 5 years
    - Abandon wells and decommission/remove pumps at end of project
- Extraction Wells (all alts, where applicable for alternative duration)
    - Replace and abandon wells every 20 years
    - Rehabilitate wells every 10 years
    - Replace pumps every 5 years
    - Abandon wells and decommission/remove pumps at end of project
- Injection Wells (all alts, where applicable for alternative duration)
    - Replace and abandon wells every 10 years
    - Rehabilitate wells every 2 years
    - Abandon wells at end of project
- D&D of Systems at End of Project
    - 33% of capital costs of each IX system was used as the basis of cost for D&D of existing and new systems
    - 33% of BioNode capital cost was used as the basis of cost for D&D of new BioNode system.

Waste Sites

- Excavation – density of soil, assumed 1.5 tons per bank bcy
- Site Preparation – estimator's judgment at $25,000 to $250,000
- Assumed 100 bat brood houses every 500 feet along the tunnel area to replace habitat for the existing bat population after demolition

Institutional Controls

The estimated costs for providing the sitewide or programmatic ICs including site access, personnel badging, real estate and deeds, warning signs along the Columbia River bank and other access points, maintaining a current site wide institutional controls plan, controls for excavating soil, accessing and using groundwater, and irrigation restrictions are also included in the costs developed for each alternative:

- These costs were assembled and where appropriate a 50% adjustment was made to represent CERCLA cleanup as a portion of the current Hanford Site mission. The TPA currently identifies 22 CERCLA Records of Decision, so each ROD would be allocated

an equal portion of the CERCLA programmatic ICs costs. The programmatic ICs costs are projected for the next 150 years. In 2068 ICs costs are reduced by 50% to reflect removal of the 100 area reactors, as the more active programmatic controls, like site access, would be likewise reduced.

- The total non-discounted cost for the ICs for 150 years is estimated to be $563,000,000 for the Hanford site ($25,600,000 per ROD). The total discounted cost for the ICs at Hanford are estimated at $221,000,000 (about $10,100,000 per ROD).
- The total non-discounted cost for the 5-Year Reviews for 150 years is estimated to be $14,000,000 ($625,000 per ROD). The total discounted cost for the 5-Year Reviews for 150 years is estimated to be $4,000,000 (about $190,000 per ROD).

6.2.3 Alternative Specific Assumptions Used in Estimate

The following assumptions for the GW portion of the alternatives are based on data for the 100-HR3 operable unit, as presented in Chapter 9 of DOE/RL-2010-95.

Alternative 1- No Action

- No Action

Alternative 2— RTD and Grouting for Waste Site and Pump-and-Treat with Biological Treatment for Groundwater.

DX:

- Pump and Treat with Ex-Situ ion exchange treatment of Cr(VI)
- Existing system includes 37 extraction wells already in use as part of the interim action pump and treat system.
- Install and connect 4 new extraction wells to the DX pump and treat system as part of the FS and converting 4 monitoring wells to extraction wells.
- Existing system includes 14 injection wells already in use as part of the interim action pump and treat system.
- Install and connect 7 new injection wells to the DX pump and treat system as part of the FS.
- Includes 73 existing monitoring wells.
- Install 6 new monitoring wells
- Operate Cr(VI) selective ion exchange treatment systems through year 2039
- Performance sampling will system operating for 25 years (year 2039) and compliance monitoring for 5 additional years (to year 2044) after shutdown.

HX:

- Existing system includes 31 extraction wells already in use as part of the interim action pump and treat system.
- Install and connect 17 new extraction wells (7 to Feed Bioremediation System) to the HX pump and treat system as part of the FS. Convert 6 existing EWs to feed the bioremediation system.
- Existing system includes 15 injection wells already in use as part of the interim action pump and treat system.
- Install and connect 3 new injection wells (2 for the bioremediation system) to the HX pump and treat system as part of the FS.
- Convert 3 wells (EWs and IWs) for bioremediation system

- Includes 64 existing monitoring wells
- Includes installation of transfer station
- Install 6 new monitoring wells
- Install one Bio-node mixing facility for bio-substrate injections.
- Pipe via above ground pipelines from Node to bio-injection wells.
- Operate Cr(VI) selective ion exchange treatment systems through year 2039

- Performance sampling will system operating for 25 years (year 2039) and compliance monitoring for 5 additional years (to year 2044) after shutdown.

Alternative 3— RTD and Grouting of Waste Site and Increased Capacity Groundwater Pump-and-Treat for Groundwater.

DX:

- Existing system includes 37 extraction wells already in use as part of the interim action pump and treat system.
- Install and connect 21 new extraction wells to the DX pump and treat system as part of the FS and converting 8 wells from monitoring or injection wells to extraction wells.
- Existing system includes 14 injection wells already in use as part of the interim action pump and treat system.
- Install and connect 12 new injection wells to the DX pump and treat system as part of the FS.
- Construct new ion exchange treatment system at 100-D; Capacity of 625 GPM at 85% required. Cost includes Acceptance Test Plan (ATP), Operational Test Plan (OTP), Construction Acceptance Test (CAT).
- Includes 73 existing monitoring wells.
- Includes installation of transfer station
- Install 6 new monitoring wells
- Operate Cr(VI) selective ion exchange treatment systems through year 2026

- Performance sampling will system operating for 12 years (year 2026) and compliance monitoring for 5 additional years (to year 2031) after shutdown.

HX:

- Existing system includes 31 extraction wells already in use as part of the interim action pump and treat system.
- Install and connect 36 new extraction wells to the HX pump and treat system as part of the FS.
- Existing system includes 15 injection wells already in use as part of the interim action pump and treat system.
- Install and connect 13 new injection wells to the HX pump and treat system as part of the FS.
- Construct new ion exchange treatment system at 100-H; Capacity of 800 GPM at 85% utilization required. Cost includes ATP, OTP and CAT.
- Includes 64 existing monitoring wells
- Includes installation of transfer station
- Install 6 new monitoring wells
- Operate Cr(VI) selective ion exchange treatment systems through year 2026

- Performance sampling will system operating for 12 years (year 2026) and compliance monitoring for 5 additional years (to year 2031) after shutdown.

Alternative 4— RTD for Waste Sites and Pump-and-Treat for Groundwater.

DX:

- Pump and Treat with Ex-Situ ion exchange treatment of Cr(VI)
- Existing system includes 37 extraction wells already in use as part of the interim action pump and treat system.
- Install and connect 5 new extraction wells to the DX pump and treat system as part of the FS and convert 8 monitoring or injection wells to extraction wells.
- Existing system includes 14 injection wells already in use as part of the interim action pump and treat system.
- Install and connect 7 new injection wells to the DX pump and treat system as part of the FS.
- Includes 73 existing monitoring wells.
- Includes installation of transfer station
- Install 6 new monitoring wells
- Operate Cr(VI) selective ion exchange treatment systems through year 2053
- Performance sampling will system operating for 39 years (year 2053) and compliance monitoring for 5 additional years (to year 2058) after shutdown.

HX:

- Existing system includes 31 extraction wells already in use as part of the interim action pump and treat system.
- Install and connect 18 new extraction wells to the HX pump and treat system as part of the FS.
- Existing system includes 15 injection wells already in use as part of the interim action pump and treat system.
- Install and connect 5 new injection wells to the HX pump and treat system as part of the FS.
- Includes installation of transfer station
- Includes 64 existing monitoring wells
- Install 6 new monitoring wells
- Operate Cr(VI) selective ion exchange treatment systems through year 2053
- Performance sampling will system operating for 39 years (year 2053) and compliance monitoring for 5 additional years (to year 2058) after shutdown.

6.2.4 Modified Standard TRACE Unit Costs

The following unit costs were used in the cost estimate and were added to the original TRACE V3 default costs. The source of the unit cost is listed beside the item in the list below:

Vadose Zone - Capital

- Cost, box flume – RACER 2011
- Spillway below box flume – RACER 2011
- Grout Flume Box @ 100-H-36 –Estimate in “grouting” tab of workbook
- Load and Haul cost for 100-H-58 – RACER 2011
- Removed Mud Dauber nests from 100-H-58 site power pole – Estimate in “site 100-H-58” of workbook

- Bat Brood and Nesting Boxes (Ecological Habitat Mitigation) – vendor quote
- 24" pipe end cap – Vendor quote
- Cap maintenance for an ET cap – RACER 2011
- CTA Construction /Scales/Survey Tent – 100K Area Contract Escalated to 2012
- Pipe Fitters – Labor Cost (C081)
- Safety Engineer – Labor Cost (E120)
- First Line Supervisor – Labor Cost (M010)
- Alt 2 & 3 Industrial Hygienists – Labor Cost (P090)
- Alt 4 Other Scientists – Labor Cost (S090)

Vadose Zone – Annual and periodic

- Site Visit (annual) – Hanford budget cost

The unit costs used in the groundwater cost TRACE V4 estimate are shown in Tables A-5 and A-6 in the Appendix. The table provides notes and references for each of the unit costs used.

7 Exclusions

This section identifies costs that have not been included in the estimate. The following items have been excluded from the estimate:

- Escalation – Separate escalation has not been included in these calculations. The costs are all based on fiscal year 2012 costs distributed into years that the activities and associated costs would occur, and a present value (PV) analysis is performed to convert all costs back to fiscal year 2012 basis using the alternative-specific stated OMB real discount rate.
- Costs for remediating the sites individually under separate contracts. The costs in this estimate assume that the sites are remediated under one contract corresponding to the specific alternative, or at most one vadose zone and one groundwater contract. If sites are remediated separately, the individual site costs would be expected to be higher than shown for the individual sites in Table 6, since certain fixed costs would not be spread over a group of sites and certain activity economies of scale would not be present.

8 Markups

The following markups have been included in the Cost Estimate:

- Contractor Overhead at 10 percent.
- Contractor Profit at 8 percent.
- PRC direct distributable/general and administrative (DD/G&A) costs have been applied at a rate of 30.24[1] percent to all PRC labor, material, and equipment. G&A is also applied to the FP contractor costs. This markup includes a number of job-related overhead items:

[1] DD/G&A rate is obtained from CH2M Hill Plateau Remediation Company (DRAFT) FY 2012 Rates/Multipliers, http://prc.rl.gov/rapidweb/Finance/index.cfm?PageNum=11

- Taxes
- Project-specific insurance
- Bonds
- Permits and licenses
- General supervision
- Temporary office personnel
- Schedules
- Preparatory work and testing services
- Temporary project facilities and O&M of these facilities
- Temporary utilities (e.g. phone, electrical)
- Project vehicles
- Personal protective equipment and Occupational Health and Safety requirements
- Quality controls
- Mobilization and demobilization
- Site security

9 Contingencies

Contingency is factored into a cost estimate to cover unknowns, unforeseen circumstances, or unanticipated conditions that are not possible to evaluate from the available data at the time the estimate is prepared. It is used to reduce the risk of possible cost overruns.

The two main types of contingency are scope and bid. Scope contingency covers unknown costs due to scope changes that may occur during design. Bid contingency covers unknown costs associated with constructing and implementing a given project scope. Contingency rates have been applied to the capital costs as per EPA/540/R-00/002, Section 5.4 for soil excavation and groundwater treatment. The scope contingency for Waste Site Alternatives 2, 3, and 4 were set at 35%. The scope contingency for Groundwater Alternatives 2, 3, and 4 were set at 45%.

- Bid Contingency. The range for bid contingency is typically from 10 to 20 percent. The bid contingency for this estimate has been set at 20% for the vadose zone estimate and is included in the 45% scope contingency for the groundwater estimate.
- O&M Contingency. The O&M contingency included in the groundwater and waste site estimates was set at 20% for the vadoze zone estimate and 25% for the groundwater estimate.

10 Project Management, Remedial Design, and Construction Management Costs

Project management, remedial design, and construction management capital costs are estimated using factors based on EPA/540/R-00/002, Exhibit 5-8:

- For projects with construction costs less than $100,000 – remedial design is planned at 20 percent, project management is planned at 10 percent, and construction management is planned at 15 percent of the construction cost.
- For projects with construction costs from $100,000 to $500,000 – remedial design is planned at 15 percent, project management is planned at 8 percent, and construction management is planned at 10 percent of the construction cost.
- For projects with construction costs from $500,000 to $2 million – remedial design is planned at 12 percent, project management is planned at 6 percent, and construction management is planned at 8 percent of the construction cost.

- For projects with construction costs from $2 million to $10 million – remedial design is planned at 8 percent, project management is planned at 5 percent, and construction management is planned at 6 percent of the construction cost.
- For projects with construction costs greater than $10 million – remedial design is planned at 6 percent, project management is planned at 5 percent, and construction management is planned at 6 percent of the construction cost.

Since all alternatives for groundwater (capital) and waste sites (capital) have estimated construction costs greater than $10 million, the following percentages were used in these estimates:

- Remedial Design at 6%
- Project Management at 5%
- Construction Management at 6%

The Remedial Design, Project Management, and Construction Management markups were applied to the individual O&M line items. The following percentages were used for the vadoze estimate as:

- Remedial Design at 20%
- Project Management at 10%
- Construction Management at 15%

The following range of percentages were used for the groundwater estimate:

- Remedial Design at 6 to 20%
- Project Management at 5 to 10%
- Construction Management at 6 to 15%

11 Present Worth

As per EPA Guidance, EPA/540/R-00/002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study***,** OSWER 9355.0-75 (EPA, 2000) the estimate includes present worth calculations for work performed in out years.

The costs are presented as present worth values. The present worth value method establishes a common baseline for evaluating costs that occur during different time periods, thus allowing for direct cost comparisons between different alternatives. The present worth value represents the dollars that would need to be set aside today, at the defined real discount rate, to ensure that funds would be available in the future as they are needed to perform the response action alternative.

Present worth costs were estimated using the real discount rate published in Appendix C of the Office of Management and Budget (OMB) Circular No. A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs, effective through January 2013* (OMB, 2011). Based on this guidance and the duration of 23 years for waste site alternatives 2 and 3, a discount rate of 1.8% was used. A discount

rate was not used for waste site alternative 4 as the duration is only 1 year. Also, based on this guidance, and durations of 31 years for groundwater alternative 2 and 45 years for groundwater alternative 4, a real discount rate of 1.1% was used. For groundwater alternative 3 with duration of 18 years, a real discount rate of 0.7% was used in groundwater alternative cost estimate present value calculations.

12 Estimate Classification

This estimate was prepared in accordance with the guidelines of "*A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, EPA 540-R-00-002, OSWER 9355.0-75, July 2000. It's important to remember that at the FS stage, the design for the response action project is still conceptual, not detailed, and the cost estimate is considered to be "order-of-magnitude." The expected accuracy range of the cost estimate at this stage is approximately plus 50 percent, minus 30 percent.

The expected accuracy range is an indication of the degree to which the final cost outcome for a given project could vary from the estimated cost. Accuracy is traditionally expressed as a +/- percentage range around the point estimate after application of contingency, with a stated level of confidence that the actual cost outcome would fall within this range (+/- measures are a useful simplification, given that actual cost outcomes have different frequency distributions for different types of projects). Typically, this results in a 90% confidence that the actual cost will fall within the bounds of the low and high ranges.

The accuracy range of an estimate is dependent upon a number of characteristics of the estimate input information and the estimating process. The extent and the maturity of the input information as measured by percentage completion (and related to level of project definition) is an important determinant of accuracy. However, there are factors besides the available input information that also greatly affect estimate accuracy measures. Primary among these are the state of technology in the project and the quality of reference cost estimating data.

The accuracy of any given estimate is not fixed or determined by its classification category. Significant variations in accuracy from estimate to estimate are possible if any of the determinants of accuracy, such as technology, quality of reference cost data, quality of the estimating process, and skill and knowledge of the estimator vary. Accuracy is also not necessarily determined by the methodology used or the effort expended. Estimate accuracy must be evaluated on an estimate-by estimate basis, usually in conjunction with some form of risk analysis process.

13 Cost Resources

The following is a list of the cost resources used in the development of the cost estimate.

- TRACE V3 (ECF-Hanford-11-0098 through 0107)
- TRACE V4 (ECF-Hanford-14-0003 through 0010)
- RACER™
- RS Means
- 100 K RI/FS previous cost estimate
- UP-1 previous cost estimate
- Hanford historical actual costs
- Estimator Judgment

14 Estimate Methodology

The cost estimate for the 100 D/H project was developed in accordance with EPA/540/R-00/002, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study***,** OSWER 9355.0-75 (EPA,

2000), and Hanford internal procedure for cost estimating *for response action decision-making*. The TRACE V3 and V4 cost estimating workbooks in conjunction with the RACER™ Cost Estimator software were used to develop the cost estimate for each of the removal action alternatives.

This cost estimate has been prepared for guidance in project evaluation from the information available at the time of the estimate. The final cost of the project will depend on final design, selected scope of work, actual labor and material costs, competitive market conditions, implementation schedule and other variable factors. As a result, the final project costs will vary from the estimate presented here. Because of this, project feasibility and funding needs must be carefully reviewed prior to making specific financial decisions to help ensure proper project evaluation and adequate funding.

15 Sensitivity Analysis

Sensitivity analysis for this cost estimate was not performed. The following factors might cause the estimate to significantly change.

- Levels of contamination
- Depth and extent of contamination encountered during RTD of vadose zone sites
- Rate(s) of groundwater extraction and injection
- Potential adding of pretreatment systems for nitrate and Sr-90
- Duration of extraction and injection systems
- Duration and actual operations and maintenance requirements for groundwater treatment systems
- Less favorable working conditions and/or increased monitoring requirements that would significantly increase the impact of working in health and safety protection and/or increase the health and safety protection requirements.

Because of these factors:

1. The remedy selection process must consider differences in response action cost uncertainties/cost risks in addition to response action-specific cost estimates and ranges.
2. Funding needs must be carefully reviewed before making specific financial decisions or establishing final budgets.

16 Labor Costs

Fixed-price (FP) construction craft labor rates are those listed in Appendix A of the Site Stabilization Agreement for All Construction Work for the U.S. Department of Energy at the Hanford Site (commonly known as the Hanford Site Stabilization Agreement [HSSA]). The HSSA rates include base wage, fringe benefits, and other compensation as negotiated between CH2M HILL Plateau Remediation Company (CHPRC) and the National Building and Construction Trades Department American Federation of Labor-Congress of Industrial Organizations (AFL-CIO). Other factors that account for additional costs (Workman's Compensation, Federal Insurance Contributions Act (FICA), and state and Federal unemployment insurance) to develop a fully burdened rate by craft, have been incorporated. The labor rates used are for 2012.

Plateau Remediation Contractor (PRC) labor rates for management, engineering, safety oversight, and technical support are based on the PRC-approved planning rates for fiscal year 2012.

17 Sales Tax

Washington State sales tax has been applied to all materials and equipment purchases at 8.3 percent and is included in the PRC general and administrative (G&A) percentage discussed in section 7.

18 References

EPA 540-R-00-002, 2000, *A Guide to Developing and Documenting Cost Estimates During the Feasibility Study*, OSWER 9355.0-75, Office of Emergency and Remedial Response, U.S. Environmental Protection Agency, Washington, D.C.

Means, R. S., 2001, ECHOS *Environmental Remediation Cost Date Unit Price*, Robert S. Means Company, Kingston, Massachusetts.

Means, R. S., 2011a, *Building Construction Cost Book*, 68th annual ed., Robert S. Means Company, Kingston, Massachusetts.

Means, R. S., 2011b, *Heavy Construction Cost Data*, 24th annual ed., Robert S. Means Company, Kingston, Massachusetts.

OMB Circular No. A-94, 2011, "Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs" (memorandum for Heads of Executive Departments and Establishments), Appendix C, "Discount Rates for Cost-Effectiveness, Lease Purchase, and Related Analyses," as revised, Office of Management and Budget, Washington, D.C.

Site Stabilization Agreement for All Construction Work for the U.S. Department of Energy at the Hanford Site, 1984, as amended, commonly known as the Hanford Site Stabilization Agreement (HSSA)(original title, *Site Stabilization Agreement, Hanford Site, between J.A. Jones Construction Services Company and Morrison-Knudsen Company, Inc., and the Building and Construction Trades Department of the AFL-CIO and its affiliated international unions, and the International Brotherhood of Teamsters, Chauffeurs, Warehousemen, and Helpers of America.*

ECF-Hanford-11-0164, Environmental Calculation File TRACEV3 – Site Cost Distribution

ECF-Hanford-11-0098, Environmental Calculation File for TRACE_V3-Overview, (Rev1)

ECF-Hanford-11-0099, Environmental Calculation File for TRACE_V3-Actual Costs, (Rev1)

ECF-Hanford-11-0100, Environmental Calculation File for TRACE_V3- RACER Costs, (Rev1)

ECF-Hanford-11-0101, Environmental Calculation File for TRACE_V3-Calculations, (Rev1)

ECF-Hanford-11-0102 Environmental Calculation File for TRACE_V3-Unit Costs, (Rev1)

ECF-Hanford-11-0103, Environmental Calculation File for TRACE_V3-Capital Cost, (Rev1)

ECF-Hanford-11-0104, Environmental Calculation File for TRACE_V3-O&M Cost, (Rev1)

ECF-Hanford-11-0105, Environmental Calculation File for TRACE_V3-O&M Distribution, (Rev1)

ECF-Hanford-11-0106, Environmental Calculation File for TRACE_V3-Present Value, (Rev1)

ECF-Hanford-11-0107, Environmental Calculation File for TRACE_V3-Totals, (Rev1)

ECF-Hanford-11-0037, Environmental Calculation File for Excavation Template_V1

ECF-Hanford-12-0067, Institutional Controls Costs Apportioned by ROD Groups

ECF-Hanford-14-0003, TRACE V4 – Alternatives 01 through 06

ECF-Hanford-14-0004, TRACE V4 – Project Setup

ECF-Hanford-14-0005, TRACE V4 – Site Setup

ECF-Hanford-14-0006, TRACE V4 - Overview

ECF-Hanford-14-0007, TRACE V4 – Alternative Cost Comparison

ECF-Hanford-14-0008, TRACE V4 - Capital Unit Cost

ECF-Hanford-14-0009, TRACE V4 - O&M Unit Cost

ECF-Hanford-14-0010, TRACE V4 - Site Summary

DOE/RL-2001-41, Revision 5, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions and RCRA Corrective Actions*, June 2012

The Hanford Sitewide Institutional Control Plan, DOE/RL-2001-41, Rev. 5

EPA/ROD/R10-00/121, Record of Decision for the USDOE Hanford 100-Area, Benton County, Washington

EPA, 2001, USDOE Hanford Site, First Five-Year Review Report

EPA/ROD/R10-01/119, Record of Decision for the USDOE Hanford 300 Area, Benton County, Washington

DOE/EIS-0222-F, Final Hanford Comprehensive Land-Use Plan Environmental Impact Statements

DOE/EIS-0019F, NEPA Environmental Impact Statement, Decommissioning of Eight Surplus Production Reactors at the Hanford Site, Richland, Washington, December 1992.

Circular No. A-94, *Guidelines and Discount Rates for Benefit-Cost Analysis of Federal Programs*, Appendix C of the Office of Management and Budget (OMB), Washington D.C., *20*

Appendix

Table A-1. Summary of Costs by Waste Site

Site Summary - 100-DH

	Alt 2 WASTE SITE RTD and Grouting for Waste Site and Pump-and-Treat with Biological Treatment for GW	Alt 3 WASTE SITES RTD and Grouting of Waste site and Increased Capacity Groundwater Pump-and-Treatment for GW	Alt 4 WASTE SITES RTD for Waste Sites and Pump-and-Treat for GW
Site number 1			
Site name		**116-D-8**	***Please see 100-D-50:2 for costs***
Capital Cost	$ -	$ -	
Annual	$ 37,000	$ 37,000	
Periodic	$ 102,000	$ 102,000	
Individual Site (Non Discounted)	$ 139,000	$ 139,000	
Discounted (PV)	$ 98,000	$ 98,000	
Site number 4			
Site name	**100-D-75:1**		
Capital Cost	$ 6,164,000	$ 6,164,000	$ 6,164,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 6,164,000	$ 6,164,000	$ 6,164,000
Discounted (PV)	$ 6,164,000	$ 6,164,000	$ 6,164,000
Site number 5			
Site name	**100-H-36**		
Capital Cost	$ 983,000	$ 983,000	$ 2,653,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 983,000	$ 983,000	$ 2,653,000
Discounted (PV)	$ 983,000	$ 983,000	$ 2,653,000
Site number 6	includes site 100-D-25	includes site 100-D-25	
Site name	**116-DR-9**		
Capital Cost	$ -	$ -	$ 2,159,000
Annual	$ 37,000	$ 37,000	$ -
Periodic	$ 102,000	$ 102,000	$ -
Individual Site (Non Discounted)	$ 139,000	$ 139,000	$ 2,159,000
Discounted (PV)	$ 98,000	$ 98,000	$ 2,159,000
Site number 7			
Site name	**118-DR-2:2**		
Capital Cost	$ 1,522,000	$ 1,522,000	$ 1,522,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 1,522,000	$ 1,522,000	$ 1,522,000
Discounted (PV)	$ 1,522,000	$ 1,522,000	$ 1,522,000
Site number 12			
Site name	**100-D-10**		
Capital Cost	$ 1,971,000	$ 1,971,000	$ 1,971,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 1,971,000	$ 1,971,000	$ 1,971,000
Discounted (PV)	$ 1,971,000	$ 1,971,000	$ 1,971,000
Site number 13			
Site name	**100-D-101**		
Capital Cost	$ 1,477,000	$ 1,477,000	$ 1,477,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 1,477,000	$ 1,477,000	$ 1,477,000
Discounted (PV)	$ 1,477,000	$ 1,477,000	$ 1,477,000

Site number 14			
Site name	**100-D-102**		
Capital Cost	$ 4,544,000	$ 4,544,000	$ 4,544,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 4,544,000	$ 4,544,000	$ 4,544,000
Discounted (PV)	$ 4,544,000	$ 4,544,000	$ 4,544,000

Site number 15			
Site name	**100-D-103**		
Capital Cost	$ 768,000	$ 768,000	$ 768,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 768,000	$ 768,000	$ 768,000
Discounted (PV)	$ 768,000	$ 768,000	$ 768,000

Site number 16			
Site name	**100-D-52**		
Capital Cost	$ 1,120,000	$ 1,120,000	$ 1,120,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 1,120,000	$ 1,120,000	$ 1,120,000
Discounted (PV)	$ 1,120,000	$ 1,120,000	$ 1,120,000

Site number 17			
Site name	**100-D-59**		
Capital Cost	$ 668,000	$ 668,000	$ 668,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 668,000	$ 668,000	$ 668,000
Discounted (PV)	$ 668,000	$ 668,000	$ 668,000

Site number 25			
Site name	**100-D-96**		
Capital Cost	$ 1,188,000	$ 1,188,000	$ 1,188,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 1,188,000	$ 1,188,000	$ 1,188,000
Discounted (PV)	$ 1,188,000	$ 1,188,000	$ 1,188,000

Site number 26			
Site name	**100-D-98**		
Capital Cost	$ -	$ -	$ -
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ -	$ -	$ -
Discounted (PV)	$ -	$ -	$ -

Site number 28			
Site name	**100-H-28:7 (pipeline)**		
Capital Cost	$ 7,836,000	$ 7,836,000	$ 7,836,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 7,836,000	$ 7,836,000	$ 7,836,000
Discounted (PV)	$ 7,836,000	$ 7,836,000	$ 7,836,000

Site number 33			
Site name	**100-H-5**		
Capital Cost	$ 7,844,000	$ 7,844,000	$ 7,844,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 7,844,000	$ 7,844,000	$ 7,844,000
Discounted (PV)	$ 7,844,000	$ 7,844,000	$ 7,844,000

Site number 38			
Site name	**100-H-57**		
Capital Cost	$ 1,405,000	$ 1,405,000	$ 1,405,000

Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 1,405,000	$ 1,405,000	$ 1,405,000
Discounted (PV)	$ 1,405,000	$ 1,405,000	$ 1,405,000

Site number 39			
Site name		**100-D-50:2**	***includes site 116-D-8***
Capital Cost	$ 34,000	$ 34,000	$ 8,047,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 34,000	$ 34,000	$ 8,047,000
Discounted (PV)	$ 34,000	$ 34,000	$ 8,047,000

Site number 71			
Site name		**100-H-58: Above Grade Contaminated Nests**	
Capital Cost	$ 74,000	$ 74,000	$ 74,000
Annual	$ -	$ -	$ -
Periodic	$ -	$ -	$ -
Individual Site (Non Discounted)	$ 74,000	$ 74,000	$ 74,000
Discounted (PV)	$ 74,000	$ 74,000	$ 74,000

Institutional Controls		**Institutional Controls**	
Annual (Programmatic ICs (100-DH) 150 Yrs	$ 25,600,000	$ 25,600,000	$ 25,600,000
Periodic (5-Year Review (100-DH) 150 Yrs)	$ 625,000	$ 625,000	$ 625,000
Individual Site (Non Discounted)	**$ 26,225,000**	**$ 26,225,000**	**$ 26,225,000**
Discounted (PV)	$ 10,290,000	$ 10,290,000	$ 10,290,000

Total Capital (Non-discounted)	**$ 37,598,000**	**$ 37,598,000**	**$ 49,440,000**
Total Annual (Non-discounted)	**$ 25,674,000**	**$ 25,674,000**	**$ 25,600,000**
Total Periodic (Non-discounted)	**$ 829,000**	**$ 829,000**	**$ 625,000**
Total Non Discounted	**$ 64,101,000**	**$ 64,101,000**	**$ 75,665,000**
Total Discounted (Discounted)	**$ 48,084,000**	**$ 48,084,000**	**$ 59,730,000**

NOTE: The above plume/area totals are rounded up to nearest thousand dollars individually - if added together they will give slightly different totals (approximately 0.003% more) for each Response Action Alternative than the corresponding totals in the TRACE V3 "Totals" spreadsheet (the latter totals cost for all line items for all plumes and then rounds to the nearest thousand dollars).

Institutional Controls Costs
from the ECF for the Institutional Controls, 2012 (ECF-HANFORD-12-0067, Rev 0)
*The total non-discounted cost for the ICs for 150 years is estimated to be $562,781,000 for the Hanford site (about **$25,600,000 per ROD**). The total discounted cost for the ICs at Hanford are estimated at $221,299,000 (about **$10,100,000 per ROD**).*

*The total non-discounted cost for the 5-Year Reviews for 150 years is estimated to be $13,740,000 (about **$625,000 per ROD**). The total discounted cost for the 5-Year Reviews for 150 years is estimated to be $4,175,000 (about **$190,000 per ROD**).*

Table A-2. Important Quantities, Waste Sites

IMPORTANT QUANTITIES

		Alt 2 WASTE SITE	Alt 3 WASTE SITES	Alt 4 WASTE SITES
	Excavation			
	116-D-8			Considered part of 100-D-50:2
1	116-D-8 Depth, ft	MNA	MNA	3.00
Excavation	116-D-8 Depth to Top of Contamination	MNA	MNA	-
	116-D-8 Waste Site Ground Surface Area (sf)	MNA	MNA	11,296.68
	116-D-8 Total Volume of Excavation(cy)	MNA	MNA	1,443.46
	116-D-8 Total Volume Contaminated (cy)			1,443.46
	116-D-8 Expected Safety Level			D
4	100-D-75:1 Depth, ft	3	3	3
Excavation	100-D-75:1 Depth to Top of Contamination	-	-	-
	100-D-75:1 Waste Site Contaminated Surface Area (sf)	135,625.00	135,625.00	135,625.00
	100-D-75:1 Waste Site Ground Surface Area (sf)	142,334.36	142,334.91	142,334.91
	100-D-75:1 Total Volume of Excavation(cy)	17,329.79	17,329.86	17,329.86
	100-D-75:1 Total Volume Contaminated (cy)	17,329.79	17,329.86	17,329.86
	100-D-75:1 Expected Safety Level	D	D	D
5	100-H-36 Depth, ft			1
Excavation	100-H-36 Depth to Top of Contamination	grouting	grouting	-
	100-H-36 Waste Site Contaminated Surface Area (sf)			3,229.00
	100-H-36 Waste Site Ground Surface Area (sf)			11,241.15
	100-H-36 Total Volume of Excavation(cy)			5,053.83
	100-H-36 Total Volume Contaminated (cy)			2,255.52
	100-H-36 Expected Safety Level			
6	116-DR-9 Depth, ft ***(includes site 100-D-25)***			15
Excavation	116-DR-9 Depth to Top of Contamination	MNA	MNA	3.30
	116-DR-9 Waste Site Contaminated Surface Area (sf)	MNA	MNA	5,820.29
	116-DR-9 Waste Site Ground Surface Area (sf)	MNA	MNA	14,711.47
	116-DR-9 Total Volume of Excavation(cy)	MNA	MNA	6,558.76
	116-DR-9 Total Volume Contaminated (cy)			2,900.45
	116-DR-9 Expected Safety Level			D
7	118-DR-2:2 Depth, ft	15	15	15
Excavation	118-DR-2:2 Depth to Top of Contamination	-	-	-
	118-DR-2:2 Waste Site Contaminated Surface Area (sf)	2,926.28	2,926.28	2,926.28
	118-DR-2:2 Waste Site Ground Surface Area (sf)	9,819.85	9,819.85	9,819.85
	118-DR-2:2 Total Volume of Excavation(cy)	4,071.68	4,071.68	4,071.68
	118-DR-2:2 Total Volume Contaminated (cy)	1,869.57	1,869.57	1,869.57
	118-DR-2:2 Expected Safety Level	D	D	D
12	100-D-10			
Excavation	Depth, ft	19.68	19.68	19.68
	Depth to Top of Contamination			
	100-D-10 Waste Site Contaminated Surface Area (sf)	2,705.00	2,705.00	2,705.00
	Waste Site Ground Surface Area (sf)	12,335.34	12,335.34	12,335.34
	Total Volume of Excavation(cy)	6,305.17	6,305.17	6,305.17
	Total Volume Contaminated (cy)	2,267.96	2,267.96	2,267.96
	Expected Safety Level	D	D	D
13	100-D-101			
Excavation	Depth, ft	8.20	8.20	8.20
	Depth to Top of Contamination	-	-	-
	100-D-101 Waste Site Contaminated Surface Area (sf)	6,650.00	6,650.00	6,650.00
	Waste Site Ground Surface Area (sf)	11,267.30	11,267.30	11,267.30
	Total Volume of Excavation(cy)	3,128.89	3,128.89	3,128.89
	Total Volume Contaminated (cy)	2,322.57	2,322.57	2,322.57
	Expected Safety Level	D	D	D
14	100-D-102			
Excavation	Depth, ft	15.00	15.00	15.00
	Depth to Top of Contamination			
	100-D-102 Waste Site Contaminated Surface Area (sf)	13,824.50	13,824.50	13,824.50
	Waste Site Ground Surface Area (sf)	26,431.49	26,431.49	26,431.49
	Total Volume of Excavation(cy)	12,859.55	12,859.55	12,859.55
	Total Volume Contaminated (cy)	8,832.32	8,832.32	8,832.32
	Expected Safety Level	D	D	D

15	100-D-103			
Excavation	Depth, ft	15.00	15.00	15.00
	Depth to Top of Contamination			
	100-D-103 Waste Site Contaminated Surface Area (sf)	495.00	495.00	495.00
	Waste Site Ground Surface Area (sf)	4,522.37	4,522.37	4,522.37
	Total Volume of Excavation(cy)	1,602.77	1,602.77	1,602.77
	Total Volume Contaminated (cy)	316.25	316.25	316.25
	Expected Safety Level	D	D	D
16	100-D-52			
Excavation	Depth, ft	24.93	24.93	24.93
	Depth to Top of Contamination		-	
	Waste Site Contaminated Surface Area (sf)	72.00	72.00	72.00
	Waste Site Ground Surface Area (sf)	6,936.93	6,936.93	6,936.93
	Total Volume of Excavation(cy)	3,721.80	3,721.80	3,721.80
	Total Volume Contaminated (cy)	372.18	372.18	372.18
	Expected Safety Level	D	D	D
17	100-D-59			
Excavation	Depth, ft	15.10	15.10	15.10
	Depth to Top of Contamination		-	
	Waste Site Contaminated Surface Area (sf)	1.70	1.70	1.70
	Waste Site Ground Surface Area (sf)	2,171.92	2,171.92	2,171.92
	Total Volume of Excavation(cy)	698.98	698.98	698.98
	Total Volume Contaminated (cy)	69.90	69.90	69.90
	Expected Safety Level	D	D	D
25	100-D-96			
Excavation	Depth, ft	15.10	15.10	15.10
	Depth to Top of Contamination	-	-	-
	Waste Site Contaminated Surface Area (sf)	29.91	29.91	29.91
	Waste Site Ground Surface Area (sf)	2,577.48	2,577.48	2,577.48
	Total Volume of Excavation(cy)	838.47	838.47	838.47
	Total Volume Contaminated (cy)	83.85	83.85	83.85
	Expected Safety Level	D	D	D
28	100-H-28:7 (pipeline)			
Excavation	Depth, ft	15.10	15.10	15.10
	Depth to Top of Contamination	-	-	-
	Waste Site Contaminated Surface Area (sf)	32,100.00	32,100.00	32,100.00
	Waste Site Ground Surface Area (sf)	50,384.41	50,384.41	50,384.41
	Total Volume of Excavation(cy)	26,524.85	26,524.85	26,524.85
	Total Volume Contaminated (cy)	20,645.06	20,645.06	20,645.06
	Expected Safety Level	D	D	D
33	100-H-5			
Excavation	Depth, ft	24.90	24.90	24.90
	Depth to Top of Contamination		-	
	Waste Site Contaminated Surface Area (sf)	16,137.60	16,137.60	16,137.60
	Waste Site Ground Surface Area (sf)	40,696.55	40,696.55	40,696.55
	Total Volume of Excavation(cy)	30,137.89	30,137.89	30,137.89
	Total Volume Contaminated (cy)	17,114.82	17,114.82	17,114.82
	Expected Safety Level	D	D	D
38	100-H-57			
Excavation	Depth, ft	15.10	15.10	15.10
	Depth to Top of Contamination		-	
	Waste Site Contaminated Surface Area (sf)	2,495.90	2,495.90	2,495.90
	Waste Site Ground Surface Area (sf)	9,074.27	9,074.27	9,074.27
	Total Volume of Excavation(cy)	3,720.67	3,720.67	3,720.67
	Total Volume Contaminated (cy)	1,605.23	1,605.23	1,605.23
	Expected Safety Level	D	D	D
39	100-D-50:2 - Piping inside of intact subgrade tunnels			RTD
Excavation	Depth, ft	capping pipe	capping pipe	24.08
	Depth to Top of Contamination	capping pipe	capping pipe	16.08
	Waste Site Contaminated Surface Area (sf)	capping pipe	capping pipe	106,964.77
	Waste Site Ground Surface Area (sf)	capping pipe	capping pipe	8,815.89
	Total Volume of Excavation(cy)	capping pipe	capping pipe	59,374.04
	Total Volume Contaminated (cy)	capping pipe	capping pipe	5,759.53
	Expected Safety Level	C	C	D
	quantity of soil to fill in excavation			2,587.14

71	100-H-58	The site is a mud dauber (wasp) nests in power lines (above ground)		
Excavation	Depth, ft	na	na	na
	Depth to Top of Contamination	na	na	na
	Waste Site Contaminated Surface Area (sf)	na	na	na
	Waste Site Ground Surface Area (sf)	na	na	na
	Total Volume of Excavation(cy)	na	na	na
	Total Volume Contaminated (cy)	1.71	1.71	1.71
	Expected Safety Level	D	D	D
	Void Fill Grouting	ALT 3	SAME AS ALT 3	ALT 4
5	100-H-36 Depth, ft	1.00	1.00	RTD
Grouting	100-H-36 Length void to grout fill (ft)	72.60	72.60	RTD
	100-H-36 Length of void to grout fill (ft)	390.00	390.00	RTD
	100-H-36 Total Volume of Grout (cy)	1,048.67	1,048.67	RTD
	100-H-36 Expected Safety Level	D	D	
	MNA			
1	116-D-8			
MNA	MNA through year	2035	2035	RTD
				RTD
6	116-DR-9/100-D-25			
MNA	MNA through year	2035	2035	RTD
				RTD
	End Capping of Pipes			
39	100-D-50:2 - Piping inside of intact subgrade tunnels			
END CAPPING	Number of end caps for pipelines	8.00	8.00	RTD
	size of pipes	24"	24"	RTD
	Expected Safety Level	C	C	RTD

Table A-3. Summary of Total Groundwater Costs

Table A-3

COMPARISON OF TOTAL COST OF REMEDIAL ACTION ALTERNATIVES

Location: 100-DH **Base Year:** 2012
Phase: Feasibility Study **Date:** 1/28/2014

		1	2	3	4
GW-100DX		**Alternative 01**	**Alternative 02**	**Alternative 03**	**Alternative 04**
		Alternative 1 - No Action	Alternative 2 - GW (Pump-and-Treat with Biological Treatment	Alternative 3 - GW (Increased Capacity Groundwater Pump-	Alternative 4 -GW (Pump-and-Treat for Groundwater)
	Total Project Duration (Years)	0	31	18	45
	Capital Cost	$0	$12,277,518	$62,536,687	$20,543,495
	Annual O&M Cost	$0	$102,136,433	$63,420,770	$169,455,698
	Periodic O&M Cost	$0	$59,719,161	$50,126,307	$112,927,454
	Total Non-Discounted Cost	$0	$174,133,113	$176,083,764	$302,926,647
	Total Present Value of Alternative	$0	$132,446,253	$160,136,239	$205,789,851
GW-100HX		**Alternative 01**	**Alternative 02**	**Alternative 03**	**Alternative 04**
		Alternative 1 - No Action	(Pump-and-Treat with Biological Treatment for GW)	(Increased Capacity Groundwater Pump-and-Treatment for	Alternative 4 -GW (Pump-and-Treat for Groundwater)
	Total Project Duration (Years)	0	31	18	45
	Capital Cost	$0	$20,989,587	$69,389,027	$20,137,918
	Annual O&M Cost	$0	$70,942,069	$30,141,419	$63,212,706
	Periodic O&M Cost	$0	$83,878,219	$63,368,794	$138,592,271
	Total Non-Discounted Cost	$0	$175,809,875	$162,899,240	$221,942,895
	Total Present Value of Alternative	$0	$134,766,343	$148,298,777	$149,336,177

	Alternative 01	**Alternative 02**	**Alternative 03**	**Alternative 04**
Capital Cost	$0	$33,267,106	$131,925,714	$40,681,412
Annual O&M Cost	$0	$173,078,503	$93,562,189	$232,668,405
Periodic O&M Cost	$0	$143,597,380	$113,495,101	$251,519,724
Total Non-Discounted Cost	$0	$349,942,989	$338,983,004	$524,869,541
Total Present Value of Alternative	$0	$267,212,597	$308,435,015	$355,126,028

COMPARISON OF TOTAL COST OF REMEDIAL ACTION ALTERNATIVES

Location: 100-DH **Base Year:** 2012
Phase: Feasibility Study **Date:** 1/28/2014

	1	2	3	4
	Alternative 01	**Alternative 02**	**Alternative 03**	**Alternative 04**
	Alternative 1 - No Action	Alternative 2 - GW (Pump-and-Treat with Biological Treatment for GW)	Alternative 3 - GW (Increased Capacity Groundwater Pump-and-Treatment for GW)	Alternative 4 -GW (Pump-and-Treat for Groundwater)
Total Project Duration (Years)	0	31	18	45
Capital Cost	$0	$33,267,106	$131,925,714	$40,681,412
Annual O&M Cost	$0	$173,078,503	$93,562,189	$232,668,405
Periodic O&M Cost	$0	$143,597,380	$113,495,101	$251,519,724
Total Non-Discounted Cost	$0	$349,942,989	$338,983,004	$524,869,541
Total Present Value of Alternative	$0	$267,212,597	$308,435,015	$355,126,028
Expected Accuracy Range for Total Present Value is -30% to +50%				
-30%	$0	$187,048,818	$215,904,511	$248,588,220
50%	$0	$400,818,895	$462,652,523	$532,689,042

Disclaimer: The information in this cost estimate is based on the best available information regarding the anticipated scope of the remedial action objectives. Changes in the cost elements may occur as a result of new information and data collected during the engineering design of the remedial alternatives. This is an order-of-magnitude cost estimate that is expected to be within -30 to +50 percent of the actual project costs.

Table A-4. Important Quantities, GW

	B	C	D	E
1	*Note: these quantities are linked to the alternative quantities*			
2	**IMPORTANT QUANTITIES (GW)**			
3		**Alt 2 GW**	**Alt 3 GW**	**Alt 4 GW**
4	**General Quantities (DX & HX)**			
7	**General Well Quantities (DX)**			
8	MW, EW, IW Well Depths, feet	110	110	110
9	New Monitoring Wells (MWs)	6	6	6
10	Existing DX MWs	73	73	73
11	**GW Extraction Wells (DX)**			
12	Existing Extraction Wells (EWs)	37	37	37
13	New EWs	4	21	5
14	Convert MW to EW	4	4	4
15	Convert Existing IWs to EWs	NA	4	4
16	**GW Injection Wells (DX)**			
17	Existing Injection Wells (IWs)	14	14	14
18	New IWs	7	12	7
19	**Ion Exchange (IX) System (DX)**			
20	Construct New IX Systems, X gpm		625	
21	Transfer stations	0	1	1
22	IX System Annual Operating Time (%)	85%	85%	85%
23	Flowrate, Extraction gpm	510	1041	510
24	Flowrate, Injection gpm	510	1041	510
25	Number of IX System Operating Years	25	12	39
26	Constituent 1	Cr(VI)	Cr(VI)	Cr(VI)
27	Concentration Range, mg/L	>0.05-.1	>0.05-.1	>0.05-.1
28	Installation type	Fixed	Fixed	Fixed
29	Number of IX Trains (100 gpm per train)	6	6	6
30	Number of Vessels per train	4	4	4
31	Change our Resin Every XX yrs	1	1	1
32	Size of Vessel (Cu Ft)	77	77	77
33	Samples to be taken each resin change	12	12	12
34	Total resin (cu Ft) to be disposed of	1848	1848	1848
35	**General Well Quantities (HX)**			
36	MW, EW, IW Well Depths, feet	70	70	70
37	New Monitoring Wells (MW)	6	6	6
38	Existing HX MWs	64	64	64
39	**GW Extraction Wells (HX)**			
40	Existing Extraction Wells (EWs)	31	31	31
41	New EWs	10	36	18
42	Convert Existing IWs to EWs	0	0	1
43	New EWs to Feed Bioremediation System	7	NA	NA
44	Convert Existing EWs to Feed Bioremediation System	6	NA	NA
45	**GW Injection Wells (HX)**			
46	Existing Injection Wells (IWs)	15	15	15
47	New IWs for Flow from IX System	1	13	5

	B	C	D	E
48	New IWs for Bioremediation System	2	NA	NA
49	Convert EW to IW for Bioremediation System	2	NA	NA
50	Convert IW to be used for Bioremediation System	1	NA	NA
51	**Ion Exchange (IX) System (HX)**			
52	Construct New IX Systems, X gpm		800	
53	Transfer stations	1	2	1
54	IX System Annual Operating Time (%)	85%	85%	85%
55	Flowrate, gpm (avg)	680	1358	679
56	Run IX sys # 0f years	25	12	39
57	Constituent 1	Cr(VI)	Cr(VI)	Cr(VI)
58	Concentration Range, mg/L	>0.05-.1	>0.05-.1	>0.05-.1
59	Installation type	Fixed	Fixed	Fixed
60	Number of IX Trains (100 gpm per train)	8	8	8
61	Number of Vessels per train	4	4	4
62	Change our Resin Every XX yrs	3	3	3
63	Number of vessels per change out	8	8	8
64	Size of Vessel (Cu Ft)	77	77	77
65	Samples to be taken each resin change	16	16	16
66	Total resin (cu Ft) to be disposed of	2464	2464	2464
67	**Bioremediation System**	**1**		
68	Flow Mechanism	1	NA	NA
69	Transfer Piping (HDPE, 3 in), feet	34912	NA	NA
70	6,000 Gallon Horizontal Plastic Substrate Tank	2	NA	NA
71	2,000 Gallon Horizontal Plastic Substrate Tank	1	NA	NA
72	20,000 Gallon Horizontal Plastic Equalization Tank	1	NA	NA
73	10,000 Gallon Horizontal Plastic Equalization tank	1	NA	NA
74	100 GPM, 5hp, Transfer pump with motor, valves, piping	2	NA	NA
75	150gpm, 5hp, transfer pump with motor, valves, piping	1	NA	NA
76	Electrical Service Conections to Bionodes	3	NA	NA
77	Biofouling Prevention Chemical Feeder	3	NA	NA
78	Substrate (Ethanol)	x	NA	NA
79				
80	**DX New Pipe Length**	FT	FT	FT
81	P&T	70,882	179,288	79,739
82	**HX New Pipe Length**	FT	FT	FT
83	P&T	55,810	197,526	93,751
84	Bio	28,678		

Table A-5. Unit Costs – GW

	Item	Unit Cost (unburdended)	Units	Notes/References
	Acceptance Testing			
	Alt 2			
33	CAT (DX Alt 2-IX new wells)	$ 184,432	LS	Construction Acceptance Test (CAT): assume 5% of capital installed equipment
34	ATP (DX Alt 2-IX new wells)	$ 184,432	LS	Acceptance Test Plan (ATP): assume 5% of capital installed equipment
35	OTP (DX Alt 2-IX new wells)	$ 92,216	LS	Operational Test Plan (OTP): assume 2.5% of capital installed equipment
112	ATP - HX Alt 2 - Cr Equalization Tank	$ 3,225	LS	Acceptance Test Plan (ATP): @ 5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for functional acceptance testing.
113	CAT - HX Alt 2 - Cr Transfer Building & Equalization Tank	$ 99,553	LS	Construction Acceptance Test (CAT): @ 5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for demonstration testing for customer acceptance
114	OTP - HX Alt 2 - Transfer Building & Equalization Tank	$ 49,776	LS	Operational Test Plan (OTP): @ 2.5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for demonstration testing for customer acceptance
153	CAT (BioNode-HX)	$ 55,213	LS	Construction Acceptance Test (CAT): assume 5% of capital installed equipment (not including wells)
154	ATP (BioNode-HX)	$ 55,213	LS	Acceptance Test Plan (ATP): assume 5% of capital installed equipment (not including wells)
155	OTP (BioNode-HX)	$ 27,606	LS	Operational Test Plan (OTP): assume 2.5% of capital installed equipment (not including wells)
157	CAT (HX Alt 2 IX New Well System)	$ 123,449	LS	Construction Acceptance Test (CAT): assume 5% of capital installed equipment
158	ATP (HX Alt 2 IX New Well System)	$ 123,449	LS	Acceptance Test Plan (ATP): assume 5% of capital installed equipment
159	OTP (HX Alt 2 IX New Well System)	$ 61,724	LS	Operational Test Plan (OTP): assume 2.5% of capital installed equipment
207	CAT (HX Alt 2 BioNode Well System)	$ 71,386	LS	Construction Acceptance Test (CAT): assume 5% of capital installed equipment for new BioNode system
208	ATP (HX Alt 2 BioNode Well System)	$ 71,386	LS	Acceptance Test Plan (ATP): assume 5% of capital installed equipment for new BioNode system
209	OTP (HX Alt 2 BioNode Well System)	$ 35,693	LS	Operational Test Plan (OTP): assume 2.5% of capital installed equipment for new BioNode system
27	O&M Labor Resources-DX - Alt 2	$ 329,119	LS	Includes Project management, Engineer Technicians, System operators, fitters, etc.
28	O&M Labor Resources-HX - Alt 2	$ 329,119	LS	Includes Project management, Engineer Technicians, System operators, fitters, etc.
31	Capital Labor for setup of BioNode system	$ 43,133	LS	Includes Project management, Engineer Technicians, System operators, fitters, etc.
29	O&M Labor Resources-HX for BioNode system Alt 2	$ 329,119	LS	Includes Project management, Engineer Technicians, System operators, fitters, etc.
134	D&D of IX System & Transfer Buildings - Alt 2 (DX)	3,574,861	LS	33% of DX capital (pretreatment systems, transfer systems, Cr treatment systems, pipes, sys, structure)
135	D&D of BioNode System & Transfer Buidling - Alt 2 (HX)	$67,287	LS	33% of HX capital (BioNode System, pipes, sys, structure)
136	D&D of IX System & Transfer Buildings - Alt 4 (HX)	$4,547,465	LS	33% of HX capital (pretreatment systems, transfer systems, Cr treatment systems, pipes, sys, structure)
	Alt 3			
58	CAT (DX Alt 3-IX new wells)	$ 439,719	LS	Construction Acceptance Test (CAT): assume 5% of capital installed equipment
59	ATP (DX Alt3-IX new wells)	$ 439,719	LS	Acceptance Test Plan (ATP): assume 5% of capital installed equipment
60	OTP (DX Alt 3-IX new wells)	$ 219,860	LS	Operational Test Plan (OTP): assume 2.5% of capital installed equipment
62	CAT (HX Alt 3-IX new wells)	$ 413,796	LS	Construction Acceptance Test (CAT): assume 5% of capital installed equipment
63	ATP (HX Alt3-IX new wells)	$ 413,796	LS	Acceptance Test Plan (ATP): assume 5% of capital installed equipment
64	OTP (HX Alt 3-IX new wells)	$ 206,898	LS	Operational Test Plan (OTP): assume 2.5% of capital installed equipment
176	ATP - (DX Alt 3: Cr Equalization Tank)	$ 3,225	LS	Acceptance Test Plan (ATP): @ 5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for functional acceptance testing.
177	CAT - (Alt 3DX: Cr Transfer Building & Equalization Tank)	$ 99,553	LS	Construction Acceptance Test (CAT): @ 5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for demonstration testing for customer acceptance
178	OTP - (Alt 3 DX: Cr Transfer Building & Equalization Tank)	$ 49,776	LS	Operational Test Plan (OTP): @ 2.5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for demonstration testing for customer acceptance
191	ATP - (HX Alt 3: Cr Equalization Tank)	$ 3,225	LS	Acceptance Test Plan (ATP): @ 5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for functional acceptance testing.
192	CAT - (HX Alt 3: Cr Transfer Building & Equalization Tank)	$ 99,553	LS	Construction Acceptance Test (CAT): @ 5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for demonstration testing for customer acceptance

	Item	Unit Cost (unburdended)	Units	Notes/References
193	OTP - (HX Alt 3: Transfer Building & Equalization Tank)	$ 49,776	LS	Operational Test Plan (OTP): @ 2.5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for demonstration testing for customer acceptance
13	Capital Labor for setup of new DX IX system - Alt 3	$ 609,638	LS	assume 2 construction engineers. First, 1700 hrs and 2nd construction engineer at 50% time (850 hrs). assume supervisor for 10% of time of main construction engineer. Assume 1,750 hrs for Buyer/Procurement/Contracting. Assume 10% of the Buyer's time is Manager's time.
14	Capital Labor for setup of new HX IX system - Alt 3	$ 609,638	LS	assume 2 construction engineers. First, 1700 hrs and 2nd construction engineer at 50% time (850 hrs). assume supervisor for 10% of time of main construction engineer. Assume 1,750 hrs for Buyer/Procurement/Contracting. Assume 10% of the Buyer's time is Manager's time.
129	O&M Labor Resources-DX - Alt 3	$ 658,238	LS	Includes Project management, Engineer Technicians, System operators, fitters, etc.
130	O&M Labor Resources-HX - Alt 3	$ 658,238	LS	Includes Project management, Engineer Technicians, System operators, fitters, etc.
137	D&D of IX System & Transfer Buildings - Alt 3 (DX)	$7,149,721	LS	33% of DX capital (pretreatment systems, transfer systems, new & existing Cr treatment systems, pipes, sys, structure. Assuming existing costs equals new system costs)
138	D&D of IX System & Transfer Buildings - Alt 3 (HX)	$9,094,931	LS	33% of HX capital (pretreatment systems, transfer systems, new & existing Cr treatment systems, pipes, sys, structure. Assuming existing costs equals new system costs)
	Alt 4			
79	CAT (DX Alt 4-IX new wells)	$ 215,903	LS	Construction Acceptance Test (CAT): assume 5% of capital installed equipment
80	ATP (DX Alt 4-IX new wells)	$ 215,903	LS	Acceptance Test Plan (ATP): assume 5% of capital installed equipment
81	OTP (DX Alt 4-IX new wells)	$ 107,952	LS	Operational Test Plan (OTP): assume 2.5% of capital installed equipment
85	CAT (HX Alt 4-IX new wells)	$ 209,684	LS	Construction Acceptance Test (CAT): assume 5% of capital installed equipment
86	ATP (HX Alt 4-IX new wells)	$ 209,684	LS	Acceptance Test Plan (ATP): assume 5% of capital installed equipment
87	OTP (HX Alt 4-IX new wells)	$ 104,842	LS	Operational Test Plan (OTP): assume 2.5% of capital installed equipment
104	ATP - DX Alt 4 - Cr Equalization Tank	$ 3,225	LS	Acceptance Test Plan (ATP): @ 5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for functional acceptance testing.
105	CAT - DX Alt 4 - Cr Transfer Building & Equalization Tank	$ 99,553	LS	Construction Acceptance Test (CAT): @ 5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for demonstration testing for customer acceptance
106	OTP - DX Alt 4 - Transfer Building & Equalization Tank	$ 49,776	LS	Operational Test Plan (OTP): @ 2.5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for demonstration testing for customer acceptance
108	ATP - HX Alt 4 - Cr Equalization Tank	$ 3,225	LS	Acceptance Test Plan (ATP): @ 5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for functional acceptance testing.
109	CAT - HX Alt 4 - Cr Transfer Building & Equalization Tank	$ 99,553	LS	Construction Acceptance Test (CAT): @ 5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for demonstration testing for customer acceptance
110	OTP - HX Alt 4 - Transfer Building & Equalization Tank	$ 49,776	LS	Operational Test Plan (OTP): @ 2.5% of installed capital (per Hanford and process industry experience - see Peters & Timmerhaus, Plant Design Economics for Chemical Engineers for comparative typical startup cost ranges). Assume 3-4 wks for demonstration testing for customer acceptance
131	O&M Labor Resources-DX - Alt 4	$ 329,119	LS	Includes Project management, Engineer Technicians, System operators, fitters, etc.
132	O&M Labor Resources-HX - Alt 4	$ 329,119	LS	Includes Project management, Engineer Technicians, System operators, fitters, etc.
140	D&D of IX System & Transfer Buildings - Alt 4 (DX)	$3,574,861	LS	33% of DX capital (pretreatment systems, transfer systems, Cr treatment systems, pipes, sys, structure)
141	D&D of IX System & Transfer Buildings - Alt 4 (HX)	$4,547,465	LS	33% of HX capital (pretreatment systems, transfer systems, Cr treatment systems, pipes, sys, structure)
	Wells			
2	Avg $/ft for drilling Wells in 100DH Area	$ 875	FT	2013 Hanford drilling contracts
89	Well Pump, 1.5 Hp w/ Controls (33-55 gpm, 21 to 100 ft TDH)	$ 3,048	EA	RS Means
90	Well Pump, 3 Hp w/ Controls (56 to 95 gpm, 41 to 100 ft TDH)	$ 4,118	EA	RS Means
101	Convert MW to EW	$ 75,000	LS	Built up cost (includes pump, stainless steel pipe, labor, couplers, water level transducer, landing plate, pvc tube to water level + 20 ft, power line, electrical & mech rack, 4" HDPE pipe and labor)
171	Convert existing Ews to feed bioremediation system	$ 30,000	LS	check PMB for this cost
172	Convert EW to IW for bioremediation system	$ 30,000	LS	
173	Convert IW to be used in bioremediation system	$ 30,000	LS	
8	Avg $/ft for drilling Wells in 100DH Area	$ 875	FT	2013 Hanford drilling contracts
52	Well 6" DIA), rehab cost	$ 140	FT	
60	Well Pump Replacement, 1.5 Hp w/ Controls (33-55 gpm, 21 to 100 ft TDH)	$ 3,963	EA	

	Item	Unit Cost (unburdended)	Units	Notes/References
61	Well Pump Replacement, 3 Hp w/ Controls (56 to 95 gpm, 41 to 100 ft TDH)	$ 5,354	EA	
64	Abandon Monitoring Well	$ 4,285	EA	
65	Abandon 6" Extraction/Injection Well (Up to 400 ft)	$ 6,394	EA	
62	Standard Performance Monitoring	$ 782	EA	Includes Aquifer tubes, based on costs from GW report 2012. GW report states $ for DX +HX (620 samples/yr) = $729,123. GW report states HX+DX performance monitoring = $484,600. therefore, $484,600/620 samples = $782/sample.
	BioNode System			
132	10,000 Gallon Plastic Equalization Tank	$ 9,135	LS	Vendor quote (plastic-mart), http://www.plastic-mart.com/product/5265/10000-gallon-plastic-water-storage-tank-43132. Added 50% extra to cover the shipping and misc costs.
133	20,000 Gallon Horizontal Plastic Equalization Tank	$ 34,617	LS	Vendor quote (plastic-mart), http://www.plastic-mart.com/product/6508/20000-gallon-vertical-plastic-storage-tank-lt-blue-43827. Added 50% extra to cover the shipping and misc costs.
134	2,000 Gallon Horizontal Plastic Substrate Tank	$ 7,336	LS	Vendor quote (Plastic-mart), includes 2,035 gallon horizontal tank, shipping of tank, tie down hoops, skid, skid shipping, and 15% adder for misc.
135	6,000 Gallon Horizontal Plastic Substrate Tank	$ 7,050	LS	Vendor quote (plastic-mart), http://www.plastic-mart.com/product/567/6000-gallon-vertical-plastic-storage-tank-40226. Added 50% extra to cover the shipping and misc costs.
136	100 GPM, 5 hp, Transfer Pump with motor, valves, and piping	$ 4,551	LS	Vendor quote (Grainger), http://www.grainger.com/product/GOULDS-WATER-TECHNOLOGY-Self-Priming-Centrifugal-Pump-WP33846/_/N-/Ntt-100+gpm%2C+5+hp?sst=subset&s_pp=false. Added 50% for misc costs
137	150 GPM, 5hp, transfer pump with motor, valves, and piping	$ 1,931	LS	Vendor quote (Grainger), http://www.grainger.com/product/DAYTON-Chemical-Resistant-Centrifugal-WP33163/_/N-/Ntt-150+gpm%2C+5hp?sst=subset&s_pp=false. Added 50% for misc costs
139	Bio fouling prevention chemical feeder	$ 627	EA	Vendor quote (Locke Well & Pump Company 800-432-0293, http://www.lockewell.com/index.php?main_page=shopping_cart. Added shipping and 50% to cost for misc.
10	Annual electrical/mechanical O&M allowance for Bionode sys	$ 25,000	YR	Estimator Allowance
11	Ethanol use rate @ 263 gpm & 500 mg/L; 45 days/qrtr	$ 108,446	YR	Assume using a concentration of 500 mg/L, Ethanol use rate @ 500 mg/L and injection rate of 263 gpm for 45 days every quarter (per ECF). Ethanol assumptions ($2.30 per gallon & 6 lbs per gallon).
	IX system			
175	Chromium ION Exchange System - New (DX)	$ 8,841,861	LS	Based on 200 W IX system. Includes Chemtech SIR-700 (resin for Chromium), material, tools, etc., Includes ATP, OTP, and CAT testing.
179	Chromium ION Exchange System - New (HX)	$ 11,789,148	LS	Based on 200 W IX system. Includes Chemtech SIR-700 (resin for Chromium), material, tools, etc., Includes ATP, OTP, and CAT testing.
181	Piping for DX System	$ 24	LF	Pipe is Single Wall pipe ($3.75/LF) + ($20.29/LF for labor and equipment). o 4" diameter HDPE pipe. This cost includes training record submittal, chemical inventory submittal, air emission sources submittal, competent persons submittal, safety meetings, truck, operator, forklift for rough terrain, fusion of pipe joints, flush lines, walk down completion, PPE, subcontractor supervisor and manager.
182	Piping for HX system	$ 24	LF	Pipe is Single Wall pipe ($3.75/LF) + ($20.29/LF for labor and equipment). o 4" diameter HDPE pipe. This cost includes training record submittal, chemical inventory submittal, air emission sources submittal, competent persons submittal, safety meetings, truck, operator, forklift for rough terrain, fusion of pipe joints, flush lines, walk down completion, PPE, subcontractor supervisor and manager.
186	Tank: 8,000 gallon influent equalization tank	$ 64,500	LS	Based on Report of Final Inventory of Property report from 200 W Pump & Treat. TC-99 System Inlet Tank. Contract # 41700. $43,000 X 1.5% allowance for miscellaneous mechanical, electrical, and instrumentation. Also checked vs. 1/20 of contract 00039529 = $77,857 (TCSIT-Y20 FRP Tc-99 Inlet tank). ~8,000 gallon (fiberglass (FRP)). Allowance includes for duplex pumps, piping & valves, miscellaneous mechanical, electrical, and instrumentation and control (see P&ID for TCSIT-Y20 Tank for example process equipment and instrumentation scope).
188	Transfer Building: Cr	$ 1,926,550	EA	Based on estimate check by Bruce Gilkeson of S-SX Transfer building. Date of estimate April 14, 2011. 200-UP-1 OU-S-SX Interim Extraction System Planning, Design, Construction and Operation. Building is approximately 2,400 sf. Structure is a pre-engineered building 50ft x 48 ft. The building includes pumping transfer process systems and is based on S-SX size and equipment. o The cost for the transfer building is a built up cost at $1,926,550 per building. It has Mob-demob, civil site costs, concrete foundations, slab, etc.; steel or other metals; Electrical; Mechanical; HVAC, and ATP test support.
14	ERDF Disposal sample Cost ($/Sample)	$ 669	EA	
16	Annual elec/mech O&M allowance - Alt 2 - DX	$ 105,943	LS	1% of DX capital (pretreatment systems, transfer systems,pipes & pumps) for elec/mech O&M
17	Annual elec/mech O&M allowance - Alt 2 - HX	$ 121,961	LS	1% of HX capital (pretreatment systems, transfer systems, pipes & pumps) for elec/mech O&M
18	Annual elec/mech O&M allowance - Alt 3 - DX	$ 152,090	LS	1% of DX capital (pretreatment systems, transfer systems, pipes & pumps) for elec/mech O&M
19	Annual elec/mech O&M allowance - Alt 3 - HX	$ 137,490	LS	1% of HX capital (pretreatment systems, transfer systems, pipes & pumps) for elec/mech O&M

	Item	Unit Cost (unburdended)	Units	Notes/References
20	Annual elec/mech O&M allowance - Alt 4 - DX	$ 127,540	LS	1% of DX capital (pretreatment systems, transfer systems, pipes & pumps) for elec/mech O&M
21	Annual elec/mech O&M allowance - Alt 4 - HX	$ 131,108	LS	1% of HX capital (pretreatment systems, transfer systems, pipes & pumps) for elec/mech O&M
31	Influent/Effluent Analytical costs (full suite)	$ 6,338	EA	Based on 2014 WSCF lab analysis costs: Alkalinity, Hex chrome, Metals, Tc-99, Semivolatile Organics, VOCs, Alpha Energy, Gross Alpha/Beta, I-129, Strontium 89/90, Tritium, Pu-241, Total Dissolved Solids, Total Alpha/Beta, Alpha Energy for Radium 226.
	Resin			
90	Chemtech SIR-700 (resin for Chromium))	$ 239	CF	
92	DX: Alt 2 - Other costs associated with resin (20% of resin $)	$ 8,842	LS	Handling, disposal, etc., assume 20% of resin costs
93	Resin disposal costs (per vessel)	$ 22,875	Vessel(s)	From HANDI output, alternative evaluation (SGW-46687). Cost per vessel = (2.26m3/vessel*$10,000/m3)+($55/ton*5 ton /vessel) = $22,875 per vessel.
123	HX: Alt 2 - Other costs associated with resin (20% of resin $)	$ 117,897	LS	Handling, disposal, etc., assume 20% of resin costs
124	HX: Alt 3 - Other costs associated with resin (20% of resin $)	$ 117,897	LS	Handling, disposal, etc., assume 20% of resin costs
125	DX: Alt 3 - Other costs associated with resin (20% of resin $)	$ 88,423	LS	Handling, disposal, etc., assume 20% of resin costs
126	HX: Alt 4 - Other costs associated with resin (20% of resin $)	$ 117,897	LS	Handling, disposal, etc., assume 20% of resin costs
127	DX: Alt 4 - Other costs associated with resin (20% of resin $)	$ 88,423	LS	Handling, disposal, etc., assume 20% of resin costs
67	Alt 2 remove pipe, process systems & deconstruct structures (DX)	$ 3,496,103	LS	33% of DX capital (pretreatment Transfer systems, pipes & pumps)
68	Alt 2 remove pipe, process systems & deconstruct structures (HX)	$ 4,024,725	LS	33% of HX capital (pretreatment Transfer systems, pipes & pumps)
69	Alt 3 remove pipe, process systems & deconstruct structures (DX)	$ 5,018,984	LS	33% of DX capital (pretreatment systems, transfer systems, new Cr treatment systems, pipes, sys, structure)
70	Alt 3 remove pipe, process systems & deconstruct structures (HX)	$ 4,537,178	LS	33% of HX capital (pretreatment systems, transfer systems, new Cr treatment systems, pipes, sys, structure)
74	Alt 4 remove pipe, process systems & deconstruct structures (DX)	$ 4,208,811	LS	33 % of DX capital (pretreatment systems, transfer systems, pipes & pumps)
75	Alt 4 remove pipe, process systems & deconstruct structures (HX)	$ 4,326,580	LS	33% of HX capital (pretreatment systems, transfer systems, pipes & pumps)
76	ALT 2 - moderate renovation of DX P&T systems to extend life beyond 25 yrs	$ 5,271,510	LS	50 % of DX capital (pretreatment systems, transfer systems,pipes & pumps)
77	ALT 2 - moderate renovation of HX P&T systems to extend life beyond 25 yrs	$ 6,053,921	LS	50% of HX capital (pretreatment systems, transfer systems, pipes & pumps)
78	ALT 4 - major renovation of DX P&T systems to extend life beyond 25 yrs	$ 6,341,076	LS	50 % of DX capital (pretreatment systems, transfer systems, pipes & pumps)
79	ALT 4 - major renovation of HX P&T systems to extend life beyond 25 yrs	$ 6,509,219	LS	50% of HX capital (pretreatment systems, transfer systems, pipes & pumps)
84	Pump and Treat System Unit Rates			
	Start & End Site			
11	Site Preparation	$ 100,000	EA	RACER 2013 Calculated cost
63	Site Closeout Report - High	$ 105,820	EA	RACER 2013 Calculated cost
	Blue cells represent line items used in O&M			
	LS = Lump Sum			
	LF = Linear Feet			
	EA = Each			
	CF = Cubic Feet			
	YR = Year			
	FT = Feet			
	HR = Hour			

Table A-6. WCH Waste Site Costs

	Waste Site	Description		CHPRC Alt 2	CHPRC Alt 3	CHPRC Alt 4
				$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS
WCH	100-D-98:1	ACTIVE ELECTRICAL SUBSTATION	Capital Cost	$1.50	$1.50	$1.50
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$1.50	$1.50	$1.50
			Discounted (PV)	**$1.50**	**$1.50**	**$1.50**
WCH	100-D-98:2	Inactive electrical substations at 100-D Area	Capital Cost	$1.50	$1.50	$1.50
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$1.50	$1.50	$1.50
			Discounted (PV)	**$1.50**	**$1.50**	**$1.50**
WCH	100-D-105	100-D/DR-Area Pipelines Discovered During Remediation	Capital Cost	$5.78	$5.78	$5.78
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$5.78	$5.78	$5.78
			Discounted (PV)	**$5.78**	**$5.78**	**$5.78**
WCH	100-D-106	1607-D1 Influent Pipelines	Capital Cost	$0.50	$0.50	$0.50
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.50	$0.50	$0.50
			Discounted (PV)	**$0.50**	**$0.50**	**$0.50**
WCH	100-D-107	Soil beneath the 1713-DA Essential Materials Warehouse	Capital Cost	$0.22	$0.22	$0.22
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.22	$0.22	$0.22
			Discounted (PV)	**$0.22**	**$0.22**	**$0.22**
WCH	100-H-51:6	Carbon steel pipe	Capital Cost	$0.50	$0.50	$0.50
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.50	$0.50	$0.50
			Discounted (PV)	**$0.50**	**$0.50**	**$0.50**
WCH	100-H-54	100-H Shoreline Survey Unplanned Release	Capital Cost	$1.97	$1.97	$1.97
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$1.97	$1.97	$1.97
			Discounted (PV)	**$1.97**	**$1.97**	**$1.97**
WCH	100-H-56	100-H Area Miscellaneous Pipelines	Capital Cost	$5.78	$5.78	$5.78
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$5.78	$5.78	$5.78
			Discounted (PV)	**$5.78**	**$5.78**	**$5.78**
WCH	100-H-59	100-H Area Railroad Track Soil Contamination Area	Capital Cost	$0.11	$0.11	$0.11
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.11	$0.11	$0.11
			Discounted (PV)	**$0.11**	**$0.11**	**$0.11**
WCH	600-380	Segment 4 Unknown Cylinder	Capital Cost	$0.12	$0.12	$0.12
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.12	$0.12	$0.12
			Discounted (PV)	**$0.12**	**$0.12**	**$0.12**

	Waste Site	Description		CHPRC Alt 2	CHPRC Alt 3	CHPRC Alt 4
				$ IN MILLIONS	$ IN MILLIONS	$ IN MILLIONS
WCH	600-381	Segment 4 Underground Structure with Wooden Air Vents	Capital Cost	$0.12	$0.12	$0.12
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.12	$0.12	$0.12
			Discounted (PV)	**$0.12**	**$0.12**	**$0.12**
WCH	600-382:1-5	THIS ESTIMATE INCLUDES THE FOLLOWING SITES: 600-382:1, 600-382:2, 600-382:3, 600-382:4, 600-382:5	Capital Cost	$0.12	$0.12	$0.12
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.12	$0.12	$0.12
			Discounted (PV)	**$0.12**	**$0.12**	**$0.12**
WCH	600-383:1-10	THIS ESTIMATE INCLUDES THE FOLLOWING SITES: 600-383:1, 600-383:2, 600-383:3, 600-383:4, 600-383:5, 600-383:6, 600-383:7, 600-383:8, 600-383:9, 600-383:10	Capital Cost	$0.12	$0.12	$0.12
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.12	$0.12	$0.12
			Discounted (PV)	**$0.12**	**$0.12**	**$0.12**
WCH	600-384:1-5	THIS ESTIMATE INCLUDES THE FOLLOWING SITES: 600-384:1, 600-384:2, 600-384:3, 600-384:4, 600-384:5	Capital Cost	$0.12	$0.12	$0.12
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.12	$0.12	$0.12
			Discounted (PV)	**$0.12**	**$0.12**	**$0.12**
WCH	600-385	Segment 4 Transite, Concrete, and Metal Debris Area	Capital Cost	$0.12	$0.12	$0.12
			Annual	$0.00	$0.00	$0.00
			Periodic	$0.00	$0.00	$0.00
			Individual Site (non discounted)	$0.12	$0.12	$0.12
			Discounted (PV)	**$0.12**	**$0.12**	**$0.12**
			31 Waste Sites Sub-Total Capital (Non-discounted)	$18.58	$18.58	$18.58
			31 Waste Sites Sub-Total Annual (Non-discounted)	$0.00	$0.00	$0.00
			31 Waste Sites Sub-Total Periodic (Non-discounted)	$0.00	$0.00	$0.00
			31 Waste Sites Sub-Total Non-Discounted	$18.58	$18.58	$18.58
			31 Waste Sites Sub-Total Discounted (PV)	**$18.58**	**$18.58**	**$18.58**

CH2MHILL Plateau Remediation Company

Environmental Calculation Cover Page

Part 1: Completed by the Responsible Manager

Project: 100-DH Remedial Investigation/Feasibility Study **Date:** 11/14/2012

Calculation Title & Description: 100-DH Cost Estimate Scoping Forms for Feasibility Study Alternative Costing

Preparer: Jason Hulstrom	**Basis of Qualification:** Experience and Education
Checker: Kris Ivarson	**Basis of Qualification:** Experience and Education
Senior Reviewer: Art Lee	**Basis of Qualification:** Experience and Education

Part 2: Completed by Preparer

Calculation No.: ECF-100DR1-12-0022 **Revision No.:** 2

Revision History:

Revision No.	Description	Date	Affected Pages
R1	Removed waste sites 100-D-84:1, 100-D-88, 100-H-50, 100-H-51:4, and persistent plume area116-DR-1&2.	7/26/12	Page 1, Appendix A, B, C, and D
R2	Removed waste sites 100-D-75:3, 100-H-35, 100-H-49:2, 100-H-51:5, 100-H-53, 100-D-31:11, 100-D-31:12, 100-D-69, 100-D-72, 100-D-75:2, 100-D-99, 100-D-31:4, 132-D-2, 132-D-3, and 132-DR-1. Added sites 100-D-50:2 and 116-D-8 AND 100-D-98 MJH REMOVED	11/14/2012	All

Part 3: Document Review & Approval:

Preparer:

Jason Hulstrom
NAME/POSITION

Jason Hulstrom
SIGNATURE

11/14/2012
DATE

Checker:

Kris Ivarson / Fred Biebesheimer
NAME/POSITION

Approved by Fred Biebesheimer via email - see attached
SIGNATURE

11/20/2012
DATE

Senior Reviewer:

Art Lee
NAME/POSITION

approved via email - see attached
SIGNATURE

11/14/2012
DATE

Responsible Manager:

Mike Hickey
NAME/POSITION

SIGNATURE

11/28/2012
DATE

Hulstrom, Jason A

From: Biebesheimer, Frederick H
Sent: Tuesday, November 20, 2012 12:00 PM
To: Lee, Art K
Cc: Hulstrom, Jason A
Subject: RE: 100-DH Cost Estimate Input Calc

Based on my evaluation of the email below, I am approving the ECF.

Fred

From: Lee, Art K
Sent: Tuesday, November 20, 2012 9:08 AM
To: Biebesheimer, Frederick H
Cc: Hulstrom, Jason A
Subject: FW: 100-DH Cost Estimate Input Calc

Fred,

We are trying to get the ECF for the D/H RI/FS cost estimate basis approved today. Kris reviewed and said the ECF looks fine (e-mail below) but not sure if this can be taken as approval. I am already an approver on the ECF so I was checking if you could approve for Kris in her absence. If so, could you please reply to this e-mail with Jason on cc. Thanks,

Art

From: Ivarson, Kristine A
Sent: Thursday, November 15, 2012 2:19 PM
To: Hulstrom, Jason A; Lee, Art K
Subject: RE: 100-DH Cost Estimate Input Calc

Jason – Looks fine to me. Thanks – Kris

From: Hulstrom, Jason A
Sent: Wednesday, November 14, 2012 10:01 AM***[Fred Biebesheimer]***
To: Lee, Art K; Ivarson, Kristine A
Subject: 100-DH Cost Estimate Input Calc

Art and Kris,

Here are the cleaned up version of the 100DH input calculation. Please have one last look to see if anything was missed. If you are happy with the files I will be around to collect signatures sometime today.

Should you wish to make changes on IDMS, I have loaded these files at the following location under 100-DH:

http://idmsweb.rl.gov/idms/livelink.exe?func=ll&objId=173714680&objAction=browse&viewType=1

Thanks,

Jason A. Hulstrom
INTERA, Inc.

Hulstrom, Jason A

From: Lee, Art K
Sent: Wednesday, November 14, 2012 4:20 PM
To: Hulstrom, Jason A; Ivarson, Kristine A
Subject: RE: 100-DH Cost Estimate Input Calc
Attachments: ECF_100DR1_12_0022_R2.docx; ECF_100DR1_12_0022_Appendix_A_R2.xlsx

Jason,

I couldn't get to IDMS so I updated the files you sent. Alternative descriptions in the ECF file to be the same as provided in Chapter 9 of the FS (no track changes). Appendix A Excel file updated to show "NA" for void fill grouting quantities under Alt 4, and updated GW quantities to show only 1 year at interim action P&T flows and added row for number of years that P&T operates under implemented alternative.

Please use the files attached and I approve the ECF via this e-mail. Thanks,

Art

From: Hulstrom, Jason A
Sent: Wednesday, November 14, 2012 10:01 AM
To: Lee, Art K; Ivarson, Kristine A
Subject: 100-DH Cost Estimate Input Calc

Art and Kris,

Here are the cleaned up version of the 100DH input calculation. Please have one last look to see if anything was missed. If you are happy with the files I will be around to collect signatures sometime today.

Should you wish to make changes on IDMS, I have loaded these files at the following location under 100-DH:

http://idmsweb.rl.gov/idms/livelink.exe?func=ll&objId=173714680&objAction=browse&viewType=1

Thanks,

Jason A. Hulstrom
INTERA, Inc.
2420 Stevens Drive
Richland, WA 99352
Tel: (509) 376-0309

Contents

Appendices

Attachment

Terms

CERCLA	Comprehensive Environmental Compensation and Liability Act of 1980.
COC	Contaminant of Concern
FS	Feasibility Study
GPM	gallons per minute
GW	groundwater
HDPE	High density polyethylene
IC	Institutional Controls
IX	Ion exchange
MCL	Maximum Contaminant Level
MNA	Monitored Natural Attenuation
NCP	National Contingency Plan
OU	Operable Unit
P&T	Pump-and-treat
RTD	Remove, treat, dispose

1 Purpose

The purpose of this calculation is to document and describe cost estimate inputs and key assumptions that support the *Remedial Investigation/Feasibility Study for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units* (DOE/RL-2010-95). The feasibility study (FS) cost inputs are derived from site features, physical parameters, and characteristics of the 100-D/H source operable units (OUs) and the 100-HR-3 groundwater OU. The FS cost estimates are prepared to an accuracy of +50% to -30%, and are used as part of the detailed and comparative analysis of remedial alternatives under the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, (CERCLA). This analysis ultimately leads to recommendation of a preferred alternative in the proposed plan.

2 Background

This calculation brief supports development of remedial action alternative cost estimates for the identified 100-D/H source OU waste sites and the 100-HR-3 groundwater OU contaminant plumes (remedial action target area). A range of alternatives were developed in the FS, for each target area based on the type of preliminary remediation goal exceeded. Table 1 lists the waste sites that were evaluated as part of this process.

Table 1. 100-DH Waste Sites

100-D-10	100-D-59	100-H-5
100-D-101	100-D-63	100-H-57
100-D-102	100-D-75:1	100-H-58
100-D-103	100-D-96	116-D-8[b]
100-D-25[a]	100-H-28:7	116-DR-9
100-D-50:2	100-H-36	118-DR-2:2
100-D-52	100-H-38	--

a – 100-D-25 was addressed inside the large foot print of 116-DR-9

b – If action is taken at 116-D-8 the cost will be incorporated into 100-D-50:2.

The waste site and groundwater alternatives were developed independently to allow greater flexibility in selecting recommended alternatives for each target area. The following remedial action alternatives were developed for consideration in the FS:

Waste Site and Groundwater Alternatives:

- **Alternative 1: (No Action [as required by the NCP]).** No Further Action is taken to protect human health and the environment. Under this alternative, no remedial actions would be taken and all soil and groundwater interim actions would be discontinued. The NCP requires consideration of a No Action Alternative ("Remedial Investigation/Feasibility Study and Selection of Remedy" [40 CFR 300.430(e)(6)]).
- **Alternative 2— RTD and Grouting for Waste Site and Pump-and-Treat with Biological Treatment for Groundwater.** RTD and Grouting for Waste Site and Pump-

and-Treat with Biological Treatment for Groundwater. This alternative uses RTD for removal of contamination to cleanup levels for waste sites. Void-fill grouting will be used for the box flume of waste site 100-H-36 where RTD would have large ecological impacts near the river. For groundwater, a pump-and-treat system and biological treatment of Cr(VI) will be used. Nitrate and strontium-90 contaminated groundwater plumes are within the treatment footprint for the Cr(VI) plume and will be co-extracted by the extraction well network used for the Cr(VI) plume remediation. The groundwater treatment system effluent is not expected to exceed MCLs and no treatment is proposed for strontium 90 and nitrate. Specific treatment would be provided if the extracted groundwater in the pump-and-treat effluent stream exceeds the MCLs for the respective COCs prior to reinjection. MNA and institutional controls will be used for strontium 90. Groundwater monitoring will confirm effectiveness of MNA for strontium-90 and determine the impact of pump-and-treat on the persistence of the COC within the aquifer over time. Institutional controls to restrict excavation will be applied at individual waste sites with residual risks associated with contamination at depths greater than 4.6 m (15 ft) bgs after remediation, but there is no direct exposure pathway. Additional institutional controls to waste sites may be added through closure reclassifications.

- **Alternative 3— RTD and Grouting of Waste Site and Increased Capacity Groundwater Pump-and-Treat for Groundwater**. This alternative uses RTD for removal of contamination to cleanup levels for waste sites. Void-fill grouting will be used for the box flume of waste site 100-H-36 where RTD would have large ecological impacts near the river. For groundwater, an expanded pump-and-treat system for treatment of Cr(VI) will be used. Nitrate and strontium-90 contaminated groundwater plumes are within the treatment footprint for the Cr(VI) plume and will be co-extracted by the extraction well network used for the Cr(VI) plume remediation. The groundwater treatment system effluent is not expected to exceed MCLs and no treatment is proposed for strontium 90 and nitrate. Specific treatment would be provided if the extracted groundwater in the pump-and-treat effluent stream exceeds the MCLs for the respective COCs prior to reinjection. MNA and institutional controls will be used for strontium 90. Groundwater monitoring will confirm effectiveness of MNA for strontium-90 and determine the impact of pump-and-treat on the persistence of the COC within the aquifer over time. Institutional controls to restrict excavation will be applied at individual waste sites with residual risks associated with contamination at depths greater than 4.6 m (15 ft) bgs after remediation, but there is no direct exposure pathway. Additional institutional controls to waste sites may be added through closure reclassifications.

- **Alternative 4— RTD for Waste Sites and Pump-and-Treat for Groundwater**. This alternative uses RTD for removal of contamination to cleanup levels for waste sites. For groundwater, pump-and-treat system for treatment of Cr(VI) will be used. Nitrate and strontium-90 contaminated groundwater plumes are within the treatment footprint for the Cr(VI) plume and will be co-extracted by the extraction well network used for the Cr(VI) plume remediation. The groundwater treatment system effluent is not expected to exceed MCLs and no treatment is proposed for strontium 90 and nitrate. Specific treatment would be provided if the extracted groundwater in the pump-and-treat effluent stream exceeds the MCLs for the respective COCs prior to reinjection. MNA and institutional controls will be used for strontium 90. Groundwater monitoring will confirm effectiveness of MNA for strontium-90 and determine the impact of pump-and-treat on the persistence of the COC within the aquifer over time. Institutional controls to restrict

excavation will be applied at individual waste sites with residual risks associated with contamination at depths greater than 4.6 m (15 ft) bgs after remediation, but there is no direct exposure pathway.

3 Methodology

Development of the cost inputs for the 100-D/H OU alternatives generally requires simple calculations performed in Microsoft Excel (MS Excel)™ spreadsheets. Examples of the types of calculations included in this calculation brief include:

- Total number of groundwater samples = Number of groundwater samples per well x number of wells
- Total pipe length (ft) = Average length of pipe run for each extraction and injection well (ft) x number of wells
- Average groundwater extraction rate = nominal flow rate for each well x number of wells.

Due to the basic nature of these calculations, development of a detailed methodology for each calculation was not conducted. Section 4 provides the key inputs and assumptions that support each calculation and section 6 provides a summary of the spreadsheet calculations

4 Assumptions and Input

This section describes the overall assumptions applicable to the 100-D/H alternatives. The information used in the form presented in section 7 came from Chapters 8, 9, 10 and Appendix J of DOE/RL-2010-95. Table 2 lists the reference by input parameter used in the vadose zone and groundwater cost estimate. Appendix B contains narrative files with site specific assumptions and inputs used for both soil sites and groundwater. Appendix C contains pdf copies of the Waste Site Information Database Summaries for all sites listed in Table 1.

Table 2. Vadose Zone and Groundwater Cost Estimate Parameter Assumptions and Inputs

Input Parameter	Reference Source / Or General Equation
Excavation	
Depth, ft	DOE/RL-2010-95, Appendix J
Depth to Top of Contamination	DOE/RL-2010-95, Appendix J
Length (ft)	DOE/RL-2010-95, Appendix J
Width (ft)	DOE/RL-2010-95, Appendix J
Waste Site Area (m^2)	DOE/RL-2010-95, Appendix J
Waste Site Contaminated Surface Area (sf)	calculated using the Length x Width or Waste Site Area x 3.28^2.
Waste Site Ground Surface Area (sf)	ECE-100HR311-00004
Total Volume of Excavation (cy)	ECE-100HR311-00004
Total Volume Contaminated (cy)	ECE-100HR311-00004

™ Microsoft Excel (MS Excel) is a trademark of Microsoft Corporation.

Table 2. Vadose Zone and Groundwater Cost Estimate Parameter Assumptions and Inputs

Input Parameter	Reference Source / Or General Equation
Expected Safety Level	Engineering Judgment
Void Fill Grouting	
Depth, ft	DOE/RL-2010-95, Appendix J
Area of void to grout fill (sf)	DOE/RL-2010-95, Appendix J
Length of void to grout fill (ft)	DOE/RL-2010-95, Appendix J
Total Volume Contaminated (cy)	ECE-100HR311-00004
Expected Safety Level	Engineering Judgment
GW Extraction Wells (DX)	
# of wells	ECF-100HR3-11-0114
flow rate per well, gpm	ECF-100HR3-11-0114
depth to static water table, ft	Based on surrounding wells
depth to base of contam, ft	Based on surrounding wells
Expected Safety Level	Engineering Judgment
type of submersible pump	Engineering Judgment
well casing dia, in	Engineering Judgment
type of enclosure	Engineering Judgment
screen length, ft	Engineering Judgment
pipe type/location	Engineering Judgment
type	Engineering Judgment
length, ft	--
transfer piping dia, in	Engineering Judgment
GW Extraction Wells (DX)	--
Existing Extraction Wells	*100-DX System Design Description* (HNF-47527):
New Extraction Wells	ECF-100HR3-11-0114
GW Injection Wells (DX)	--
Existing Injection Wells	*100-DX System Design Description* (HNF-47527):
New Injection Wells	ECF-100HR3-11-0114
GW Extraction Wells (HX)	--
Existing Extraction Wells	*100-HX Pump and Treat System Design Description* (SGW-48961):
New Extraction Wells	ECF-100HR3-11-0114
GW Injection Wells (HX)	--

Table 2. Vadose Zone and Groundwater Cost Estimate Parameter Assumptions and Inputs

Input Parameter	Reference Source / Or General Equation
Existing Injection Wells	*100-HX Pump and Treat System Design Description* (SGW-48961):
New Injection Wells	ECF-100HR3-11-0114
New Monitoring Wells	Engineering Judgment
New Monitoring Wells	
Depth to GW, ft	Based on surrounding wells
Number of wells	Engineering Judgment
Include guard posts	Engineering Judgment
Expected Safety Level	Engineering Judgment
avg well depth, ft	Based on surrounding wells
drilling method	Engineering Judgment
well dia, in	Engineering Judgment
Flow Rates DX + HX	--
Year 1 with Interim Action still in place	--
IX Extr Wells Operating (avg)	ECF-100HR3-11-0114
Extr GPM Total	ECF-100HR3-11-0114
IX Inj Wells Operating (avg)	ECF-100HR3-11-0114
Inj GPM Total	ECF-100HR3-11-0114
Bioinjection, gpm	ECF-100HR3-11-0114
Months	ECF-100HR3-11-0114
Year 2, Begin Alternative Remedy Config - Completion	--
IX Extr Wells Operating (avg)	ECF-100HR3-11-0114
Extr GPM Total	ECF-100HR3-11-0114
IX Inj Wells Operating (avg)	ECF-100HR3-11-0114
Inj GPM Total	ECF-100HR3-11-0114
Bioinjection, gpm	ECF-100HR3-11-0114
Months	ECF-100HR3-11-0114
IX System	
Flow rate, gpm (avg)	ECF-100HR3-11-0114
Constituent 1	Engineering Judgment
Concentration Range, mg/L	Engineering Judgment

Table 2. Vadose Zone and Groundwater Cost Estimate Parameter Assumptions and Inputs

Input Parameter	Reference Source / Or General Equation
Installation type	Engineering Judgment
Bio System	
Flow Mechanism	Engineering Judgment
Transfer Piping Diameter (HDPE, in)	Engineering Judgment
6000 Gallon Horizontal Plastic Substrate Tank	Engineering Judgment
2000 Gallon Horizontal Plastic Substrate Tank	Engineering Judgment
20000 Gallon Horizontal Plastic Equalization Tank	Engineering Judgment
10000 Gallon Horizontal Plastic Equalization tank	Engineering Judgment
100 GPM, 5hp, Transfer pump with motor, valves, piping	Engineering Judgment
150gpm, 5hp, transfer pump with motor, valves, piping	Engineering Judgment
Electrical Service to node	Engineering Judgment
MNA	
Expected Safety Level	Engineering Judgment
GW, avg sample depth, ft	lower range of unconfined aquifer thickness + upper range of unconfined aquifer thickness ÷ 2
GW, # of events (1st year)	Engineering Judgment
GW, samples/event (1st yr)	Engineering Judgment
GW, # of out yrs	Engineering Judgment
GW, Samples/event (out yrs)	Engineering Judgment
Subsurface, avg sample depth, ft	total contamination depth ÷ 2
Subsurface, # of Events (1st yr)	Engineering Judgment
Subsurface, samples/event (1st yr)	Engineering Judgment
Subsurface, # of yrs (out yrs)	Engineering Judgment
Subsurface, Events/yr (out yr)	Engineering Judgment
Subsurface, Samples/event (out yrs)	Engineering Judgment
Start year	Engineering Judgment

Notes:

Extr	extraction	Hp	horse power
Gpm	gallon per minute	Inj	injection
GW	groundwater	IX	ion exchange

DOE/RL-2010-97, *Remedial Investigation/Feasibility Study for the 100-KR-1, 100-KR-2, and 100-KR-4 Operable Units*

ECE-100HR311-00004, Environmental Cost Estimate for 100 D/H Vadose Zone and Groundwater RI/FS

Table 2. Vadose Zone and Groundwater Cost Estimate Parameter Assumptions and Inputs	
Input Parameter	**Reference Source / Or General Equation**
ECF-100HR3-11-0114, Modeling of RI/FS Design Alternatives for 100-HR-3	

Table 3 presents how costs associated with institutional controls will be handled for the 100-DH FS cost estimate.

Table 3. River Corridor Institutional Control Approach	
Program Scope (Scope and Costs Associated with the Site Institutional Controls (Cost to be borne by the Program)	**Individual Waste Site Scope** (Costs to be included within the FS for sites that require institutional controls and/or leave contamination less than 15 ft below land surface)
Five Year review preparation and reporting	Annual Inspection of the waste site (based on existing records annual inspections are estimated to be approximately $1500/year)
Maintenance and Operation of the Excavation Permit Program	If included in the remedial alternative, maintenance of an existing soil cover (costs and frequency to be estimated based on existing program used for the Central Plateau and adjusted for waste site size)
Deed Maintenance, Zoning Restrictions, and Legal costs	If Barrier is included in the remedial alternative, all costs associated with the O&M of the barrier (to be based on size and type of barrier recommended)
Signage and access to waste sites	If groundwater monitoring is required--costs of new monitoring wells, sampling of the wells, analytical costs and associated reporting
Site Security	
Notes: FS feasibility study ICs institutional controls O&M operation & maintenance	

5 Software Applications

Microsoft Office Excel 2007 was used to perform the calculations. Excel is a "Site Licensed Client Software" and is exempt from formal control requirements of PRC-PRO-IRM-309, Controlled Software Management.

6 Calculation

This section provides calculations for cost estimate inputs for each alternative. The cost estimate calculations are broken down into the following calculation categories:

- Soil and Groundwater Sampling for waste sites
- Groundwater Extraction, Injection and Treatment Rates

Each of these categories is discussed in the following subsections.

6.1 Soil and Groundwater Sampling for waste sites

The following calculations were performed in support of cost estimating for waste site soil and groundwater sampling:

1. Average Sample depth (groundwater): lower range of unconfined aquifer thickness + upper range of unconfined aquifer thickness ÷ 2
2. Average Sample depth (subsurface soil): total contamination depth ÷ 2

6.2 Groundwater Extraction, Injection and Treatment Flow Rates

Groundwater alternatives 2, 3, and 4 require calculation of groundwater extraction, injection, and treatment flow rates. Assumptions were made based on modeling information from ECF-100HR3-11-0114, *Modeling of RI/FS Design Alternatives for 100-HR-3* (see Appendix B). To facilitate cost estimating, the following calculations were made:

- Flow Rate for Extraction wells = Sum of all wells gallons per minute (GPM) ÷ total number of wells
- GPM for System running 85% of the time: used 525948.766 minutes per year which represents the number of minutes in a Julian calendar.
    - Average GPM = sum of individual well GPM ÷ number of wells
    - Total Annual GPM = Average GPM × 525948.766
    - GPM for System running 85% of the time = Total Annual GPM × .85

7 Results/Conclusions

The cost inputs, assumptions, and calculations presented in the previous sections were used to develop detailed descriptions for each alternative, and document cost estimate assumptions in standard estimating forms to be used by the estimator. Appendix A presents all assumptions, inputs, and calculations that are carried forward into the final cost estimate.

8 References

DOE/RL-2010-95, Draft A, *Remedial Investigation/Feasibility Study for the 100-DR-1, 100-DR-2, 100-HR-1, 100-HR-2, and 100-HR-3 Operable Units*, CH2M Hill Plateau Remediation Company, Richland, Washington

ECE-100HR311-00004, Rev.2, *Draft Final*, Environmental Cost Estimate for 100 D/H Vadose Zone and Groundwater RI/FS, CH2M Hill Plateau Remediation Company, Richland, Washington

ECF-100HR3-11-0114, Rev. 1, *Modeling of RI/FS Design Alternatives for 100-HR-3*, CH2M Hill Plateau Remediation Company, Richland, Washington

Appendix A

Cost Estimate Inputs and Assumptions

Table A-1. 100-DH IMPORTANT QUANTITY INPUTS

	Alt 2 WASTE SITE	Alt 2 GW	Alt 3 WASTE SITE	Alt 3 GW	Alt 4 WASTE SITE	Alt 4 GW
Excavation						
116-D-8 (Alt 4 volumns will be added to the cost of 100-D-50:2)						
Depth, ft	NA	NA	NA	NA	--	NA
Depth to Top of Contamination	NA	NA	NA	NA	--	NA
Length (ft)	NA	NA	NA	NA	--	NA
Width (ft)	NA	NA	NA	NA	--	NA
Waste Site Area (m^2)	NA	NA	NA	NA	--	NA
Waste Site Contaminated Surface Area (ft^2)	NA	NA	NA	NA	--	NA
Waste Site Ground Surface Area (ft^2)	NA	NA	NA	NA	11,296.68	NA
Total Volume of Excavation (ft^3)	NA	NA	NA	NA	38,973.55	NA
Total Volume Contaminated (ft^3)	NA	NA	NA	NA	38,973.55	NA
Total Volume of Excavation (cy)	NA	NA	NA	NA	1,443.46	NA
Total Volume Contaminated (cy)	NA	NA	NA	NA	1,443.46	NA
Expected Safety Level	NA	NA	NA	NA	D	NA
100-D-75:1						
Depth, ft	3.00	NA	3.00	NA	3.00	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA
Waste Site Area (m^2)	12,600.00	NA	12,600.00	NA	12,600.00	NA
Waste Site Contaminated Surface Area (ft^2)	135,625.00	NA	135,625.00	NA	135,625.00	NA
Waste Site Ground Surface Area (ft^2)	142,334.36	NA	142,334.36	NA	142,334.36	NA
Total Volume of Excavation (ft^3)	467,904.39	NA	467,904.39	NA	467,904.39	NA
Total Volume Contaminated (ft^3)	467,904.39	NA	467,904.39	NA	467,904.39	NA
Total Volume of Excavation (cy)	17,329.79	NA	17,329.79	NA	17,329.79	NA
Total Volume Contaminated (cy)	17,329.79	NA	17,329.79	NA	17,329.79	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-H-36						

Table A-1. 100-DH IMPORTANT QUANTITY INPUTS

	Alt 2 WASTE SITE	Alt 2 GW	Alt 3 WASTE SITE	Alt 3 GW	Alt 4 WASTE SITE	Alt 4 GW
Depth, ft	1.00	NA	1.00	NA	22.96 ft for flume box, 1 ft for runoff pad	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA
Waste Site Area (m^2)	1,150.00	NA	1,150.00	NA	NA	NA
Waste Site Contaminated Surface Area (ft^2)	12,379.00	NA	12,379.00	NA	3,229.00	NA
Waste Site Ground Surface Area (ft^2)	13,055.52	NA	13,055.52	NA	11,241.15	NA
Total Volume of Excavation (ft^3)	14,235.79	NA	14,235.79	NA	150,689.31	NA
Total Volume Contaminated (ft^3)	14,235.79	NA	14,235.79	NA	75,134.73	NA
Total Volume of Excavation (cy)	527.25	NA	527.25	NA	5,581.09	NA
Total Volume Contaminated (cy)	527.25	NA	527.25	NA	2,782.77	NA
Expected Safety Level	D	NA	D	NA	D	NA
116-DR-9						
Depth, ft	NA	NA	NA	NA	15.00	NA
Depth to Top of Contamination	NA	NA	NA	NA	3.30	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA
Waste Site Area (m^2)	NA	NA	NA	NA	541.00	NA
Waste Site Contaminated Surface Area (ft^2)	NA	NA	NA	NA	5,820.29	NA
Waste Site Ground Surface Area (ft^2)	NA	NA	NA	NA	14,711.47	NA
Total Volume of Excavation (ft^3)	NA	NA	NA	NA	177,086.48	NA
Total Volume Contaminated (ft^3)	NA	NA	NA	NA	78,312.06	NA
Total Volume of Excavation (cy)	NA	NA	NA	NA	6,558.76	NA
Total Volume Contaminated (cy)	NA	NA	NA	NA	2,900.45	NA
Expected Safety Level	NA	NA	NA	NA	D	NA
118-DR-2:2						
Depth, ft	15.00	NA	15.00	NA	15.00	NA

Table A-1. 100-DH IMPORTANT QUANTITY INPUTS

	Alt 2 WASTE SITE	Alt 2 GW	Alt 3 WASTE SITE	Alt 3 GW	Alt 4 WASTE SITE	Alt 4 GW
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA
Waste Site Area (m^2)	272.00	NA	272.00	NA	272.00	NA
Waste Site Contaminated Surface Area (ft^2)	2,926.28	NA	2,926.28	NA	2,926.28	NA
Waste Site Ground Surface Area (ft^2)	9,819.85	NA	9,819.85	NA	9,819.85	NA
Total Volume of Excavation (ft^3)	109,935.39	NA	109,935.39	NA	109,935.39	NA
Total Volume Contaminated (ft^3)	50,478.41	NA	50,478.41	NA	50,478.41	NA
Total Volume of Excavation (cy)	4,071.68	NA	4,071.68	NA	4,071.68	NA
Total Volume Contaminated (cy)	1,869.57	NA	1,869.57	NA	1,869.57	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-D-10						
Depth, ft	20	NA	20	NA	20	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA
Waste Site Area (m^2)	251.43	NA	251.43	NA	251.43	NA
Waste Site Contaminated Surface Area (ft^2)	2705	NA	2705	NA	2705	NA
Waste Site Ground Surface Area (ft^2)	12,335.34	NA	12,335.34	NA	12,335.34	NA
Total Volume of Excavation (ft^3)	170,239.50	NA	170,239.50	NA	170,239.50	NA
Total Volume Contaminated (ft^3)	61,235.05	NA	61,235.05	NA	61,235.05	NA
Total Volume of Excavation (cy)	6,305.17	NA	6,305.17	NA	6,305.17	NA
Total Volume Contaminated (cy)	2,267.96	NA	2,267.96	NA	2,267.96	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-D-101						
Depth, ft	8.20	NA	8.20	NA	8.20	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA

Table A-1. 100-DH IMPORTANT QUANTITY INPUTS

	Alt 2 WASTE SITE	Alt 2 GW	Alt 3 WASTE SITE	Alt 3 GW	Alt 4 WASTE SITE	Alt 4 GW
Waste Site Area (m^2)	618.10	NA	618.10	NA	618.10	NA
Waste Site Contaminated Surface Area (ft^2)	6650.00	NA	6650.00	NA	6650.00	NA
Waste Site Ground Surface Area (ft^2)	11267.30	NA	11267.30	NA	11267.30	NA
Total Volume of Excavation (ft^3)	84480.06	NA	84480.06	NA	84480.06	NA
Total Volume Contaminated (ft^3)	62709.50	NA	62709.50	NA	62709.50	NA
Total Volume of Excavation (cy)	3128.89	NA	3128.89	NA	3128.89	NA
Total Volume Contaminated (cy)	2322.57	NA	2322.57	NA	2322.57	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-D-102						
Depth, ft	15.00	NA	15.00	NA	15.00	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA
Waste Site Area (m^2)	1,284.00	NA	1,284.30	NA	1,284.30	NA
Waste Site Contaminated Surface Area (ft^2)	13824.5	NA	13824.5	NA	13824.5	NA
Waste Site Ground Surface Area (ft^2)	26,431	NA	26,431	NA	26,431	NA
Total Volume of Excavation (ft^3)	347220.00	NA	347220.00	NA	347220.00	NA
Total Volume Contaminated (ft^3)	238464.00	NA	238464.00	NA	238464.00	NA
Total Volume of Excavation (cy)	12,860	NA	12,860	NA	12,860	NA
Total Volume Contaminated (cy)	8,832	NA	8,832	NA	8,832	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-D-103						
Depth, ft	15.00	NA	15.00	NA	15.00	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA
Waste Site Area (m^2)	46.00	NA	46.00	NA	46.00	NA
Waste Site Contaminated Surface Area (ft^2)	495	NA	495	NA	495	NA
Waste Site Ground Surface Area (ft^2)	4,522	NA	4,522	NA	4,522	NA

Table A-1. 100-DH IMPORTANT QUANTITY INPUTS

	Alt 2 WASTE SITE	Alt 2 GW	Alt 3 WASTE SITE	Alt 3 GW	Alt 4 WASTE SITE	Alt 4 GW
Total Volume of Excavation (ft^3)	43,281	NA	43,281	NA	43,281	NA
Total Volume Contaminated (ft^3)	8,532	NA	8,532	NA	8,532	NA
Total Volume of Excavation (cy)	1,603	NA	1,603	NA	1,603	NA
Total Volume Contaminated (cy)	316	NA	316	NA	316	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-D-50:2 - Piping inside of intact subgrade tunnels	End Capping		End Capping			
Depth, ft	8.00	NA	8.00	NA	24.00	NA
Depth to Top of Contamination	NA	NA	NA	NA	16.00	NA
Length (ft)	NA	NA	NA	NA	1,208.00	NA
Width (ft)	NA	NA	NA	NA	7.00	NA
Waste Site Area (m^2)	NA	NA	NA	NA	819.00	NA
Waste Site Contaminated Surface Area (ft^2)	NA	NA	NA	NA	106,965	NA
Waste Site Ground Surface Area (ft^2)	NA	NA	NA	NA	8,816	NA
Total Volume of Excavation (ft^3)	NA	NA	NA	NA	1,603,099.04	NA
Total Volume Contaminated (ft^3)	NA	NA	NA	NA	155,507.25	NA
Total Volume of Excavation (cy)	NA	NA	NA	NA	59,374	NA
Total Volume Contaminated (cy)	NA	NA	NA	NA	5,760	NA
Expected Safety Level	C	NA	C	NA	D	NA
100-D-52						
Depth, ft	24.93	NA	24.93	NA	24.93	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA
Waste Site Area (m^2)	6.70	NA	6.70	NA	6.70	NA
Waste Site Contaminated Surface Area (ft^2)	72.00	NA	72.00	NA	72.00	NA
Waste Site Ground Surface Area (ft^2)	6,937	NA	6,937	NA	6,937	NA
Total Volume of Excavation (ft^3)	100,494	NA	100,494	NA	100,494	NA
Total Volume Contaminated (ft^3)	10,044	NA	10,044	NA	10,044	NA
Total Volume of Excavation (cy)	3,722	NA	3,722	NA	3,722	NA

Table A-1. 100-DH IMPORTANT QUANTITY INPUTS

	Alt 2 WASTE SITE	Alt 2 GW	Alt 3 WASTE SITE	Alt 3 GW	Alt 4 WASTE SITE	Alt 4 GW
Total Volume Contaminated (cy)	372	NA	372	NA	372	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-D-59						
Depth, ft	15.10	NA	15.10	NA	15.10	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA
Waste Site Area (m^2)	0.16	NA	0.16	NA	0.16	NA
Waste Site Contaminated Surface Area (ft^2)	1.70	NA	1.70	NA	1.70	NA
Waste Site Ground Surface Area (ft^2)	2,172	NA	2,172	NA	2,172	NA
Total Volume of Excavation (ft^3)	18,873	NA	18,873	NA	18,873	NA
Total Volume Contaminated (ft^3)	1,890	NA	1,890	NA	1,890	NA
Total Volume of Excavation (cy)	699	NA	699	NA	699	NA
Total Volume Contaminated (cy)	70	NA	70	NA	70	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-D-63 (pipeline)						
Depth, ft	15.10	NA	15.10	NA	15.10	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	32,800.00	NA	32,800.00	NA	32,800.00	NA
Width (ft)	6.00	NA	6.00	NA	6.00	NA
Waste Site Area (m^2)	NA	NA	NA	NA	NA	NA
Waste Site Contaminated Surface Area (ft^2)	196,800.00	NA	196,800.00	NA	196,800.00	NA
Waste Site Ground Surface Area (ft^2)	239,044	NA	239,044	NA	239,044	NA
Total Volume of Excavation (ft^3)	3,784,212	NA	3,784,212	NA	3,784,212	NA
Total Volume Contaminated (ft^3)	3,417,444	NA	3,417,444	NA	3,417,444	NA
Total Volume of Excavation (cy)	140,156	NA	140,156	NA	140,156	NA
Total Volume Contaminated (cy)	126,572	NA	126,572	NA	126,572	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-D-96						
Depth, ft	15.10	NA	15.10	NA	15.10	NA

Table A-1. 100-DH IMPORTANT QUANTITY INPUTS

	Alt 2 WASTE SITE	Alt 2 GW	Alt 3 WASTE SITE	Alt 3 GW	Alt 4 WASTE SITE	Alt 4 GW
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA
Waste Site Area (m^2)	2.78	NA	2.78	NA	2.78	NA
Waste Site Contaminated Surface Area (ft^2)	29.91	NA	29.91	NA	29.91	NA
Waste Site Ground Surface Area (ft^2)	2,577	NA	2,577	NA	2,577	NA
Total Volume of Excavation (ft^3)	22,639	NA	22,639	NA	22,639	NA
Total Volume Contaminated (ft^3)	2,264	NA	2,264	NA	2,264	NA
Total Volume of Excavation (cy)	838	NA	838	NA	838	NA
Total Volume Contaminated (cy)	84	NA	84	NA	84	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-H-28:7 (pipeline)						
Depth, ft	15.10	NA	15.10	NA	15.10	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	6,420.00	NA	6,420.00	NA	6,420.00	NA
Width (ft)	5.00	NA	5.00	NA	5.00	NA
Waste Site Area (m^2)	NA	NA	NA	NA	NA	NA
Waste Site Contaminated Surface Area (ft^2)	32,100.00	NA	32,100.00	NA	32,100.00	NA
Waste Site Ground Surface Area (ft^2)	50,384	NA	50,384	NA	50,384	NA
Total Volume of Excavation (ft^3)	716,175	NA	716,175	NA	716,175	NA
Total Volume Contaminated (ft^3)	557,415	NA	557,415	NA	557,415	NA
Total Volume of Excavation (cy)	26,525	NA	26,525	NA	26,525	NA
Total Volume Contaminated (cy)	20,645	NA	20,645	NA	20,645	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-H-38						
Depth, ft	15.10	NA	15.10	NA	15.10	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA

Table A-1. 100-DH IMPORTANT QUANTITY INPUTS

	Alt 2 WASTE SITE	Alt 2 GW	Alt 3 WASTE SITE	Alt 3 GW	Alt 4 WASTE SITE	Alt 4 GW
Waste Site Area (m^2)	NA	NA	NA	NA	NA	NA
Waste Site Contaminated Surface Area (ft^2)	130,680.00	NA	130,680.00	NA	130,680.00	NA
Waste Site Ground Surface Area (ft^2)	165,484	NA	165,484	NA	165,484	NA
Total Volume of Excavation (ft^3)	2,571,453	NA	2,571,453	NA	2,571,453	NA
Total Volume Contaminated (ft^3)	2,269,269	NA	2,269,269	NA	2,269,269	NA
Total Volume of Excavation (cy)	95,239	NA	95,239	NA	95,239	NA
Total Volume Contaminated (cy)	84,047	NA	84,047	NA	84,047	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-H-5						
Depth, ft	24.90	NA	24.90	NA	24.90	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	328.00	NA	328.00	NA	328.00	NA
Width (ft)	49.20	NA	49.20	NA	49.20	NA
Waste Site Area (m^2)	NA	NA	NA	NA	NA	NA
Waste Site Contaminated Surface Area (ft^2)	16,137.60	NA	16,137.60	NA	16,137.60	NA
Waste Site Ground Surface Area (ft^2)	40,697	NA	40,697	NA	40,697	NA
Total Volume of Excavation (ft^3)	813,456	NA	813,456	NA	813,456	NA
Total Volume Contaminated (ft^3)	462,105	NA	462,105	NA	462,105	NA
Total Volume of Excavation (cy)	30,128	NA	30,128	NA	30,128	NA
Total Volume Contaminated (cy)	17,115	NA	17,115	NA	17,115	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-H-57						
Depth, ft	15.10	NA	15.10	NA	15.10	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Length (ft)	NA	NA	NA	NA	NA	NA
Width (ft)	NA	NA	NA	NA	NA	NA
Waste Site Area (m^2)	231.88	NA	231.88	NA	231.88	NA
Waste Site Contaminated Surface Area (ft^2)	2,495.90	NA	2,495.90	NA	2,495.90	NA
Waste Site Ground Surface Area (ft^2)	9,074	NA	9,074	NA	9,074	NA

Table A-1. 100-DH IMPORTANT QUANTITY INPUTS

	Alt 2 WASTE SITE	Alt 2 GW	Alt 3 WASTE SITE	Alt 3 GW	Alt 4 WASTE SITE	Alt 4 GW
Total Volume of Excavation (ft^3)	100,467	NA	100,467	NA	100,467	NA
Total Volume Contaminated (ft^3)	43,335	NA	43,335	NA	43,335	NA
Total Volume of Excavation (cy)	3,721	NA	3,721	NA	3,721	NA
Total Volume Contaminated (cy)	1,605	NA	1,605	NA	1,605	NA
Expected Safety Level	D	NA	D	NA	D	NA
100-H-58						
Depth, ft	--	NA	--	NA	--	NA
Depth to Top of Contamination	--	NA	--	NA	--	NA
Waste Site Contaminated Surface Area (ft^2)	--	NA	--	NA	--	NA
Waste Site Ground Surface Area (ft^2)	--	NA	--	NA	--	NA
Total Volume of Excavation (ft^3)	--	NA	--	NA	--	NA
Total Volume Contaminated (ft^3)	45.90	NA	45.90	NA	45.90	NA
Total Volume of Excavation (cy)	--	NA	--	NA	--	NA
Total Volume Contaminated (cy)	1.70	NA	1.70	NA	1.70	NA
Expected Safety Level	D	NA	D	NA	D	NA
Void Fill Grouting						
100-H-36						
Depth, ft	1.00	NA	1.00	NA	NA	NA
100-H-36 Area of void tof grout fill (sf)	3 flumes @ 72.732	NA	3 flumes @ 72.732	NA	NA	NA
100-H-36 Length of void to grout fill (ft)	3 flumes @ 130	NA	3 flumes @ 130	NA	NA	NA
Total volume of Grout (cy)	3,152	NA	3,152	NA	NA	NA
100-H-36 Expected Safety Level	D	NA	D	NA	NA	NA
GW Extraction Wells						
GW Exstraction Wells (DX)						
Existing Extraction Wells	NA	37.00	NA	37.00	NA	37.00
New Extraction Wells	NA	4.00	NA	21.00	NA	5.00
MW Converted to Extraction Wells	NA	4.00	NA	4.00	NA	4.00
IW Converted to Extraction Wells	NA	--	NA	NA	NA	4.00

Table A-1. 100-DH IMPORTANT QUANTITY INPUTS

	Alt 2 WASTE SITE	Alt 2 GW	Alt 3 WASTE SITE	Alt 3 GW	Alt 4 WASTE SITE	Alt 4 GW
GW Injection Wells (DX)						
Existing Injection Wells	NA	14.00	NA	14.00	NA	14.00
New Injection Wells	NA	7.00	NA	12.00	NA	7.00
GW Extraction Wells (HX)						
Existing Extraction Wells	NA	31.00	NA	31.00	NA	31.00
New Extraction Wells	NA	10.00	NA	36.00	NA	18.00
MW Converted to Extraction Wells	NA	--	NA	--	NA	--
IW Converted to Extraction Wells	NA	--	NA	--	NA	1.00
GW Injection Wells (HX)						
Existing Injection Wells	NA	15.00	NA	15.00	NA	15.00
New Injection Wells	NA	1.00	NA	13.00	NA	5.00
New Monitoring Wells (HX and DX Combined)	NA	12.00	NA	12.00	NA	12.00
Bioremediation Wells (HX)						
New Exraction Wells for Bio	NA	7.00	NA	NA	NA	NA
Coverted Wells to Extraction Wells for Bio	NA	6.00	NA	NA	NA	NA
New Injection Wells for Bio	NA	2.00	NA	NA	NA	NA
Converted Wells to Injection Wells for Bio	NA	2.00	NA	NA	NA	NA
Flow Rates DX + HX						
Year 1 with Interim Action still in place						
IX Extr Wells Operating (avg)	NA	65.00	NA	65.00	NA	65.00
Extr GPM Total	NA	(1,190.00)	NA	(1,190.00)	NA	(1,190.00)
IX Inj Wells Operating (avg)	NA	26.00	NA	26.00	NA	26.00
Inj GPM Total	NA	1,190.00	NA	1,190.00	NA	1,190.00
Bioinjection, gpm	NA	NA	NA	NA	NA	NA
Months	NA	12.00	NA	12.00	NA	12.00
Year 2, Begin Alternative Remedy Config - Completion						
Number of Years After 2013	NA	25.00	NA	12.00	NA	48.00
IX Extr Wells Operating (avg)	NA	74.00	NA	130.00	NA	95.00
Extr GPM Total	NA	(1,190.00)	NA	(2,396.00)	NA	(1,190.00)
IX Inj Wells Operating (avg)	NA	34.00	NA	47.00	NA	33.00
Inj GPM Total	NA	1,190.00	NA	2,396.00	NA	1,190.00

Table A-1. 100-DH IMPORTANT QUANTITY INPUTS

	Alt 2 WASTE SITE	Alt 2 GW	Alt 3 WASTE SITE	Alt 3 GW	Alt 4 WASTE SITE	Alt 4 GW
Bioinjection, gpm	NA	263.00	NA	NA	NA	NA
Bioinjection frequency (days injection/quarter)	NA	45.00	NA	NA	NA	NA
Years	NA	25.00	NA	12.00	NA	39.00
IX System						
Flowrate, gpm (avg)	78.5	78.5	78.5	78.5	78.5	78.5
Constituent 1	CrVI	CrVI	CrVI	CrVI	CrVI	CrVI
Concentration Range, mg/L	>0.05-.1	>0.05-.1	>0.05-.1	>0.05-.1	>0.05-.1	>0.05-.1
Installation type	Fixed	Fixed	Fixed	Fixed	Fixed	Fixed
Bio System						
Flow Mechanism	Force Main	NA	NA	NA	NA	NA
Transfer Piping Diameter (HDPE, in)	3	NA	NA	NA	NA	NA
6000 Gallon Horizontal Plastic Substrate Tank	2	NA	NA	NA	NA	NA
2000 Gallon Horizontal Plastic Substrate Tank	1	NA	NA	NA	NA	NA
20000 Gallon Horizontal Plastic Equalization Tank	2	NA	NA	NA	NA	NA
10000 Gallon Horizontal Plastic Equalization tank	1	NA	NA	NA	NA	NA
100 GPM, 5hp, Transfer pump with motor, valves, piping	2	NA	NA	NA	NA	NA
150gpm, 5hp, transfer pump with motor, valves, piping	1	NA	NA	NA	NA	NA
Electrical Service to node	3	NA	NA	NA	NA	NA

Appendix B

Well Flow Rate Information for 100-HR-3 Groundwater OU

Table B-1. Names, Geographic Coordinates, and Extraction and Injection Rates of 100-HR-3 Wells – Alternative 1

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12
199-D5-104	573265.48	151422.43	DX	-	-	-	-	-	-	(17.1)	(21.5)	(20.5)	(20.5)	(24.1)	(25.0)	(25.0)	(22.0)	(25.0)	(24.2)	(25.0)	(23.9)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)
199-D5-20	573239.97	152030.15	DX	-	-	-	-	-	-	(8.2)	(8.3)	(3.9)	(3.9)	(0.0)	-	-	-	(0.0)	(7.6)	(9.5)	(9.1)	(9.8)	(9.5)	(9.5)	(9.5)	(9.5)	(9.5)
199-D5-32	573372.04	151903.39	DX	(15.4)	(17.8)	(18.8)	(17.2)	(16.0)	(15.5)	(15.8)	(14.9)	(17.0)	(17.0)	(18.1)	(18.4)	(17.5)	(15.7)	(18.0)	(17.6)	(19.0)	(17.6)	(16.9)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)
199-D5-39	573142.858	151428.428	DX	-	-	-	-	-	-	(20.2)	(24.3)	(22.9)	(22.9)	(24.5)	(24.9)	(24.4)	(21.7)	(24.9)	(23.8)	(25.0)	(23.0)	(24.8)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)
199-D5-42	573479.771	151622.674	DX	-	-	-	-	-	-	31.5	33.2	28.0	28.0	22.7	23.7	23.0	17.0	24.4	25.9	25.3	22.6	24.6	25.3	25.3	25.3	25.3	25.3
199-D5-44	572993.581	151835.736	DX	86.5	87.1	66.1	40.7	34.2	33.7	43.9	46.6	45.3	45.3	44.5	46.9	45.7	35.3	39.9	34.2	26.7	25.7	26.4	26.7	26.7	26.7	26.7	26.7
199-D5-92	573131.93	152009.82	DX	-	-	-	-	-	-	(21.2)	(23.5)	(17.0)	(17.0)	(15.6)	(18.0)	(18.5)	(21.2)	(29.0)	(29.7)	(33.0)	(30.3)	(29.8)	(33.0)	(33.0)	(33.0)	(33.0)	(33.0)
199-D4-95	572613	151227	DX	(13.0)	(12.5)	(12.6)	(12.1)	(10.2)	(10.9)	(9.0)	(10.0)	(12.2)	(12.2)	(12.5)	(13.0)	(13.0)	(11.4)	(13.0)	(12.6)	(13.0)	(11.4)	(11.5)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)
199-D4-96	572777	151520	DX	(13.1)	(12.7)	(12.6)	(13.3)	(10.5)	(13.8)	(15.0)	(15.0)	(15.1)	(15.1)	(13.0)	(10.7)	(7.8)	(4.7)	(5.9)	(2.7)	(7.0)	(7.0)	(8.0)	(7.0)	(7.0)	(7.0)	(7.0)	(7.0)
199-D4-97	572906.53	151624.87	DX	(12.8)	(12.2)	(12.2)	(12.1)	(10.2)	(10.9)	(10.3)	(10.0)	(11.4)	(11.4)	(12.5)	(13.0)	(13.0)	(11.4)	(12.2)	(11.6)	(12.0)	(11.5)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)
199-D4-98	572575.59	151483.28	DX	(13.0)	(12.4)	(12.7)	(11.9)	(10.2)	(10.7)	(11.5)	(10.0)	(11.0)	(11.0)	(11.6)	(12.5)	(13.0)	(11.1)	(13.0)	(12.6)	(13.0)	(12.4)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)
199-D4-99	572526.48	151376.63	DX	(19.5)	(16.3)	(15.4)	(13.7)	(11.0)	(15.8)	(16.5)	(15.0)	(15.6)	(15.6)	(11.1)	(16.5)	(18.0)	(15.4)	(18.9)	(18.4)	(19.0)	(18.0)	(17.2)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)
199-D2-10	574470.7	153465.17	DX	2.7	2.5	0.4	0.4	0.8	-	-	-	0.1	0.1	0.6	0.1	0.1	5.1	1.1	0.6	-	-	-	-	-	-	-	-
199-D2-12	574343.4	153300.8	DX	8.8	10.4	4.0	2.1	1.2	-	-	-	0.4	0.4	5.5	3.3	2.4	3.4	5.7	2.8	0.0	-	-	0.0	0.0	0.0	0.0	0.0
199-D8-6	573434.693	152060.822	DX	(14.7)	(14.3)	(13.7)	(10.9)	-	-	-	-	-	-	-	-	-	-	-	-	-	(2.0)	(6.9)	-	-	-	-	-
199-D8-89	573479.46	152250.4	DX	(11.5)	(11.2)	(14.0)	(13.9)	(12.4)	(13.5)	(18.4)	(19.1)	(13.3)	(13.3)	(12.1)	(11.1)	(10.6)	(9.6)	(11.1)	(11.1)	(12.1)	(11.6)	(12.4)	(12.1)	(12.1)	(12.1)	(12.1)	(12.1)
199-D8-90	573948.74	152646.2	DX	(19.5)	(18.8)	(19.3)	(13.6)	(11.5)	(14.2)	(18.5)	(17.9)	(16.1)	(16.1)	(12.5)	(19.4)	(18.4)	(10.6)	(18.7)	(18.4)	(17.2)	(17.6)	(17.6)	(17.2)	(17.2)	(17.2)	(17.2)	(17.2)
199-D8-91	574037.21	152741.29	DX	(19.6)	(19.0)	(20.1)	(14.0)	(11.5)	(14.8)	(22.5)	(23.3)	(16.7)	(16.7)	(17.0)	(20.5)	(19.0)	(10.7)	(16.8)	(17.3)	(18.9)	(17.7)	(17.6)	(18.9)	(18.9)	(18.9)	(18.9)	(18.9)
199-D8-93	574148.99	153085.76	DX	13.4	14.6	14.8	8.5	2.1	-	-	-	-	-	0.2	(0.0)	(0.0)	(0.0)	(0.0)	-	-	-	-	-	-	-	-	-
199-D8-94	574047.13	152949.35	DX	5.9	1.4	2.8	1.9	0.9	-	-	-	-	-	-	2.9	7.4	5.1	8.8	3.9	0.0	-	-	0.0	0.0	0.0	0.0	0.0
199-D8-53	573889.86	152452.26	DX	(17.0)	(15.6)	(15.1)	(14.4)	(1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-D8-54A	573781.17	152408.03	DX	(18.6)	(19.9)	(19.7)	(17.3)	(1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-D8-68	573711.67	152427.1	DX	(52.0)	(50.8)	(53.8)	(49.9)	(3.3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-D8-72	573570.481	152211.774	DX	(3.7)	(8.4)	(7.4)	(7.2)	(0.7)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
199-D4-101	572800.1	151425.94	DX	(2.5)	(4.3)	(2.2)	(0.0)	(0.0)	(0.0)	-	(0.0)	(0.0)	(0.0)	-	-	-	-	(6.8)	(8.2)	(4.9)	-	(3.8)	(4.9)	(4.9)	(4.9)	(4.9)	(4.9)
199-D4-38	572671.317	151537.856	DX	(8.0)	(7.5)	(7.6)	(7.4)	(6.3)	(7.5)	(8.9)	(7.7)	(8.1)	(8.1)	(5.8)	-	-	-	(6.2)	(7.7)	(8.0)	(7.5)	(8.0)	(8.0)	(8.0)	(8.0)	(8.0)	(8.0)
199-D4-39	572747.453	151650.84	DX	(16.4)	(15.5)	(16.0)	(13.8)	(11.0)	(17.1)	(15.4)	(13.6)	(14.4)	(14.4)	(16.1)	(15.4)	(15.0)	(13.2)	(15.9)	(15.5)	(14.5)	(12.4)	(13.8)	(14.5)	(14.5)	(14.5)	(14.5)	(14.5)
199-D4-83	572859.432	151723.418	DX	-	-	-	(0.1)	-	-	-	-	-	-	-	-	-	-	-	-	(5.0)	(9.3)	(11.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)
199-D4-84	572568.043	151433.521	DX	(10.7)	(11.2)	(11.9)	(11.6)	(9.9)	(10.9)	(10.3)	(10.0)	(9.4)	(9.4)	(9.1)	(9.6)	(9.7)	(7.9)	(9.4)	(10.1)	(11.0)	(10.3)	(11.2)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)
199-D4-85	572486.163	151324.202	DX	(19.7)	(18.7)	(18.8)	(13.8)	(12.4)	(16.6)	(16.6)	(15.0)	(15.7)	(15.7)	(11.1)	(13.1)	(14.1)	(16.3)	(16.5)	(18.2)	(19.0)	(17.6)	(17.1)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)
199-D5-101	572943.04	151521.52	DX	(23.0)	(21.0)	(21.3)	(15.1)	(11.0)	(20.2)	(22.2)	(22.7)	(17.9)	(17.9)	(26.1)	(26.3)	(26.0)	(22.9)	(26.9)	(26.1)	(27.0)	(25.9)	(25.1)	(27.0)	(27.0)	(27.0)	(27.0)	(27.0)
199-D5-127	572992.26	151428.31	DX	(17.8)	(17.6)	(14.3)	(13.0)	(11.0)	(13.2)	(13.8)	(10.9)	(8.5)	(8.5)	(3.9)	-	-	-	(0.0)	-	-	-	(4.7)	-	-	-	-	-
199-D5-128	573622.04	151237.06	DX	77.0	80.4	80.3	72.5	61.0	68.4	81.4	78.0	75.5	75.5	73.4	77.1	75.2	58.1	81.7	84.0	91.3	87.6	90.1	91.3	91.3	91.3	91.3	91.3
199-D5-129	573733.26	151465.18	DX	85.0	87.1	92.2	78.0	65.6	73.5	88.0	83.8	81.2	81.2	79.0	83.0	80.8	62.5	87.8	90.7	99.0	95.6	98.6	99.0	99.0	99.0	99.0	99.0
199-D5-130	574039.2	151928.51	DX	(14.5)	(13.8)	(15.0)	(13.1)	(13.3)	(12.0)	(13.2)	(14.6)	(14.8)	(14.8)	(15.5)	(15.8)	(14.7)	(10.5)	(12.0)	(11.6)	(12.0)	(11.1)	(8.8)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)
199-D5-131	573684.39	152006.75	DX	(17.2)	(15.8)	(15.5)	(13.3)	(12.4)	(13.4)	(13.7)	(14.6)	(15.1)	(15.1)	(17.9)	(18.2)	(17.9)	(15.7)	(18.0)	(17.4)	(17.5)	(16.7)	(17.2)	(17.5)	(17.5)	(17.5)	(17.5)	(17.5)
199-D6-1	574129.87	151691.71	DX	10.6	3.1	16.3	14.7	11.5	32.9	48.2	51.8	47.0	47.0	47.4	52.4	50.4	27.2	51.0	43.9	47.4	40.8	39.2	47.4	47.4	47.4	47.4	47.4
199-D6-2	574544.61	151970.2	DX	52.0	49.6	71.1	70.2	62.0	48.4	54.4	54.4	51.2	51.2	50.9	45.3	36.0	24.9	36.3	30.9	24.1	25.9	28.9	24.1	24.1	24.1	24.1	24.1
199-D7-3	574151.38	152363.41	DX	(18.4)	(19.0)	(18.0)	(14.3)	(11.5)	(14.4)	(16.7)	(14.7)	(17.6)	(17.6)	(19.7)	(20.2)	(18.4)	(10.6)	(15.9)	(16.1)	(17.0)	(16.1)	(17.2)	(17.0)	(17.0)	(17.0)	(17.0)	(17.0)
199-D7-4	574377.07	152369.64	DX	21.6	25.5	22.6	17.5	15.1	31.1	33.6	39.8	37.5	37.5	37.3	41.6	41.7	29.7	50.4	78.5	101.7	103.1	115.1	101.7	101.7	101.7	101.7	101.7
199-D7-5	574434.31	152678.72	DX	53.3	48.0	68.0	67.0	59.3	46.7	44.2	39.1	36.5	36.5	36.5	41.0	40.6	28.5	41.1	42.7	51.2	52.3	58.8	51.2	51.2	51.2	51.2	51.2
199-D7-6	574429.2	152980.43	DX	(16.7)	(16.3)	(16.4)	(12.9)	(11.5)	(14.2)	(14.9)	(12.3)	(14.7)	(14.7)	(12.0)	(14.6)	(14.1)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.5)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)
199-D8-55	573620.954	152364.345	DX	20.9	15.8	11.2	8.7	2.9	2.3	3.3	3.5	3.4	3.4	2.9	1.4	3.6	2.2	4.0	3.4	2.7	1.6	2.5	2.7	2.7	2.7	2.7	2.7
199-D8-69	573843.61	152552.201	DX	(18.8)	(19.0)	(19.4)	(14.3)	(12.4)	(14.9)	(18.8)	(18.1)	(17.0)	(17.0)	(18.1)	(19.2)	(17.9)	(10.7)	(20.6)	(20.1)	(20.9)	(19.6)	(20.2)	(20.9)	(20.9)	(20.9)	(20.9)	(20.9)
199-D8-73	573388.7	152167.38	DX	(3.2)	(3.2)	(3.8)	(3.8)	(3.3)	(3.1)	(3.7)	(3.6)	(3.0)	(3.0)	(2.8)	(3.1)	(2.9)	(1.1)	(0.1)	(4.6)	(5.4)	(5.1)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)
199-D8-88	573292.33	152141.26	DX	-	-	(0.4)	(0.6)	(0.0)	(3.3)	(2.8)	(1.9)	(2.2)	(2.2)	(2.3)	(3.6)	(3.8)	(3.7)	(4.8)	(6.0)	(6.3)	(6.2)	(7.7)	(6.3)	(6.3)	(6.3)	(6.3)	(6.3)
199-D8-95	573611.96	152160.61	DX	(16.4)	(16.3)	(16.9)	(13.8)	(12.4)	(14.0)	(15.9)	(14.6)	(14.4)	(14.4)	(17.7)	(15.7)	(17.1)	(10.7)	(17.8)	(17.7)	(17.9)	(17.0)	(17.6)	(17.9)	(17.9)	(17.9)	(17.9)	(17.9)
199-D8-96	573706	152152.24	DX	(21.8)	(22.1)	(22.5)	(15.2)	(12.8)	(14.6)	(16.4)	(14.6)	(18.3)	(18.3)	(23.2)	(23.7)	(23.9)	(20.9)	(23.9)	(23.2)	(24.0)	(22.3)	(21.0)	(24.0)	(24.0)	(24.0)	(24.0)	(24.0)

Table B-1. Names, Geographic Coordinates, and Extraction and Injection Rates of 100-HR-3 Wells – Alternative 1

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12
199-D8-97	573859.56	152087.42	DX	(17.5)	(17.2)	(19.5)	(14.8)	(12.4)	(16.3)	(19.1)	(19.4)	(18.9)	(18.9)	(21.2)	(21.1)	(19.1)	(11.5)	(17.8)	(17.5)	(18.9)	(17.7)	(17.6)	(18.9)	(18.9)	(18.9)	(18.9)	(18.9)
199-D8-98	574013.12	152123.02	DX	(17.4)	(16.8)	(18.1)	(14.0)	(10.7)	(14.5)	(16.8)	(14.6)	(16.5)	(16.5)	(19.7)	(13.3)	(12.3)	(12.4)	(18.9)	(18.4)	(18.5)	(17.1)	(17.5)	(18.5)	(18.5)	(18.5)	(18.5)	(18.5)
199-D8-99	574006.77	152364.37	DX	9.5	10.1	8.7	6.0	5.3	57.6	83.4	77.3	72.9	72.9	73.2	81.0	80.3	58.9	86.7	85.2	90.9	76.1	71.8	90.9	90.9	90.9	90.9	90.9
199-H1-5	574850.72	153090.3	DX	(19.0)	(19.0)	(19.3)	(13.6)	(11.5)	(16.2)	(18.8)	(19.4)	(14.4)	(14.4)	(10.8)	(14.6)	(14.1)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.5)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)
199-H4-80	575238.97	152568.16	DX	(14.6)	(14.1)	(15.4)	(13.9)	(12.4)	(13.5)	(16.5)	(14.7)	(15.0)	(15.0)	(12.9)	(16.6)	(16.0)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.6)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)
199-H4-81	575236.93	153035.36	DX	(14.7)	(14.5)	(15.2)	(13.5)	(12.4)	(12.4)	(15.5)	(14.6)	(14.8)	(14.8)	(13.4)	(15.8)	(15.7)	(4.1)	(15.0)	(15.1)	(16.4)	(16.1)	(16.9)	(16.4)	(16.4)	(16.4)	(16.4)	(16.4)
199-H4-82	574906.99	152677.72	DX	(0.2)	(10.1)	(12.7)	(10.3)	(7.7)	(15.6)	(19.0)	(19.5)	(15.5)	(15.5)	(11.1)	(17.4)	(16.9)	(3.8)	(17.6)	(17.5)	(18.4)	(17.9)	(17.8)	(18.4)	(18.4)	(18.4)	(18.4)	(18.4)
199-H4-14	577803.747	152752.359	HX	91.1	97.6	95.8	90.4	7.5	-	-	-	-	19.6	20.9	15.3	14.8	14.5	15.6	11.0	11.0	8.5	11.6	11.0	11.0	11.0	11.0	11.0
199-H4-15A	577905.999	153051.9969	HX	(19.0)	(19.1)	(18.7)	(17.9)	(1.5)	-	-	-	-	(35.2)	(34.3)	(38.5)	(33.3)	(37.5)	(37.7)	(38.2)	(39.1)	(32.1)	(31.0)	(39.1)	(39.1)	(39.1)	(39.1)	(39.1)
199-H4-17	577779.175	153037.635	HX	52.2	51.3	53.9	49.1	11.5	-	-	-	-	8.5	10.8	11.6	9.6	10.3	9.2	7.1	5.8	5.4	6.7	5.8	5.8	5.8	5.8	5.8
199-H4-18	578018.292	152756.478	HX	40.4	50.3	46.5	42.8	3.5	-	-	-	-	22.2	13.7	12.8	12.2	12.1	13.2	11.7	11.4	9.5	7.3	11.4	11.4	11.4	11.4	11.4
199-H4-4	578060.859	152853.956	HX	-	(8.7)	(4.8)	(5.5)	(0.6)	-	-	-	-	(2.4)	(4.5)	(5.3)	(4.2)	(2.5)	(6.1)	(11.0)	(11.0)	(10.9)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)
199-H4-63	578185.825	152665.531	HX	(24.0)	(24.1)	(23.4)	(21.1)	(1.6)	-	-	-	-	(25.0)	(24.7)	(25.6)	(25.7)	(26.0)	(26.3)	(26.1)	(27.4)	(26.8)	(27.0)	(27.4)	(27.4)	(27.4)	(27.4)	(27.4)
199-H4-64	577946.11	153010.582	HX	-	-	-	-	-	-	-	-	-	(8.2)	(12.1)	(13.3)	(12.3)	(11.7)	(14.9)	(22.9)	(20.7)	(20.1)	(15.0)	(20.7)	(20.7)	(20.7)	(20.7)	(20.7)
199-H3-2C	577632.065	152750.302	HX	-	-	-	-	-	-	-	-	-	(46.0)	(45.5)	(45.6)	(47.4)	(48.0)	(47.8)	(46.8)	(50.0)	(49.4)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)
199-H4-12C	578011.772	152919.812	HX	-	-	-	-	-	-	-	-	-	(27.2)	(26.5)	(29.4)	(29.4)	(29.7)	(29.2)	(28.8)	(30.0)	(29.6)	(30.0)	(30.0)	(30.0)	(30.0)	(30.0)	(30.0)
199-H3-4	577544.287	152293.21	HX	-	-	-	-	-	-	-	-	-	(84.6)	(102.9)	(125.0)	(124.2)	(125.0)	(123.9)	(108.8)	(113.4)	(95.6)	(99.4)	(113.4)	(113.4)	(113.4)	(113.4)	(113.4)
199-H1-1	576702.31	153384.49	HX	-	-	-	-	-	-	-	-	-	(28.7)	(29.2)	(30.0)	(29.9)	(29.4)	(30.1)	(26.1)	(29.5)	(26.7)	(19.9)	(29.5)	(29.5)	(29.5)	(29.5)	(29.5)
199-H1-2	576451.07	153378.26	HX	-	-	-	-	-	-	-	-	-	(3.1)	(2.6)	(2.4)	(2.1)	(1.9)	(1.9)	(2.2)	(4.6)	(6.1)	(6.9)	(4.6)	(4.6)	(4.6)	(4.6)	(4.6)
199-H1-20	575706.04	154183.61	HX	-	-	-	-	-	-	-	-	-	72.3	68.8	74.3	71.6	69.2	72.7	79.0	23.9	19.3	0.7	23.9	23.9	23.9	23.9	23.9
199-H1-21	575896.84	154163.8	HX	-	-	-	-	-	-	-	-	-	96.1	88.7	94.7	91.8	90.0	94.0	96.0	67.9	65.7	2.1	67.9	67.9	67.9	67.9	67.9
199-H1-25	576279.64	154069.97	HX	-	-	-	-	-	-	-	-	-	(17.5)	(24.5)	(28.9)	(28.6)	(26.6)	(28.4)	(28.7)	(29.1)	(26.3)	(16.1)	(29.1)	(29.1)	(29.1)	(29.1)	(29.1)
199-H1-27	576403.86	154024.21	HX	-	-	-	-	-	-	-	-	-	(11.2)	(18.0)	(22.1)	(21.5)	(18.7)	(23.8)	(28.7)	(29.6)	(26.4)	(19.0)	(29.6)	(29.6)	(29.6)	(29.6)	(29.6)
199-H1-32	576767.07	153766	HX	-	-	-	-	-	-	-	-	-	(1.3)	(1.7)	(1.5)	(1.4)	(0.3)	(1.7)	(9.5)	(18.5)	(19.7)	(19.0)	(18.5)	(18.5)	(18.5)	(18.5)	(18.5)
199-H1-33	576833.29	153716.23	HX	-	-	-	-	-	-	-	-	-	(4.8)	(7.6)	(11.5)	(6.6)	(0.2)	(6.2)	(22.8)	(27.8)	(25.3)	(19.9)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)
199-H1-34	576883.13	153667.06	HX	-	-	-	-	-	-	-	-	-	(11.2)	(13.9)	(14.4)	(13.3)	(11.0)	(15.1)	(25.3)	(27.4)	(27.6)	(27.8)	(27.4)	(27.4)	(27.4)	(27.4)	(27.4)
199-H1-35	576958.26	153628.14	HX	-	-	-	-	-	-	-	-	-	(23.6)	(25.3)	(28.5)	(27.4)	(23.1)	(25.0)	(26.3)	(22.0)	(26.5)	(26.8)	(22.0)	(22.0)	(22.0)	(22.0)	(22.0)
199-H1-36	576885.62	153486.51	HX	-	-	-	-	-	-	-	-	-	(8.1)	(7.1)	(6.9)	(6.3)	(5.3)	(4.7)	(7.7)	(9.0)	(8.9)	(8.9)	(9.0)	(9.0)	(9.0)	(9.0)	(9.0)
199-H1-37	577106.92	153641.63	HX	-	-	-	-	-	-	-	-	-	(7.8)	(10.7)	(12.8)	(7.7)	(3.0)	(10.1)	(27.5)	(27.8)	(27.6)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)
199-H1-38	577161	153555.01	HX	-	-	-	-	-	-	-	-	-	(6.1)	(4.3)	(4.0)	(3.4)	(4.3)	(6.3)	(13.5)	(24.4)	(24.5)	(24.9)	(24.4)	(24.4)	(24.4)	(24.4)	(24.4)
199-H1-39	577223.54	153533.4	HX	-	-	-	-	-	-	-	-	-	(1.9)	(1.8)	(1.1)	(1.0)	(0.6)	(2.3)	(32.9)	(41.1)	(37.6)	(29.8)	(41.1)	(41.1)	(41.1)	(41.1)	(41.1)
199-H1-40	577279.34	153500.19	HX	-	-	-	-	-	-	-	-	-	(3.7)	(3.1)	(3.5)	(2.6)	(2.5)	(4.1)	(10.4)	(22.4)	(29.2)	(19.9)	(22.4)	(22.4)	(22.4)	(22.4)	(22.4)
199-H1-42	577127.18	153391.65	HX	-	-	-	-	-	-	-	-	-	(27.2)	(27.6)	(29.0)	(27.6)	(28.9)	(27.9)	(27.9)	(29.0)	(28.0)	(27.8)	(29.0)	(29.0)	(29.0)	(29.0)	(29.0)
199-H1-43	577213.74	153384.28	HX	-	-	-	-	-	-	-	-	-	(28.7)	(28.5)	(19.9)	(21.8)	(24.6)	(29.0)	(28.3)	(29.6)	(29.6)	(29.8)	(29.6)	(29.6)	(29.6)	(29.6)	(29.6)
199-H1-45	577240.96	153062.41	HX	-	-	-	-	-	-	-	-	-	(25.8)	(25.6)	(26.5)	(26.7)	(27.0)	(26.9)	(26.7)	(9.3)	(4.1)	(27.0)	(9.3)	(9.3)	(9.3)	(9.3)	(9.3)
199-H1-6	576037.81	153745.74	HX	-	-	-	-	-	-	-	-	-	(2.2)	(1.5)	(0.4)	(0.1)	(1.0)	(2.2)	(2.8)	(6.3)	(8.5)	(11.7)	(6.3)	(6.3)	(6.3)	(6.3)	(6.3)
199-H3-25	577410.36	152978.49	HX	-	-	-	-	-	-	-	-	-	44.1	49.1	53.3	51.3	49.8	53.3	65.9	90.7	88.2	94.0	90.7	90.7	90.7	90.7	90.7
199-H3-26	577440.83	152846.5	HX	-	-	-	-	-	-	-	-	-	41.0	42.7	45.2	43.9	42.7	45.5	55.9	83.8	83.9	89.4	83.8	83.8	83.8	83.8	83.8
199-H3-27	577567.05	152811.14	HX	-	-	-	-	-	-	-	-	-	35.0	36.8	39.0	37.8	36.6	39.5	55.0	73.5	70.9	75.1	73.5	73.5	73.5	73.5	73.5
199-H4-69	578014.05	152686.66	HX	-	-	-	-	-	-	-	-	-	(26.0)	(24.8)	(27.6)	(27.2)	(21.3)	(24.4)	(27.7)	(28.0)	(27.7)	(28.0)	(28.0)	(28.0)	(28.0)	(28.0)	(28.0)
199-H4-70	578003.82	152646.45	HX	-	-	-	-	-	-	-	-	-	(22.8)	(22.7)	(23.6)	(23.7)	(24.0)	(23.9)	(23.4)	(21.0)	(22.3)	(23.0)	(21.0)	(21.0)	(21.0)	(21.0)	(21.0)
199-H4-71	578010.64	152581.53	HX	-	-	-	-	-	-	-	-	-	27.8	31.7	33.6	32.2	31.1	34.2	43.5	60.7	58.8	62.9	60.7	60.7	60.7	60.7	60.7
199-H4-72	578036.28	152500.14	HX	-	-	-	-	-	-	-	-	-	14.7	20.2	23.1	22.2	20.7	24.2	33.6	58.9	58.6	62.7	58.9	58.9	58.9	58.9	58.9
199-H4-73	577940.58	152369.98	HX	-	-	-	-	-	-	-	-	-	18.4	23.9	25.9	24.6	22.5	25.6	34.9	54.7	53.6	57.7	54.7	54.7	54.7	54.7	54.7
199-H4-74	577239.07	152268.83	HX	-	-	-	-	-	-	-	-	-	34.3	33.8	35.7	34.7	33.5	36.1	45.7	66.8	68.9	75.7	66.8	66.8	66.8	66.8	66.8
199-H4-75	577212.36	152704.64	HX	-	-	-	-	-	-	-	-	-	(19.1)	(19.0)	(19.7)	(19.7)	(20.0)	(19.0)	(18.1)	(19.0)	(19.1)	(20.0)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)
199-H4-76	576787.32	152976.85	HX	-	-	-	-	-	-	-	-	-	(14.0)	(9.0)	(4.0)	(1.1)	-	-	(0.0)	(3.5)	(13.6)	(17.9)	(3.5)	(3.5)	(3.5)	(3.5)	(3.5)
199-H4-77	576487.79	152975.43	HX	-	-	-	-	-	-	-	-	-	(12.4)	(11.1)	(10.1)	(9.9)	(9.1)	(8.7)	(7.1)	(9.3)	(9.3)	(8.4)	(9.3)	(9.3)	(9.3)	(9.3)	(9.3)

Table B-1. Names, Geographic Coordinates, and Extraction and Injection Rates of 100-HR-3 Wells – Alternative 1

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12
199-H4-78	576168.23	152166.12	HX	-	-	-	-	-	-	-	-	-	50.7	54.6	58.2	55.8	52.2	56.2	71.8	101.2	96.1	122.2	101.2	101.2	101.2	101.2	101.2
199-H4-79	575659.13	151989.31	HX	-	-	-	-	-	-	-	-	-	38.8	58.4	69.3	65.8	62.0	70.1	67.2	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)
199-H6-2	577886.5	152194.11	HX	-	-	-	-	-	-	-	-	-	15.1	18.1	20.3	19.2	17.7	20.5	29.9	49.9	52.3	56.2	49.9	49.9	49.9	49.9	49.9

Table B-2. Names, Geographic Coordinates, and Extraction and Injection Rates of 100-HR-3 Wells – Alternative 2

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan2013-Dec2087	Jan2013-Dec2087_Bio
199-D5-104	573265.48	151422.43	DX	-	-	-	-	-	-	(17.1)	(21.5)	(20.5)	(20.5)	(24.1)	(25.0)	(25.0)	(22.0)	(25.0)	(24.2)	(25.0)	(23.9)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)	(11.0)	
199-D5-20	573239.97	152030.15	DX	-	-	-	-	-	-	(8.2)	(8.3)	(3.9)	(3.9)	(0.0)	-	-	-	(0.0)	(7.6)	(9.5)	(9.1)	(9.8)	(9.5)	(9.5)	(9.5)	(9.5)	(9.5)	(9.0)	
199-D5-32	573372.04	151903.39	DX	(15.4)	(17.8)	(18.8)	(17.2)	(16.0)	(15.5)	(15.8)	(14.9)	(17.0)	(17.0)	(18.1)	(18.4)	(17.5)	(15.7)	(18.0)	(17.6)	(19.0)	(17.6)	(16.9)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	-	
199-D5-39	573142.858	151428.428	DX	-	-	-	-	-	-	(20.2)	(24.3)	(22.9)	(22.9)	(24.5)	(24.9)	(24.4)	(21.7)	(24.9)	(23.8)	(25.0)	(23.0)	(24.8)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)	(18.0)	
199-D5-42	573479.771	151622.674	DX	-	-	-	-	-	-	31.5	33.2	28.0	28.0	22.7	23.7	23.0	17.0	24.4	25.9	25.3	22.6	24.6	25.3	25.3	25.3	25.3	25.3	20.0	
199-D5-44	572993.581	151835.736	DX	86.5	87.1	66.1	40.7	34.2	33.7	43.9	46.6	45.3	45.3	44.5	46.9	45.7	35.3	39.9	34.2	26.7	25.7	26.4	26.7	26.7	26.7	26.7	26.7	20.0	
199-D5-92	573131.93	152009.82	DX	-	-	-	-	-	-	(21.2)	(23.5)	(17.0)	(17.0)	(15.6)	(18.0)	(18.5)	(21.2)	(29.0)	(29.7)	(33.0)	(30.3)	(29.8)	(33.0)	(33.0)	(33.0)	(33.0)	(33.0)	(18.0)	
199-D4-95	572613	151227	DX	(13.0)	(12.5)	(12.6)	(12.1)	(10.2)	(10.9)	(9.0)	(10.0)	(12.2)	(12.2)	(12.5)	(13.0)	(13.0)	(11.4)	(13.0)	(12.6)	(13.0)	(11.4)	(11.5)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)	(10.0)	
199-D4-96	572777	151520	DX	(13.1)	(12.7)	(12.6)	(13.3)	(10.5)	(13.8)	(15.0)	(15.0)	(15.1)	(15.1)	(13.0)	(10.7)	(7.8)	(4.7)	(5.9)	(2.7)	(7.0)	(7.0)	(8.0)	(7.0)	(7.0)	(7.0)	(7.0)	(7.0)	(8.0)	
199-D4-97	572906.53	151624.87	DX	(12.8)	(12.2)	(12.2)	(12.1)	(10.2)	(10.9)	(10.3)	(10.0)	(11.4)	(11.4)	(12.5)	(13.0)	(13.0)	(11.4)	(12.2)	(11.6)	(12.0)	(11.5)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	(8.0)	
199-D4-98	572575.59	151483.28	DX	(13.0)	(12.4)	(12.7)	(11.9)	(10.2)	(10.7)	(11.5)	(10.0)	(11.0)	(11.0)	(11.6)	(12.5)	(13.0)	(11.1)	(13.0)	(12.6)	(13.0)	(12.4)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)	(10.0)	
199-D4-99	572526.48	151376.63	DX	(19.5)	(16.3)	(15.4)	(13.7)	(11.0)	(15.8)	(16.5)	(15.0)	(15.6)	(15.6)	(11.1)	(16.5)	(18.0)	(15.4)	(18.9)	(18.4)	(19.0)	(18.0)	(17.2)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	(12.0)	
199-D2-10	574470.7	153465.17	DX	2.7	2.5	0.4	0.4	0.8	-	-	-	0.1	0.1	0.6	0.1	0.1	5.1	1.1	0.6	-	-	-	-	-	-	-	-	-	
199-D2-12	574343.4	153300.8	DX	8.8	10.4	4.0	2.1	1.2	-	-	-	0.4	0.4	5.5	3.3	2.4	3.4	5.7	2.8	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	
199-D8-6	573434.693	152060.822	DX	(14.7)	(14.3)	(13.7)	(10.9)	-	-	-	-	-	-	-	-	-	-	-	-	-	(2.0)	(6.9)	-	-	-	-	-	(6.8)	
199-D8-89	573479.46	152250.4	DX	(11.5)	(11.2)	(14.0)	(13.9)	(12.4)	(13.5)	(18.4)	(19.1)	(13.3)	(13.3)	(12.1)	(11.1)	(10.6)	(9.6)	(11.1)	(11.1)	(12.1)	(11.6)	(12.4)	(12.1)	(12.1)	(12.1)	(12.1)	(12.1)	(11.0)	
199-D8-90	573948.74	152646.2	DX	(19.5)	(18.8)	(19.3)	(13.6)	(11.5)	(14.2)	(18.5)	(17.9)	(16.1)	(16.1)	(12.5)	(19.4)	(18.4)	(10.6)	(18.7)	(18.4)	(17.2)	(17.6)	(17.6)	(17.2)	(17.2)	(17.2)	(17.2)	(17.2)	(18.0)	
199-D8-91	574037.21	152741.29	DX	(19.6)	(19.0)	(20.1)	(14.0)	(11.5)	(14.8)	(22.5)	(23.3)	(16.7)	(16.7)	(17.0)	(20.5)	(19.0)	(10.7)	(16.8)	(17.3)	(18.9)	(17.7)	(17.6)	(18.9)	(18.9)	(18.9)	(18.9)	(18.9)	(18.0)	
199-D8-93	574148.99	153085.76	DX	13.4	14.6	14.8	8.5	2.1	-	-	-	-	-	0.2	(0.0)	(0.0)	(0.0)	(0.0)	-	-	-	-	-	-	-	-	-	-	
199-D8-94	574047.13	152949.35	DX	5.9	1.4	2.8	1.9	0.9	-	-	-	-	-	-	2.9	7.4	5.1	8.8	3.9	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-	
DX-10	574369	153271	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25.0	
DX-11	574540	153430	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.0	
DX-14	574168	153136	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.0	
DX-4	572444	151191	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(10.0)	
DX-5	572527	151059	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(10.0)	
DX-8	573234	151733	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	
DX-9	574034	152909	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40.0	
DX-20	572329	150994	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(12.0)	
DX-21	572491	150778	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(12.0)	
DX-22	573030	151013	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60.0	
199-D8-53	573889.86	152452.26	DX	(17.0)	(15.6)	(15.1)	(14.4)	(1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(7.2)	
199-D8-54A	573781.17	152408.03	DX	(18.6)	(19.9)	(19.7)	(17.3)	(1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(12.5)	
199-D8-68	573711.67	152427.1	DX	(52.0)	(50.8)	(53.8)	(49.9)	(3.3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(11.5)	
199-D8-72	573570.481	152211.774	DX	(3.7)	(8.4)	(7.4)	(7.2)	(0.7)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(10.5)	
199-D4-101	572800.1	151425.94	DX	(2.5)	(4.3)	(2.2)	(0.0)	(0.0)	(0.0)	-	(0.0)	(0.0)	(0.0)	-	-	-	-	(6.8)	(8.2)	(4.9)	-	(3.8)	(4.9)	(4.9)	(4.9)	(4.9)	(4.9)	(3.8)	
199-D4-38	572671.317	151537.856	DX	(8.0)	(7.5)	(7.6)	(7.4)	(6.3)	(7.5)	(8.9)	(7.7)	(8.1)	(8.1)	(5.8)	-	-	-	(6.2)	(7.7)	(8.0)	(7.5)	(8.0)	(8.0)	(8.0)	(8.0)	(8.0)	(8.0)	(8.0)	
199-D4-39	572747.453	151650.84	DX	(16.4)	(15.5)	(16.0)	(13.8)	(11.0)	(17.1)	(15.4)	(13.6)	(14.4)	(14.4)	(16.1)	(15.4)	(15.0)	(13.2)	(15.9)	(15.5)	(14.5)	(12.4)	(13.8)	(14.5)	(14.5)	(14.5)	(14.5)	(14.5)	(10.0)	
199-D4-83	572859.432	151723.418	DX	-	-	-	(0.1)	-	-	-	-	-	-	-	-	-	-	-	-	(5.0)	(9.3)	(11.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	-	
199-D4-84	572568.043	151433.521	DX	(10.7)	(11.2)	(11.9)	(11.6)	(9.9)	(10.9)	(10.3)	(10.0)	(9.4)	(9.4)	(9.1)	(9.6)	(9.7)	(7.9)	(9.4)	(10.1)	(11.0)	(10.3)	(11.2)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)	
199-D4-85	572486.163	151324.202	DX	(19.7)	(18.7)	(18.8)	(13.8)	(12.4)	(16.6)	(16.6)	(15.0)	(15.7)	(15.7)	(11.1)	(13.1)	(14.1)	(16.3)	(16.5)	(18.2)	(19.0)	(17.6)	(17.1)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	(12.0)	
199-D5-101	572943.04	151521.52	DX	(23.0)	(21.0)	(21.3)	(15.1)	(11.0)	(20.2)	(22.2)	(22.7)	(17.9)	(17.9)	(26.1)	(26.3)	(26.0)	(22.9)	(26.9)	(26.1)	(27.0)	(25.9)	(25.1)	(27.0)	(27.0)	(27.0)	(27.0)	(27.0)	(20.0)	
199-D5-127	572992.26	151428.31	DX	(17.8)	(17.6)	(14.3)	(13.0)	(11.0)	(13.2)	(13.8)	(10.9)	(8.5)	(8.5)	(3.9)	-	-	-	(0.0)	-	-	-	(4.7)	-	-	-	-	-	(4.7)	
199-D5-128	573622.04	151237.06	DX	77.0	80.4	80.3	72.5	61.0	68.4	81.4	78.0	75.5	75.5	73.4	77.1	75.2	58.1	81.7	84.0	91.3	87.6	90.1	91.3	91.3	91.3	91.3	91.3	40.0	
199-D5-129	573733.26	151465.18	DX	85.0	87.1	92.2	78.0	65.6	73.5	88.0	83.8	81.2	81.2	79.0	83.0	80.8	62.5	87.8	90.7	99.0	95.6	98.6	99.0	99.0	99.0	99.0	99.0	35.0	
199-D5-130	574039.2	151928.51	DX	(14.5)	(13.8)	(15.0)	(13.1)	(13.3)	(12.0)	(13.2)	(14.6)	(14.8)	(14.8)	(15.5)	(15.8)	(14.7)	(10.5)	(12.0)	(11.6)	(12.0)	(11.1)	(8.8)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	-	
199-D5-131	573684.39	152006.75	DX	(17.2)	(15.8)	(15.5)	(13.3)	(12.4)	(13.4)	(13.7)	(14.6)	(15.1)	(15.1)	(17.9)	(18.2)	(17.9)	(15.7)	(18.0)	(17.4)	(17.5)	(16.7)	(17.2)	(17.5)	(17.5)	(17.5)	(17.5)	(17.5)	(14.0)	
199-D6-1	574129.87	151691.71	DX	10.6	3.1	16.3	14.7	11.5	32.9	48.2	51.8	47.0	47.0	47.4	52.4	50.4	27.2	51.0	43.9	47.4	40.8	39.2	47.4	47.4	47.4	47.4	47.4	35.0	
199-D6-2	574544.61	151970.2	DX	52.0	49.6	71.1	70.2	62.0	48.4	54.4	54.4	51.2	51.2	50.9	45.3	36.0	24.9	36.3	30.9	24.1	25.9	28.9	24.1	24.1	24.1	24.1	24.1	25.0	
199-D7-3	574151.38	152363.41	DX	(18.4)	(19.0)	(18.0)	(14.3)	(11.5)	(14.4)	(16.7)	(14.7)	(17.6)	(17.6)	(19.7)	(20.2)	(18.4)	(10.6)	(15.9)	(16.1)	(17.0)	(16.1)	(17.2)	(17.0)	(17.0)	(17.0)	(17.0)	(17.0)	(12.0)	
199-D7-4	574377.07	152369.64	DX	21.6	25.5	22.6	17.5	15.1	31.1	33.6	39.8	37.5	37.5	37.3	41.6	41.7	29.7	50.4	78.5	101.7	103.1	115.1	101.7	101.7	101.7	101.7	101.7	55.0	
199-D7-5	574434.31	152678.72	DX	53.3	48.0	68.0	67.0	59.3	46.7	44.2	39.1	36.5	36.5	36.5	41.0	40.6	28.5	41.1	42.7	51.2	52.3	58.8	51.2	51.2	51.2	51.2	51.2	40.0	
199-D7-6	574429.2	152980.43	DX	(16.7)	(16.3)	(16.4)	(12.9)	(11.5)	(14.2)	(14.9)	(12.3)	(14.7)	(14.7)	(12.0)	(14.6)	(14.1)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.5)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)	(15.0)	
199-D8-55	573620.954	152364.345	DX	20.9	15.8	11.2	8.7	2.9	2.3	3.3	3.5	3.4	3.4	2.9	1.4	3.6	2.2	4.0	3.4	2.7	1.6	2.5	2.7	2.7	2.7	2.7	2.7	2.5	
199-D8-69	573843.61	152552.201	DX	(18.8)	(19.0)	(19.4)	(14.3)	(12.4)	(14.9)	(18.8)	(18.1)	(17.0)	(17.0)	(18.1)	(19.2)	(17.9)	(10.7)	(20.6)	(20.1)	(20.9)	(19.6)	(20.2)	(20.9)	(20.9)	(20.9)	(20.9)	(20.9)	(16.5)	
199-D8-73	573388.7	152167.38	DX	(3.2)	(3.2)	(3.8)	(3.8)	(3.3)	(3.1)	(3.7)	(3.6)	(3.0)	(3.0)	(2.8)	(3.1)	(2.9)	(1.1)	(0.1)	(4.6)	(5.4)	(5.1)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)	
199-D8-88	573292.33	152141.26	DX	-	-	(0.4)	(0.6)	(0.0)	(3.3)	(2.8)	(1.9)	(2.2)	(2.2)	(2.3)	(3.6)	(3.8)	(3.7)	(4.8)	(6.0)	(6.3)	(6.2)	(7.7)	(6.3)	(6.3)	(6.3)	(6.3)	(6.3)	(7.7)	
199-D8-95	573611.96	152160.61	DX	(16.4)	(16.3)	(16.9)	(13.8)	(12.4)	(14.0)	(15.9)	(14.6)	(14.4)	(14.4)	(17.7)	(15.7)	(17.1)	(10.7)	(17.8)	(17.7)	(17.9)	(17.0)	(17.6)	(17.9)	(17.9)	(17.9)	(17.9)	(17.9)	(15.0)	

Table B-2. Names, Geographic Coordinates, and Extraction and Injection Rates of 100-HR-3 Wells – Alternative 2

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan2013-Dec2087	Jan2013-Dec2087_Bio
199-D8-96	573706	152152.24	DX	(21.8)	(22.1)	(22.5)	(15.2)	(12.8)	(14.6)	(16.4)	(14.6)	(18.3)	(18.3)	(23.2)	(23.7)	(23.9)	(20.9)	(23.9)	(23.2)	(24.0)	(22.3)	(21.0)	(24.0)	(24.0)	(24.0)	(24.0)	(24.0)	(18.0)	
199-D8-97	573859.56	152087.42	DX	(17.5)	(17.2)	(19.5)	(14.8)	(12.4)	(16.3)	(19.1)	(19.4)	(18.9)	(18.9)	(21.2)	(21.1)	(19.1)	(11.5)	(17.8)	(17.5)	(18.9)	(17.7)	(17.6)	(18.9)	(18.9)	(18.9)	(18.9)	(18.9)	(16.0)	
199-D8-98	574013.12	152123.02	DX	(17.4)	(16.8)	(18.1)	(14.0)	(10.7)	(14.5)	(16.8)	(14.6)	(16.5)	(16.5)	(19.7)	(13.3)	(12.3)	(12.4)	(18.9)	(18.4)	(18.5)	(17.1)	(17.5)	(18.5)	(18.5)	(18.5)	(18.5)	(18.5)	(16.0)	
199-D8-99	574006.77	152364.37	DX	9.5	10.1	8.7	6.0	5.3	57.6	83.4	77.3	72.9	72.9	73.2	81.0	80.3	58.9	86.7	85.2	90.9	76.1	71.8	90.9	90.9	90.9	90.9	90.9	71.8	
199-H1-5	574850.72	153090.3	DX	(19.0)	(19.0)	(19.3)	(13.6)	(11.5)	(16.2)	(18.8)	(19.4)	(14.4)	(14.4)	(10.8)	(14.6)	(14.1)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.5)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)	(19.0)	
199-H4-80	575238.97	152568.16	DX	(14.6)	(14.1)	(15.4)	(13.9)	(12.4)	(13.5)	(16.5)	(14.7)	(15.0)	(15.0)	(12.9)	(16.6)	(16.0)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.6)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)	(12.5)	
199-H4-81	575236.93	153035.36	DX	(14.7)	(14.5)	(15.2)	(13.5)	(12.4)	(12.4)	(15.5)	(14.6)	(14.8)	(14.8)	(13.4)	(15.8)	(15.7)	(4.1)	(15.0)	(15.1)	(16.4)	(16.1)	(16.9)	(16.4)	(16.4)	(16.4)	(16.4)	(16.4)	(17.0)	
199-H4-82	574906.99	152677.72	DX	(0.2)	(10.1)	(12.7)	(10.3)	(7.7)	(15.6)	(19.0)	(19.5)	(15.5)	(15.5)	(11.1)	(17.4)	(16.9)	(3.8)	(17.6)	(17.5)	(18.4)	(17.9)	(17.8)	(18.4)	(18.4)	(18.4)	(18.4)	(18.4)	(12.0)	
199-H4-14	577803.747	152752.359	HX	91.1	97.6	95.8	90.4	7.5	-	-	-	-	19.6	20.9	15.3	14.8	14.5	15.6	11.0	11.0	8.5	11.6	11.0	11.0	11.0	11.0	11.0	10.0	
199-H4-15A	577905.999	153051.9969	HX	(19.0)	(19.1)	(18.7)	(17.9)	(1.5)	-	-	-	-	(35.2)	(34.3)	(38.5)	(33.3)	(37.5)	(37.7)	(38.2)	(39.1)	(32.1)	(31.0)	(39.1)	(39.1)	(39.1)	(39.1)	(39.1)	-	
199-H4-17	577779.175	153037.635	HX	52.2	51.3	53.9	49.1	11.5	-	-	-	-	8.5	10.8	11.6	9.6	10.3	9.2	7.1	5.8	5.4	6.7	5.8	5.8	5.8	5.8	5.8	-	
199-H4-18	578018.292	152756.478	HX	40.4	50.3	46.5	42.8	3.5	-	-	-	-	22.2	13.7	12.8	12.2	12.1	13.2	11.7	11.4	9.5	7.3	11.4	11.4	11.4	11.4	11.4	-	
199-H4-4	578060.859	152853.956	HX	-	(8.7)	(4.8)	(5.5)	(0.6)	-	-	-	-	(2.4)	(4.5)	(5.3)	(4.2)	(2.5)	(6.1)	(11.0)	(11.0)	(10.9)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)	-	
199-H4-63	578185.825	152665.531	HX	(24.0)	(24.1)	(23.4)	(21.1)	(1.6)	-	-	-	-	(25.0)	(24.7)	(25.6)	(25.7)	(26.0)	(26.3)	(26.1)	(27.4)	(26.8)	(27.0)	(27.4)	(27.4)	(27.4)	(27.4)	(27.4)	(17.0)	
199-H4-64	577946.11	153010.582	HX	-	-	-	-	-	-	-	-	-	(8.2)	(12.1)	(13.3)	(12.3)	(11.7)	(14.9)	(22.9)	(20.7)	(20.1)	(15.0)	(20.7)	(20.7)	(20.7)	(20.7)	(20.7)	-	
199-H3-2C	577632.065	152750.302	HX	-	-	-	-	-	-	-	-	-	(46.0)	(45.5)	(45.6)	(47.4)	(48.0)	(47.8)	(46.8)	(50.0)	(49.4)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)	
199-H4-12C	578011.772	152919.812	HX	-	-	-	-	-	-	-	-	-	(27.2)	(26.5)	(29.4)	(29.4)	(29.7)	(29.2)	(28.8)	(30.0)	(29.6)	(30.0)	(30.0)	(30.0)	(30.0)	(30.0)	(30.0)	(30.0)	
199-H3-4	577544.287	152293.21	HX	-	-	-	-	-	-	-	-	-	(84.6)	(102.9)	(125.0)	(124.2)	(125.0)	(123.9)	(108.8)	(113.4)	(95.6)	(99.4)	(113.4)	(113.4)	(113.4)	(113.4)	(113.4)	(99.4)	
199-H1-1	576702.31	153384.49	HX	-	-	-	-	-	-	-	-	-	(28.7)	(29.2)	(30.0)	(29.9)	(29.4)	(30.1)	(26.1)	(29.5)	(26.7)	(19.9)	(29.5)	(29.5)	(29.5)	(29.5)	(29.5)	-	(19.9)
199-H1-2	576451.07	153378.26	HX	-	-	-	-	-	-	-	-	-	(3.1)	(2.6)	(2.4)	(2.1)	(1.9)	(1.9)	(2.2)	(4.6)	(6.1)	(6.9)	(4.6)	(4.6)	(4.6)	(4.6)	(4.6)	-	(6.9)
199-H1-20	575706.04	154183.61	HX	-	-	-	-	-	-	-	-	-	72.3	68.8	74.3	71.6	69.2	72.7	79.0	23.9	19.3	0.7	23.9	23.9	23.9	23.9	23.9	40.0	
199-H1-21	575896.84	154163.8	HX	-	-	-	-	-	-	-	-	-	96.1	88.7	94.7	91.8	90.0	94.0	96.0	67.9	65.7	2.1	67.9	67.9	67.9	67.9	67.9	40.0	
199-H1-25	576279.64	154069.97	HX	-	-	-	-	-	-	-	-	-	(17.5)	(24.5)	(28.9)	(28.6)	(26.6)	(28.4)	(28.7)	(29.1)	(26.3)	(16.1)	(29.1)	(29.1)	(29.1)	(29.1)	(29.1)	(10.0)	
199-H1-27	576403.86	154024.21	HX	-	-	-	-	-	-	-	-	-	(11.2)	(18.0)	(22.1)	(21.5)	(18.7)	(23.8)	(28.7)	(29.6)	(26.4)	(19.0)	(29.6)	(29.6)	(29.6)	(29.6)	(29.6)	(19.0)	
199-H1-32	576767.07	153766	HX	-	-	-	-	-	-	-	-	-	(1.3)	(1.7)	(1.5)	(1.4)	(0.3)	(1.7)	(9.5)	(18.5)	(19.7)	(19.0)	(18.5)	(18.5)	(18.5)	(18.5)	(18.5)	(19.0)	
199-H1-33	576833.29	153716.23	HX	-	-	-	-	-	-	-	-	-	(4.8)	(7.6)	(11.5)	(6.6)	(0.2)	(6.2)	(22.8)	(27.8)	(25.3)	(19.9)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)	(19.9)	
199-H1-34	576883.13	153667.06	HX	-	-	-	-	-	-	-	-	-	(11.2)	(13.9)	(14.4)	(13.3)	(11.0)	(15.1)	(25.3)	(27.4)	(27.6)	(27.8)	(27.4)	(27.4)	(27.4)	(27.4)	(27.4)	-	(27.8)
199-H1-35	576958.26	153628.14	HX	-	-	-	-	-	-	-	-	-	(23.6)	(25.3)	(28.5)	(27.4)	(23.1)	(25.0)	(26.3)	(22.0)	(26.5)	(26.8)	(22.0)	(22.0)	(22.0)	(22.0)	(22.0)	(26.8)	
199-H1-36	576885.62	153486.51	HX	-	-	-	-	-	-	-	-	-	(8.1)	(7.1)	(6.9)	(6.3)	(5.3)	(4.7)	(7.7)	(9.0)	(8.9)	(8.9)	(9.0)	(9.0)	(9.0)	(9.0)	(9.0)	-	(8.9)
199-H1-37	577106.92	153641.63	HX	-	-	-	-	-	-	-	-	-	(7.8)	(10.7)	(12.8)	(7.7)	(3.0)	(10.1)	(27.5)	(27.8)	(27.6)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)	
199-H1-38	577161	153555.01	HX	-	-	-	-	-	-	-	-	-	(6.1)	(4.3)	(4.0)	(3.4)	(4.3)	(6.3)	(13.5)	(24.4)	(24.5)	(24.9)	(24.4)	(24.4)	(24.4)	(24.4)	(24.4)	(24.9)	
199-H1-39	577223.54	153533.4	HX	-	-	-	-	-	-	-	-	-	(1.9)	(1.8)	(1.1)	(1.0)	(0.6)	(2.3)	(32.9)	(41.1)	(37.6)	(29.8)	(41.1)	(41.1)	(41.1)	(41.1)	(41.1)	(29.8)	
199-H1-40	577279.34	153500.19	HX	-	-	-	-	-	-	-	-	-	(3.7)	(3.1)	(3.5)	(2.6)	(2.5)	(4.1)	(10.4)	(22.4)	(29.2)	(19.9)	(22.4)	(22.4)	(22.4)	(22.4)	(22.4)	(19.9)	
199-H1-42	577127.18	153391.65	HX	-	-	-	-	-	-	-	-	-	(27.2)	(27.6)	(29.0)	(27.6)	(28.9)	(27.9)	(27.9)	(29.0)	(28.0)	(27.8)	(29.0)	(29.0)	(29.0)	(29.0)	(29.0)	-	(27.8)
199-H1-43	577213.74	153384.28	HX	-	-	-	-	-	-	-	-	-	(28.7)	(28.5)	(19.9)	(21.8)	(24.6)	(29.0)	(28.3)	(29.6)	(29.6)	(29.8)	(29.6)	(29.6)	(29.6)	(29.6)	(29.6)	(27.4)	
199-H1-45	577240.96	153062.41	HX	-	-	-	-	-	-	-	-	-	(25.8)	(25.6)	(26.5)	(26.7)	(27.0)	(26.9)	(26.7)	(9.3)	(4.1)	(27.0)	(9.3)	(9.3)	(9.3)	(9.3)	(9.3)	(27.1)	
199-H1-6	576037.81	153745.74	HX	-	-	-	-	-	-	-	-	-	(2.2)	(1.5)	(0.4)	(0.1)	(1.0)	(2.2)	(2.8)	(6.3)	(8.5)	(11.7)	(6.3)	(6.3)	(6.3)	(6.3)	(6.3)	-	(11.7)
199-H3-25	577410.36	152978.49	HX	-	-	-	-	-	-	-	-	-	44.1	49.1	53.3	51.3	49.8	53.3	65.9	90.7	88.2	94.0	90.7	90.7	90.7	90.7	90.7	70.0	
199-H3-26	577440.83	152846.5	HX	-	-	-	-	-	-	-	-	-	41.0	42.7	45.2	43.9	42.7	45.5	55.9	83.8	83.9	89.4	83.8	83.8	83.8	83.8	83.8	70.0	
199-H3-27	577567.05	152811.14	HX	-	-	-	-	-	-	-	-	-	35.0	36.8	39.0	37.8	36.6	39.5	55.0	73.5	70.9	75.1	73.5	73.5	73.5	73.5	73.5	60.0	
199-H4-69	578014.05	152686.66	HX	-	-	-	-	-	-	-	-	-	(26.0)	(24.8)	(27.6)	(27.2)	(21.3)	(24.4)	(27.7)	(28.0)	(27.7)	(28.0)	(28.0)	(28.0)	(28.0)	(28.0)	(28.0)	(27.0)	
199-H4-70	578003.82	152646.45	HX	-	-	-	-	-	-	-	-	-	(22.8)	(22.7)	(23.6)	(23.7)	(24.0)	(23.9)	(23.4)	(21.0)	(22.3)	(23.0)	(21.0)	(21.0)	(21.0)	(21.0)	(21.0)	(22.0)	
199-H4-71	578010.64	152581.53	HX	-	-	-	-	-	-	-	-	-	27.8	31.7	33.6	32.2	31.1	34.2	43.5	60.7	58.8	62.9	60.7	60.7	60.7	60.7	60.7	55.0	
199-H4-72	578036.28	152500.14	HX	-	-	-	-	-	-	-	-	-	14.7	20.2	23.1	22.2	20.7	24.2	33.6	58.9	58.6	62.7	58.9	58.9	58.9	58.9	58.9	55.0	
199-H4-73	577940.58	152369.98	HX	-	-	-	-	-	-	-	-	-	18.4	23.9	25.9	24.6	22.5	25.6	34.9	54.7	53.6	57.7	54.7	54.7	54.7	54.7	54.7	50.0	
199-H4-74	577239.07	152268.83	HX	-	-	-	-	-	-	-	-	-	34.3	33.8	35.7	34.7	33.5	36.1	45.7	66.8	68.9	75.7	66.8	66.8	66.8	66.8	66.8	64.0	
199-H4-75	577212.36	152704.64	HX	-	-	-	-	-	-	-	-	-	(19.1)	(19.0)	(19.7)	(19.7)	(20.0)	(19.0)	(18.1)	(19.0)	(19.1)	(20.0)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	(20.0)	
199-H4-76	576787.32	152976.85	HX	-	-	-	-	-	-	-	-	-	(14.0)	(9.0)	(4.0)	(1.1)	-	-	(0.0)	(3.5)	(13.6)	(17.9)	(3.5)	(3.5)	(3.5)	(3.5)	(3.5)	-	42.0
199-H4-77	576487.79	152975.43	HX	-	-	-	-	-	-	-	-	-	(12.4)	(11.1)	(10.1)	(9.9)	(9.1)	(8.7)	(7.1)	(9.3)	(9.3)	(8.4)	(9.3)	(9.3)	(9.3)	(9.3)	(9.3)	-	42.0
199-H4-78	576168.23	152166.12	HX	-	-	-	-	-	-	-	-	-	50.7	54.6	58.2	55.8	52.2	56.2	71.8	101.2	96.1	122.2	101.2	101.2	101.2	101.2	101.2	-	55.0
199-H4-79	575659.13	151989.31	HX	-	-	-	-	-	-	-	-	-	38.8	58.4	69.3	65.8	62.0	70.1	67.2	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	58.0	
199-H6-2	577886.5	152194.11	HX	-	-	-	-	-	-	-	-	-	15.1	18.1	20.3	19.2	17.7	20.5	29.9	49.9	52.3	56.2	49.9	49.9	49.9	49.9	49.9	50.0	
HX-10	576249	153374	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(18.0)	
HX-11	576048.239	152955.554	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62.0
HX-12	576064	152570	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)
HX-13	576879	152042	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	58.0	
HX-16	576881	152563	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(18.0)	

Table B-2. Names, Geographic Coordinates, and Extraction and Injection Rates of 100-HR-3 Wells – Alternative 2

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan2013-Dec2087	Jan2013-Dec2087_Bio
HX-7	576178	153765	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
HX-8	576583	153898	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(18.0)	
HX-9	577225	153229	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(18.0)	
HX-20	575666	152949	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	62.0
HX-21	575670	152548	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(30.0)
HX-22	575254	153343	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)
HX-23	575243	153759	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)
HX-24	575668	153761	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.0)
HX-25	576468	153705	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.0)
HX-26	577823	152013	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)	
HX-27	578238	152072	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(26.0)	
HX-28	576083	151746	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.0)	
HX-29	576710	151757	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.0)	

Table B-3. Names, Geographic Coordinates, and Extraction and Injection Rates of 100 -HR-3 Wells – Alternative 3

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan2013-Dec2087
199-D5-104	573265.48	151422.43	DX	-	-	-	-	-	-	(17.1)	(21.5)	(20.5)	(20.5)	(24.1)	(25.0)	(25.0)	(22.0)	(25.0)	(24.2)	(25.0)	(23.9)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)
199-D5-20	573239.97	152030.15	DX	-	-	-	-	-	-	(8.2)	(8.3)	(3.9)	(3.9)	(0.0)	-	-	-	(0.0)	(7.6)	(9.5)	(9.1)	(9.8)	(9.5)	(9.5)	(9.5)	(9.5)	(9.5)	(9.8)
199-D5-32	573372.04	151903.39	DX	(15.4)	(17.8)	(18.8)	(17.2)	(16.0)	(15.5)	(15.8)	(14.9)	(17.0)	(17.0)	(18.1)	(18.4)	(17.5)	(15.7)	(18.0)	(17.6)	(19.0)	(17.6)	(16.9)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	(16.9)
199-D5-39	573142.858	151428.428	DX	-	-	-	-	-	-	(20.2)	(24.3)	(22.9)	(22.9)	(24.5)	(24.9)	(24.4)	(21.7)	(24.9)	(23.8)	(25.0)	(23.0)	(24.8)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)	(24.8)
199-D5-42	573479.771	151622.674	DX	-	-	-	-	-	-	31.5	33.2	28.0	28.0	22.7	23.7	23.0	17.0	24.4	25.9	25.3	22.6	24.6	25.3	25.3	25.3	25.3	25.3	25.0
199-D5-44	572993.581	151835.736	DX	86.5	87.1	66.1	40.7	34.2	33.7	43.9	46.6	45.3	45.3	44.5	46.9	45.7	35.3	39.9	34.2	26.7	25.7	26.4	26.7	26.7	26.7	26.7	26.7	40.0
199-D5-92	573131.93	152009.82	DX	-	-	-	-	-	-	(21.2)	(23.5)	(17.0)	(17.0)	(15.6)	(18.0)	(18.5)	(21.2)	(29.0)	(29.7)	(33.0)	(30.3)	(29.8)	(33.0)	(33.0)	(33.0)	(33.0)	(33.0)	(29.8)
199-D4-95	572613	151227	DX	(13.0)	(12.5)	(12.6)	(12.1)	(10.2)	(10.9)	(9.0)	(10.0)	(12.2)	(12.2)	(12.5)	(13.0)	(13.0)	(11.4)	(13.0)	(12.6)	(13.0)	(11.4)	(11.5)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)
199-D4-96	572777	151520	DX	(13.1)	(12.7)	(12.6)	(13.3)	(10.5)	(13.8)	(15.0)	(15.0)	(15.1)	(15.1)	(13.0)	(10.7)	(7.8)	(4.7)	(5.9)	(2.7)	(7.0)	(7.0)	(8.0)	(7.0)	(7.0)	(7.0)	(7.0)	(7.0)	(8.0)
199-D4-97	572906.53	151624.87	DX	(12.8)	(12.2)	(12.2)	(12.1)	(10.2)	(10.9)	(10.3)	(10.0)	(11.4)	(11.4)	(12.5)	(13.0)	(13.0)	(11.4)	(12.2)	(11.6)	(12.0)	(11.5)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)
199-D4-98	572575.59	151483.28	DX	(13.0)	(12.4)	(12.7)	(11.9)	(10.2)	(10.7)	(11.5)	(10.0)	(11.0)	(11.0)	(11.6)	(12.5)	(13.0)	(11.1)	(13.0)	(12.6)	(13.0)	(12.4)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)
199-D4-99	572526.48	151376.63	DX	(19.5)	(16.3)	(15.4)	(13.7)	(11.0)	(15.8)	(16.5)	(15.0)	(15.6)	(15.6)	(11.1)	(16.5)	(18.0)	(15.4)	(18.9)	(18.4)	(19.0)	(18.0)	(17.2)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	(17.2)
199-D2-10	574470.7	153465.17	DX	2.7	2.5	0.4	0.4	0.8	-	-	-	0.1	0.1	0.6	0.1	0.1	5.1	1.1	0.6	-	-	-	-	-	-	-	-	-
199-D2-12	574343.4	153300.8	DX	8.8	10.4	4.0	2.1	1.2	-	-	-	0.4	0.4	5.5	3.3	2.4	3.4	5.7	2.8	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-
199-D8-6	573434.693	152060.822	DX	(14.7)	(14.3)	(13.7)	(10.9)	-	-	-	-	-	-	-	-	-	-	-	-	-	(2.0)	(6.9)	-	-	-	-	-	(7.6)
199-D8-89	573479.46	152250.4	DX	(11.5)	(11.2)	(14.0)	(13.9)	(12.4)	(13.5)	(18.4)	(19.1)	(13.3)	(13.3)	(12.1)	(11.1)	(10.6)	(9.6)	(11.1)	(11.1)	(12.1)	(11.6)	(12.4)	(12.1)	(12.1)	(12.1)	(12.1)	(12.1)	(12.4)
199-D8-90	573948.74	152646.2	DX	(19.5)	(18.8)	(19.3)	(13.6)	(11.5)	(14.2)	(18.5)	(17.9)	(16.1)	(16.1)	(12.5)	(19.4)	(18.4)	(10.6)	(18.7)	(18.4)	(17.2)	(17.6)	(17.6)	(17.2)	(17.2)	(17.2)	(17.2)	(17.2)	(18.0)
199-D8-91	574037.21	152741.29	DX	(19.6)	(19.0)	(20.1)	(14.0)	(11.5)	(14.8)	(22.5)	(23.3)	(16.7)	(16.7)	(17.0)	(20.5)	(19.0)	(10.7)	(16.8)	(17.3)	(18.9)	(17.7)	(17.6)	(18.9)	(18.9)	(18.9)	(18.9)	(18.9)	(18.0)
199-D8-93	574148.99	153085.76	DX	13.4	14.6	14.8	8.5	2.1	-	-	-	-	-	0.2	(0.0)	(0.0)	(0.0)	(0.0)	-	-	-	-	-	-	-	-	-	-
199-D8-94	574047.13	152949.35	DX	5.9	1.4	2.8	1.9	0.9	-	-	-	-	-	-	2.9	7.4	5.1	8.8	3.9	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-
DX-4	572444	151191	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.0)
DX-5	573104	151367	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(17.0)
DX-6	572916	151466	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(17.0)
DX-7	574859	152811	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(26.0)
DX-8	574956	152104	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65.0
DX-9	574133	152590	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)
DX-10	574034	152909	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55.0
DX-11	574168	153136	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55.0
DX-12	574369	153271	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	52.0
DX-13	574540	153430	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50.0
DX-14	572202	150840	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
DX-15	572294	150956	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.0)
DX-16	573030	150742	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	65.0
DX-17	572541	151079	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(23.0)
DX-18	572745	151182	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
DX-19	575247	153355	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45.0
DX-20	573746	152057	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
DX-21	574053	151461	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	55.0
DX-22	573023	151531	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(17.0)
DX-23	572689	151347	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(24.0)
DX-24	573402	152115	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(17.0)
DX-25	574855	153338	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45.0
DX-26	575246	153219	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(26.0)
DX-27	572524	150923	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(28.0)
DX-28	572839	151295	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(17.0)
DX-29	574049	152802	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(17.0)
DX-30	574852	152956	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(26.0)
DX-31	575249	152835	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50.0
DX-3	572361	151065	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.0)
DX-1	573806	151810	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(17.0)
DX-41	572491	150778	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
199-D8-53	573889.86	152452.26	DX	(17.0)	(15.6)	(15.1)	(14.4)	(1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(7.2)

Table B-3. Names, Geographic Coordinates, and Extraction and Injection Rates of 100 -HR-3 Wells – Alternative 3

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan2013-Dec2087
199-D8-54A	573781.17	152408.03	DX	(18.6)	(19.9)	(19.7)	(17.3)	(1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(14.5)
199-D8-68	573711.67	152427.1	DX	(52.0)	(50.8)	(53.8)	(49.9)	(3.3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(40.0)
199-D8-72	573570.481	152211.774	DX	(3.7)	(8.4)	(7.4)	(7.2)	(0.7)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(11.1)
199-D4-38	572671.317	151537.856	DX	(8.0)	(7.5)	(7.6)	(7.4)	(6.3)	(7.5)	(8.9)	(7.7)	(8.1)	(8.1)	(5.8)	-	-	-	(6.2)	(7.7)	(8.0)	(7.5)	(8.0)	(8.0)	(8.0)	(8.0)	(8.0)	(8.0)	(8.0)
199-D4-39	572747.453	151650.84	DX	(16.4)	(15.5)	(16.0)	(13.8)	(11.0)	(17.1)	(15.4)	(13.6)	(14.4)	(14.4)	(16.1)	(15.4)	(15.0)	(13.2)	(15.9)	(15.5)	(14.5)	(12.4)	(13.8)	(14.5)	(14.5)	(14.5)	(14.5)	(14.5)	(13.8)
199-D4-83	572859.432	151723.418	DX	-	-	-	(0.1)	-	-	-	-	-	-	-	-	-	-	-	-	(5.0)	(9.3)	(11.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	(11.0)
199-D4-84	572568.043	151433.521	DX	(10.7)	(11.2)	(11.9)	(11.6)	(9.9)	(10.9)	(10.3)	(10.0)	(9.4)	(9.4)	(9.1)	(9.6)	(9.7)	(7.9)	(9.4)	(10.1)	(11.0)	(10.3)	(11.2)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)	(11.2)
199-D4-85	572486.163	151324.202	DX	(19.7)	(18.7)	(18.8)	(13.8)	(12.4)	(16.6)	(16.6)	(15.0)	(15.7)	(15.7)	(11.1)	(13.1)	(14.1)	(16.3)	(16.5)	(18.2)	(19.0)	(17.6)	(17.1)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	(10.0)
199-D8-55	573620.954	152364.345	DX	20.9	15.8	11.2	8.7	2.9	2.3	3.3	3.5	3.4	3.4	2.9	1.4	3.6	2.2	4.0	3.4	2.7	1.6	2.5	2.7	2.7	2.7	2.7	2.7	2.5
199-D8-69	573843.61	152552.201	DX	(18.8)	(19.0)	(19.4)	(14.3)	(12.4)	(14.9)	(18.8)	(18.1)	(17.0)	(17.0)	(18.1)	(19.2)	(17.9)	(10.7)	(20.6)	(20.1)	(20.9)	(19.6)	(20.2)	(20.9)	(20.9)	(20.9)	(20.9)	(20.9)	(20.2)
199-D8-73	573388.7	152167.38	DX	(3.2)	(3.2)	(3.8)	(3.8)	(3.3)	(3.1)	(3.7)	(3.6)	(3.0)	(3.0)	(2.8)	(3.1)	(2.9)	(1.1)	(0.1)	(4.6)	(5.4)	(5.1)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)
199-D8-88	573292.33	152141.26	DX	-	-	(0.4)	(0.6)	(0.0)	(3.3)	(2.8)	(1.9)	(2.2)	(2.2)	(2.3)	(3.6)	(3.8)	(3.7)	(4.8)	(6.0)	(6.3)	(6.2)	(7.7)	(6.3)	(6.3)	(6.3)	(6.3)	(6.3)	(7.7)
199-D4-101	572800.1	151425.94	DX	(2.5)	(4.3)	(2.2)	(0.0)	(0.0)	(0.0)	-	(0.0)	(0.0)	(0.0)	-	-	-	-	(6.8)	(8.2)	(4.9)	-	(3.8)	(4.9)	(4.9)	(4.9)	(4.9)	(4.9)	(3.8)
199-D8-97	573859.56	152087.42	DX	(17.5)	(17.2)	(19.5)	(14.8)	(12.4)	(16.3)	(19.1)	(19.4)	(18.9)	(18.9)	(21.2)	(21.1)	(19.1)	(11.5)	(17.8)	(17.5)	(18.9)	(17.7)	(17.6)	(18.9)	(18.9)	(18.9)	(18.9)	(18.9)	(17.6)
199-D5-101	572943.04	151521.52	DX	(23.0)	(21.0)	(21.3)	(15.1)	(11.0)	(20.2)	(22.2)	(22.7)	(17.9)	(17.9)	(26.1)	(26.3)	(26.0)	(22.9)	(26.9)	(26.1)	(27.0)	(25.9)	(25.1)	(27.0)	(27.0)	(27.0)	(27.0)	(27.0)	(25.1)
199-D8-95	573611.96	152160.61	DX	(16.4)	(16.3)	(16.9)	(13.8)	(12.4)	(14.0)	(15.9)	(14.6)	(14.4)	(14.4)	(17.7)	(15.7)	(17.1)	(10.7)	(17.8)	(17.7)	(17.9)	(17.0)	(17.6)	(17.9)	(17.9)	(17.9)	(17.9)	(17.9)	(17.6)
199-D5-130	574039.2	151928.51	DX	(14.5)	(13.8)	(15.0)	(13.1)	(13.3)	(12.0)	(13.2)	(14.6)	(14.8)	(14.8)	(15.5)	(15.8)	(14.7)	(10.5)	(12.0)	(11.6)	(12.0)	(11.1)	(8.8)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	(8.8)
199-D5-127	572992.26	151428.31	DX	(17.8)	(17.6)	(14.3)	(13.0)	(11.0)	(13.2)	(13.8)	(10.9)	(8.5)	(8.5)	(3.9)	-	-	-	(0.0)	-	-	-	(4.7)	-	-	-	-	-	(4.7)
199-D6-1	574129.87	151691.71	DX	10.6	3.1	16.3	14.7	11.5	32.9	48.2	51.8	47.0	47.0	47.4	52.4	50.4	27.2	51.0	43.9	47.4	40.8	39.2	47.4	47.4	47.4	47.4	47.4	37.5
199-D8-99	574006.77	152364.37	DX	9.5	10.1	8.7	6.0	5.3	57.6	83.4	77.3	72.9	72.9	73.2	81.0	80.3	58.9	86.7	85.2	90.9	76.1	71.8	90.9	90.9	90.9	90.9	90.9	60.0
199-D7-4	574377.07	152369.64	DX	21.6	25.5	22.6	17.5	15.1	31.1	33.6	39.8	37.5	37.5	37.3	41.6	41.7	29.7	50.4	78.5	101.7	103.1	115.1	101.7	101.7	101.7	101.7	101.7	90.0
199-H4-80	575238.97	152568.16	DX	(14.6)	(14.1)	(15.4)	(13.9)	(12.4)	(13.5)	(16.5)	(14.7)	(15.0)	(15.0)	(12.9)	(16.6)	(16.0)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.6)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)	(17.6)
199-H4-81	575236.93	153035.36	DX	(14.7)	(14.5)	(15.2)	(13.5)	(12.4)	(12.4)	(15.5)	(14.6)	(14.8)	(14.8)	(13.4)	(15.8)	(15.7)	(4.1)	(15.0)	(15.1)	(16.4)	(16.1)	(16.9)	(16.4)	(16.4)	(16.4)	(16.4)	(16.4)	(16.9)
199-D7-3	574151.38	152363.41	DX	(18.4)	(19.0)	(18.0)	(14.3)	(11.5)	(14.4)	(16.7)	(14.7)	(17.6)	(17.6)	(19.7)	(20.2)	(18.4)	(10.6)	(15.9)	(16.1)	(17.0)	(16.1)	(17.2)	(17.0)	(17.0)	(17.0)	(17.0)	(17.0)	(17.2)
199-D5-129	573733.26	151465.18	DX	85.0	87.1	92.2	78.0	65.6	73.5	88.0	83.8	81.2	81.2	79.0	83.0	80.8	62.5	87.8	90.7	99.0	95.6	98.6	99.0	99.0	99.0	99.0	99.0	80.0
199-D5-131	573684.39	152006.75	DX	(17.2)	(15.8)	(15.5)	(13.3)	(12.4)	(13.4)	(13.7)	(14.6)	(15.1)	(15.1)	(17.9)	(18.2)	(17.9)	(15.7)	(18.0)	(17.4)	(17.5)	(16.7)	(17.2)	(17.5)	(17.5)	(17.5)	(17.5)	(17.5)	(17.2)
199-D8-98	574013.12	152123.02	DX	(17.4)	(16.8)	(18.1)	(14.0)	(10.7)	(14.5)	(16.8)	(14.6)	(16.5)	(16.5)	(19.7)	(13.3)	(12.3)	(12.4)	(18.9)	(18.4)	(18.5)	(17.1)	(17.5)	(18.5)	(18.5)	(18.5)	(18.5)	(18.5)	(17.5)
199-D8-96	573706	152152.24	DX	(21.8)	(22.1)	(22.5)	(15.2)	(12.8)	(14.6)	(16.4)	(14.6)	(18.3)	(18.3)	(23.2)	(23.7)	(23.9)	(20.9)	(23.9)	(23.2)	(24.0)	(22.3)	(21.0)	(24.0)	(24.0)	(24.0)	(24.0)	(24.0)	(21.0)
199-D6-2	574544.61	151970.2	DX	52.0	49.6	71.1	70.2	62.0	48.4	54.4	54.4	51.2	51.2	50.9	45.3	36.0	24.9	36.3	30.9	24.1	25.9	28.9	24.1	24.1	24.1	24.1	24.1	26.0
199-D7-5	574434.31	152678.72	DX	53.3	48.0	68.0	67.0	59.3	46.7	44.2	39.1	36.5	36.5	36.5	41.0	40.6	28.5	41.1	42.7	51.2	52.3	58.8	51.2	51.2	51.2	51.2	51.2	50.0
199-H4-82	574906.99	152677.72	DX	(0.2)	(10.1)	(12.7)	(10.3)	(7.7)	(15.6)	(19.0)	(19.5)	(15.5)	(15.5)	(11.1)	(17.4)	(16.9)	(3.8)	(17.6)	(17.5)	(18.4)	(17.9)	(17.8)	(18.4)	(18.4)	(18.4)	(18.4)	(18.4)	(17.8)
199-H1-5	574850.72	153090.3	DX	(19.0)	(19.0)	(19.3)	(13.6)	(11.5)	(16.2)	(18.8)	(19.4)	(14.4)	(14.4)	(10.8)	(14.6)	(14.1)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.5)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)	(17.5)
199-D7-6	574429.2	152980.43	DX	(16.7)	(16.3)	(16.4)	(12.9)	(11.5)	(14.2)	(14.9)	(12.3)	(14.7)	(14.7)	(12.0)	(14.6)	(14.1)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.5)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)	(17.5)
199-D5-128	573622.04	151237.06	DX	77.0	80.4	80.3	72.5	61.0	68.4	81.4	78.0	75.5	75.5	73.4	77.1	75.2	58.1	81.7	84.0	91.3	87.6	90.1	91.3	91.3	91.3	91.3	91.3	90.1
199-H4-14	577803.747	152752.359	HX	91.1	97.6	95.8	90.4	7.5	-	-	-	-	19.6	20.9	15.3	14.8	14.5	15.6	11.0	11.0	8.5	11.6	11.0	11.0	11.0	11.0	11.0	11.6
199-H4-15A	577905.999	153051.9969	HX	(19.0)	(19.1)	(18.7)	(17.9)	(1.5)	-	-	-	-	(35.2)	(34.3)	(38.5)	(33.3)	(37.5)	(37.7)	(38.2)	(39.1)	(32.1)	(31.0)	(39.1)	(39.1)	(39.1)	(39.1)	(39.1)	(31.0)
199-H4-17	577779.175	153037.635	HX	52.2	51.3	53.9	49.1	11.5	-	-	-	-	8.5	10.8	11.6	9.6	10.3	9.2	7.1	5.8	5.4	6.7	5.8	5.8	5.8	5.8	5.8	5.0
199-H4-18	578018.292	152756.478	HX	40.4	50.3	46.5	42.8	3.5	-	-	-	-	22.2	13.7	12.8	12.2	12.1	13.2	11.7	11.4	9.5	7.3	11.4	11.4	11.4	11.4	11.4	7.0
199-H4-4	578060.859	152853.956	HX	-	(8.7)	(4.8)	(5.5)	(0.6)	-	-	-	-	(2.4)	(4.5)	(5.3)	(4.2)	(2.5)	(6.1)	(11.0)	(11.0)	(10.9)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)
199-H4-63	578185.825	152665.531	HX	(24.0)	(24.1)	(23.4)	(21.1)	(1.6)	-	-	-	-	(25.0)	(24.7)	(25.6)	(25.7)	(26.0)	(26.3)	(26.1)	(27.4)	(26.8)	(27.0)	(27.4)	(27.4)	(27.4)	(27.4)	(27.4)	(27.0)
199-H4-64	577946.11	153010.582	HX	-	-	-	-	-	-	-	-	-	(8.2)	(12.1)	(13.3)	(12.3)	(11.7)	(14.9)	(22.9)	(20.7)	(20.1)	(15.0)	(20.7)	(20.7)	(20.7)	(20.7)	(20.7)	(15.0)
199-H3-2C	577632.065	152750.302	HX	-	-	-	-	-	-	-	-	-	(46.0)	(45.5)	(45.6)	(47.4)	(48.0)	(47.8)	(46.8)	(50.0)	(49.4)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)
199-H3-4	577544.287	152293.21	HX	-	-	-	-	-	-	-	-	-	(84.6)	(102.9)	(125.0)	(124.2)	(125.0)	(123.9)	(108.8)	(113.4)	(95.6)	(99.4)	(113.4)	(113.4)	(113.4)	(113.4)	(113.4)	(115.0)
199-H4-12C	578011.772	152919.812	HX	-	-	-	-	-	-	-	-	-	(27.2)	(26.5)	(29.4)	(29.4)	(29.7)	(29.2)	(28.8)	(30.0)	(29.6)	(30.0)	(30.0)	(30.0)	(30.0)	(30.0)	(30.0)	(30.0)
199-H1-38	577161	153555.01	HX	-	-	-	-	-	-	-	-	-	(6.1)	(4.3)	(4.0)	(3.4)	(4.3)	(6.3)	(13.5)	(24.4)	(24.5)	(24.9)	(24.4)	(24.4)	(24.4)	(24.4)	(24.4)	(24.9)
199-H1-37	577106.92	153641.63	HX	-	-	-	-	-	-	-	-	-	(7.8)	(10.7)	(12.8)	(7.7)	(3.0)	(10.1)	(27.5)	(27.8)	(27.6)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)
199-H1-32	576767.07	153766	HX	-	-	-	-	-	-	-	-	-	(1.3)	(1.7)	(1.5)	(1.4)	(0.3)	(1.7)	(9.5)	(18.5)	(19.7)	(19.0)	(18.5)	(18.5)	(18.5)	(18.5)	(18.5)	(19.0)
199-H1-36	576885.62	153486.51	HX	-	-	-	-	-	-	-	-	-	(8.1)	(7.1)	(6.9)	(6.3)	(5.3)	(4.7)	(7.7)	(9.0)	(8.9)	(8.9)	(9.0)	(9.0)	(9.0)	(9.0)	(9.0)	(8.9)
199-H1-40	577279.34	153500.19	HX	-	-	-	-	-	-	-	-	-	(3.7)	(3.1)	(3.5)	(2.6)	(2.5)	(4.1)	(10.4)	(22.4)	(29.2)	(19.9)	(22.4)	(22.4)	(22.4)	(22.4)	(22.4)	(19.9)
199-H1-33	576833.29	153716.23	HX	-	-	-	-	-	-	-	-	-	(4.8)	(7.6)	(11.5)	(6.6)	(0.2)	(6.2)	(22.8)	(27.8)	(25.3)	(19.9)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)	(19.9)
199-H1-35	576958.26	153628.14	HX	-	-	-	-	-	-	-	-	-	(23.6)	(25.3)	(28.5)	(27.4)	(23.1)	(25.0)	(26.3)	(22.0)	(26.5)	(26.8)	(22.0)	(22.0)	(22.0)	(22.0)	(22.0)	(26.8)
199-H1-42	577127.18	153391.65	HX	-	-	-	-	-	-	-	-	-	(27.2)	(27.6)	(29.0)	(27.6)	(28.9)	(27.9)	(27.9)	(29.0)	(28.0)	(27.8)	(29.0)	(29.0)	(29.0)	(29.0)	(29.0)	(27.8)

Table B-3. Names, Geographic Coordinates, and Extraction and Injection Rates of 100 -HR-3 Wells – Alternative 3

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan2013-Dec2087
199-H1-34	576883.13	153667.06	HX	-	-	-	-	-	-	-	-	-	(11.2)	(13.9)	(14.4)	(13.3)	(11.0)	(15.1)	(25.3)	(27.4)	(27.6)	(27.8)	(27.4)	(27.4)	(27.4)	(27.4)	(27.4)	(27.8)
199-H1-39	577223.54	153533.4	HX	-	-	-	-	-	-	-	-	-	(1.9)	(1.8)	(1.1)	(1.0)	(0.6)	(2.3)	(32.9)	(41.1)	(37.6)	(29.8)	(41.1)	(41.1)	(41.1)	(41.1)	(41.1)	(29.8)
199-H3-25	577410.36	152978.49	HX	-	-	-	-	-	-	-	-	-	44.1	49.1	53.3	51.3	49.8	53.3	65.9	90.7	88.2	94.0	90.7	90.7	90.7	90.7	90.7	65.0
199-H1-21	575896.84	154163.8	HX	-	-	-	-	-	-	-	-	-	96.1	88.7	94.7	91.8	90.0	94.0	96.0	67.9	65.7	2.1	67.9	67.9	67.9	67.9	67.9	42.0
199-H1-20	575706.04	154183.61	HX	-	-	-	-	-	-	-	-	-	72.3	68.8	74.3	71.6	69.2	72.7	79.0	23.9	19.3	0.7	23.9	23.9	23.9	23.9	23.9	42.0
199-H3-27	577567.05	152811.14	HX	-	-	-	-	-	-	-	-	-	35.0	36.8	39.0	37.8	36.6	39.5	55.0	73.5	70.9	75.1	73.5	73.5	73.5	73.5	73.5	62.0
199-H3-26	577440.83	152846.5	HX	-	-	-	-	-	-	-	-	-	41.0	42.7	45.2	43.9	42.7	45.5	55.9	83.8	83.9	89.4	83.8	83.8	83.8	83.8	83.8	72.0
199-H1-45	577240.96	153062.41	HX	-	-	-	-	-	-	-	-	-	(25.8)	(25.6)	(26.5)	(26.7)	(27.0)	(26.9)	(26.7)	(9.3)	(4.1)	(27.0)	(9.3)	(9.3)	(9.3)	(9.3)	(9.3)	(27.0)
199-H1-25	576279.64	154069.97	HX	-	-	-	-	-	-	-	-	-	(17.5)	(24.5)	(28.9)	(28.6)	(26.6)	(28.4)	(28.7)	(29.1)	(26.3)	(16.1)	(29.1)	(29.1)	(29.1)	(29.1)	(29.1)	(16.1)
199-H1-27	576403.86	154024.21	HX	-	-	-	-	-	-	-	-	-	(11.2)	(18.0)	(22.1)	(21.5)	(18.7)	(23.8)	(28.7)	(29.6)	(26.4)	(19.0)	(29.6)	(29.6)	(29.6)	(29.6)	(29.6)	(19.0)
199-H4-70	578003.82	152646.45	HX	-	-	-	-	-	-	-	-	-	(22.8)	(22.7)	(23.6)	(23.7)	(24.0)	(23.9)	(23.4)	(21.0)	(22.3)	(23.0)	(21.0)	(21.0)	(21.0)	(21.0)	(21.0)	(23.0)
199-H4-73	577940.58	152369.98	HX	-	-	-	-	-	-	-	-	-	18.4	23.9	25.9	24.6	22.5	25.6	34.9	54.7	53.6	57.7	54.7	54.7	54.7	54.7	54.7	50.0
199-H4-69	578014.05	152686.66	HX	-	-	-	-	-	-	-	-	-	(26.0)	(24.8)	(27.6)	(27.2)	(21.3)	(24.4)	(27.7)	(28.0)	(27.7)	(28.0)	(28.0)	(28.0)	(28.0)	(28.0)	(28.0)	(28.0)
199-H4-71	578010.64	152581.53	HX	-	-	-	-	-	-	-	-	-	27.8	31.7	33.6	32.2	31.1	34.2	43.5	60.7	58.8	62.9	60.7	60.7	60.7	60.7	60.7	55.0
199-H4-72	578036.28	152500.14	HX	-	-	-	-	-	-	-	-	-	14.7	20.2	23.1	22.2	20.7	24.2	33.6	58.9	58.6	62.7	58.9	58.9	58.9	58.9	58.9	55.0
199-H6-2	577886.5	152194.11	HX	-	-	-	-	-	-	-	-	-	15.1	18.1	20.3	19.2	17.7	20.5	29.9	49.9	52.3	56.2	49.9	49.9	49.9	49.9	49.9	50.0
199-H1-43	577213.74	153384.28	HX	-	-	-	-	-	-	-	-	-	(28.7)	(28.5)	(19.9)	(21.8)	(24.6)	(29.0)	(28.3)	(29.6)	(29.6)	(29.8)	(29.6)	(29.6)	(29.6)	(29.6)	(29.6)	(29.8)
199-H1-3	576163	153372	HX	-	-	-	-	-	-	-	-	-	(0.1)	(0.0)	-	-	-	-	-	(0.0)	(0.0)	-	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	-
199-H1-2	576451.07	153378.26	HX	-	-	-	-	-	-	-	-	-	(3.1)	(2.6)	(2.4)	(2.1)	(1.9)	(1.9)	(2.2)	(4.6)	(6.1)	(6.9)	(4.6)	(4.6)	(4.6)	(4.6)	(4.6)	(6.9)
199-H1-1	576702.31	153384.49	HX	-	-	-	-	-	-	-	-	-	(28.7)	(29.2)	(30.0)	(29.9)	(29.4)	(30.1)	(26.1)	(29.5)	(26.7)	(19.9)	(29.5)	(29.5)	(29.5)	(29.5)	(29.5)	(30.0)
199-H4-79	575659.13	151989.31	HX	-	-	-	-	-	-	-	-	-	38.8	58.4	69.3	65.8	62.0	70.1	67.2	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	60.0
199-H4-76	576787.32	152976.85	HX	-	-	-	-	-	-	-	-	-	(14.0)	(9.0)	(4.0)	(1.1)	-	-	(0.0)	(3.5)	(13.6)	(17.9)	(3.5)	(3.5)	(3.5)	(3.5)	(3.5)	(17.9)
199-H4-78	576168.23	152166.12	HX	-	-	-	-	-	-	-	-	-	50.7	54.6	58.2	55.8	52.2	56.2	71.8	101.2	96.1	122.2	101.2	101.2	101.2	101.2	101.2	60.0
199-H4-75	577212.36	152704.64	HX	-	-	-	-	-	-	-	-	-	(19.1)	(19.0)	(19.7)	(19.7)	(20.0)	(19.0)	(18.1)	(19.0)	(19.1)	(20.0)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	(20.0)
199-H4-74	577239.07	152268.83	HX	-	-	-	-	-	-	-	-	-	34.3	33.8	35.7	34.7	33.5	36.1	45.7	66.8	68.9	75.7	66.8	66.8	66.8	66.8	66.8	75.7
199-H1-4	575826.78	153366.87	HX	-	-	-	-	-	-	-	-	-	(1.3)	(0.6)	(0.0)	(0.0)	-	(0.0)	(0.2)	(0.2)	(0.0)	-	(0.2)	(0.2)	(0.2)	(0.2)	(0.2)	-
199-H4-77	576487.79	152975.43	HX	-	-	-	-	-	-	-	-	-	(12.4)	(11.1)	(10.1)	(9.9)	(9.1)	(8.7)	(7.1)	(9.3)	(9.3)	(8.4)	(9.3)	(9.3)	(9.3)	(9.3)	(9.3)	(8.4)
199-H1-6	576037.81	153745.74	HX	-	-	-	-	-	-	-	-	-	(2.2)	(1.5)	(0.4)	(0.1)	(1.0)	(2.2)	(2.8)	(6.3)	(8.5)	(11.7)	(6.3)	(6.3)	(6.3)	(6.3)	(6.3)	(11.7)
HX-1	576496	152478	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(30.0)
HX-3	576877	152466	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50.0
HX-9	576561	151766	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80.0
HX-10	575667	151735	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	80.0
HX-11	577762	153219	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-12	575558	153153	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)
HX-13	576061	153370	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45.0
HX-14	576600	153663	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-15	577049	153203	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)
HX-16	576309	151901	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)
HX-17	577769	152377	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-18	577311	151922	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60.0
HX-19	577233	152071	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-20	577809	151993	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40.0
HX-21	578177	151971	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-22	578441	151889	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-23	578333	152279	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-24	575859	153629	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(17.0)
HX-25	577497	153427	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-26	576661	153871	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-27	576397	153776	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-28	577715	153261	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-29	576534	153942	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-30	578390	152090	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)

Table B-3. Names, Geographic Coordinates, and Extraction and Injection Rates of 100 -HR-3 Wells – Alternative 3

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan2013-Dec2087
HX-31	576073	152720	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45.0
HX-32	575546	153455	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(17.0)
HX-33	576759	153585	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-34	576889	152207	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)
HX-35	577230	152474	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
HX-36	575991	152558	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(35.0)
HX-37	576854	153322	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	26.0
HX-38	576059	152977	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)
HX-39	576520	152745	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45.0
HX-40	576478	153199	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)
HX-41	577647	153315	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
HX-42	577643	153161	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
HX-43	578520	151973	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
HX-2	575742	152964	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40.0
HX-4	575507	152880	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(25.0)
HX-5	575550	152391	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(30.0)
HX-6	575668	152556	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	50.0
HX-7	576860	153171	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-8	575480	153927	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	85.0
HX-44	575422	152713	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.0)
HX-45	576735	152701	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(30.0)

Table B-4. Names, Geographic Coordinates, and Extraction and Injection Rates of 100 -HR-3 Wells – Alternative 4

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan2013-Dec2087
199-D5-104	573265.48	151422.43	DX	-	-	-	-	-	-	(17.1)	(21.5)	(20.5)	(20.5)	(24.1)	(25.0)	(25.0)	(22.0)	(25.0)	(24.2)	(25.0)	(23.9)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)	(11.0)
199-D5-20	573239.97	152030.15	DX	-	-	-	-	-	-	(8.2)	(8.3)	(3.9)	(3.9)	(0.0)	-	-	-	(0.0)	(7.6)	(9.5)	(9.1)	(9.8)	(9.5)	(9.5)	(9.5)	(9.5)	(9.5)	(9.0)
199-D5-32	573372.04	151903.39	DX	(15.4)	(17.8)	(18.8)	(17.2)	(16.0)	(15.5)	(15.8)	(14.9)	(17.0)	(17.0)	(18.1)	(18.4)	(17.5)	(15.7)	(18.0)	(17.6)	(19.0)	(17.6)	(16.9)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	-
199-D5-39	573142.858	151428.428	DX	-	-	-	-	-	-	(20.2)	(24.3)	(22.9)	(22.9)	(24.5)	(24.9)	(24.4)	(21.7)	(24.9)	(23.8)	(25.0)	(23.0)	(24.8)	(25.0)	(25.0)	(25.0)	(25.0)	(25.0)	(18.0)
199-D5-42	573479.771	151622.674	DX	-	-	-	-	-	-	31.5	33.2	28.0	28.0	22.7	23.7	23.0	17.0	24.4	25.9	25.3	22.6	24.6	25.3	25.3	25.3	25.3	25.3	20.0
199-D5-44	572993.581	151835.736	DX	86.5	87.1	66.1	40.7	34.2	33.7	43.9	46.6	45.3	45.3	44.5	46.9	45.7	35.3	39.9	34.2	26.7	25.7	26.4	26.7	26.7	26.7	26.7	26.7	20.0
199-D5-92	573131.93	152009.82	DX	-	-	-	-	-	-	(21.2)	(23.5)	(17.0)	(17.0)	(15.6)	(18.0)	(18.5)	(21.2)	(29.0)	(29.7)	(33.0)	(30.3)	(29.8)	(33.0)	(33.0)	(33.0)	(33.0)	(33.0)	(18.0)
199-D4-95	572613	151227	DX	(13.0)	(12.5)	(12.6)	(12.1)	(10.2)	(10.9)	(9.0)	(10.0)	(12.2)	(12.2)	(12.5)	(13.0)	(13.0)	(11.4)	(13.0)	(12.6)	(13.0)	(11.4)	(11.5)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)	(10.0)
199-D4-96	572777	151520	DX	(13.1)	(12.7)	(12.6)	(13.3)	(10.5)	(13.8)	(15.0)	(15.0)	(15.1)	(15.1)	(13.0)	(10.7)	(7.8)	(4.7)	(5.9)	(2.7)	(7.0)	(7.0)	(8.0)	(7.0)	(7.0)	(7.0)	(7.0)	(7.0)	(8.0)
199-D4-97	572906.53	151624.87	DX	(12.8)	(12.2)	(12.2)	(12.1)	(10.2)	(10.9)	(10.3)	(10.0)	(11.4)	(11.4)	(12.5)	(13.0)	(13.0)	(11.4)	(12.2)	(11.6)	(12.0)	(11.5)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	(8.0)
199-D4-98	572575.59	151483.28	DX	(13.0)	(12.4)	(12.7)	(11.9)	(10.2)	(10.7)	(11.5)	(10.0)	(11.0)	(11.0)	(11.6)	(12.5)	(13.0)	(11.1)	(13.0)	(12.6)	(13.0)	(12.4)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)	(13.0)	(10.0)
199-D4-99	572526.48	151376.63	DX	(19.5)	(16.3)	(15.4)	(13.7)	(11.0)	(15.8)	(16.5)	(15.0)	(15.6)	(15.6)	(11.1)	(16.5)	(18.0)	(15.4)	(18.9)	(18.4)	(19.0)	(18.0)	(17.2)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	(12.0)
199-D2-10	574470.7	153465.17	DX	2.7	2.5	0.4	0.4	0.8	-	-	-	0.1	0.1	0.6	0.1	0.1	5.1	1.1	0.6	-	-	-	-	-	-	-	-	-
199-D2-12	574343.4	153300.8	DX	8.8	10.4	4.0	2.1	1.2	-	-	-	0.4	0.4	5.5	3.3	2.4	3.4	5.7	2.8	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-
199-D8-6	573434.693	152060.822	DX	(14.7)	(14.3)	(13.7)	(10.9)	-	-	-	-	-	-	-	-	-	-	-	-	-	(2.0)	(6.9)	-	-	-	-	-	(6.8)
199-D8-89	573479.46	152250.4	DX	(11.5)	(11.2)	(14.0)	(13.9)	(12.4)	(13.5)	(18.4)	(19.1)	(13.3)	(13.3)	(12.1)	(11.1)	(10.6)	(9.6)	(11.1)	(11.1)	(12.1)	(11.6)	(12.4)	(12.1)	(12.1)	(12.1)	(12.1)	(12.1)	(11.0)
199-D8-90	573948.74	152646.2	DX	(19.5)	(18.8)	(19.3)	(13.6)	(11.5)	(14.2)	(18.5)	(17.9)	(16.1)	(16.1)	(12.5)	(19.4)	(18.4)	(10.6)	(18.7)	(18.4)	(17.2)	(17.6)	(17.6)	(17.2)	(17.2)	(17.2)	(17.2)	(17.2)	(18.0)
199-D8-91	574037.21	152741.29	DX	(19.6)	(19.0)	(20.1)	(14.0)	(11.5)	(14.8)	(22.5)	(23.3)	(16.7)	(16.7)	(17.0)	(20.5)	(19.0)	(10.7)	(16.8)	(17.3)	(18.9)	(17.7)	(17.6)	(18.9)	(18.9)	(18.9)	(18.9)	(18.9)	(18.0)
199-D8-93	574148.99	153085.76	DX	13.4	14.6	14.8	8.5	2.1	-	-	-	-	-	0.2	(0.0)	(0.0)	(0.0)	(0.0)	-	-	-	-	-	-	-	-	-	-
199-D8-94	574047.13	152949.35	DX	5.9	1.4	2.8	1.9	0.9	-	-	-	-	-	-	2.9	7.4	5.1	8.8	3.9	0.0	-	-	0.0	0.0	0.0	0.0	0.0	-
DX-10	574369	153271	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	25.0
DX-11	574540	153430	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.0
DX-14	574168	153136	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.0
DX-4	572444	151191	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(10.0)
DX-5	572527	151059	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(10.0)
DX-8	573234	151733	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
DX-9	574034	152909	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	40.0
DX-20	572329	150994	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(12.0)
DX-21	572491	150778	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(12.0)
DX-22	573030	151013	DX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	60.0
199-D8-53	573889.86	152452.26	DX	(17.0)	(15.6)	(15.1)	(14.4)	(1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(7.2)
199-D8-54A	573781.17	152408.03	DX	(18.6)	(19.9)	(19.7)	(17.3)	(1.0)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(12.5)
199-D8-68	573711.67	152427.1	DX	(52.0)	(50.8)	(53.8)	(49.9)	(3.3)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(11.5)
199-D8-72	573570.481	152211.774	DX	(3.7)	(8.4)	(7.4)	(7.2)	(0.7)	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(10.5)
199-D4-101	572800.1	151425.94	DX	(2.5)	(4.3)	(2.2)	(0.0)	(0.0)	(0.0)	-	(0.0)	(0.0)	(0.0)	-	-	-	-	(6.8)	(8.2)	(4.9)	-	(3.8)	(4.9)	(4.9)	(4.9)	(4.9)	(4.9)	(3.8)
199-D4-38	572671.317	151537.856	DX	(8.0)	(7.5)	(7.6)	(7.4)	(6.3)	(7.5)	(8.9)	(7.7)	(8.1)	(8.1)	(5.8)	-	-	-	(6.2)	(7.7)	(8.0)	(7.5)	(8.0)	(8.0)	(8.0)	(8.0)	(8.0)	(8.0)	(8.0)
199-D4-39	572747.453	151650.84	DX	(16.4)	(15.5)	(16.0)	(13.8)	(11.0)	(17.1)	(15.4)	(13.6)	(14.4)	(14.4)	(16.1)	(15.4)	(15.0)	(13.2)	(15.9)	(15.5)	(14.5)	(12.4)	(13.8)	(14.5)	(14.5)	(14.5)	(14.5)	(14.5)	(10.0)
199-D4-83	572859.432	151723.418	DX	-	-	-	(0.1)	-	-	-	-	-	-	-	-	-	-	-	-	(5.0)	(9.3)	(11.0)	(5.0)	(5.0)	(5.0)	(5.0)	(5.0)	-
199-D4-84	572568.043	151433.521	DX	(10.7)	(11.2)	(11.9)	(11.6)	(9.9)	(10.9)	(10.3)	(10.0)	(9.4)	(9.4)	(9.1)	(9.6)	(9.7)	(7.9)	(9.4)	(10.1)	(11.0)	(10.3)	(11.2)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)
199-D4-85	572486.163	151324.202	DX	(19.7)	(18.7)	(18.8)	(13.8)	(12.4)	(16.6)	(16.6)	(15.0)	(15.7)	(15.7)	(11.1)	(13.1)	(14.1)	(16.3)	(16.5)	(18.2)	(19.0)	(17.6)	(17.1)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	(12.0)
199-D5-101	572943.04	151521.52	DX	(23.0)	(21.0)	(21.3)	(15.1)	(11.0)	(20.2)	(22.2)	(22.7)	(17.9)	(17.9)	(26.1)	(26.3)	(26.0)	(22.9)	(26.9)	(26.1)	(27.0)	(25.9)	(25.1)	(27.0)	(27.0)	(27.0)	(27.0)	(27.0)	(20.0)
199-D5-127	572992.26	151428.31	DX	(17.8)	(17.6)	(14.3)	(13.0)	(11.0)	(13.2)	(13.8)	(10.9)	(8.5)	(8.5)	(3.9)	-	-	-	(0.0)	-	-	-	(4.7)	-	-	-	-	-	(4.7)
199-D5-128	573622.04	151237.06	DX	77.0	80.4	80.3	72.5	61.0	68.4	81.4	78.0	75.5	75.5	73.4	77.1	75.2	58.1	81.7	84.0	91.3	87.6	90.1	91.3	91.3	91.3	91.3	91.3	40.0
199-D5-129	573733.26	151465.18	DX	85.0	87.1	92.2	78.0	65.6	73.5	88.0	83.8	81.2	81.2	79.0	83.0	80.8	62.5	87.8	90.7	99.0	95.6	98.6	99.0	99.0	99.0	99.0	99.0	35.0
199-D5-130	574039.2	151928.51	DX	(14.5)	(13.8)	(15.0)	(13.1)	(13.3)	(12.0)	(13.2)	(14.6)	(14.8)	(14.8)	(15.5)	(15.8)	(14.7)	(10.5)	(12.0)	(11.6)	(12.0)	(11.1)	(8.8)	(12.0)	(12.0)	(12.0)	(12.0)	(12.0)	-
199-D5-131	573684.39	152006.75	DX	(17.2)	(15.8)	(15.5)	(13.3)	(12.4)	(13.4)	(13.7)	(14.6)	(15.1)	(15.1)	(17.9)	(18.2)	(17.9)	(15.7)	(18.0)	(17.4)	(17.5)	(16.7)	(17.2)	(17.5)	(17.5)	(17.5)	(17.5)	(17.5)	(14.0)
199-D6-1	574129.87	151691.71	DX	10.6	3.1	16.3	14.7	11.5	32.9	48.2	51.8	47.0	47.0	47.4	52.4	50.4	27.2	51.0	43.9	47.4	40.8	39.2	47.4	47.4	47.4	47.4	47.4	35.0
199-D6-2	574544.61	151970.2	DX	52.0	49.6	71.1	70.2	62.0	48.4	54.4	54.4	51.2	51.2	50.9	45.3	36.0	24.9	36.3	30.9	24.1	25.9	28.9	24.1	24.1	24.1	24.1	24.1	25.0
199-D7-3	574151.38	152363.41	DX	(18.4)	(19.0)	(18.0)	(14.3)	(11.5)	(14.4)	(16.7)	(14.7)	(17.6)	(17.6)	(19.7)	(20.2)	(18.4)	(10.6)	(15.9)	(16.1)	(17.0)	(16.1)	(17.2)	(17.0)	(17.0)	(17.0)	(17.0)	(17.0)	(12.0)
199-D7-4	574377.07	152369.64	DX	21.6	25.5	22.6	17.5	15.1	31.1	33.6	39.8	37.5	37.5	37.3	41.6	41.7	29.7	50.4	78.5	101.7	103.1	115.1	101.7	101.7	101.7	101.7	101.7	55.0
199-D7-5	574434.31	152678.72	DX	53.3	48.0	68.0	67.0	59.3	46.7	44.2	39.1	36.5	36.5	36.5	41.0	40.6	28.5	41.1	42.7	51.2	52.3	58.8	51.2	51.2	51.2	51.2	51.2	40.0
199-D7-6	574429.2	152980.43	DX	(16.7)	(16.3)	(16.4)	(12.9)	(11.5)	(14.2)	(14.9)	(12.3)	(14.7)	(14.7)	(12.0)	(14.6)	(14.1)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.5)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)	(15.0)
199-D8-55	573620.954	152364.345	DX	20.9	15.8	11.2	8.7	2.9	2.3	3.3	3.5	3.4	3.4	2.9	1.4	3.6	2.2	4.0	3.4	2.7	1.6	2.5	2.7	2.7	2.7	2.7	2.7	2.5

Table B-4. Names, Geographic Coordinates, and Extraction and Injection Rates of 100 -HR-3 Wells – Alternative 4

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan2013-Dec2087
199-D8-69	573843.61	152552.201	DX	(18.8)	(19.0)	(19.4)	(14.3)	(12.4)	(14.9)	(18.8)	(18.1)	(17.0)	(17.0)	(18.1)	(19.2)	(17.9)	(10.7)	(20.6)	(20.1)	(20.9)	(19.6)	(20.2)	(20.9)	(20.9)	(20.9)	(20.9)	(20.9)	(16.5)
199-D8-73	573388.7	152167.38	DX	(3.2)	(3.2)	(3.8)	(3.8)	(3.3)	(3.1)	(3.7)	(3.6)	(3.0)	(3.0)	(2.8)	(3.1)	(2.9)	(1.1)	(0.1)	(4.6)	(5.4)	(5.1)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)	(5.4)
199-D8-88	573292.33	152141.26	DX	-	-	(0.4)	(0.6)	(0.0)	(3.3)	(2.8)	(1.9)	(2.2)	(2.2)	(2.3)	(3.6)	(3.8)	(3.7)	(4.8)	(6.0)	(6.3)	(6.2)	(7.7)	(6.3)	(6.3)	(6.3)	(6.3)	(6.3)	(7.7)
199-D8-95	573611.96	152160.61	DX	(16.4)	(16.3)	(16.9)	(13.8)	(12.4)	(14.0)	(15.9)	(14.6)	(14.4)	(14.4)	(17.7)	(15.7)	(17.1)	(10.7)	(17.8)	(17.7)	(17.9)	(17.0)	(17.6)	(17.9)	(17.9)	(17.9)	(17.9)	(17.9)	(15.0)
199-D8-96	573706	152152.24	DX	(21.8)	(22.1)	(22.5)	(15.2)	(12.8)	(14.6)	(16.4)	(14.6)	(18.3)	(18.3)	(23.2)	(23.7)	(23.9)	(20.9)	(23.9)	(23.2)	(24.0)	(22.3)	(21.0)	(24.0)	(24.0)	(24.0)	(24.0)	(24.0)	(18.0)
199-D8-97	573859.56	152087.42	DX	(17.5)	(17.2)	(19.5)	(14.8)	(12.4)	(16.3)	(19.1)	(19.4)	(18.9)	(18.9)	(21.2)	(21.1)	(19.1)	(11.5)	(17.8)	(17.5)	(18.9)	(17.7)	(17.6)	(18.9)	(18.9)	(18.9)	(18.9)	(18.9)	(16.0)
199-D8-98	574013.12	152123.02	DX	(17.4)	(16.8)	(18.1)	(14.0)	(10.7)	(14.5)	(16.8)	(14.6)	(16.5)	(16.5)	(19.7)	(13.3)	(12.3)	(12.4)	(18.9)	(18.4)	(18.5)	(17.1)	(17.5)	(18.5)	(18.5)	(18.5)	(18.5)	(18.5)	(16.0)
199-D8-99	574006.77	152364.37	DX	9.5	10.1	8.7	6.0	5.3	57.6	83.4	77.3	72.9	72.9	73.2	81.0	80.3	58.9	86.7	85.2	90.9	76.1	71.8	90.9	90.9	90.9	90.9	90.9	71.8
199-H1-5	574850.72	153090.3	DX	(19.0)	(19.0)	(19.3)	(13.6)	(11.5)	(16.2)	(18.8)	(19.4)	(14.4)	(14.4)	(10.8)	(14.6)	(14.1)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.5)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)	(19.0)
199-H4-80	575238.97	152568.16	DX	(14.6)	(14.1)	(15.4)	(13.9)	(12.4)	(13.5)	(16.5)	(14.7)	(15.0)	(15.0)	(12.9)	(16.6)	(16.0)	(3.8)	(15.7)	(15.6)	(17.4)	(17.0)	(17.6)	(17.4)	(17.4)	(17.4)	(17.4)	(17.4)	(12.5)
199-H4-81	575236.93	153035.36	DX	(14.7)	(14.5)	(15.2)	(13.5)	(12.4)	(12.4)	(15.5)	(14.6)	(14.8)	(14.8)	(13.4)	(15.8)	(15.7)	(4.1)	(15.0)	(15.1)	(16.4)	(16.1)	(16.9)	(16.4)	(16.4)	(16.4)	(16.4)	(16.4)	(17.0)
199-H4-82	574906.99	152677.72	DX	(0.2)	(10.1)	(12.7)	(10.3)	(7.7)	(15.6)	(19.0)	(19.5)	(15.5)	(15.5)	(11.1)	(17.4)	(16.9)	(3.8)	(17.6)	(17.5)	(18.4)	(17.9)	(17.8)	(18.4)	(18.4)	(18.4)	(18.4)	(18.4)	(12.0)
199-H4-14	577803.747	152752.359	HX	91.1	97.6	95.8	90.4	7.5	-	-	-	-	19.6	20.9	15.3	14.8	14.5	15.6	11.0	11.0	8.5	11.6	11.0	11.0	11.0	11.0	11.0	10.0
199-H4-15A	577905.999	153051.9969	HX	(19.0)	(19.1)	(18.7)	(17.9)	(1.5)	-	-	-	-	(35.2)	(34.3)	(38.5)	(33.3)	(37.5)	(37.7)	(38.2)	(39.1)	(32.1)	(31.0)	(39.1)	(39.1)	(39.1)	(39.1)	(39.1)	-
199-H4-17	577779.175	153037.635	HX	52.2	51.3	53.9	49.1	11.5	-	-	-	-	8.5	10.8	11.6	9.6	10.3	9.2	7.1	5.8	5.4	6.7	5.8	5.8	5.8	5.8	5.8	-
199-H4-18	578018.292	152756.478	HX	40.4	50.3	46.5	42.8	3.5	-	-	-	-	22.2	13.7	12.8	12.2	12.1	13.2	11.7	11.4	9.5	7.3	11.4	11.4	11.4	11.4	11.4	-
199-H4-4	578060.859	152853.956	HX	-	(8.7)	(4.8)	(5.5)	(0.6)	-	-	-	-	(2.4)	(4.5)	(5.3)	(4.2)	(2.5)	(6.1)	(11.0)	(11.0)	(10.9)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)	(11.0)	-
199-H4-63	578185.825	152665.531	HX	(24.0)	(24.1)	(23.4)	(21.1)	(1.6)	-	-	-	-	(25.0)	(24.7)	(25.6)	(25.7)	(26.0)	(26.3)	(26.1)	(27.4)	(26.8)	(27.0)	(27.4)	(27.4)	(27.4)	(27.4)	(27.4)	-
199-H4-64	577946.11	153010.582	HX	-	-	-	-	-	-	-	-	-	(8.2)	(12.1)	(13.3)	(12.3)	(11.7)	(14.9)	(22.9)	(20.7)	(20.1)	(15.0)	(20.7)	(20.7)	(20.7)	(20.7)	(20.7)	-
199-H3-2C	577632.065	152750.302	HX	-	-	-	-	-	-	-	-	-	(46.0)	(45.5)	(45.6)	(47.4)	(48.0)	(47.8)	(46.8)	(50.0)	(49.4)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)	(50.0)
199-H4-12C	578011.772	152919.812	HX	-	-	-	-	-	-	-	-	-	(27.2)	(26.5)	(29.4)	(29.4)	(29.7)	(29.2)	(28.8)	(30.0)	(29.6)	(30.0)	(30.0)	(30.0)	(30.0)	(30.0)	(30.0)	(30.0)
199-H3-4	577544.287	152293.21	HX	-	-	-	-	-	-	-	-	-	(84.6)	(102.9)	(125.0)	(124.2)	(125.0)	(123.9)	(108.8)	(113.4)	(95.6)	(99.4)	(113.4)	(113.4)	(113.4)	(113.4)	(113.4)	(56.0)
199-H1-1	576702.31	153384.49	HX	-	-	-	-	-	-	-	-	-	(28.7)	(29.2)	(30.0)	(29.9)	(29.4)	(30.1)	(26.1)	(29.5)	(26.7)	(19.9)	(29.5)	(29.5)	(29.5)	(29.5)	(29.5)	(14.0)
199-H1-2	576451.07	153378.26	HX	-	-	-	-	-	-	-	-	-	(3.1)	(2.6)	(2.4)	(2.1)	(1.9)	(1.9)	(2.2)	(4.6)	(6.1)	(6.9)	(4.6)	(4.6)	(4.6)	(4.6)	(4.6)	(6.0)
199-H1-20	575706.04	154183.61	HX	-	-	-	-	-	-	-	-	-	72.3	68.8	74.3	71.6	69.2	72.7	79.0	23.9	19.3	0.7	23.9	23.9	23.9	23.9	23.9	37.0
199-H1-21	575896.84	154163.8	HX	-	-	-	-	-	-	-	-	-	96.1	88.7	94.7	91.8	90.0	94.0	96.0	67.9	65.7	2.1	67.9	67.9	67.9	67.9	67.9	37.0
199-H1-25	576279.64	154069.97	HX	-	-	-	-	-	-	-	-	-	(17.5)	(24.5)	(28.9)	(28.6)	(26.6)	(28.4)	(28.7)	(29.1)	(26.3)	(16.1)	(29.1)	(29.1)	(29.1)	(29.1)	(29.1)	(10.0)
199-H1-27	576403.86	154024.21	HX	-	-	-	-	-	-	-	-	-	(11.2)	(18.0)	(22.1)	(21.5)	(18.7)	(23.8)	(28.7)	(29.6)	(26.4)	(19.0)	(29.6)	(29.6)	(29.6)	(29.6)	(29.6)	(15.0)
199-H1-32	576767.07	153766	HX	-	-	-	-	-	-	-	-	-	(1.3)	(1.7)	(1.5)	(1.4)	(0.3)	(1.7)	(9.5)	(18.5)	(19.7)	(19.0)	(18.5)	(18.5)	(18.5)	(18.5)	(18.5)	(14.0)
199-H1-33	576833.29	153716.23	HX	-	-	-	-	-	-	-	-	-	(4.8)	(7.6)	(11.5)	(6.6)	(0.2)	(6.2)	(22.8)	(27.8)	(25.3)	(19.9)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)	(16.0)
199-H1-34	576883.13	153667.06	HX	-	-	-	-	-	-	-	-	-	(11.2)	(13.9)	(14.4)	(13.3)	(11.0)	(15.1)	(25.3)	(27.4)	(27.6)	(27.8)	(27.4)	(27.4)	(27.4)	(27.4)	(27.4)	(19.0)
199-H1-35	576958.26	153628.14	HX	-	-	-	-	-	-	-	-	-	(23.6)	(25.3)	(28.5)	(27.4)	(23.1)	(25.0)	(26.3)	(22.0)	(26.5)	(26.8)	(22.0)	(22.0)	(22.0)	(22.0)	(22.0)	(19.0)
199-H1-36	576885.62	153486.51	HX	-	-	-	-	-	-	-	-	-	(8.1)	(7.1)	(6.9)	(6.3)	(5.3)	(4.7)	(7.7)	(9.0)	(8.9)	(8.9)	(9.0)	(9.0)	(9.0)	(9.0)	(9.0)	(8.0)
199-H1-37	577106.92	153641.63	HX	-	-	-	-	-	-	-	-	-	(7.8)	(10.7)	(12.8)	(7.7)	(3.0)	(10.1)	(27.5)	(27.8)	(27.6)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)	(27.8)	(19.0)
199-H1-38	577161	153555.01	HX	-	-	-	-	-	-	-	-	-	(6.1)	(4.3)	(4.0)	(3.4)	(4.3)	(6.3)	(13.5)	(24.4)	(24.5)	(24.9)	(24.4)	(24.4)	(24.4)	(24.4)	(24.4)	(20.0)
199-H1-39	577223.54	153533.4	HX	-	-	-	-	-	-	-	-	-	(1.9)	(1.8)	(1.1)	(1.0)	(0.6)	(2.3)	(32.9)	(41.1)	(37.6)	(29.8)	(41.1)	(41.1)	(41.1)	(41.1)	(41.1)	(21.0)
199-H1-40	577279.34	153500.19	HX	-	-	-	-	-	-	-	-	-	(3.7)	(3.1)	(3.5)	(2.6)	(2.5)	(4.1)	(10.4)	(22.4)	(29.2)	(19.9)	(22.4)	(22.4)	(22.4)	(22.4)	(22.4)	(15.0)
199-H1-42	577127.18	153391.65	HX	-	-	-	-	-	-	-	-	-	(27.2)	(27.6)	(29.0)	(27.6)	(28.9)	(27.9)	(27.9)	(29.0)	(28.0)	(27.8)	(29.0)	(29.0)	(29.0)	(29.0)	(29.0)	(21.0)
199-H1-43	577213.74	153384.28	HX	-	-	-	-	-	-	-	-	-	(28.7)	(28.5)	(19.9)	(21.8)	(24.6)	(29.0)	(28.3)	(29.6)	(29.6)	(29.8)	(29.6)	(29.6)	(29.6)	(29.6)	(29.6)	(21.0)
199-H1-45	577240.96	153062.41	HX	-	-	-	-	-	-	-	-	-	(25.8)	(25.6)	(26.5)	(26.7)	(27.0)	(26.9)	(26.7)	(9.3)	(4.1)	(27.0)	(9.3)	(9.3)	(9.3)	(9.3)	(9.3)	(21.0)
199-H1-6	576037.81	153745.74	HX	-	-	-	-	-	-	-	-	-	(2.2)	(1.5)	(0.4)	(0.1)	(1.0)	(2.2)	(2.8)	(6.3)	(8.5)	(11.7)	(6.3)	(6.3)	(6.3)	(6.3)	(6.3)	(11.0)
199-H3-25	577410.36	152978.49	HX	-	-	-	-	-	-	-	-	-	44.1	49.1	53.3	51.3	49.8	53.3	65.9	90.7	88.2	94.0	90.7	90.7	90.7	90.7	90.7	50.0
199-H3-26	577440.83	152846.5	HX	-	-	-	-	-	-	-	-	-	41.0	42.7	45.2	43.9	42.7	45.5	55.9	83.8	83.9	89.4	83.8	83.8	83.8	83.8	83.8	50.0
199-H3-27	577567.05	152811.14	HX	-	-	-	-	-	-	-	-	-	35.0	36.8	39.0	37.8	36.6	39.5	55.0	73.5	70.9	75.1	73.5	73.5	73.5	73.5	73.5	50.0
199-H4-69	578014.05	152686.66	HX	-	-	-	-	-	-	-	-	-	(26.0)	(24.8)	(27.6)	(27.2)	(21.3)	(24.4)	(27.7)	(28.0)	(27.7)	(28.0)	(28.0)	(28.0)	(28.0)	(28.0)	(28.0)	(20.0)
199-H4-70	578003.82	152646.45	HX	-	-	-	-	-	-	-	-	-	(22.8)	(22.7)	(23.6)	(23.7)	(24.0)	(23.9)	(23.4)	(21.0)	(22.3)	(23.0)	(21.0)	(21.0)	(21.0)	(21.0)	(21.0)	-
199-H4-71	578010.64	152581.53	HX	-	-	-	-	-	-	-	-	-	27.8	31.7	33.6	32.2	31.1	34.2	43.5	60.7	58.8	62.9	60.7	60.7	60.7	60.7	60.7	35.0
199-H4-72	578036.28	152500.14	HX	-	-	-	-	-	-	-	-	-	14.7	20.2	23.1	22.2	20.7	24.2	33.6	58.9	58.6	62.7	58.9	58.9	58.9	58.9	58.9	35.0
199-H4-73	577940.58	152369.98	HX	-	-	-	-	-	-	-	-	-	18.4	23.9	25.9	24.6	22.5	25.6	34.9	54.7	53.6	57.7	54.7	54.7	54.7	54.7	54.7	35.0
199-H4-74	577239.07	152268.83	HX	-	-	-	-	-	-	-	-	-	34.3	33.8	35.7	34.7	33.5	36.1	45.7	66.8	68.9	75.7	66.8	66.8	66.8	66.8	66.8	40.0
199-H4-75	577212.36	152704.64	HX	-	-	-	-	-	-	-	-	-	(19.1)	(19.0)	(19.7)	(19.7)	(20.0)	(19.0)	(18.1)	(19.0)	(19.1)	(20.0)	(19.0)	(19.0)	(19.0)	(19.0)	(19.0)	(15.0)
199-H4-76	576787.32	152976.85	HX	-	-	-	-	-	-	-	-	-	(14.0)	(9.0)	(4.0)	(1.1)	-	-	(0.0)	(3.5)	(13.6)	(17.9)	(3.5)	(3.5)	(3.5)	(3.5)	(3.5)	(14.0)
199-H4-77	576487.79	152975.43	HX	-	-	-	-	-	-	-	-	-	(12.4)	(11.1)	(10.1)	(9.9)	(9.1)	(8.7)	(7.1)	(9.3)	(9.3)	(8.4)	(9.3)	(9.3)	(9.3)	(9.3)	(9.3)	(8.0)

Table B-4. Names, Geographic Coordinates, and Extraction and Injection Rates of 100 -HR-3 Wells – Alternative 4

Well Name	Easting	Northing	SYSTEM	Jan-11	Feb-11	Mar-11	Apr-11	May-11	Jun-11	Jul-11	Aug-11	Sep-11	Oct-11	Nov-11	Dec-11	Jan-12	Feb-12	Mar-12	Apr-12	May-12	Jun-12	Jul-12	Aug-12	Sep-12	Oct-12	Nov-12	Dec-12	Jan2013-Dec2087
199-H4-78	576168.23	152166.12	HX	-	-	-	-	-	-	-	-	-	50.7	54.6	58.2	55.8	52.2	56.2	71.8	101.2	96.1	122.2	101.2	101.2	101.2	101.2	101.2	44.0
199-H4-79	575659.13	151989.31	HX	-	-	-	-	-	-	-	-	-	38.8	58.4	69.3	65.8	62.0	70.1	67.2	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	(0.0)	45.0
199-H6-2	577886.5	152194.11	HX	-	-	-	-	-	-	-	-	-	15.1	18.1	20.3	19.2	17.7	20.5	29.9	49.9	52.3	56.2	49.9	49.9	49.9	49.9	49.9	35.0
HX-10	575997	153368	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(14.0)
HX-11	576048.239	152955.554	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(12.0)
HX-12	576064	152675	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(14.0)
HX-13	576879	152042	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45.0
HX-14	575429	153062	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
HX-16	576881	152563	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(14.0)
HX-7	576178	153765	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(13.0)
HX-8	576583	153898	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
HX-9	577225	153229	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
HX-20	575666	152949	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	36.0
HX-21	575670	152663	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
HX-22	575254	153343	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	45.0
HX-23	575243	153759	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	20.0
HX-24	575668	153761	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	30.0
HX-25	576468	153705	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
HX-26	577823	152013	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(15.0)
HX-27	578238	152072	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(19.0)
HX-28	576083	151746	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.0)
HX-29	576710	151757	HX	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	(20.0)

Appendix C

Vadose Zone and Groundwater Input Narratives

100-DH Vadose Zone Alternatives

Waste Site Action for Alternative 1- (No Action [as required by the NCP]):

- No action for all Waste Sites.

Waste Site Action for Alternative 2- RTD and Grouting for Waste Site and Pump-and-Treat with Biological Treatment for Groundwater:

The following assumptions are based on data for the 100-D/H Area waste sites presented in Appendix J, Table J-1, in DOE/RL-2010-95

Site 100-D-25: Human health impact

- Considered with 116-DR-9

100-D-75:1: Human Health Direct Contact and/or Ecological risk likely in shallow soil

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 12,600 m^2 (135,625 ft^2) to 1 m (3 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-36: Structure

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- Grout void fill of remaining box flume (3 side by side channels 2.3 m^2 (24.2 ft^2) x 40 m (130 ft) length)
- RTD of Spillway Pad below box flume (1,150 m^2 (12,379 ft^2) x 0.3 m (1 ft) thickness)
- Disposal of excavated soil at ERDF

116-D-8: Human Health Impact (Shallow)

- Institutional controls for 23 years (to year 2035)

116-DR-9: Human Health Impact (Shallow)

- Institutional controls for 35 years

118-DR-2:2: Human Health Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 272 m^2 (2,926 ft^2) to 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

Estimating Parameters for Candidate Sites

100-D-10: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 251.43 m^2 (2,705 ft^2)x 6 m (20 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-101: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 618.1 m^2 (6,650 ft^2) x 2.5 m (8.2 ft) excavation depth
- Disposal of excavated soil at ERDF

100-D-102: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 1,284 m^2 (13,825 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-103: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 46 m^2 (495 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-50:2: Pipeline inside of intact subgrade tunnels

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- Place cap over end of pipeline
- Entry and excavation restriction ICs

100-D-52: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 6.7 m^2 (72 ft^2) x 7.6 m (24.9 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-59: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling

- RTD of 0.16 m^2 (1.70 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-63: Pipeline

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 10,000 m (32,800 ft) of linear pipe length x 4.6 m (15.0 ft) excavation depth
- Disposal of excavated soil at ERDF

100-D-96: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 8 French drains totaling 2.78 m^2 (29.9 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-28:7: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 1,957 linear m (6,420 ft) x 1.5 m (5 ft) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-38: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 3 acres (WIDS description) (130,680 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-5: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 100 m (328 ft) x 15 m (49.2 ft) x 7.6 m (24.9 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-57: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 231.88 m^2 (est)(2,495.9 ft^2) x 4.6 m (15.0 ft) below ground surface

- Disposal of excavated soil at ERDF

100-H-58: Above Grade Contaminated Nests

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of estimate 1.3 m^3 (45.9 ft^3)
- Disposal of excavated soil at ERDF

Waste Site Action for Alternative 3- RTD and Grouting of Waste Site and Increased Capacity Groundwater Pump-and-Treat for Groundwater:

The following assumptions are based on data for the 100-D/H Area waste sites presented in Appendix J, Table J-1, DOE/RL-2010-95

Site 100-D-25: Human health impact

- Considered with 116-DR-9

100-D-75:1: Human Health Direct Contact and/or Ecological risk likely in shallow soil

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 12,600 m^2 (135,625 ft^2) to 1 m (3 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-36: Structure

- Minimal Design Sampling, RTD of (building demolition) of two structures, use rule of thumb for confirmation/verification sampling
- Grout void fill of remaining box flume (3 side by side channels 2.3 m^2 (24.2 ft^2) x 40 m (130 ft) length)
- RTD of Spillway Pad below box flume (1,150 m^2 (12,379 ft^2) x 0.3 m (1 ft) thickness)
- Disposal of excavated soil at ERDF

116-D-8: Human Health Impact (Shallow)

- Institutional controls for 23 years (to year 2035)

116-DR-9: Human Health Impact (Shallow)

Institutional controls for 35 years

118-DR-2:2: Human Health Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 272 m^2 (2,926 ft^2) to 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

Estimating Parameters for Candidate Sites

100-D-10: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 251.43 m^2 (2,705 ft^2) x 6 m (below ground surface
- Disposal of excavated soil at ERDF

100-D-101: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 618.1 m^2 (6,650 ft^2) x 2.5 m (8.2 ft) excavation depth
- Disposal of excavated soil at ERDF

100-D-102: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 1,284 m^2 (13,825 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-103: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 46 m^2 (495 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-50:2: Pipeline inside of intact subgrade tunnels

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- Place cap over end of pipeline
- Entry and excavation restriction ICs

100-D-52: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 6.7 m^2 (72 ft^2) x 7.6 m (24.9 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-59: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 0.16 m^2 (1.70 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-63: Pipeline

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 10,000 m (32,800 ft) of linear pipe length x 4.6 m (15.0 ft) excavation depth
- Disposal of excavated soil at ERDF

100-D-96: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 8 French drains totaling 2.78 m^2 (29.9 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-28:7: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 1,957 linear m (6,420 ft) x 1.5 m (5 ft) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-38: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 3 acres (WIDS description) (130,680 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-5: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 100 m (328 ft) x 15 m (49.2 ft) x 7.6 m (24.9 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-57: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling

- RTD of 231.88 m^2 (est)(2,495.9 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-58: Above Grade Contaminated Nests

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of estimate 1.3 m^3 (45.9 ft^3)
- Disposal of excavated soil at ERDF

Waste Site Action for Alternative 4- RTD for Waste Sites and Pump-and-Treat for Groundwater:

The following assumptions are based on data for the 100-D/H Area waste sites presented in Appendix J, Table J-1, in DOE/RL-2010-95

Site 100-D-25: Human health impact

- Considered with 116-DR-9

100-D-75:1: Human Health Direct Contact and/or Ecological risk likely in shallow soil

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 12,600 m^2 (135,625 ft^2) to 1 m (3 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-36: Structure

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of (building demolition) of two structures,
    - Remaining box flume (300 m^2 (3,229 ft^2) x 2 m (6.6 ft) tall with 5 m (16.4 ft)) concrete foundation
    - Spillway Pad below box flume (1,150 m^2 (12,379 ft^2) x 0.3 m (1 ft) thickness)
- Disposal of excavated soil at ERDF

116-D-8: Human Health Impact (Shallow)

- Considered with 100-D-50:2

116-DR-9: Human Health Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 541 m^2 (5,823 ft^2) to 4.6 m (15 ft) below ground surface
- Disposal of excavated soil at ERDF

118-DR-2:2: Human Health Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 272 m^2 (2,926 ft^2) to 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

Estimating Parameters for Candidate Sites

100-D-10: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 251.43 m^2 (2,705 ft^2)x 6 m (20 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-101: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 618.1 m^2 (6,650 ft^2) x 2.5 m (8.2 ft) excavation depth
- Disposal of excavated soil at ERDF

100-D-102: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 1,284 m^2 (13,825 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-103: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 46 m^2 (495 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-50:2: Pipeline inside of intact subgrade tunnels

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 819 m^2 (106,965 ft^2) x 7.3 m (24.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-52: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 6.7 m^2 (72 ft^2) x 7.6 m (24.9 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-59: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 0.16 m^2 (1.70 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-D-63: Pipeline

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 10,000 m (32,800 ft) of linear pipe length x 4.6 m (15.0 ft) excavation depth
- Disposal of excavated soil at ERDF

100-D-96: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 8 French drains totaling 2.78 m^2 (29.9 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-28:7: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 1,957 linear m (6,420 ft) x 1.5 m (5 ft) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-38: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 3 acres (WIDS description) (130,680 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-5: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 100 m (328 ft) x 15 m (49.2 ft) x 7.6 m (24.9 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-57: Human Health Direct Contact Impact (Shallow)

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of 231.88 m^2 (est)(2,495.9 ft^2) x 4.6 m (15.0 ft) below ground surface
- Disposal of excavated soil at ERDF

100-H-58: Above Grade Contaminated Nests

- Minimal Design Sampling, use rule of thumb for confirmation/verification sampling
- RTD of estimate 1.3 m^3 (45.9 ft^3)
- Disposal of excavated soil at ERDF

100-D/H Groundwater Alternatives

The following assumptions are based on data for the 100-HR3 operable unit, as presented in Chapter 9 of DOE/RL-2010-95

GW Alternative 1- (No Action [as required by the NCP])

- Operate current system at 85% capacity until December 31, 2012.
- No active treatment from that point forward.
- No monitoring

GW Action for Alternative 2- RTD and Grouting for Waste Site and Pump-and-Treat with Biological Treatment for Groundwater:

Pump and Treat with Ex-Situ ion exchange treatment of Cr(VI)

- DX:
    - Existing system includes 37 extraction wells already in use as part of the interim action pump and treat system.
    - Install and connect 4 new extraction wells to the DX pump and treat system as part of the FS.
    - Convert 4 existing monitoring wells to extraction wells and connect to the DX pump and treat system as part of the FS.
    - Existing system includes 14 injection wells already in use as part of the interim action pump and treat system.
    - Install and connect 7 new injection wells to the DX pump and treat system as part of the FS.
    - Includes installation of 6 new monitoring wells
    - Operate ion exchange systems at 85% capacity for 25 years following implementation of the alternative remedy.
    - Total flow rates for system operating at 85% are:
        - Extraction – 509.1 gpm
        - Injection – 509.3 gpm
            - Detailed well flow rate information for ion exchange is presented in Appendix B.
- HX:
    - Existing system includes 31 extraction wells already in use as part of the interim action pump and treat system.
    - Install and connect 10 new extraction wells to the HX pump and treat system as part of the FS.
    - Install 7 new extraction wells to be used for groundwater in situ bioremediation.

- Convert 6 existing extraction wells to be used for groundwater in situ bioremediation.
- Existing system includes 15 injection wells already in use as part of the interim action pump and treat system.
- Install and connect 1 new injection wells to the HX pump and treat system as part of the FS.
- Install 2 new injection wells to be used for injection of amended groundwater for in situ bioremediation.
- Convert 2 existing extraction wells to be used for injection of amended groundwater for in situ bioremediation.
- Convert 1 existing injection well to be used for injection of amended groundwater for in situ bioremediation.
- Includes installation of 6 new monitoring wells
- Install one Bio-node mixing facility for bio-substrate injections.
- Pipe via above ground pipelines from Node to bio-injection wells.
- Operate ion exchange systems at 85% capacity for 25 years following implementation of the alternative remedy
- Total flow rates for system operating at 85% are:
  - Extraction – 680 gpm
  - Injection – 680 gpm
    - Detailed well flow rate information for ion exchange and bio is presented in Appendix B.

GW Action for Alternative 3 – RTD and Grouting of Waste Site and Increased Capacity Groundwater Pump-and-Treat for Groundwater:

Pump and Treat with Ex-Situ ion exchange treatment of Cr(VI)

- DX:
  - Existing system includes 37 extraction wells already in use as part of the interim action pump and treat system.
  - Install and connect 21 new extraction wells to the DX pump and treat system as part of the FS.
  - Convert 4 existing monitoring wells to extraction wells and connect to the DX pump and treat system as part of the FS.
  - Convert 4 existing injection wells to extraction wells and connect to the DX pump and treat system as part of the FS.
  - Existing system includes 14 injection wells already in use as part of the interim action pump and treat system.

- Install and connect 12 new injection wells to the DX pump and treat system as part of the FS.
- Construct new ion exchange treatment system at 100-D; Capacity of 625 GPM required.
- Includes installation of 6 new monitoring wells
- Operate ion exchange systems at 85% capacity for 12 years following implementation of the alternative remedy.
- Total flow rates for system operating at 85% are:
  - Extraction – 1038.1 gpm
  - Injection – 1038.1 gpm
    - Detailed well flow rate information for ion exchange is presented in Appendix B.

- HX:
  - Existing system includes 31 extraction wells already in use as part of the interim action pump and treat system.
  - Install and connect 36 new extraction wells to the HX pump and treat system as part of the FS.
  - Existing system includes 15 injection wells already in use as part of the interim action pump and treat system.
  - Install and connect 13 new injection wells to the HX pump and treat system as part of the FS.
  - Construct new ion exchange treatment system at 100-H; Capacity of 800 GPM required.
  - Includes installation of 6 new monitoring wells
  - Operate ion exchange systems at 85% capacity for 12 years following implementation of the alternative remedy.
  - Total flow rates for system operating at 85% are:
    - Extraction – 1358.4 gpm
    - Injection – 1358.3 gpm
      - Detailed well flow rate information for ion exchange is presented in Appendix B.

GW Action for Alternative 4 – RTD for Waste Sites and Pump-and-Treat for Groundwater:

Pump and Treat with Ex-Situ ion exchange treatment of Cr(VI)

- DX:

  - Existing system includes 37 extraction wells already in use as part of the interim action pump and treat system.
  - Install and connect 5 new extraction wells to the DX pump and treat system as part of the FS.
  - Convert 4 existing monitoring wells to extraction wells and connect to the DX pump and treat system as part of the FS.
  - Convert 4 existing injection wells to extraction wells and connect to the DX pump and treat system as part of the FS.
  - Existing system includes 14 injection wells already in use as part of the interim action pump and treat system.
  - Install and connect 7 new injection wells to the DX pump and treat system as part of the FS.
  - Includes installation of 6 new monitoring wells
  - Operate ion exchange systems at 85% capacity for 39 years following implementation of the alternative remedy.
  - Total flow rates for system operating at 85% are:
    - Extraction – 509.1 gpm
    - Injection – 509.3 gpm
      - Detailed well flow rate information for ion exchange is presented in Appendix B.

- HX:
  - Existing system includes 31 extraction wells already in use as part of the interim action pump and treat system.
  - Install and connect 18 new extraction wells to the HX pump and treat system as part of the FS.
  - Existing system includes 15 injection wells already in use as part of the interim action pump and treat system.
  - Install and connect 5 new injection wells to the HX pump and treat system as part of the FS.
  - Convert 1 existing injection wells to extraction wells and connect to the HX pump and treat system as part of the FS.
  - Includes installation of 6 new monitoring wells
  - Operate ion exchange systems at 85% capacity or 39 years following implementation of the alternative remedy.
  - Total flow rates for system operating at 85% are:
    - Extraction – 679 gpm
    - Injection – 679 gpm

- Detailed well flow rate information for ion exchange is presented in Appendix B.

Appendix D

Waste Site Information Database Summary Reports

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-D-10 **Site Classification: Not Accepted**

Site Names: 100-D-10; Storm Drain Outfall; Undocumented Liquid Waste Site

Site Type: Depression/Pit (nonspecific)
Status: Inactive
Hanford Area: 100D
OU/WMA: Not Applicable

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The Technical Baseline Report (section 4.40) states that reportedly there was a small outfall structure upstream of the 1907-DR outfall. It was demolished at the same time as the 1907-DR outfall. The Technical Baseline Report states that the structure was similar in construction to the 1907-DR, only much smaller. It was used as a discharge outfall for the storm drain system of the 190-DR tank pit, which consisted of drains, sump, and pump to lift runoff to the outfall. The trench from the outfall structure to the waterline is apparent and appears to have a telephone cable buried in its bottom.

Location Description:

The structure was located adjacent to the concrete block telephone building on the Columbia River bank and just south of the 100-D Area fence.

Associated Structures:

The site was related to the 190-DR tank pit.

Waste Information:

Type: Stormwater Runoff
Category: Nondangerous/nonradioactive
Physical State: Liquid

Amount:
Units: Not Specified
Reported Date:

Description:

The unit reportedly received storm water run-off from the 190-DR tank pit.

References:

1. R. W. Carpenter, 9/20/1993, 100-D Area Technical Baseline Report, WHC-SD-EN-TI-181, Rev 0.

Field Work:

Type: Site Walkdown
Begin Date: 3/29/1999
End Date: 3/29/1999
Purpose: verification

References:

1. CR Webb, 1/2/1997, Field Logbook assigned to Christine Webb, EL-1255 and EL-1255-1.

Type: Site Walkdown
Begin Date: 3/29/1999
End Date: 3/29/1999
Purpose: RARA Walkdown

Comment:
Demolished stormwater outfall, telephone lines run through trench.

Type: GPS Surveys
Begin Date: 4/13/1999
End Date: 4/13/1999
Purpose: to verify site location

Comment:
The upper part of the ravine where the waste site is found was mapped. The reference for this task is an electronic file found under \\BHI002\hgis-gps\job-241. The DIS CCN for this survey is 0511005.

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor: None
Reclassifying Contractor/Subcontractor: None
Responsible Project: Not Specified

Site Evaluation

Solid Waste Management Unit: No
TPA Waste Management Unit Type : Not Specified

Permitting

RCRA Part B Permit:	No	**TSD Number:**	
RCRA Part A Permit:	No	**Closure Plan:**	No
RCRA Permit Status:	Not Specified		
Septic Permit:	No	**216/218 Permit:**	
Inert LandFill:	No	**NPDES:**	
Air Operating Permit:	No	**State Waste Discharge Permit:**	
Air Operating Permit Number(s):			

Tri-Party Agreement

Lead Regulatory Agency: Ecology
Unit Category: CERCLA Past Practice (CPP)
TPA Appendix: None

Remediation and Closure

Decision Document: None
Decision Document Status: None
Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

Images:

Pathname: //mapweb.rl.gov/widsimg/100d/1830/1830_01.jpg **Date Taken:** 3/30/1999
Description:
Photo shows the trench with some debris.

Pathname: //mapweb.rl.gov/widsimg/100d/1830/1830_02.jpg **Date Taken:** 3/30/1999
Description:
Photo shows the trench outlet to the river.

References:

1. R. W. Carpenter, 9/20/1993, 100-D Area Technical Baseline Report, WHC -SD-EN-TI-181, Rev 0.
2. CR Webb, 1/2/1997, Field Logbook assigned to Christine Webb, EL-1255 and EL-1255-1.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-D-101 **Site Classification: Accepted** Page 1

Site Names: 100-D-101; 108-D Acid Pit and Sump; 108-D Car Spot; 108-D Sodium Silicate Sump; 108-D Storage Tanks; Miscellaneous Structures

Site Type: Sump
Status: Inactive
Hanford Area: 100D
OU/WMA: 100-DR-1

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The site consists of four chemical storage tanks, an acid neutralization pit/sump, a sodium silicate sump, two sets of pumps, and a car spot. All located to the west of the 108-D building. Two chemicals were stored near 108-D, sulfuric acid and sodium silicate, which each had its own set of two large storage tanks. Additionally, each chemical had a set of two pumps for unloading solution out of railroad tank cars. An acid neutralization pit/sump was located underneath the acid storage tanks, while another sump was placed near the sodium silicate tanks. A car spot and railroad line passed through the site for delivering the solutions.

Location Description:

The site was located west of the 108-D building.

Process Description:

Two elevated sulfuric acid storage tanks were located in the site footprint. Each measured 2.7 by 11.0 m (9 by 36 ft) and was oriented horizontally, at a height of approximately 5 m off the ground (HAN-10970, HW-75014) A set of wooden stairs allowed workers to reach the top of the tanks (HW-74549). To fill the tanks, two self-priming unloading pumps were situated nearby in a protective shed. The capacity of each pump was 50 gpm and they were run by 440 V electric motors. These storage tanks were removed sometime prior to 1952. The two sulfuric acid tanks were located west of the 108-D building at (E573738.62886, N151772.25873) and (E573738.70631, N151768.65750). The separation between the two tanks was .9 m (3 ft). The pumps for sulfuric acid were located at (E573744.09046, N151775.85017), off the northeast corner of the tanks.
The sulfuric acid (68-70%), brought in by railroad tank cars, was delivered to the storage tanks. From the storage tanks, a gravity-flow line supplied the 105-D building with acid for controlling the pH of process water. In addition, equipment was set up in the 108-D building for diluting the sulfuric acid. Pumps with suction piping were used to transport acid from the tanks into the 108-D building. Historic photographs indicate that the sulfuric acid tanks were removed before 1952.
The 108-D Acid Neutralization Pit and Sump was located underground beneath the sulfuric acid storage tanks on the west side of the 108-D building. The pit was covered with a removable 1.4 m (4 ft, 8 in) wooden plank. A 10.1 cm (4 in) overflow pipe was attached to the south end of the pit, which connected to the water treatment process sewer. The northern portion of the pit was separated from the rest by a brick barrier and was used as a sump. Two 5.1 cm (2 in) inlet pipes inside an underground wooden box structure brought acidic solution into the sump. In addition, there were two 10.1 cm (4 in) drain pipes extending from the west ends of the acid tanks, with another 10.1 cm (4 in) drain line originating from the pump shed. Another overflow drain line connected from the center of the tanks. All of these overflow lines connected to the sump portion of the pi All piping was above ground, except the 5.1 cm (2 in) inlet lines in the wooden box and the sewer drain line.
The 108-D Acid Pit was located to the west of the 108-D building, directly underneath the elevated sulfuric acid tanks, at coordinates (E573736.72, N151770.62). It is also in the sidewall of 100-D-31.
The Acid Pit consisted of two layers of acid-proof brick. The bottom layer was laid in asphalt, while the top layer was laid in Tegal Vitrabond. Joints were sealed with Vitrabond. The acid pit (excluding the sump portion) had an additional third layer, which was coated with 10.1 cm (4 in) of asphalt (HW-74807).The acid pit was used to safely neutralize acidic solutions. In particular, piping was in place to transfer acid that overflowed or leaked out of the tanks and pumps during the unloading process. Also, by using valves located both near the

pumps and near the acid pit, acid could be released directly into the pit. According to drawing HW-74807, only sulfuric acid was supposed to be used in the acid pit.
Two elevated sodium silicate tanks were located just north of the sulfuric acid tanks. Each of these measured 6.1 m (20 ft) in diameter and 4.6 m (15 ft) in height, and had an internal steam heating coil system (HAN-10970, SPEC HW-2036). The tanks were removed prior to 1970 (photograph 53352-5CN) and most of th soil underneath them falls within the cleanup footprint for 100-D-56. According to HAN-10970, the pumps used for unloading sodium silicate from the car spot were identical to those used for the sulfuric acid (50 gpm flow rate). However, SPEC-HW-2036 states instead that there were two 100 gpm pumps. These pumps were also used to transfer sodium silicate into the 108-D building and were housed in a wooden shed with a radiator (SPEC-HW-2036, HW-74550). The tanks were located to the west of the 108-D building and north of the sulfuric acid tanks at (E573737.28065, N151780.51975) and (E573737.28309, N151787.92000). The two tanks were separated by 1.5 m (5 ft). The sodium silicate pumps were located at (E573744.18968, N151787.46223), east of the northernmost storage tank. Both tanks are partially located in the sidewall of 100-D-56.
Sodium silicate was received in railroad tank cars and moved to the two storage tanks by using the nearby pumps. Those same pumps were then used to transfer the silicate into the 108-D building, where it was diluted with process water. This weaker solution was later transported to 185-D for process water treatment (SPEC-HW-2036).
The 108-D Sodium Silicate Sump was constructed in 1954, as part of a series of modifications to the water treatment system (HW-29542). It was located just north of the sodium silicate pumps, and received liquid from the process sewer. The underground structure was fed by a single 15 cm (6 in) vitrified clay pipe that drained the sump (H-1-5239). The sump was covered by a steel grating.
The 108-D Sodium Silicate Sump was built as part of the Alum-Activated Silica Water Treatment Facilities project in 1954. The purpose of the sump was to address the issue of potential spills during the unloading and transfer of sodium silicate solution. However, there is no indication of any drains extending to it from the sodium silicate tanks or pumps, so it is not clear how the sump addressed this issue. The sump drained to the process sewer (H-1-5239).
The 108-D Sodium Silicate Sump was just north of the sodium silicate pumps, at (E573743.77016, N151790.73936) between the sulfuric acid tanks and the sodium silicate tanks, and was used for unloading liquids. It included a platform for unloading chemicals, stairs to reach the top of railroad tank cars, flexible hoses to unload liquids, and a safety shower (HW-75250).
The 108-D Car Spot was used to unload liquid chemicals for the 108-D building and the nearby storage tanks. Using flexible connecting hoses, sodium silicate solution and sulfuric acid were pumped out of railcars and into the storage tanks. A second car spot, 100-D-73, was used to unload solids and move them into the 108-D building. Among the chemicals transported this way was sodium dichromate.

Waste Information:

Type:	Soil	**Amount:**	
Category:	Hazardous/Dangerous	**Units:**	Not Specified
Physical State:	Solid	**Reported Date:**	

Description:

Site contaminants of potential concern include mercury, lead, sodium silicate, and sodium dichromate. It is possible that contaminants leaked into the soil during the lifetime of the sulfuric acid storage tanks and the associated components, particularly prior to 1954 when there was no sump. Resulting in potentially high concentrations of heavy metals such as mercury and lead. In addition, during the process of filling the tanks or pumping it into the 108-D building, acid may have spilled into the soil elsewhere in the site footprint. Near the southern portion of the site boundary, sodium dichromate may have been released as it was being unloaded in the nearby car spot, which is included in the adjacent waste site 100-D-73.

Dimensions:

Site Shape: Not Specified

Site Code: 100-D-101 **Site Classification: Accepted**

Comments:

The sulfuric acid tanks each measured 2.7 by 11.0 m (9 ft by 36 ft) (HAN-10970). The entire Acid Neutralizatior Pit structure (including the side walls and bottom) measured 2.1 by 3.9 m (6 ft, 9 in by 12 ft, 9 in) and extended to a depth of 2.5 m (8 ft, 1 in). The interior of the pit measured 1.4 by 2.4 m (4 ft, 8 in by 8 ft) and was 2.1 m (7 ft) deep (HW-74807). According to HAN-10970, the sodium silicate storage tanks measured 6.1 by 4.6 m (20 b 15 ft), and could hold 151,400 liters (40,000 gallons) of liquid. SPEC-HW-2036 lists their capacity as 35,000 gallons each. The Sodium Silicate Sump was a square structure with each side measuring 0.76 m (2 ft, 6 in) along the interior. The exterior side length was 1.1 m (3 ft, 6 in). The depth of the structure is not provided in drawing H-1-5239. The car spot measured approximately 6.8 by 4.6 m (22 feet, 4 inches by 15 feet). The safet shower had a 1.1 m (3 ft, 7 in) square footprint (W-75250).

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor: WCH Washington Closure Hanford
Reclassifying Contractor/Subcontractor: None
Responsible Project: Not Specified

Site Evaluation

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

Permitting

RCRA Part B Permit:
TSD Number:
RCRA Part A Permit:
Closure Plan:
RCRA Permit Status: Not Specified
Septic Permit:
216/218 Permit:
Inert LandFill:
NPDES:
Air Operating Permit:
State Waste Discharge Permit:
Air Operating Permit Number(s):

Tri-Party Agreement

Lead Regulatory Agency: Not Specified
Unit Category: To Be Determined (TBD)
TPA Appendix : C

Remediation and Closure

Decision Document: None
Decision Document Status: None
Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

Images:

Pathname: //mapweb.rl.gov/widsimg/100D/5599/5599_01.jpg **Date Taken:** 8/19/1944

Description:

Photo shows the sulfuric acid and sodium silicate tanks already in place near the site of 108-D, which is under construction. The piping underneath the sulfuric acid tanks has not yet been installed.

Pathname: //mapweb.rl.gov/widsimg/100D/5599/5599_02.jpg **Date Taken:** 11/24/1944

Description:

Photo shows the sulfuric acid and the recently-painted sodium silicate tanks, with the completed 108-D building in the background.

Pathname: //mapweb.rl.gov/widsimg/100D/5599/5599_03.jpg **Date Taken:** 1/5/1952

Description:

At the far left of the photo, the sodium silicate tanks and a portion of the 108-D building are visible. The sulfuric acid tanks have been removed.

Pathname: //mapweb.rl.gov/widsimg/100D/5599/5599_04.jpg **Date Taken:** 10/21/1970

Description:

Photo shows the 108-D building in 1970, after the end of reactor operations. Both the sulfuric acid and the sodium silicate tanks have been removed.

References:

1. 1/15/1945, 108 B, D & F Acid Car Spot Plan & Sections Arrangement, HW-75250.
2. 7/24/1944, Bldg. No. 108-B-D-F Piping Diagram, HW-74640, Sht 1.
3. 3/1/1944, Building No's 108 B,D&F Arrangements, HW-74553.
4. 7/27/1944, Bldg. No 108-B-D-F Piping Diagram, HW-74641, Sht 2.
5. 4/29/1944, Bldg 108 B,D,F Concrete Acid Storage Area, Hanford Engineer Works, HW-74807.
6. 7/30/1946, Building No. 108-B-D-F Arrangement Ground Floor Plan, HW-74550.
7. 5/1/1944, Building No. 108-B-D-F Arrangement -Plan-40-11-6 Sections D-D.-E-E., HW-74549.
8. GE, 10/19/1953, Project Proposal: Alum-Activated Silica Water Treatment Facilities, HW-29542.
9. E. I. du Pont de Nemours & Company, Inc., 8/9/1945, Construction - Hanford Engineer Works - History of the Project, HAN-10970, Vol. 3 & 4.
10. 4/5/1944, Building No's 108B, D, &F Arrangement Section AA, W-74552.
11. M. S. Gerber, Manhattan Project Buildings and Facilities at the Hanford Site: a Construction History, WHC-MR-0425.
12. 5/9/1944, Specification 2036 for Chemical Feed System Process Water Treatment: Buildings: 105, 108 and 185,
Hanford Engineer Works, SPEC-HW-2036.
13. 1/1/1954, Vicinity Layout 100-D Alum - Activated Silica Water Treatment System, H-1-5239, Rev 1.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-D-102 **Site Reclassification Status: No Action**

Site Names: 100-D-102; Suspect Effluent Leak Adjacent to 107-DR Basin

Site Type: Unplanned Release
Status: Inactive
Hanford Area: 100D
OU/WMA: 100-DR-1

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The site code 100-D-102 was assigned to this site in April 2009. It was created to address potential contamination observed in a historical photograph outside the boundaries of waste site 100-D-29. The feature on the photograph was an irregular shaped, dark feature visible in a 1962 aerial photograph (10974-PHOTO) adjacent to 116-DR-9. The surface of the site has been re-graded many times and is no longer discernible fron the surrounding area.

Location Description:

The site is located immediately to the southwest corner of 107-DR retention basin.

Process Description:

The 107-DR retention basin (116-DR-9) received cooling water effluent from the 105-DR Reactor, and reactor floor wastes from the 1608-DR Waste Water Pump House. The cooling water was held in the basin for as long as operating time would permit, allowing the water to thermally cool and for short-lived radionuclides to decay The water was then discharged to the center of the river via the outfall structures and associated pipelines. The basin experienced several unplanned liquid releases during its lifetime.
The irregular shaped feature visible in the 1962 aerial photograph (10974-PHOTO) is suspected to be an effluent leak. There are several planned and unplanned releases of cooling water effluent reported near the 107-D and 107-DR retention basins. A number of reports published during the operation of the 100-D/DR Area detail the releases. Previously identified releases have been documented as 100-D-4, Sludge Trench #5, 100-D-18, Sludge Trench #4, 100-D-19, Sludge Trench #6, 100-D-20, Sludge Trench #3, 100-D-21, Sludge Trench #2, 100-D-22, Sludge Trench #1, 100-D-29, Effluent Leak #2, 100-D-48, 100-D Reactor Cooling Water Effluent Underground Pipelines, 100-D-49, 100-DR Reactor Cooling Water Effluent Underground Pipelines, 116-D-7, 107-D Retention Basin, 116-DR-1&2, 107-DR Liquid Waste Disposal Trench #1, 116-DR-9, 107-DR Retention Basin, UPR-100-D-2, Effluent Line Leak #1, UPR-100-D-3, Effluent Line Leak #3, UPR-100-D-4, 107-Basin Leaks, UPR-100-D-5, Effluent Line Leak #4 waste sites. The footprint of the waste site 100-D-102 falls outside the footprints of all the other waste sites previously identified. The original drawings which were used to define the boundary of the waste sites were imprecise. It is possible that the aerial photograph shows the actual footprint of a waste site that was previously identified and located using the less precise historical drawings.

Associated Structures:

The waste sites located near and associated with the retention basins include the following WIDS site codes: 100-D-4, Sludge Trench #5, 100-D-18, Sludge Trench #4, 100-D-19, Sludge Trench #6, 100-D-20, Sludge Trench #3, 100-D-21, Sludge Trench #2, 100-D-22, Sludge Trench #1, 100-D-29, Effluent Leak #2, 100-D-48, 100-D Reactor Cooling Water Effluent Underground Pipelines, 100-D-49, 100-DR Reactor Cooling Water Effluer Underground Pipelines, 116-D-7, 107-D Retention Basin, 116-DR-1&2, 107-DR Liquid Waste Disposal Trench #1, 116-DR-9, 107-DR Retention Basin, UPR-100-D-2, Effluent Line Leak #1, UPR-100-D-3, Effluent Line Leak #3, UPR-100-D-4, 107-D Basin Leaks, UPR-100-D-5, Effluent Line Leak #4.

Release Description:

The first known inventory of radioactive releases to the ground in the 100-D/DR area is contained in the

January 29, 1953 report titled "Unconfined Underground Radioactive Waste and Contamination" (HW-27337) b H.G. Ruppert. The report identifies five locations near the retention basins. These sites are later assigned the following waste site codes: 100-D-29, 116-DR-1&2, UPR-100-D-2, UPR-100-D-3 and UPR-100-D-4. A memo was issued with corrections to this report on July 16, 1953 (HW-28737). The corrections to the report did not affect any of the releases near the 107-D/DR retention basins.
Another inventory was made in October 1954 (HW-33305). The report listed those facilities that used for disposal of radioactive liquid wastes. It did not contain unplanned radioactive releases (as was done previously in HW-27337). The report listed just two locations (100-D-29 and 116-DR-1&2) near the 107-D/DR retention basins.
The inventory was updated again in May 1956 (HW-43121). It contained six additional disposal facilities from that reported in HW-33305. The new facilities were later assigned the following waste site codes: 100-D-4, 100-D-18, 100-D-19, 100-D-20, 100-D-21 and 100-D-22.
A comprehensive listing of underground radioactive contamination including planned and unplanned releases was issued again in November 1956 (HW-46715). It contained all of the waste sites mentioned previously but did not add any new ones in the vicinity of the 107-D/DR retention basins.
Hanford drawing (H-1-4046) which shows the underground radioactive waste sites in the 100-D/DR Area was revised in June 1964. It shows many (but not all) of the waste sites previously discussed. The drawing depicts two effluent leaks south of 107-DR. One of these is consistent with the location of 100-D-29. The shape and location was used for the remediation design of the 100-D-29 waste site. The other leak identified on the drawing did not correspond to any of the previously reported releases. This location was subsequently assigne to the UPR-100-D-5 waste site.
A report was issued in November 1967, following the deactivation of the 105-D/DR reactors (DUN-3063). This report mentioned the two retention basins and the sludge buried from 107-DR (100-D-22). It did not reveal an new information related to releases near the 107-D/DR retention basins.

Waste Information:

Type:	Process Effluent	**Amount:**	
Category:	Radioactive	**Units:**	Not Specified
Physical State:	Solid and Liquid	**Reported Date:**	

Description:

Contaminants of potential concern (COPCs) include: Co-60, Cs-134, Cs-137, Eu-152, Eu-154, Eu-155, H-3, Pu-238, Pu-239, Pu-241, Sr-90, U-238, Am-241, Sr-90, arsenic, chromium, lead, and zinc and should be the same as those for the 107-D/DR Retention Basins. The waste is contaminated soil from an unplanned release process effluent.

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor: WCH Washington Closure Hanford
Reclassifying Contractor/Subcontractor: None
Responsible Project: Not Specified

Site Evaluation

Solid Waste Management Unit: No
TPA Waste Management Unit Type : Unplanned Release Unit

Permitting

RCRA Part B Permit: **TSD Number:**
RCRA Part A Permit: **Closure Plan:**

RCRA Permit Status: Not Specified
Septic Permit:
216/218 Permit:
Inert LandFill:
NPDES:
Air Operating Permit:
State Waste Discharge Permit:
Air Operating Permit Number(s):

Tri-Party Agreement

Lead Regulatory Agency: Not Specified
Unit Category: To Be Determined (TBD)
TPA Appendix: C

Remediation and Closure

Decision Document: None
Decision Document Status: None
Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

Images:

Pathname: //mapweb.rl.gov/widsimg/100D/5600/5600_01.pdf **Date Taken:** 6/18/2009
Description:
General location map showing 100-D-102.

Pathname: //mapweb.rl.gov/widsimg/100D/5600/5600_02.pdf **Date Taken:** 6/18/2009
Description:
This graphic was created by overlying shapes on a cropped image of 10974-PHOTO.

Pathname: //mapweb.rl.gov/widsimg/100D/5600/5600-04.jpeg **Date Taken:** 9/29/1962
Description:
The photo is an aerial image of the 100-D Area. There is a dark, irregular shape on the side of 116-DR-9 that represents the basis for creating site 100-D-102.

References:

1. Habel, Len, 4/8/2009, New site code request, 100-D-102 Suspect Effluent Leak Adjacent to 107-DR Basin, 100-D-102.
2. K. R. Heid, 11/14/1956, Unconfined Underground Radioactive Waste and Contamination - 100 Areas, HW-46715.
3. H. V. Clukey, 5/10/1956, Tabulation of Radioactive Liquid Waste Disposal Facilities, HW-43121.
4. H. V. Clukey, 10/8/1954, Tabulation of Radioactive Liquid Waste Disposal Facilities, HW-33305.
5. Ruppert, H.G., 1/1/1953, Unconfined Underground Radioactive Waste and Contamination, HW-27337.
6. Radiological Sciences Department, 6/11/1964, 100-D & DR AREAS, PROCESS WASTE AND BURIAL, H-1-4046.
7. W. J. Tatum, 11/15/1967, Underground Radioactive Materials at 100-D Plant, DUN-3063.
8. Len Habel, 12/12/2011, 100-D-102.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-D-103 **Site Classification: Accepted** Page 1

Site Names: 100-D-103; Suspected Trench and French Drain from 116-D-8 Cask Pad

Site Type: French Drain
Status: Inactive
Hanford Area: 100D
OU/WMA: 100-DR-1

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

WCH investigation identified a surface feature resembling a trench, it is visible in a December 1949 aerial photograph running south from the 116-D-8 Cask Pad.

Location Description:

The area is located at approximately (E) 573,698, (N) 151,250.

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor: WCH Washington Closure Hanford
Reclassifying Contractor/Subcontractor: None
Responsible Project: Not Specified

Site Evaluation

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

Permitting

RCRA Part B Permit:
RCRA Part A Permit:
RCRA Permit Status: Not Specified
Septic Permit:
Inert LandFill:
Air Operating Permit:
Air Operating Permit Number(s):
TSD Number:
Closure Plan:
216/218 Permit:
NPDES:
State Waste Discharge Permit:

Tri-Party Agreement

Lead Regulatory Agency: Not Specified
Unit Category: To Be Determined (TBD)
TPA Appendix: C

Remediation and Closure

Decision Document: None
Decision Document Status: None
Closure Document: None

Site Code: 100-D-103 **Site Classification: Accepted**

Closure Type: Not Specified

Post Closure Requirments:

References:

1. Habel, Len, 4/9/2009, 100-D-103, WCH new orphan site, 100-D-103.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-D-25 **Site Reclassification Status: Interim Closed Out**

Site Names: 100-D-25; Unplanned Release - 116-DR-9 (107-DR) Retention Basin Leaks

Site Type: Unplanned Release
Status: Inactive
Hanford Area: 100D
OU/WMA: 100-DR-1

Start Date: 1/1/1951
End Date:
Pipe Type: Not Specified

Site Description:

This unplanned release site was remediated with the 116-DR-9 Retention Basin under the provisions of the Interim Action Record of Decision for "proximity sites." Leakage from the 107-DR Basin was confined at the south end and beneath the basin. The contamination could not be separately distinguished in the gravel retention basin area. 100-D-25 was remediated with the 116-DR-9 Retention Basin under the provisions for "proximity sites."

Location Description:

The release was located beneath the 107-DR Retention Basin.

Process Description:

The basin had a history of leaking and underwent repairs in 1951. Waste site 100-D-25 documents leakage beneath the basin and outside the south end of the basin where the neoprene seals in the concrete floor failed and the pipes pulled away from the basin walls at the retention basin inlet. The contamination could not be distinguished from other contaminated soil.

Associated Structures:

The leak was associated with 116-DR-9 (the 107-DR Retention Basin).

Site Comment:

Institutional Control (IC) requirements were revised by DOE letter 05-AMRC-0078 on 1/4/2005.

Release Description:

The release involved leakage from the 107-DR Basin.

Waste Information:

Type: Water
Category: Radioactive
Physical State: Liquid

Amount:
Units: Not Specified
Reported Date:

Description:

Radioactively contaminated effluent was released to the site.

References:

1. Carpenter, R. W. to J. G. Woolard, 3/2/1995, Investigation and Characterization 100-D Area Retention Basins, BHI Document 010745.

Field Work:

Type: Analytical Sampling

Begin Date: 2/18/1999
End Date: 3/11/1999
Purpose: Verification sampling

Comment:

Site 100-D-25 was excavated and closed out with the 116-DR-9 Retention Basin, since they are indistinguishable in the field. Samples were taken in both the deep zone (the floor of the excavation at 4.75 meters (15.6 feet)] and the shallow zone (the sidewalls of the excavation]. The contaminants of concern were cobalt-60, cesium-137, europium-152,154,155, nickel-63, plutonium-238, 239/240, strontium-90, chromium VI, and arochlors 1242 and 1260 (PCBs). Shallow zone samples numbers are B0TYW2 through B0TYW9, and B0TYX0 through B0TYX9. Deep zone samples are B0TV37 through B0TV51, B0TVK0 through B0TVK9, and B0TVJ5 through B0TVJ9.

References:

1. Cleanup Verification Package for the 116-DR-9 Retention Basin, CVP-99-00006, Rev 0.

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor:	WCH	Washington Closure Hanford
Reclassifying Contractor/Subcontractor:		None
Responsible Project:		Not Specified

Site Evaluation

Solid Waste Management Unit: No
TPA Waste Management Unit Type : Unplanned Release Unit

Permitting

RCRA Part B Permit:	No	**TSD Number:**	
RCRA Part A Permit:	No	**Closure Plan:**	No
RCRA Permit Status:	Not Specified		
Septic Permit:	No	**216/218 Permit:**	
Inert LandFill:	No	**NPDES:**	
Air Operating Permit:	No	**State Waste Discharge Permit:**	
Air Operating Permit Number(s):			

Tri-Party Agreement

Lead Regulatory Agency: Ecology
Unit Category: CERCLA Past Practice (CPP)
TPA Appendix: C

Remediation and Closure

Decision Document: Explanation of Significant Difference for the 100 Area Remaining Sites Interim ROD (8/2009)
Decision Document Status: Final
Closure Document: Cleanup Verification Package (CVP)
Closure Type: Not Specified

Post Closure Requirments:

Revegetation; Institutional Controls to prevent uncontrolled drilling or excavations into the deep zone (below 4 meters (15 feet) are required.

Closure Group:

Closure Group Name: CG 116-DR-9 and 100-D-25
Type: Interim

Remediation Action:

The 116-DR-9 retention basin received cooling water effluent from the 105-DR Reactor from 1950 until 1965. After the 105-D Reactor was deactivated in 1965, the basin remained active until 1967 as part of the 105-D Reactor effluent system. Leakage occurred as unplanned releases in 1951 beneath the basin and outside the south end of the basin when seals in the concrete floor of the basin failed and the pipes pulled away from the basin walls at the retention basin inlet. The basin had a history of leaking and underwent repairs in 1951. Was site 100-D-25 documents leakage beneath the basin and outside the south end of the basin where the neopre seals in the concrete floor failed and the pipes pulled away from the basin walls at the retention basin inlet. Th contamination could not be distinguished from other contaminated soil. It was remediated with the 116-DR-9 Retention Basin under the provisions for "proximity sites."
Excavation began on October 21, 1997, by removing the overburden materials and underlying contaminated s Overburden materials, which were contaminated, were disposed at the ERDF. On December 28, 1998, the excavation had reached the design limits below the base of the engineered structure (El. 130.25 m [427.35 ft] and cleanup verification sampling was Initiated. At the completion of the remedial action, the excavation area floor was approximately 16,352 square meters (176,013 sq ft) at a depth of 4.75 meters (15.6 ft), and approximately 201,519 metric tons (222,122 tons) of material from the site were disposed of at the ERDF. The excavation will be backfilled in the near future with clean fill materials to the reference grade of El. 135.0 mete (443 ft).
Contaminated soil associated with the process effluent pipelines was not removed completely, but deferred for final remediation with the pipeline waste sites. The 116-DR-9 sidewall areas that are adjacent to future pipelin excavation areas were not sampled as part of the basin cleanup verification effort. These areas will be sample and verified clean as part of the effluent pipeline remediation efforts.

Excavated Material:

Quantity: 201,519.00
Unit Type: Metric Tons
Disposition: Environmental Restoration Disposal Facility

Sampling:

Sampling Region: Verification Samples
Constituent List: Hexavalent Chromium, Stronium-90, PCBs, Gamma Spec, Ni-63, Isotopic Pu

Institutional Controls:

Institutional control (IC) information has been revised as directed by the U. S. DOE letter, 05-AMRC-0078, 1/4/05, following a review of the Institutional Controls (ICs) in the WIDS. For some sites, including this one, WIDS had shown that no IC restrictions were required but the sites were remediated with deep zone criteria s that ICs actually were required. The 2005 evaluation determined that contamination was found in the deep zo so Intuitional Controls to prevent uncontrolled drilling and excavation are required.

Statement Of Protectiveness:

As demonstrated in this verification package, the RAGs for direct exposure, groundwater protection, and surfa

water protection (including protection of the Columbia River) have all been achieved. Because the RAGs have been achieved, the RAOs have also been met. Materials that contain COCs at concentrations that exceed the RAGs have been excavated, sampled, analyzed, and where required, the materials were removed and shipped to ERDF. The remaining soil has been sampled, analyzed, and modeled to show that no residual COC concentrations in vadose zone soils pose a threat to human health, groundwater, or the Columbia River. The 116-DR-9 site is thus verified to be remediated and no longer poses a threat to human health or the environment.

References:

1. 1/4/2005, Institutional Controls Data Revisions in WIDS, 05-AMRC-0078.
2. Carpenter, R. W. to J. G. Woolard, 3/2/1995, Investigation and Characterization 100-D Area Retention Basins, BHI Document 010745.
3. K. R. Heid, 11/14/1956, Unconfined Underground Radioactive Waste and Contamination - 100 Areas, HW-46715.
4. Cleanup Verification Package for the 116-DR-9 Retention Basin, CVP-99-00006, Rev 0.
5. U. S. Environmental Protection Agency, Interim Action Record of Decision for the 100-BC-1, 100-DR-1, 100-HR-1 Operable Units, Hanford Site, Benton County, Washington, EPA, 1995.
6. S.G. Weiss, 1/1/1996, Mitigation Action Plan for Liquid Waste Sites in the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, DOR/RL-96-19.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: **100-D-50:2** **Site Classification: Accepted**

Site Names: 100-D-50:2; Reactor Cooling Water Pipelines from 190-DR Pumphouse

Site Type: Process Sewer
Status: Inactive
Hanford Area: 100D
OU/WMA: 100-DR-1

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The 100-D-50:2 subsite consists of the residual process cooling water supply lines between the 183-DR clearwells and the 105 DR Reactor Building.
The administrative boundaries for the 100-D-50:2 pipelines encompass those process supply lines from the points of discharge at the former 183-DR clearwells to the boundaries of demolition of the 190-DR Pumphouse and from the points of discharge from the 190-DR valve houses to the boundaries of interim safe storage activities at the 105-DR Reactor Building. The pipelines formerly connecting these two groups have been removed as part of decommissioning and demolition of the 190-DR facility. Residual supply piping within the boundaries of the interim safe storage project has been encased in concrete.
The process lines upstream of the former 190-DR Pumphouse consist of four 0.61-m (24-in.) subsurface steel pipelines. Downstream of the 190-DR facility, these pipelines are housed in two separate tunnels that converge upstream of the 105-DR Reactor Building. Several small diameter water lines are also located in the pipe tunnels, including raw water, filtered water, fire protection water, and potential dichromate-treated process water piping. Raw water, fire protection water piping, and filtered water piping are expected to be part of the 100-D/DR clean water/service water pipelines (100-D-63 waste site). This functional pipeline group has been rejected from consideration as a WIDS site based on process knowledge at other production reactor areas (100-B-7, 100-C-5, 100-H-35, and 100-K-59), but potential process water lines (i.e, the lines labeled "SOUTH RISER," "NORTH RISER," "SOUTH PROCESS WATER," and "NORTH PROCESS WATER") will be considered as part of the 100-D-50:2 subsite.

Location Description:

The 100-D-50:2 pipelines are located between the former 183-DR Clearwells and 190-DR Pumphouse and the former 190-DR Pumphouse and 105-DR Reactor Building. The pipelines downstream of the former 190-DR facility are located within subsurface pipe tunnels.

Waste Information:

Type: Not Specified
Category:

Amount: 0.00
Units: Not Specified

Description:

The waste is any potentially contaminated pipelines

References:

1. 3/16/2005, Update site 100-D-50, add ten subsites per attached red line summary.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-D-52 **Site Reclassification Status: Interim Closed Out**

Site Names: 100-D-52; 105-D Downcomer Insulation Space Dry Well

Site Type: French Drain
Status: Inactive
Hanford Area: 100D
OU/WMA: 100-DR-1

Start Date: 1/1/1955
End Date:
Pipe Type: Not Specified

Site Description:

This site has been remediated and interim closed out.
The waste site consisted of a french drain (dry well). The 1 meter (3 foot) diameter dry well was filled with 2.2 meters (5 feet) of 2.5 to 5-centimeter (1 to 2-inch) gravel from the bottom at 6.9 meters (22 feet) below grad to the top at 5.2 meters (17 feet) below grade. The dry well was fed by a 10.2-centimeter (4-inch) steel drain pipe from Room 38A that entered the dry well at 5.8 meters (19 feet) below grade. The drain line discharged into the annulus between a vertical 25.4-centimeter (10-inch) diameter distributor pipe and vertical 10.2-centimeter (4-inch) diameter radiation monitor housing pipe in the center of the dry well. The monitor was used to ensure detection of radiation in the water (condensate or cooling water leakage) from Room 38A. (Room 38A of the 105-D Building is the concrete enclosure for the 105-D Downcomer.) The concentric distributor pipe and radiation monitoring housing pipe ended 30 centimeters (1 foot) above the bottom of the dry well. The radiation monitor pipe extended about 0.6 meters (2 feet) above grade with a valve on the uppe end.

Location Description:

The site was located next to the 105-D Reactor Building at Washington Coordinate System (WCS83S) Easting 573797.076, Northing 151625.344.

Process Description:

This drywell was installed in 1955 to drain noncontaminated condensate water and contaminated cooling wate from the space between the D Reactor process effluent downcomer and the reactor wall. The contaminated cooling water resulted from potential leakage from the downcomer (a metal baffled structure through which collected reactor cooling water cascaded prior to entry into the effluent discharge line). This site also contained a pipe providing access for radiation monitoring that extended from the bottom of the drywell to just above grade.

Associated Structures:

The site was related to 105-D Reactor Building Room 38A.

Site Comment:

An update to the post closure requirements was received from BHI to add "Revegetation; institutional controls to prevent uncontrolled drilling or excavations into the deep zone (below 4.6 meters (15 feet)". This requirement was re-evaluated in 2005.
The downcomer is a metal baffled structure through which collected reactor cooling water cascaded prior to entry into the 1.7-meter (66-inch) effluent discharge line. In about 1955 the downcomer was replaced due to increased reactor cooling water flow and damage to the original downcomer. The interface between the concrete wall (Room 38A) and the metal walls of the replacement downcomer was insulated with fiberglass board and glass wool. When the downcomer was replaced, the dry well was added to drain non-contaminated condensate water and contaminated cooling water that resulted from potential leakage of the downcomer, and collect in the above-mentioned fiberglass board and glass wool insulation attached to the walls of the downcomer (Hanford Drawing H-1-26484).

Waste Information:

Type:	Water	**Amount:**	
Category:	Radioactive	**Units:**	Not Specified
Physical State:	Liquid	**Reported Date:**	

Description:

No record could be found that indicated any radiological or chemical contamination data. Based on available information it was assumed that contamination would be limited to those radionuclides found in reactor effluent water that potentially leaked from the metal downcomer and collected nonradioactive condensate water. The COPCs for the remedial action were developed in the Sampling and Analysis Plan.

References:

1. RW Carpenter to KE Cook, 12/27/1996, 100-D Room 38A Downcomer Insulation Space Dry Well, FDO:12-27-96.
2. Mike Schwab to Kelly Cook, 2/5/1997, Errata - WIDS Input for 100-D-52, 100-D Downcomer Insulation Spac Dry Well, FDO:2-5-97.

Dimensions:

Width:	1.00	Meters	3.28	Feet
Depth/Height:	6.71	Meters	22.00	Feet
Overburden Depth:	5.18	Meters	17.00	Feet
Site Shape:	Not Specified			

References:

1. General Electric, 6/2/1954, 105-D to 107-D IMPROVEMENT PLAN & PROFILE, H-1-26425, Rev 3.

Field Work:

Type: GPS Surveys
Begin Date: 4/15/1998
End Date: 4/15/1998
Purpose: Mapping

Comment:

A single point at the center of the east side of the pipe and the 4 posts surrounding the pipe were located using a Global Positioning System (GPS).

Type: Site Walkdown
Begin Date: 4/15/1998
End Date: 4/15/1998
Purpose: Surveillance

Type: Analytical Sampling
Begin Date: 3/21/2000
End Date: 3/21/2000
Purpose: Cleanup Verification Sampling

Comment:

Seven verification samples were analyzed, including three QA/QC samples: B0XPT2, B0XPT5, B0XPT6, B0XPT7, B0XPT3 (duplicate of B0XPT2), B0XPT8 (split of B0XPT2), and B0XPT4 (equipment blank of B0XPT

References:

1. Bechtel Hanford, Inc., Cleanup Verification Package for the 100-D-52 Drywell, CVP-2000-00018, Rev 0.

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor:	WCH	Washington Closure Hanford
Reclassifying Contractor/Subcontractor:		None
Responsible Project:		Not Specified

Site Evaluation

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

Permitting

RCRA Part B Permit:	No	**TSD Number:**	
RCRA Part A Permit:	No	**Closure Plan:**	No
RCRA Permit Status:	Not Specified		
Septic Permit:	No	**216/218 Permit:**	
Inert LandFill:	No	**NPDES:**	
Air Operating Permit:	No	**State Waste Discharge Permit:**	
Air Operating Permit Number(s):			

Tri-Party Agreement

Lead Regulatory Agency:	Ecology
Unit Category:	CERCLA Past Practice (CPP)
TPA Appendix:	C

Remediation and Closure

Decision Document:	Interim Remedial Action Record of Decision, 100-BC-1, 100-DR-1, 100-HR-1 (1995); Proximity Site to 100-D-48
Decision Document Status:	Final
Closure Document:	Cleanup Verification Package (CVP)
Closure Type:	Not Specified

Post Closure Requirments:

Revegetation; no institutional controls to prevent uncontrolled drilling or excavation into the deep zone (i.e., below 4.6 m [15 feet]) are required.

Closure Group:

Closure Group Name:	CG 100-D-52		
Type:	Interim		
Reclassification Status:	Prepared	**Reclassified On:**	11/8/2000
Excavation Start Date:	1/4/00	**Excavation Completed Date:**	3/21/2000

Remediation Action:

Remedial action began on January 4, 2000, the excavation involved removing the overburden materials, the contaminated structure, and underlying contaminated soil. Contaminated materials were disposed at ERDF. Or February 25, 2000, the excavation reached the design limit at elevation 134.9 meters (443 feet).
At the completion of remedial action the excavation was approximately 415 square meters (4,467 square feet) area with a maximum depth of approximately 7.6 meters (25 feet). Approximately 199 metric tons (219 tons) material from the site were disposed at ERDF. The excavation will be backfilled with appropriate materials to tl reference grade of elevation 142.5 meters (468 feet).

Excavated Material:

Quantity: 199.00
Unit Type: Metric Tons
Disposition: Environmental Restoration Disposal Facility

Cleanup Verification:

Cleanup verification sampling began on March 21, 2000, and was finished on the same day. Waste site contaminants of concern (COCs) and contaminants of potential concern (COPCs) identified through process knowledge are listed in the 100 Area Remedial Action Sampling and Analysis Plan (SAP). The COPCs that were detected during field sampling (i.e., during remediation) were reclassified as COCs and are addressed in the CVP. These COCs are cesium-137, europium-152, uranium-233/234, uranium-238, total chromium, and lead. Hexavalent chromium is not a COC or COPC at the 100-D-52 Downcomer Insulation Space Drain Dry Well because this was a small site that was known not to have received process effluent and was not associated w disposal of liquids containing hexavalent chromium.

Sampling:

Sampling Region: Verification Samples
Constituent List: Cesium-137, Isotopic U, Lead, Europium 152, 154, 155, Total Chromium

Institutional Controls:

Institutional control (IC) information has been revised as directed by the U. S. DOE letter, 05-AMRC-0078, 1/4/05, following a review of the Institutional Controls (ICs) in the WIDS. For some sites, including this one, b the CVP/reclassification forms and WIDS had indicated that IC restrictions were needed. However, these sites were remediated only with the more restrictive shallow zone criteria; deep zone criteria were not used. Therefore, No Institutional Controls to prevent uncontrolled drilling or excavation into the deep zone (i.e., belc 4.6 m [15 feet]) are required.

Statement Of Protectiveness:

This CVP demonstrates that remedial action at the 100-D-52 site has achieved the RAOs and corresponding RAGs established in the approved interim action ROD (EPA 1995) and RDR/RAWP (DOE-RL 1998b). Materials from the 100-D-52 site that contain COCs at concentrations exceeding the RAGs have been excavated and disposed of at the ERDF. The remaining soils have been sampled, analyzed, and modeled to show that residua concentrations in the shallow zone will support future land uses that can be .represented (or bounded) by a rural-residential scenario, and that residual concentrations throughout the site pose no threat to groundwater the Columbia River. The acceptability of unrestricted direct exposure to deep zone soils has not been demonstrated; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zon (i.e., below 4.6 m [15 ft]) are required. The 100-D-52 site is verified to be remediated in accordance with the ROD and may be backfilled.

Images:

Pathname: //mapweb.rl.gov/widsimg/100d/3989/3989_01.jpg **Date Taken:**
Description:

Pathname: //mapweb.rl.gov/widsimg/100d/3989/3989_02.jpg **Date Taken:** 4/15/1998
Description:
Photo shows valved pipe extending vertically from the center of the french drain.

References:

1. LA Dietz, 2/27/2003, Updates to WIDS Database, 105989.
2. 1/4/2005, Institutional Controls Data Revisions in WIDS, 05-AMRC-0078.
3. Bechtel Hanford, Inc., Cleanup Verification Package for the 100-D-52 Drywell, CVP-2000-00018, Rev 0.
4. RW Carpenter to KE Cook, 12/27/1996, 100-D Room 38A Downcomer Insulation Space Dry Well, FDO:12-27-96.
5. Mike Schwab to Kelly Cook, 2/5/1997, Errata - WIDS Input for 100-D-52, 100-D Downcomer Insulation Space Dry Well, FDO:2-5-97.
6. General Electric, 6/2/1954, 105-D to 107-D IMPROVEMENT PLAN & PROFILE, H-1-26425, Rev 3.
7. General Electric, 5/3/1955, DOWNCOMER REPLACEMENT INSTALLATION, H-1-26484, Rev 6.
8. General Electric, 8/30/1954, DOWNCOMER REPLACEMENT, H-1-26490, Rev 2.
9. U. S. Environmental Protection Agency, Interim Action Record of Decision for the 100-BC-1, 100-DR-1, 100-HR-1 Operable Units, Hanford Site, Benton County, Washington, EPA, 1995.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-D-59 **Site Reclassification Status: Rejected**

Site Names: 100-D-59; French Drain at the 183-D Acid Transfer Station

Site Type: French Drain
Status: Inactive
Hanford Area: 100D
OU/WMA: Not Applicable

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The site is an upright vitrified clay pipe adjacent to the acid transfer structure at the railroad tracks next to the 183-D Building. Pipes used to transfer the acids from the rail cars are still on the structure, but the pipe sending overflow to the french drain has been disconnected (part of the pipe has been removed). The french drain is about 25 centimeters (10 inches) high, and 45 centimeters (18 inches) in diameter, with a steel cover and a 2.5-centimeter (1-inch) galvanized steel pipe rising up through the steel cover.

Location Description:

The drain is on the east side of the railroad tracks that lead up the west side of the 183-D Building. It is between the transfer station and the underground pipe channel.

Process Description:

Sulfuric acid was used to adjust the pH of the water in the 183-D Water Treatment Facility. It arrived in railcars and was transported to the facility via underground pipelines. The french drain received overflow from the acid transfer operations.

Associated Structures:

This drain is associated with the acid transfer station at the 183-D Building.

Site Comment:

Chemicals added at the 183-D facility were sulfuric acid (to adjust water pH), lime, chlorine, and products containing primarily ferrous sulfate (to coagulate suspended solids in the water before filtration). Sodium dichromate was added in the 190-D Building, and the sodium dichromate transfer station was south of the 183-D Building.

Waste Information:

Type: Chemical Release
Category: Unknown
Physical State: Solid

Amount:
Units: Not Specified
Reported Date:

Description:

The waste disposed to the french drain was overflow sulfuric acid from railroad car transfer operations. Any waste acid would be neutralized in the alkaline Hanford soils.

Dimensions:

Depth/Height:	0.25	Meters	0.82	Feet
Diameter:	0.45	Meters	1.48	Feet
Site Shape:	Circle			

Comments:
The depth into the ground is unknown.

References:
1. S. G. Weiss, Field Logbook, EL-1428.

Field Work:

Type: Site Walkdown
Begin Date: 1/17/2000
End Date: 1/17/2000
Purpose: field mapping

Comment:
The site was visited in order to map it using GPS. The GPS could not be used due to obstructions. A tape measure was used to determine the distance of the site from features mapped during the latest flyover. Using these data, the coordinates of the site were determined to be 573250.8, 151552.2.

References:
1. K.A. Prosser, 6/30/1999, Field Logbook, EL-1388-1.

Type: Site Walkdown
Begin Date: 1/12/2000
End Date: 1/12/2000
Purpose: Evaluate site, take photos

References:
1. S. G. Weiss, Field Logbook, EL-1428.

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor:	WCH	Washington Closure Hanford
Reclassifying Contractor/Subcontractor:		None
Responsible Project:		Not Specified

Site Evaluation

Solid Waste Management Unit: Yes
TPA Waste Management Unit Type : Inactive Contaminated Structure

Permitting

RCRA Part B Permit:	No	**TSD Number:**	
RCRA Part A Permit:	No	**Closure Plan:**	No
RCRA Permit Status:	Not Specified		
Septic Permit:	No	**216/218 Permit:**	
Inert LandFill:	No	**NPDES:**	
Air Operating Permit:	No	**State Waste Discharge Permit:**	

Air Operating Permit Number(s):

Tri-Party Agreement

Lead Regulatory Agency: Ecology
Unit Category: CERCLA Past Practice (CPP)
TPA Appendix: None

Remediation and Closure

Decision Document: None
Decision Document Status: None
Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

Images:

Pathname: //mapweb.rl.gov/widsimg/100d/4411/4411_01.jpg **Date Taken:** 1/12/2000
Description:
The acid transfer station at 183-D; the french drain is behind the tall gray metal structure.

Pathname: //mapweb.rl.gov/widsimg/100d/4411/4411_02.jpg **Date Taken:** 1/12/2000
Description:
The galvanized pipe hooking the french drain to the transfer station piping has been disconnected.

Pathname: //mapweb.rl.gov/widsimg/100d/4411/4411_03.jpg **Date Taken:** 1/12/2000
Description:
This view shows the french drain, pipe trench, and valve box.

Pathname: //mapweb.rl.gov/widsimg/100d/4411/4411_04.jpg **Date Taken:** 1/12/2000
Description:
The pipe trench enters the 183-D Building on the south side; the french drain is behind the camera.

References:

1. J. J. Sharpe, E. T. Coenenberg, 100-D/DR Reactor Area Pipeline Evaluations, CCN 075317.
2. M. S. Gerber, Manhattan Project Buildings and Facilities at the Hanford Site: a Construction History, WHC-MR-0425.
3. R. W. Carpenter, 9/20/1993, 100-D Area Technical Baseline Report, WHC -SD-EN-TI-181, Rev 0.
4. K.A. Prosser, 6/30/1999, Field Logbook, EL-1388-1.
5. S. G. Weiss, Field Logbook, EL-1428.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-D-63 **Site Classification: Accepted**

Site Names: 100-D-63; 100-D/DR Clean Water Pipelines; 100-D/DR Service Water Pipelines

Site Type: Product Piping
Status: Active
Hanford Area: 100D
OU/WMA: 100-DR-1

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The waste site is comprised of the 183-D acid addition facility. It includes a concrete trench that protected the service piping (air, steam, filtered water, lime slurry, sulfuric acid) and drained acid waste to the neutralization pit. The underground piping contained in the trench are part of the site with the exception of the filtered water line which is assigned to 100-D-63. The site also includes a dry well, two sumps (exterior to the trench), two storm drains, a storm sewer and an acid/silica supply line.

Location Description:

These pipelines were located in the 100-D Area within 100-DR-1 and 100-DR-2 Operable Units.

Process Description:

The pipelines were designed to supply raw river water from the 181-D River Pump House, treated and filtered a the 183-D Filter Plant to 100-D Area facilities, including the 184-D Boiler House, 182-D Pump House, 190-D and 190-D Annex Pump Houses, 190-DR and 190-DR Annex Pump Houses, 105-D and 105-DR Reactor Buildings, and the 187-D and 187-DR elevated water tanks adjacent to the 105-D and 105-DR Reactor Buildings. The 183-D and DR Filter Plants were used to remove suspended fine solids from river water using chemical flocculation and pH additives, sedimentation basins, and sand/coal bed filters for the physical and chemical treatment of river water to provide solids-free water suitable for reactor cooling, producing steam, and to supply the ancillary water uses within the 100-D and 100-DR Areas, e.g. water makeup, fire water, emergency cooling water (high towers), etc. Prior to 1956 - 1957, the 182-D reservoir was used as the principa water supply source for the 183-D filter plants. Following implementation of Project CG-558, the purpose of the reservoir was to provide reserve (emergency) water for reactor cooling, condenser water for the steam condensers, and raw water (export water) to the 200 Areas. The 182-D Reservoir consists of a rectangular, sloped, reinforced concrete basin. The reservoir was divided into two sections by a 25.4 centimeters (10 inches) reinforced concrete wall running parallel to the short dimension of the structure. The inlet section of the reservoir, known as the reserve section, held 56.8 million liters (15 million gallons) of water, while the other, or working section, holds 37.9 million liters (10 million gallons). The Columbia River water was filtered and chemically treated to prevent filming in the reactor process tubes. Alum, sulfuric acid and chlorine were proportioned in the 183-D Head House (component of the 183-D Filter Plant). Raw bauxite was stored in bunkers in the 183-D Filter Building Head House and flowed to a proportional dry chemical feeder which supplied bauxite at the required rate. From the conveyor belt of the proportional feeders, the bauxite fell into a lead-lined mixing chamber together with sulfuric acid and water. The sulfuric acid was used to control the pH of the water. The reaction of the bauxite and diluted sulfuric acid formed a solution of alum and excess diluted sulfuric acid. Chlorine was added at this point for algae control in the settling basins. There were two flocculators in series for each settling basin in the 183-D Filter Plant. The purpose of the settling basins was to allow heavier particulate matter to settle out of the water before entering the filters. The filter media consisted o 0.31 meters (12 inches) of graded gravel, 0.15 meters (6 inches) of sand, and 0.61 meters (24 inches) of crushed and graded anthracite coal. Water entered the gullet from the influent flume through an influent valve and flowed to both halves of the filter through port openings. An organic polyelectrolyte filter aid to improve filte efficiency was added to the water in the gullet to improve water quality. The filtered water collected in the false bottom below the filter and flowed through effluent piping to the effluent flumes. Valves controlled the amount o water passing through the effluent flumes and into the 183-D Clearwells (still within the 183-D Filter Building).

Site Code: 100-D-63 **Site Classification: Accepted**

The 183-D pump room was the primary supply point for filtered water for the entire production reactor plant. Th eastern most clearwell provided the filtered water for power house water, fire and sanitary water (chlorinated before delivery), and for emergency filtered water. Separate pumps and clearwells provided water for the primary reactor cooling water. Filter backwashing was supplied from the clearwells by backwash pumps located in the 183-D Filter Building Pump Room. Backwash water entered the filter collection area, flowed upward through the filter media into the gullet and through a waste valve into a sewer. The backwash water for the 183-DR filters was supplied from the 183-D Pump Room via a 0.76 meters (30 inches) cross-tie pipeline to the 183-DR Pipe Gallery. There was no equivalent to the 183-D Filter Plant Clearwells at 183-DR Filter Plant. This same pipeline was also used to supplement the 183-DR water requirements. The 183-D and 183-DR Filte Plant Pump Rooms were the primary supply points for filtered water for each reactor area and the associated limited area (outside the reactor exclusion area). For the primary reactor cooling system, pumps were provided to transfer water to the 190-D and 190-DR Storage Tanks via 0.91 meter (36 inch) and 0.41 meter (16 inch) pipelines, backwash water for the filters and filtered water for the emergency high tanks. The pumps that supplied the four 1,135,624 Liter (300,000 gallon) high tanks (two at 105-D and two at 105-DR) also provided filtered water for cooling the primary coolant pumps and motors, filter controls and service, reactor thermal loop and control rod cooling. Pumps at 183-D Filter Plant were provided to supply the power house water, fire and sanitary water and for additional emergency filtered water. Four pumps at the 183-D Filter Plant were connected to the combined sanitary and fire protection system. For the 184-D Power House, boiler feed water was provided from four sources of supply, the first three from the 183-D Filter Plant Pump Room and a last ditch source of raw water from the 182-D Reservoir. At the 184-D Power House, three Zeolite water softeners were used to soften the filtered water. In the 184-D, boiler water treatment chemicals, sodium sulfite and tri-sodium phosphate, were used to reduce scale. In the event of total failure of the electric power to the Hanford Site, a secondary power source was available. It was independent of the electrical or primary source, and was capable of providing adequate cooling water to the reactor until the primary system could be re-established.

Associated Structures:

The structures related to this site were the 184-D Boiler House, 182-D Pump House, 190-D and 190-D Annex Pump Houses, 190-DR and 190-DR Annex Pump Houses, 105-D and 105-DR Reactor Buildings, and the 187-D and 187-DR elevated water tanks adjacent to the Reactor Buildings. Related WIDS sites include: 100-D-63, 100-D/DR Service Water Pipelines, 100-D/DR Clean Water Pipelines, 100-D-31, 100-D Water Treatment Facilities Underground Pipelines (See Subsites), 100-D-77, DR Reactor Water Treatment Facility, Acid Facility, 183-DR Head House, 183-DR Filter Building, Sodium Dichromate Systems, 183-DR Flocculation Basins, 183-DR Sedimentation Basins.

Site Comment:

Ecology believes that the clean water pipelines (beginning at 181-D River Pump House) were contaminated based on the information in the Technical Baseline Report, page 4-66). "In May 1964, one of the river pumps was removed for disassembly and maintenance. A radiation survey with a portable GM counter revealed that the interior surfaces of the pump were contaminated with radioactive material with counts of 1,500 to 2,000 c/m. Also in May of 1964, the stator of one pump was removed for maintenance. A smear of the loose material on the windings was obtained and counted with a portable GM counter and also allowed to decay for a period. The results are that on 5/27/1964 counts were 8,000 c/m, on 6/8/1964 the counts were 300 c/m and on 6/17/1964 the counts were 400 c/m. A gamma spectrum scan of the pump stator was run for five minutes on a multi-channel analyzer with the following results; on June 18, 1964, Ce-144 and Cs-137 were present. As a result of these radiological investigations, any decommissioning activities should consider the possibility of radioactive contamination on the interior surfaces of piping systems, valves, and pumps." Thus, the clean water pipelines at 100-D are an 'Accepted" waste site and will require sampling.

Waste Information:

Type:	Water	**Amount:**	
Category:	Unknown	**Units:**	Not Specified

Site Code: 100-D-63 **Site Classification: Accepted**

Physical State: Not Specified **Reported Date:**

Description:

The pipelines were the waste, they were associated with the raw water, filtered water, sanitary water, and fire water systems in the 100-D Area. Chemical treatment included pH adjustment (with sulfuric acid or lime), chlorination for algae control, the addition of flocculants, (primarily alum prepared at the 183-D Filter Plant (Hea House component) with bauxite and sulfuric acid), and a commercial organic polymer flocculation/filtration aid. This site also includes the potable and fire water that was delivered to the 1700 (site service buildings) series buildings. Contaminants of potential concern include radiological contaminants.

Dimensions:

Site Shape: Not Specified

Comments:

The pipeline dimensions varied from 0.15 meters (6 inches), 0.20 meters (8 inches), 0.31 meters (12 inches), 0.41 (16 inches), 0.61 meters (24 inches), 0.76 meters (30 inches), 0.91 meters (36 inches), 1.07 meters (42 inches), and 1.2 meters (48 inches).

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor: WCH Washington Closure Hanford
Reclassifying Contractor/Subcontractor: None
Responsible Project: Not Specified

Site Evaluation

Solid Waste Management Unit: No
TPA Waste Management Unit Type : Inactive Contaminated Structure

Permitting

RCRA Part B Permit:
TSD Number:
RCRA Part A Permit:
Closure Plan:
RCRA Permit Status: Not Specified
Septic Permit: No
216/218 Permit:
Inert LandFill:
NPDES:
Air Operating Permit:
State Waste Discharge Permit:
Air Operating Permit Number(s):

Tri-Party Agreement

Lead Regulatory Agency: Not Specified
Unit Category: To Be Determined (TBD)
TPA Appendix: C

Remediation and Closure

Decision Document: Explanation of Significant Difference for the 100 Area Remaining Sites Interim ROD (8/2009)
Decision Document Status: Final

Site Code: 100-D-63 **Site Classification: Accepted**

Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

References:

1. 1/1/1954, 100-DR Water Plant General Excavation Plan, H-1-9604, Rev 5.
2. 11/10/2008, Updates and checklists for D Orphan sites posted on Dmshare drive by L Dietz.
3. Atomic Energy Commission, Underground Water Pipelines 100-D Area Hanford Works (No Official Title Provided), M-1901-D, Rev 0, Sht 4.
4. Atomic Energy Commission, Underground Water Pipelines 100-D Area Hanford Works (No Official Title Provided), M-1901-D, Rev 0, Sht 2.
5. 1/1/1954, Underground Water Outside Lines 100 D Area, Sheet 1, M-1901-D.
6. Atomic Energy Commission, Underground Water Pipelines 100-D Area Hanford Works (No Official Title Provided), M-1901-D, Rev 3, Sht 5.
7. The Staff of the Irradiation Processing Department, 4/1/1963, Hazards Summary Report - Description of the 100B, 100C, 100D, 100DR, 100F and 100-H Production Reactor Plants, HW-74094.
8. M. S. Gerber, Manhattan Project Buildings and Facilities at the Hanford Site: a Construction History, WHC-MR-0425.
9. 1/1/1964, Fire & Sanitary Water Modifications - 100D Area, General Electric Company., H-1-14601.
10. 1/1/1950, General Yard Process Raw Water Piping, Sheet 2, H-1-9651, Rev 2.
11. 1/1/1950, General Yard Process Raw Water Piping, Sheet 1, H-1-9650, Rev 3.
12. Chas. T. Main, Inc., 6/7/1950, GENERAL SITE PLAN - 100-DR WATER PLANT, H-1-9603, Rev 5.
13. 1/1/1945, Architectural Key Plan 190-DR Annex Reactor Plant Modifications
Company., H-1-9916-DR, Rev 1.
14. 1/1/1957, General Yard Sanitary, Fire & Filtered Water Piping, General Electric Company.,
H-1-9660-DR.
15. 1/1/1950, General Yard Makeup & Backwash Piping, H-1-9653.
16. 1/1/1950, General Yard Emergency Raw Water & Condenser Water Piping
Company., H-1-9652-DR, Rev 2.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: **100-D-75:1** **Site Classification: Accepted**

Site Names: 100-D-75:1; 151-D Primary Electrical Substation

Site Type: Electrical Substation
Status: Inactive
Hanford Area: 100D
OU/WMA: 100-DR-1

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The substation consists of a fenced, gravel-bed yard measuring approximately 165 m (541 ft) on a side with the 151-D Switch House along the northern fence line. A railroad spur enters the yard from the east, and parallels the north fence line. Concrete pads of various sizes protruded from the crushed gravel bed throughout the yard, supporting a variety of electrical equipment, including transformers, circuit breakers, and power line towers and stands.
The 31,250 KVA transformers were originally located at N 151338, E 573515; and N 151338, E 573556. Sometime after 1956 a third very large ground transformer was added at N 151374, E 573516. The circuit breakers were located at N 151300, E 573494; N 151300, E 573536; and N 151300, E 573576.

Location Description:

The 151-D Building and associated switchyard are located approximately 350 m (107 ft) southwest of the 105-D Reactor building and 235 m (72 ft) northwest of the 105-DR Reactor building, with the center point of the yard at N 151328, E 573542.

Process Description:

The Midway Station fed 230KV power to the 31,250KVA transformers located in the 151-D switchyard. From these transformers, power was transmitted via overhead and underground cables to secondary and distribution substations located throughout the 100-D/DR Area. Circuit breakers were also in service to support the switchyard operations.
PCB-containing oil was transferred, as needed, from a rail tanker on the railroad spur through over ground hoses and piping to transformers and oil circuit breakers in the yard.
An oil spill from one of the 151-D switchyard transformers was remediated in 1995 (100-D-27). This may not have been the extent of transformer leaks and spills, because such events were not consistently recorded before about 1985. And there is anecdotal information from power operators that transformer spills and leaks were not uncommon. Therefore, any transformer or circuit breaker pad and surrounding soil may have PCB contamination.
According to the Electrical Utilities Craft Supervisor, the equipment in the 151D yard is inactive. The only thing energized is the overhead lines going through the yard. Because there is a section of energized 230kV buswork that runs through the substation yard, the yard is off-limits to all except qualified T system workers. Most of the equipment within the substation has already been drained of oil.
The circuit breakers stored in the northeast corner of the switchyard are disconnected and drained. These circuit breakers could not have been in use at this location. When in service the circuit breakers would have to be put on a concrete pad and bolted to the overhead bus.
Two smaller transformers that were added at the switchyard are old 181D transformers (100-D-75:2). Both PCB Contaminated Transformers were drained on 7/12/2005. This action stopped the 5-year TSCA time requirement. Based on the available aerial photography it is evident that the two smaller transformers were added to the switchyard sometime between April 2008 and August 2009.
The switch house was used as a regulatory component to the switchyard. Historically, there are no processes that indicate any type of contamination to be associated with this structure.

Associated Structures:

Site Code: 100-D-75:1 **Site Classification: Accepted**

The 151-D Primary Substation distributed 13.8KV power to transformers located at the 151-D Switch House, 181-D River Pump House, 182 Head Houses, 183 Filter Houses, 184-D Power House, 186-D Water Treatment Plant, 190 Pump Houses, and 105-D/DR Reactors, which in turn distributed power to associated facilities.

Site Comment:

The 100-D-75:1 subsite will be recommended for cleanup by remove, treat and disposal under a final action Record of Decision.

Waste Information:

Type: Soil
Category:
Amount: 0.00
Units: Not Specified

Description:

There may be PCB contaminated soil at these substation sites.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-D-96 **Site Classification: Accepted**

Site Names: 100-D-96; 100-D/DR Additional French Drains

Site Type: French Drain
Status: Inactive
Hanford Area: 100D
OU/WMA: 100-DR-1

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The site consists of eight components (seven 100-D and 100-DR area French Drains and one dry well) and their underlying soils. These French Drains received steam condensate from non-radioactive buildings.

Process Description:

The 184-D Power House boiler facility supplied high pressure steam to all D area buildings for heating purposes through an above grade pipeline system. The boiler facility utilized clean filtered water from the 183-D filter building. The steam supply was used in a non-contact radial heating system and remained uncontaminated. The steam transport process utilized a high pressure supply line and a low pressure return or discharge line. It was necessary to bleed both the supply and return lines to prevent condensate build up. The condensate was typically blown off from the above grade piping system into a below grade covered French Drain as a safety precaution as illustrated on construction drawing H-1-9644-DR and H-1-15203. Construction drawings H-1-9640-DR thru H-1-9645-DR of the outside steam distribution system indicate steam trap locations (French Drains) and typical construction.

Site Comment:

During the research phase of the Orphan Site Evaluation (OSE) construction drawings, aerial photographs, GIS utility layers, process knowledge and field observations confirmed the locations and use of these drains. All above grade steam piping and supporting systems have been removed; all that remains are the French Drains No contaminants of concern were listed because the French drains received clean steam condensate only. Analogous rejected WIDS sites include: 300-152, 300-168, 300-102, 300-105, 300-106, 300-201, 300-169, 300-198, 300-199, 300-113, 300-158 and 400-FD8
The following six French Drains were discovered intact at locations described on drawings.
Drain 1. Site investigation conducted on 4/20/2006 found the 0.6 meters (24 inches) diameter French Drain located south of the 151-D Switch Yard, at N151278.3, E573499.3. It was constructed of concrete, cobble filled and 5 centimeters (2 inches) above grade, photos 04202006-161-34 and 04202006-161-35.
Drain 2. Site investigation conducted on 5/01/2006 found the 0.45 meters (18 inches) diameter French Drain located east of the 151-D Switch Yard, at N151354.49 E573618.03. It was constructed of concrete, cobble filled, and at grade level. Photo 05012006-205-8.
Drain 3. Site investigation conducted on 5/04/2006 found the 0.6 meters (24 inches) diameter French Drain located northeast of the 1716-D Maintenance Garage at N151801.59 E573551.46. It was constructed of concrete, at grade level, steel plate covered with pipe inlet notch, photo 05042006-289-07.
Drain 4. Site investigation conducted on 5/04/2006 found the 0.6 meters (24 inches) diameter French Drain located west of the 1902-D Water tank, N151775.94 E573403.86. It was constructed of concrete, cobble filled, and at grade level. Photo 05042006-302-22.
Drain 5. Site investigation conducted on 3/30/2006 found the 0.91 meters (36 inches) diameter French Drain located next to a utility pole with a concrete protection barrier east of the 181-D River Pump House, at N151736.05 E572813.26. It was constructed of Vitrified Clay Pipe (VCP), cobble filled, and 23 centimeters (9 inches) above grade. Photo 03302006-12-04.
Drain 6. Site investigation conducted on 5/04/2006 found the 0.91 meters (36 inches) diameter Drywell located east of the 183-D Clearwells at N151597.21 E573383.12. It was constructed of concrete, at grade level, and steel plate covered with pipe inlet notch. Photo 05042006-310-30.

Site Code: 100-D-96 **Site Classification: Accepted**

The remaining two French Drains (drain seven and drain eight) were observed on construction drawings H-1-15201 and H-1-15203. However the actual drains were not found in the filed. It is not known whether the were removed or covered during grading.
7. Site investigation conducted on 2/27/2008 was unable to locate the French Drain observed on drawings as being located west of the 184-DA building at N151743.00 E573406.00.
8. Site investigation conducted on 3/6/2008 was unable to locate the French Drain observed on drawings as being located northwest of the 1716-D Maintenance Garage at N151797.0 E573551.0.

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor: WCH Washington Closure Hanford
Reclassifying Contractor/Subcontractor: None
Responsible Project: Not Specified

Site Evaluation

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

Permitting

RCRA Part B Permit:
TSD Number:
RCRA Part A Permit:
Closure Plan:
RCRA Permit Status: Not Specified
Septic Permit: No
216/218 Permit:
Inert LandFill:
NPDES:
Air Operating Permit:
State Waste Discharge Permit:
Air Operating Permit Number(s):

Tri-Party Agreement

Lead Regulatory Agency: Not Specified
Unit Category: To Be Determined (TBD)
TPA Appendix: C

Remediation and Closure

Decision Document: Explanation of Significant Difference for the 100 Area Remaining Sites Interim ROD (8/2009)
Decision Document Status: Final
Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

References:

1. 7/3/1968, CIVIL PLOT PLAN OUTSIDE LINES: REPLACEMENT OF STEAM GENERATING FACILITY, H-1-15201, Rev 1.
2. 9/17/1968, CIVIL SECTION & DETAIL OUTSIDE LINES, H-1-15203, Rev 1.
3. 2/13/1950, Outside Steam Distribution Profile, H-1-9643-DR, Rev 2, Sht 2.

4. 2/13/1950, Outside Steam Distribution Profile, H-1-9642-DR, Rev 2, Sht 1.
5. 2/23/1950, Outside Steam Distribution Plan, H-1-9641-DR, Rev 2, Sht 2.
6. 2/13/1950, Outside Steam Distribution Misc. Details, H-1-9644-DR, Rev 2, Sht 1.
7. 2/23/1950, Outside Steam Distribution Plan, H-1-9640-DR, Rev 2, Sht 1.
8. 4/10/2006, Field Logbook for 100-F and 100-D Orphan Sites Evaluation, EL-1583-6.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: **100-H-28:7** **Site Classification: Accepted**

Site Names: 100-H-28:7; 183-H Process Water Lines

Site Type: Process Sewer
Status: Inactive
Hanford Area: 100H
OU/WMA: 100-HR-1

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

This subsite encompasses the filtered/treated water supply lines originating at the 183-H Filter Plant, including two 0.91-meters (36-inches) steel lines terminating at the 190-H building, a 0.76-meters (30-inches) line terminating at the 182-H Reservoir pumphouse, two 0.25-meters (10-inches) steel lines terminating at the 184-H Power House, and the former supply lines to the emergency cooling water high tanks at the 105-H Reactor Building.

Location Description:

The 100-H-28:7 process water lines are part of the 100-HR-1 Operable Unit. These pipelines are located between the former 183-H Filter Plant Pump House, 184-H Boiler House, 190-H Pump House, the 187 Elevated Water Towers, and the 105-H Reactor. These pipelines are approximately 1.8 to 3 m (6 to 10 ft) below existing grade.

Waste Information:

Type: Not Specified
Category:

Amount: 0.00
Units: Not Specified

Description:

The waste would be any potentially contaminated soil and remaining pipeline components.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-H-36 **Site Classification: Accepted**

Site Names: 100-H-36; 116-H-5 Spillway; 1904-H Spillway; 100-H-34:1 Flume (Spillway) for the 116-H-5 Outfall Structure

Site Type: Outfall
Status: Inactive
Hanford Area: 100H
OU/WMA: 100-HR-1

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The 100-H-36 Spillway (also referred to as a flume) is an underground concrete sluiceway that led from the 116-H-5 Outfall Structure to the river shoreline.

Location Description:

The site is located on the Columbia River shoreline north of the 116-H-7 Retention Basin. Assuming midline Washington State Plane coordinates, the underground spillway exits the south face of the 116-H-5 outfall. takes an immediate 45 degree turn in the upstream direction, and terminates.

Process Description:

The spillway carried effluent overflow from the outfall (116-H-5) structure to the shoreline of the river for release It was planned to be used only if the river effluent pipelines (100-H-34) were blocked, damaged, or undergoing maintenance. There is no corroborated physical or historical evidence that the spillway was ever used. The slope between the outfall and the river is covered with large basalt riprap boulders that have been mortared in place, extending about 73 meters (80 yards) north and south of 116-H-5. The exit end of the underground sluiceway has been covered with concrete rubble and is no longer visible. A shallow, dish-shaped concrete runoff pad extends across the beach from the spillway exit to the low water line.

Associated Structures:

The site is associated with the 100-H-34 River Effluent Pipelines and the 116-H-5 Outfall Structure.

Site Comment:

During a site visit on February 7, 2005, the two sections of basalt riprap boulders along the slope leading to the edge of the river were visible. At the bottom of the downriver (or southernmost) section of riprap bank were the remnants of a concrete ramp (or purposely placed concrete blocks) that ended abruptly just above the water line. A modified sluiceway of sorts was evident in the river that angled from the shore toward the downriver flow and had two apparent edges. The downriver (or southernmost) edge appeared to be a berm, and the upriver (o northernmost) edge appeared to be chunks of concrete in a distinct line. Originally, the 116-H-5 Outfall, Spillway (Flume) and river pipelines were entered into WIDS as one site number. Due to remediation project needs the outfall structure, the River Effluent Discharge lines (100-H-34) and the spillways (flumes) (100-H-36) have been documented as separate waste sites.

Waste Information:

Type: Construction Debris
Category: Nondangerous/nonradioactive
Physical State: Not Specified

Amount:
Units: Not Specified
Reported Date:

Description:

Possible chemical and/or radionuclide contamination (see Contaminants of Potential Concern). The contaminants of potential concern are based on those for the 116-H-5 outfall, and include C-14, Cs-137, Sr-90,

U-235, -238, and Pu-239/240.

References:
1. 1/1/2004, 100 Area Remedial Action Sampling and Analysis Plan, DOE/RL-96-22, Rev 4.

Dimensions:

Width:	7.01	Meters	23.00	Feet
Site Shape:	Not Specified			

Comments:
The spillway, which drops 3.7 meters (12 feet) from the outfall face to discharge, is a total of 7 meters (23 feet) wide, and consists of three independent chambers. The ceiling, floor, and separators are 0.3 meters (1 foot) thick concrete. Each chamber is 1 meter (3.5 feet) high and 1.9 meters (6.33 feet) wide. At the discharge is an engineered dispersal pad of heavy riprap, 12 meters (40 feet) wide and 1.5 meters (5 feet) thick.

References:
1. 1/1/1949, Discharge Structural Spillway and Details, P-2097, Rev 4.

Field Work:

Type: Site Walkdown
Begin Date: 2/7/2005
End Date: 2/7/2005
Purpose: Verification

Comment:
During a site visit on February 7, 2005, the two sections of basalt riprap boulders along the slope leading to the edge of the river were visible. At the bottom of the downriver (or southernmost) section of riprap bank were the remnants of a concrete ramp (or purposely placed concrete blocks) that ended abruptly just above the water line. A modified sluiceway of sorts was evident in the river that angled from the shore toward the downriver flow and had two apparent edges. The downriver (or southernmost) edge appeared to be a berm, and the upriver (o northernmost) edge appeared to be chunks of concrete in a distinct line.

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor:	WCH	Washington Closure Hanford
Reclassifying Contractor/Subcontractor:		None
Responsible Project:		Not Specified

Site Evaluation

Solid Waste Management Unit: Yes
TPA Waste Management Unit Type : Inactive Contaminated Structure

Permitting

RCRA Part B Permit:	No	**TSD Number:**	
RCRA Part A Permit:	No	**Closure Plan:**	No
RCRA Permit Status:	Not Specified		

Site Code: 100-H-36 **Site Classification: Accepted**

Septic Permit:	No	**216/218 Permit:**	
Inert LandFill:		**NPDES:**	
Air Operating Permit:	No	**State Waste Discharge Permit:**	
Air Operating Permit Number(s):			

Tri-Party Agreement

Lead Regulatory Agency: Ecology
Unit Category: CERCLA Past Practice (CPP)
TPA Appendix: C

Remediation and Closure

Decision Document: Explanation of Significant Difference for the 100 Area Remaining Sites Interim ROD (8/2009)
Decision Document Status: Final
Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

Images:

Pathname: //mapweb.rl.gov/widsimg/100h/5127/5127_01.jpg **Date Taken:** 4/6/1949
Description:
Photo shows basalt riprap in foreground and construction of the 116-H-5 Outfall.

Pathname: //mapweb.rl.gov/widsimg/100h/5127/5127_02.jpg **Date Taken:** 2/25/1949
Description:
Spillway under construction in 1949.

Pathname: //mapweb.rl.gov/widsimg/100h/5127/5127_03.jpg **Date Taken:** 3/7/2005
Description:
Photo shows what remains of the spillway.

References:

1. 5/3/2005, WIDS Submissions - Revisions to the Outfalls, Spillways, and River Effluent Pipelines for 100-B/C, 100-D/DR, 100-F, 100-H, 100-KE/KW, and 100-N Areas, CCN-120588.
2. D.H. Deford, M.W. Einan, 2/1/1995, 100-H Area Technical Baseline Report, BHI-00127, Rev 00.
3. 1/1/1949, Discharge Structural Spillway and Details, P-2097, Rev 4.
4. 1/1/2004, 100 Area Remedial Action Sampling and Analysis Plan, DOE/RL-96-22, Rev 4.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-H-38 **Site Classification: Accepted**

Site Names: 100-H-38; Trenches and Pit Southwest of 105-H

Site Type: Burial Ground
Status: Inactive
Hanford Area: 100H
OU/WMA: 100-HR-2

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The site consists of an area approximately 3 acres in size and is marked by ground scars resembling trenches and pits. The site is situated along a natural depression on the western boundary of the H Area perimeter fence.

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor: None
Reclassifying Contractor/Subcontractor: None
Responsible Project: Not Specified

Site Evaluation

Solid Waste Management Unit: Yes
TPA Waste Management Unit Type: Not Specified

Permitting

RCRA Part B Permit:
RCRA Part A Permit:
RCRA Permit Status: Not Specified
Septic Permit:
Inert LandFill:
Air Operating Permit:
Air Operating Permit Number(s):
TSD Number:
Closure Plan:
216/218 Permit:
NPDES:
State Waste Discharge Permit:

Tri-Party Agreement

Lead Regulatory Agency: Not Specified
Unit Category: To Be Determined (TBD)
TPA Appendix: C

Remediation and Closure

Decision Document: None
Decision Document Status: None
Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

References:

1. Habel, Len, 8/10/2009, WCH Orphan Site Walkdown site in the 100-H area., 100-H-38.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-H-5 **Site Reclassification Status: Interim Closed Out**

Site Names: 100-H-5; 107-H Buried Sludge Site; 107-H Grave; 107-H Retention Basin Sludge Burial Site; Sludge Disposal Trench

Site Type: Burial Ground
Status: Inactive
Hanford Area: 100H
OU/WMA: 100-HR-1

Start Date: 1/1/1953
End Date:
Pipe Type: Not Specified

Site Description:

This site has been remediated and closed out. The trench was about 100 meters (328 feet) long, 16 meters (52 feet) wide, and 4.6 meters (15 feet) deep.

Location Description:

The site was located east of the southeast corner of the 107-H Retention Basin. In 1997, a Ground Penetrating Radar (GPR) scan was done to establish the location of the trench. The GPR scan placed the trench approximately 52 meters (170 feet) east of the southeast corner of the 116-H-7 Basin, in an area formerly used for orchards.
According to the Technical Baseline Report, people interviewed for information on this site placed it in several locations, including farther north, immediately adjacent to the 107-H Retention Basin or further south and east of the southeast corner of 107-H. (Note the references in the technical baseline report are inverted.)

Process Description:

The site is a trench that received an unknown quantity of sludge removed from the 107-H Retention Basin during repair work in the Spring of 1953.

Associated Structures:

The 107-H Retention Basin (116-H-7) is related to this site.

Site Comment:

The trench was originally covered to grade with 1.5 meters (5 feet) of soil and marked with nonstandard monuments. In May 1965, the location was excavated to a depth of approximately 1.8 meters (6 feet) to obtain fill material for the 107-H Basin. In 1975, Dorian and Richards sampled a test hole (hole "c"), in an area where the trench was believed to be located. No contamination was identified in the hole. They believe this to be consistent with historical records that indicate the trench was released from radiological controls in 1965. Based on the Ground Penetrating Radar (GPR) scan done in 1997, the corners of the trench are located at Washington State Plane Coordinates N152624.63, E578156.95/N152629.13, E578172.30/N152533.16, E578200.42/N152528.66, E578185.06.

Waste Information:

Type: Sludge
Category: Radioactive
Physical State: Solid
Start Date: 1/1/1953

Amount:
Units: Not Specified
Reported Date:
End Date:

Description:

In 1975, samples of sludge from the basin floor had a maximum Geiger-Mueller (GM) probe reading of 20,000 counts/minute. Samples had an average concentration of 3.1E+04 picocuries/gram beta/gamma and 57 picocuries/gram of plutonium-239/240. The sludge buried in the trench would have similar characteristics.

References:

1. D.H. Deford, M.W. Einan, 2/1/1995, 100-H Area Technical Baseline Report, BHI-00127, Rev 00.

Dimensions:

Length:	99.97	Meters	328.00	Feet
Width:	15.85	Meters	52.00	Feet
Depth/Height:	4.57	Meters	15.00	Feet
Overburden Depth:	1.52	Meters	5.00	Feet
Site Shape:	Not Specified			

Comments:

The 1997 field investigation increased the size of the trench from previously documented dimensions.

References:

1. D.B. Blumenkranz, 10/8/1997, Interoffice Memorandum: Group 4 Field Investigation Results and Remedial Design Recommendations, 051553.
2. D.H. Deford, M.W. Einan, 2/1/1995, 100-H Area Technical Baseline Report, BHI-00127, Rev 00.
3. H. V. Clukey, 5/10/1956, Tabulation of Radioactive Liquid Waste Disposal Facilities, HW-43121.

Field Work:

Type: Analytical Sampling
Begin Date: 5/23/2000
End Date: 6/8/2000
Purpose: Cleanup verification sampling

Comment:

Ten samples, including two QA/QC samples, were collected from the shallow zone and analyzed for the contaminants of concern, plus arsenic and PCBs: B0YC63 through B0YC70, plus B0YC71 (duplicate of B0YC63), and B0YC72 (split of B0YC63). Six samples, including three QA/QC samples, were collected from the deep zone and analyzed for the contaminants of concern, plus arsenic and PCBs: B0X4W2, B0X4W3, B0XNF7, B0XNF8 (duplicate of B0X4W2), B0XNH0 (split of B0X4W2), and B0XNF9 (equipment blank).

References:

1. Bechtel Hanford, Inc., Cleanup Verification Package for the 100-H-5 Sludge Disposal Trench, CVP-2000-00028.

Type: Geophysical Survey
Begin Date: 7/1/1997
End Date: 7/1/1997
Purpose: Locate trench and associated features

Comment:

A trench, with a high concentration of buried material, was detected, along with other linear features.

References:

1. Kevin Bergstrom, Tom Mitchell, ERC Geophysical Investigation Summary for 100-H-5 Disposal Site, IOM 051553.

Type: Site Walkdown

Begin Date: 5/27/1998
End Date: 5/27/1998
Purpose: Surveillance

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor: WCH Washington Closure Hanford
Reclassifying Contractor/Subcontractor: None
Responsible Project: Not Specified

Site Evaluation

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

Permitting

RCRA Part B Permit:	No	**TSD Number:**	
RCRA Part A Permit:	No	**Closure Plan:**	No
RCRA Permit Status:	Not Specified		
Septic Permit:	No	**216/218 Permit:**	
Inert LandFill:	No	**NPDES:**	
Air Operating Permit:	No	**State Waste Discharge Permit:**	
Air Operating Permit Number(s):			

Tri-Party Agreement

Lead Regulatory Agency: Ecology
Unit Category: CERCLA Past Practice (CPP)
TPA Appendix: C

Remediation and Closure

Decision Document: Amendment to the Interim Remedial Action Record of Decision, 100-BC-1, 100-DR-1, 100-HR-1 (1997)
Decision Document Status: Final
Closure Document: Cleanup Verification Package (CVP)
Closure Type: Not Specified

Post Closure Requirments:
Revegetation; institutional controls to prevent uncontrolled drilling or excavation into deep zone soils.

Closure Group:

Closure Group Name: CG 100-H-5
Type: Interim
Reclassification Status: Prepared **Reclassified On:** 12/12/2000

Remediation Action:
The site was remediated to meet the cleanup standards and closed out on December 12, 2000.

Site Code: 100-H-5 **Site Reclassification Status: Interim Closed Out**

Remedial action at the 100-H-5 site began on September 27, 1999. Excavation of the site involved removing th overburden materials, buried sludge and debris, and underlying contaminated soil. Based on field screening overburden materials identified as potentially clean were placed in stockpiles for potential use as backfill. Contaminated materials were disposed of at the Environmental Restoration Disposal Facility (ERDF). During sit excavation, the area where buried sludge and debris were encountered at the south end of the site was not as wide as the estimated footprint of the sludge trench. To avoid unnecessarily excavating and disposing of uncontaminated soil, the excavation at the south end of the site narrowed from the original estimated design s footprint. On April 28, 2000, the excavation was completed.
The elevation of the bottom of the excavation was at 121.4 meters (398.2 feet) upon completion. The surface reference elevation and design backfill elevation are 126.5 meters (415 feet). The excavation was approximate 3,308 square meters (35,589 square feet) in area with a maximum depth of approximately 5.1 meters (16.7 feet). Approximately 23,525 metric tons (25,877 tons) of material from the site were disposed of at ERDF.
The 100-H-5 site has been verified to be remediated in accordance with the ROD amendment.

Excavated Material:

Quantity: 23,525.00
Unit Type: Metric Tons
Disposition: Environmental Restoration Disposal Facility

Cleanup Verification:

The COCs identified for this site are cobalt-60, cesium-137, europium-152, europium-154, plutonium-238, plutonium-239/240, strontium-90, and lead.
The Cleanup Verification Package (CVP) demonstrated that remedial action at the 100-H-5 site achieved the Remedial Action Objectives (RAOs) and corresponding Remedial Action Goals (RAGs) established in the approved interim action ROD amendment (EPA 1997) and Remedial Design Report/ Remedial Action Work Pla (RDR/RAWP) (DOE-RL 1998). The remaining soils at the 100-H-5 site have been sampled, analyzed, and modeled. The results of this effort indicate that the materials from the 100-H-5 site containing COCs at concentrations exceeding RAGs have been excavated and disposed of at the ERDF, that residual COC concentrations in the shallow zone will support future land uses that can be represented (or bounded) by a rural-residential scenario, and that residual COC concentrations throughout the site do not pose an unacceptable threat to groundwater or the Columbia River.

Sampling:

Sampling Region: Shallow and Deep verification samples
Constituent List: Cesium-137, PCBs, Isotopic Pu, Lead, Arsenic, Cobalt 60, Europium 152, 154, 155

Institutional Controls:

The acceptability of unrestricted direct exposure to deep zone soils has not been demonstrated; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone (i.e., below 4.6 meters [feet]) are required.

Statement Of Protectiveness:

This CVP demonstrates that remedial action at the 100-H-5 site has achieved the RAOs and corresponding RA established in the approved interim action ROD amendment (EPA 1997) and RDR/RAWP (DOE-RL 1998b). The remaining soils at the 100-H-5 site have been sampled, analyzed, and modeled. The results of this effort indic that the materials from the 1 00-H-5 site containing COCs at concentrations exceeding RAGs have been excavated and disposed of at the ERDF, that residual COC concentrations in the shallow zone will support futu land uses that can be represented (or bounded) by a rural-residential scenario, and that residual COC concentrations throughout the site do not pose an unacceptable threat to groundwater or the Columbia River. The acceptability of unrestricted direct exposure to deep zone soils has not been demonstrated; therefore, institutional controls to prevent uncontrolled drilling or excavation into the deep zone (i.e., below 4.6 meters [ft]) are required. The 100-H-5 site is verified to be remediated in accordance with the ROD amendment and n

be backfilled.

Images:

Pathname: //mapweb.rl.gov/widsimg/100h/1865/1865_01.jpg **Date Taken:** 5/27/1998

Description:

Photo shows a partially vegetated area with GPR stakes that is located where the trench was found.

References:

1. D.B. Blumenkranz, 10/8/1997, Interoffice Memorandum: Group 4 Field Investigation Results and Remedial Design Recommendations, 051553.
2. Bechtel Hanford, Inc., Cleanup Verification Package for the 100-H-5 Sludge Disposal Trench, CVP-2000-00028.
3. D.H. Deford, M.W. Einan, 2/1/1995, 100-H Area Technical Baseline Report, BHI-00127, Rev 00.
4. DL Smith, 1/14/1994, To C.D. Wade: Downposting of 107-H, 107-F, 100-KE Flood Plain and 100-KW Flood Plain, 85100-94-DLS-001.
5. R. D. Evans, 3/14/1990, Interview of Larry E. Denton by R. D. Evans.
6. R. D. Evans, 3/12/1990, Interview of V. R. (Bob) Richards by R. D. Evans.
7. U. S. Environmental Protection Agency, 1/1/1997, Amended Record of Decision, Decision Summary and Responsiveness Summary, Benton County, Washington, March 1997 - Hanford Site - 100 Area.
8. Kevin Bergstrom, Tom Mitchell, ERC Geophysical Investigation Summary for 100-H-5 Disposal Site, IOM 051553.
9. H. V. Clukey, 5/10/1956, Tabulation of Radioactive Liquid Waste Disposal Facilities, HW-43121.
10. Dorian and Richards, 5/26/1978, Radiological Characterization of the Retired 100 Areas, UNI-946.
11. U.S. Department of Energy, 100 Area Remedial Action Sampling and Analysis Plan, DOE/RL-96-22, Rev 1.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-H-57 **Site Classification: Accepted**

Site Names: 100-H-57; Water Tower Foundations at 100H

Site Type: Foundation
Status: Inactive
Hanford Area: 100H
OU/WMA: 100-HR-1

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The site consists of the underground piping, valves, sumps and other structures at the base of the two elevated water towers adjacent to the 105-H Reactor.

Location Description:

The towers are located on either side of the 105-H Reactor.

Process Description:

Water was provided as a means to remove heat from the pile. A network of interconnecting pipelines, by-pass lines, and standby pumping facilities were provided to insure that water service to the pile was maintained ever when a part of the system was inoperable (TNX-PG-4). The principal purpose of the two elevated storage tanks at the 105-H Reactor was to provide standby storage of cooling water in the event that the service to the pile was interrupted. The 105-H Reactor had two 300,000 gallon capacity, ellipsoidal-steel-plate tanks (187-H1 and 187-H2), elevated 120-feet above the ground level (HW-24800-2). Sodium silicate was supplied to the tanks fo corrosion prevention (H-1-13254). The construction drawings (P-1257 and P-2031) for the 187-H1 and 187-H2 tanks show a french drain receiving condensate through a 3.8 cm (1.5 in) pipeline. The drawings also suggest that the sump in the bottom of the valve pit was emptied into this french drain. The drawings show that the french drains were installed a minimum of 4.6 m (15 ft) on the north side of the tanks. However this would put them very close to a labyrinth of pipes that run east/west on the north side of the reactor. It is possible that they were actually installed in another location. One possible location for the french drain from tank 187-H2 might be waste site 100-H-8. It is not known where the influent line for 100-H-8 is piped from. There are no french drains already identified in the area near tank 187-H1. Although process knowledge about the water system at the 100-H Area would suggest that sodium dichromate was not added to the water towers, the lead regulatory agency has requested that the bases of these water towers be identified as a waste site. Their premise is that a similar waste site (100-D-94) in the D Area was created to assess the potential impact from sodium dichromate. An email from Mark Morton to Earl Prichard and Stephen Hamblin on March 17, 2003 was the first to raise the issue of sodium dichromate in the H and DR water towers (147123). The valve pits at both of the 105-H water towers was completely removed by demolition and decontamination activities.

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor: None
Reclassifying Contractor/Subcontractor: None
Responsible Project: Not Specified

Site Evaluation

Solid Waste Management Unit: No
TPA Waste Management Unit Type : Unplanned Release Unit

Site Code: 100-H-57 **Site Classification: Accepted**

Permitting

RCRA Part B Permit:
TSD Number:
RCRA Part A Permit:
Closure Plan:
RCRA Permit Status: Not Specified
Septic Permit:
216/218 Permit:
Inert LandFill:
NPDES:
Air Operating Permit:
State Waste Discharge Permit:
Air Operating Permit Number(s):

Tri-Party Agreement

Lead Regulatory Agency: Not Specified
Unit Category: To Be Determined (TBD)
TPA Appendix: C

Remediation and Closure

Decision Document: None
Decision Document Status: None
Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

Images:

Pathname: //mapweb.rl.gov/widsimg/100H/5666/5666_01.jpg **Date Taken:** 10/20/1949

Description:

Aerial view of the 105-H Reactor showing the two elevated water towers.

References:

1. Habel, Len, 4/12/2010, New site request from WCH in 100-H area., 100-H-57.
2. Morton, M R, 3/17/2003, Water Tower base statement from project engineer, BHI CCN 147123.
3. 6/26/1949, Foundation For Near & Far Side 300,000 Gallon High Tank, Rev. 1, General, P-2031, Rev 1.
4. 1/26/1964, Valve Pit Arrangement 187H Buildings, P-1257, Rev 3.
5. General Electric Company, 6/1/1952, Design and Construction History; Project C-165-A, Pile Area "H", HW-24800-2, Rev 0.
6. 4/1/1944, 100 Area - Water System Design and Equipment (Preliminary for Chapter X of the Hanford Technical Manual), TNX-PG-4.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 100-H-58 **Site Classification: Accepted**

Site Names: 100-H-58; Mud Dauber Nests On Active Powerlines In 100H Area

Site Type: Contamination Migration
Status: Active
Hanford Area: 100H
OU/WMA: 100-HR-2

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

The site consists of contaminated mud dauber (wasps) nests in the 100-H Area.

Location Description:

The nests were identified along H Avenue, Herron Avenue, and from the west of the 105-H Reactor Building to the warehouse.

Process Description:

During cleanup of the 105-H Fuel Storage Basin (FSB), dirt and sediment were removed from the lower 38 cm (15 in.) of the basin, which was 6.1 m (20 ft) below ground surface. Some dust became airborne during the scraping of the basin floor and stem walls, and airborne radiological posting criteria were exceeded. Consequently, one of the corrective actions was to maintain at least 5.1 cm (2 in.) of water on the basin floor to reduce airborne dirt and sediment, which created mud. The mud dauber wasps transported mud from the FSB floor to other sediment and debris areas surrounding the 105-H Reactor Building using the mud for construction of their tube nests. These mud dauber areas became the 100-H-37 waste site. However, during remediation of 100-H-37, multiple mud dauber nests were discovered on power lines that could not be remediated because the lines were in use. These lines are along H Avenue, Herron Avenue, and from the west of the 105-H Reactor Building to the warehouse. The nests are primarily within crevices in the wooden poles, and 35 nests have been counted. It is possible that more nests could be present, as characterization did not occur at heights above 7 ft. A mud dauber characterization strategy was developed and approved by the U.S. Department of Energy and Washington State Department of Ecology (Ecology) to guide remediation activities and provide closure documentation for the 100-H-37 waste site. The strategy included an initial characterization approach to verify the accuracy of radiological field instruments to be used in the place of soil sampling for verification and closeout purposes. On July 7, 2009, Ecology concurred that the data collected for this study indicated that radiological field instruments are reliable to ensure RAGs are achieved for the mud dauber waste site.

Associated Structures:

Other mud dauber contamination sites were 100-H-37 and 100-H-41.

Site Comment:

Contamination associated with mud dauber wasp nests was removed during remediation of 100-H-37 waste site. During this remediation, multiple mud dauber nests were discovered on power lines that could not be remediated because the lines were in use. The nests were primarily within crevices in the wooden poles. To date 35 nests have been counted, more nests are anticipated as characterization did not occur at heights above 7 ft.

Regulatory Information:

Programmatic Responsibility

Site Code: 100-H-58 **Site Classification: Accepted**

Responsible Contractor/Subcontractor: None
Reclassifying Contractor/Subcontractor: None
Responsible Project: Not Specified

Site Evaluation

Solid Waste Management Unit: No
TPA Waste Management Unit Type : Unplanned Release Unit

Permitting

RCRA Part B Permit:
TSD Number:
RCRA Part A Permit:
Closure Plan:
RCRA Permit Status: Not Specified
Septic Permit:
216/218 Permit:
Inert LandFill:
NPDES:
Air Operating Permit:
State Waste Discharge Permit:
Air Operating Permit Number(s):

Tri-Party Agreement

Lead Regulatory Agency: Not Specified
Unit Category: To Be Determined (TBD)
TPA Appendix : C

Remediation and Closure

Decision Document: None
Decision Document Status: None
Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

References:

1. Habel, Len, 6/8/2010, 100-H-58, Mud Dauber Nests On Active Powerlines In H Area, request for new site, 100-H-58.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 116-D-8 **Site Reclassification Status: Interim Closed Out**

Site Names: 116-D-8; 100-D Cask Storage Pad

Site Type: Storage
Status: Inactive
Hanford Area: 100D
OU/WMA: 100-DR-2

Start Date: 1/1/1946
End Date: 1/1/1975
Pipe Type: Not Specified

Site Description:

The site has been remediated and Interim Closed Out. It was a rectangular pad covered with gray grout (shotcrete). The grout-covered concrete pad, including the truck loading pit, degreasing pits, and french drains was removed in its entirety. It had been surrounded with Underground Radioactive Material signs. It had also been posted with Cave-in Potential signs, but the Cave-in potential signs were removed in November 1999.

Location Description:

The site was located on the west side of the 100-DR Reactor, outside the fence.

Process Description:

During the construction of the 105-D Reactor, this site functioned as the foundation and degreasing pits for a temporary airlock to clean and store reactor components before their installation. Subsequently, the concrete pad was modified to provide storage and a decontamination station for shielded casks used for shipping irradiated materials. After the 105-D Reactor was shut down in 1967, the casks and other materials were stored on the pad until general cleanup was performed in 1987. Surface contamination on the pad was stabilized by application of an asphalt fixative.
The concrete pad had two drains. The drain that handled pad decontamination and rain runoff, discharged into the 105-DR process sewer. The second drain discharged to a french drain, the location of which is unknown; however, an excavation that may be the drain was dug in 1949. There may also be a french drain beneath the loading dock, located on the west side, that provided drainage for storm runoff which is likely to be contaminated. The pad has been stabilized with a sprayed grout material and reinforced with a metal mesh material. There are two structures just south of the pad - one is a red aluminum storage tank and the other appears to be a furnace or shipping cask.

Associated Structures:

The site was associated with 100-D-50:1, 100-D-50:2 and the 1607-DR3 Sanitary Sewer Pipelines that may discharge to the 100-D-50:9 pipeline.

Site Comment:

All casks have been removed from the storage pad. However a cask still remains south of the pad. Following remediation activities, the project was authorized to remove radiological postings. A coating of either asphalt emulsion or paint was placed on the concrete to fix all surface contamination. The void space under the pad was backfilled.
The 100-D-50:2 cooling water tunnel is an ecologically sensitive area that houses maternal bat colonies.

Waste Information:

Type: Chemicals
Category: Mixed
Physical State: Liquid

Amount:
Units: Not Specified
Reported Date:

Description:

This site contains trace amounts of radionuclides and decontamination chemicals.

References:

1. KH Cramer, Hanford Site Waste Management Units Report, May 1987.

Dimensions:

Site Shape: Rectangle

Field Work:

Type: GPS Surveys
Begin Date: 4/22/1998
End Date: 4/22/1998
Purpose: Mapping

Comment:

The general area of shotcrete was GPS-ed.

Type: GPS Surveys
Begin Date: 9/29/1998
End Date: 9/29/1998
Purpose: to map GPR stakes

Comment:

Two stakes from a previous GPR investigation were gps-ed. The GPR investigation was focused on the cask pad french drain. The reference for this task is an electronic file found under \\BHI002\hgis-gps\job-197.

Type: Geophysical Survey
Begin Date: 12/21/1993
End Date: 1/21/1994
Purpose: Characterization

Comment:

A 10 foot wide linear feature, that crosses the site diagonally, is the most notable. It is believed to be the tunnel that connects toe 105-DR reactor with the 190-DR facility. Another east-west linear was identified that is characteristic of a pipeline. Two areas on the western boarder of the site appear to contain debris.

References:

1. GJ Szwartz, 4/6/1994, Geophysical Investigation of the Cask Storage Pad, 116-D-8, WHC-SD-EN-TI-224.

Type: Site Walkdown
Begin Date: 4/22/1998
End Date: 4/22/1998
Purpose: Surveillance

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor: WCH Washington Closure Hanford
Reclassifying Contractor/Subcontractor: None
Responsible Project: Not Specified

Site Evaluation

Solid Waste Management Unit: Yes
TPA Waste Management Unit Type : Other Storage Area

Permitting

RCRA Part B Permit:	No	**TSD Number:**	
RCRA Part A Permit:	No	**Closure Plan:**	No
RCRA Permit Status:	Not Specified		
Septic Permit:	No	**216/218 Permit:**	
Inert LandFill:	No	**NPDES:**	
Air Operating Permit:	No	**State Waste Discharge Permit:**	
Air Operating Permit Number(s):			

Tri-Party Agreement

Lead Regulatory Agency: Ecology
Unit Category: CERCLA Past Practice (CPP)
TPA Appendix : C

Remediation and Closure

Decision Document: Interim Action Record of Decision, 100 Area Remaining Sites (1999)
Decision Document Status: Final
Closure Document: None
Closure Type: Not Specified

Post Closure Requirments:

Closure Group:

Closure Group Name: CG 116-D-8
Type: Interim
Reclassification Status: Prepared **Reclassified On:** 8/10/2011
Excavation Start Date: 2/8/08 **Excavation Completed Date:** 6/9/2009

Remediation Action:

The grout-covered concrete pad, including the truck loading pit, degreasing pits, and french drains, was removed in its entirety. Remediation was performed from August 19, 2008 through February 8, 2009. Approximately 1,170 bank cubic meters (BCM) (1,530 bank cubic yards [BCY]) of concrete debris, asphalt emulsion, tan fibrous material, black plastic, grout, steel, and soil was removed from the waste site and disposed at the Environmental Restoration Disposal Facility (ERDF). In January 2011 an additional 0.53 BCM (0.69 BCY) of soil was removed from the area at the south degreasing pit. Approximately 1.0 BCM (1.2 BCY) o soil was removed from the south radiological contamination area. This material was also disposed of at ERDF. This is in the ecologically sensitive area associated with the 100-D-50:2 cooling water tunnel. The deepest part

of the waste site excavation was approximately 1.5 meters (5 ft) deep at the location of the former degreasing pits.
The 116-D-8 waste site is located above a section of vitrified clay sewer pipeline associated with the 100-D-50 waste site. On August 25, 2008, a manhole was discovered during excavation of the 116-D-8 waste site. Based on the coordinate location, it was determined that the manhole was associated with the 100-D-50:1 subsite. T manhole was filled with clean borrow pit soil to eliminate a safety concern and left in place. No further remediation can be conducted at the location with the cesium-137 direct exposure exceedance, without incurri significant adverse impacts to the bat colonies at the 100-D-50:2 pipeline subsite. A study conducted between June 2007 and September 2008 (WCH 2009a) showed that the bats in the 100-D-50:2, Reactor Cooling Water Pipelines (concrete tunnel) from 190-DR Pumphouse subsite use the site as a maternity roost where they give birth and rear their young.
The preferred alternative to eliminate or mitigate impacts to the bat colony is to leave the structure intact and add perimeter fencing and signage to deter human entry. Therefore, institutional controls are required at the location of the cesium-137 contamination south of the 116-D-8 cask storage pad.
A summary of the cleanup evaluation for the soil results against the applicable criteria is presented in Table ES-1. The results of the verification sampling are used to make reclassification decisions for the 116-D-8 waste site in accordance with the Tri-Party Agreement Handbook Management Procedures (DOE-RL 2007).

Excavated Material:

Quantity: 1,171.53
Unit Type: Bank Cubic Meters
Disposition: Environmental Restoration Disposal Facility

Cleanup Verification:

Statistical sampling for the 116-D-8 waste site was conducted on June 16, 2009. Focused samples were collected at the southern degreasing pit on October 6, 2009 and November 3, 2011. Focused samples were collected at the southern radiological contamination area on November 3, 2010 and February 8, 2011. These samples were collected to support a determination that residual contaminant concentrations at this site meet t cleanup criteria specified in the RDR/RAWP (DOE-RL 2009b) and the Remaining Sites ROD (EPA 1999). The verification sample results are provided in Appendix B. A more detailed discussion of the verification sample design can be found in the Work Instruction for Verification Sampling of the 116-D-8, 100-D Cask Storage Pad (WCH 2009b) and Ecology Resolution on 116-D-8 Sampling Path Forward (WCH CCN 158020).
The results indicated that the waste removal action achieved compliance with the remedial action objectives (RAOs) and remedial action goals (RAGs) for the cask storage pad portion of the 116-D-8 waste site. Direct exposure exceedances for cesium-137 in two samples at the southern radiological contamination area of the waste site from the November 2010 sampling event were identified. The project conducted further remediatio in January 2011, and dug approximately 0.3 m (1 ft) before coming in contact with the top of the concrete encasement for the 100-D-50:2 pipeline subsite (the 190-DR reactor cooling water pipelines). The locations were resampled for the original analytical suite, and analytical results for the southernmost location exceeded the direct exposure cleanup criteria for cesium-137 (6.2 pCi/g), at an activity of 7.63 pCi/g.

Sampling:

Sampling Region: Excavation samples 1-12
Constituent List: GEA, Hexavalent Chromium, Stronium-90, Metals, VOA, Semi-VOA, Nitrate, PCBs, Mercury, Isotopic U, Gross alpha, Gross beta, Anions, Nitrite, Isotopic thorium

Institutional Controls:

Institutional controls to prevent uncontrolled drilling or excavation into the deep zone of the site are required.

Statement Of Protectiveness:

The CVP/RSVP statement of protectiveness states:
The 116-D-8, 100-D Cask Storage Pad waste site verification sampling data, site evaluations, and supporting

documentation demonstrate that this site meets the objectives established in the Remedial Design Report/Remedial Action Work Plan for the 100 Area (RDR/RAWP) (DOE-RL 2009b) and the Interim Action Rec of Decision for the 100-BC-1, 100-BC-2, 100-DR-1, 100-DR-2, 100-FR-1, 100-FR-2, 100-HR-1, 100-HR-2, 100-KR-1, 100-KR-2, 100-IU-2, 100-IU-6, and 200-CW-3 Operable Units, Hanford Site, Benton County, Washington (Remaining Sites ROD) (EPA 1999). These results show that residual soil concentrations support future land uses that can be represented (or bounded) by a rural-residential scenario, with a requirement for institutional controls in the area south of the former cask storage pad, in the vicinity of the 100-D-50:2 pipelin location (the 190-DR reactor cooling water pipelines). The results also demonstrate that residual contaminant concentrations are protective of groundwater and the Columbia River.
Soil cleanup levels were established in the Remaining Sites ROD (EPA 1999) based on a limited ecological risk assessment. Although not required by the Remaining Sites ROD (EPA 1999), comparison against ecological ris screening levels has been made for the site contaminants of potential concern and other constituents. Those constituents exceeding the ecological screening level in the 2007 Washington Administrative Code 173-340, Table 749-3 were boron, selenium, and vanadium. The U.S. Environmental Protection Agency ecological soil screening levels were exceeded for antimony, lead, manganese, selenium, vanadium, and zinc. Exceeding screening values does not necessarily indicate the existence of risk to ecological receptors. Because concentrations of antimony, manganese, vanadium, and zinc are below Hanford Site background levels (DOE-2009b), it is believed that the presence of these constituents does not pose a risk to ecological receptors. All exceedances will be evaluated in the context of additional lines of evidence for ecological effects as a part of t final closeout decision for the Columbia River corridor portion of the Hanford Site. A table showing contaminar concentrations from the 116-D-8 waste site that exceed ecological screening levels is provided in Appendix A c the RSVP.

Evaluated For MTCA 2007: True

Images:

Pathname: //mapweb.rl.gov/widsimg/100d/0045/0045_01.jpg **Date Taken:** 1/1/1992
Description:
Photo shows the pad prior to being backfilled and sprayed with grout. The photo date is unknown.

Pathname: //mapweb.rl.gov/widsimg/100d/0045/0045_02.jpg **Date Taken:** 4/22/1998
Description:
Photo shows the cask storage pad covered with shotcrete.

Pathname: //mapweb.rl.gov/widsimg/100d/0045/0045_03.jpg **Date Taken:** 4/22/1998
Description:
Photo shows a white cask adjacent to the cask storage pad.

Pathname: //mapweb.rl.gov/widsimg/100d/0045/0045_04.jpg **Date Taken:** 7/1/2005
Description:
Photo shows the site covered with shotcrete.

Pathname: //mapweb.rl.gov/widsimg/100d/0045/0045_05.jpg **Date Taken:** 7/1/2005
Description:
Photo shows the storage pad and the Underground Radioactive Material signs on the posts.

References:

1. Nick Clapper, 12/5/2005, WIDS Updates for 100-D Area Sites.
2. Farris, Elizabeth, 8/13/2009, WCH update requested by Ecology, 100-D-50:9.
3. W. M. Hayward, 4/21/1993, WIDS Site Modification, Sites 116-D-8, 241-WR-Vault, 216-B-9, 216-A-524,

216-Z-12, 244-UR Vault (edits to HAZMUR).
4. KH Cramer, Hanford Site Waste Management Units Report, May 1987.
5. Nick Clapper, 1/18/2006, 116-D-8 Site Description.
6. WL Osborne, 11/18/1999, 116-D-8 Cask Pad posting removal.
7. JS Decker, 11/10/2005, Integrated Chemical and Radiological Hazard Evaluation Worksheet, IHE-2005-0019.
8. R. W. Carpenter, 9/20/1993, 100-D Area Technical Baseline Report, WHC-SD-EN-TI-181, Rev 0.
9. GJ Szwartz, 4/6/1994, Geophysical Investigation of the Cask Storage Pad, 116-D-8, WHC-SD-EN-TI-224.
10. Scott Kitts to Nancy Homan, 4/17/1990, 100N updates for WIDS, DSI.
11. A.E. Zacharias, 10/11/2011, Authorization to Downpost Legacy Wastes Sites Following Remediation.
12. Remaining Sites Verification Package for the 116-D-8, 100-D Cask Storage Pad, RSVP-2009-015.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 116-DR-9 **Site Reclassification Status: Interim Closed Out**

Site Names: 116-DR-9; 107-DR; 107-DR Retention Basin

Site Type: Retention Basin
Status: Inactive
Hanford Area: 100D
OU/WMA: 100-DR-1

Start Date: 1/1/1950
End Date: 1/1/1967
Pipe Type: Not Specified

Site Description:

This site has been remediated and Interim Closed Out. The retention basin was an open concrete structure with a vertical concrete baffle constructed lengthwise in the middle. The floor consisted of concrete slabs whose joints originally closed with neoprene water seals. The walls sloped from the floor to a point 3 meters (10 feet) above the floor level, with the remaining wall (about 3 meters [10 feet]) being vertical. The sloping wall sections were 10 centimeters (4 inches) thick, and the vertical walls were reinforced construction with a minimum thickness of 0.3 meters (1 foot) at the top and 1.75 meters (5.75 feet) at the bottom.

Location Description:

This site was located north of the 105-D Reactor Building.

Process Description:

The 116-DR-9 Retention Basin was constructed in 1950 to hold cooling water effluent from the 105-DR Reacto for a brief period of time to allow for thermal cooling and radioactive decay prior to release to the Columbia River. The retention basin was a rectangular, reinforced-concrete reservoir measuring 183 meters by 83 meters, 6 meters deep (600 ft by 273 ft by 20 ft. It was located immediately east of the 116-D-7 Retention Basin, and approximately 329 meters (1,079 ft) from the 100-year flood level of the Columbia River. The basin was partially above ground and divided into two sections by a vertical concrete baffle that ran the length of the basin. The retention basin received cooling water effluent from the 105-DR Reactor from 1950 until 1965. Afte the 105-D Reactor was deactivated in 1965, the basin remained active until 1967 as part of the 105-D Reactor effluent system.

Associated Structures:

The retention basin is associated with unplanned release 100-D-25 and four sludge trenches that were excavated adjacent to the 107-D and 107-DR Retention Basins to dispose of sludge that had accumulated at th bottom of the basins. The sludge trenches were excavated in the spring of 1953 to facilitate repair of the retention basins. After use, they were covered with approximately 1.8 meters (6 feet) of clean soil. In 1955, ar additional trench was excavated near the southeast side of the 107-DR Retention Basin to receive effluent fron the 107-D and 107-DR systems following an undetermined amount of fuel cladding failures.

Site Comment:

After the D and DR reactors were shut down, the basin walls and baffles were demolished in-situ and later surface stabilized by the Radiation Area Remedial Action Program (RARA). The basin floor was stabilized with approximately 0.9 meters (3 feet) of backfill material. The fill dirt used to cover the sludge within the basin wa obtained from the immediate vicinity around the basins. It is believed that some of the fill dirt was taken from areas where the sludge disposal trenches were located.
Institutional Control (IC) requirements were revised per DOE letter 05-AMRC-0078 on 1/4/2005.

Waste Information:

Type: Process Effluent
Category: Mixed

Amount:
Units: Not Specified

Site Code: 116-DR-9 **Site Reclassification Status: Interim Closed Out**

Physical State: Liquid **Reported Date:**
Start Date: 1/1/1950 **End Date:** 1/1/1967

Description:

This site received cooling water effluent from the 105-DR Reactor for radioactive decay and thermal cooling pri to release to the Columbia River. Total radionuclide inventories in the vicinity of the basin ranged from 5 curies over 400 curies. Seventy percent of the total radionuclide inventory is contained within the soil adjacent to the unit. Approximately 10 curies have leached into the concrete floor and walls. The basin was known to have leaked on several occasions.

References:

1. RD Stenner, KH Cramer, DA Lamar, 10/1/1988, Hazard Ranking System Evaluation of CERCLA Inactive Waste Sites at Hanford, PNL-6456 Vol 1, 2, 3.
2. R. W. Carpenter, 9/20/1993, 100-D Area Technical Baseline Report, WHC -SD-EN-TI-181, Rev 0.

Dimensions:

Length:	182.88	Meters	600.00	Feet
Width:	83.21	Meters	273.00	Feet
Depth/Height:	6.10	Meters	20.00	Feet
Sq. Area:	15,217.52	Square Meters	163799.84	Square Feet
Site Shape:	Not Specified			

Comments:

At the completion of the remedial action, the excavation area floor was approximately 16,352 square meters (176,013 square feet) at a depth of 4.75 meters (15.6 feet).

References:

1. RD Stenner, KH Cramer, DA Lamar, 10/1/1988, Hazard Ranking System Evaluation of CERCLA Inactive Waste Sites at Hanford, PNL-6456 Vol 1, 2, 3.
2. Scott Kitts to Nancy Homan, 4/17/1990, 100N updates for WIDS, DSI.

Field Work:

Type: Geophysical Survey
Begin Date: 5/1/1996
End Date: 5/1/1996
Purpose: Survey Retention Basin

Comment:

A Geophysical survey was done on the perimeter of the retention basin in 1996. See BHI-00786 for results.

Type: Analytical Sampling
Begin Date: 2/18/1999
End Date: 3/11/1999
Purpose: Verification sampling

Comment:

Samples were taken in both the deep zone (the floor of the excavation at 4.75 meters (15.6 feet)] and the shallow zone (the sidewalls of the excavation]. The contaminants of concern were cobalt-60, cesium-137, europium-152,154,155, nickel-63, plutonium-238, 239/240, strontium-90, chromium VI, and arochlors 1242 and 1260 (PCBs). Shallow zone samples numbers are B0TYW2 through B0TYW9, and B0TYX0 through B0TYX9. Deep zone samples are B0TV37 through B0TV51, B0TVK0 through B0TVK9, and B0TVJ5 through B0TVJ9.

References:

1. Cleanup Verification Package for the 116-DR-9 Retention Basin, CVP-99-00006, Rev 0.

Regulatory Information:

Programmatic Responsibility

Responsible Contractor/Subcontractor:	WCH	Washington Closure Hanford
Reclassifying Contractor/Subcontractor:		None
Responsible Project:		Not Specified

Site Evaluation

Solid Waste Management Unit: Yes

TPA Waste Management Unit Type : Waste Disposal Unit

Permitting

RCRA Part B Permit:	No	**TSD Number:**	
RCRA Part A Permit:	No	**Closure Plan:**	No
RCRA Permit Status:	Not Specified		
Septic Permit:	No	**216/218 Permit:**	
Inert LandFill:	No	**NPDES:**	
Air Operating Permit:	No	**State Waste Discharge Permit:**	
Air Operating Permit Number(s):			

Tri-Party Agreement

Lead Regulatory Agency:	Ecology
Unit Category:	CERCLA Past Practice (CPP)
TPA Appendix:	C

Remediation and Closure

Decision Document:	Interim Remedial Action Record of Decision, 100-BC-1, 100-DR-1, 100-HR-1 (1995)
Decision Document Status:	Final
Closure Document:	Cleanup Verification Package (CVP)
Closure Type:	Not Specified

Post Closure Requirments:

Revegetation; Institutional Controls to prevent uncontrolled drilling or excavations into the deep zone (below 4 meters (15 feet) are required.

Closure Group:

Closure Group Name: CG 116-DR-9 and 100-D-25

Site Code: 116-DR-9 **Site Reclassification Status: Interim Closed Out**

Type: Interim

Remediation Action:

The 116-DR-9 retention basin received cooling water effluent from the 105-DR Reactor from 1950 until 1965. After the 105-D Reactor was deactivated in 1965, the basin remained active until 1967 as part of the 105-D Reactor effluent system. Leakage occurred as unplanned releases in 1951 beneath the basin and outside the south end of the basin when seals in the concrete floor of the basin failed and the pipes pulled away from the basin walls at the retention basin inlet. The basin had a history of leaking and underwent repairs in 1951. Was site 100-D-25 documents leakage beneath the basin and outside the south end of the basin where the neopre seals in the concrete floor failed and the pipes pulled away from the basin walls at the retention basin inlet. Th contamination could not be distinguished from other contaminated soil. It was remediated with the 116-DR-9 Retention Basin under the provisions for "proximity sites."

Excavation began on October 21, 1997, by removing the overburden materials and underlying contaminated s Overburden materials, which were contaminated, were disposed at the ERDF. On December 28, 1998, the excavation had reached the design limits below the base of the engineered structure (El. 130.25 m [427.35 ft] and cleanup verification sampling was Initiated. At the completion of the remedial action, the excavation area floor was approximately 16,352 square meters (176,013 sq ft) at a depth of 4.75 meters (15.6 ft), and approximately 201,519 metric tons (222,122 tons) of material from the site were disposed of at the ERDF. The excavation will be backfilled in the near future with clean fill materials to the reference grade of El. 135.0 mete (443 ft).

Contaminated soil associated with the process effluent pipelines was not removed completely, but deferred for final remediation with the pipeline waste sites. The 116-DR-9 sidewall areas that are adjacent to future pipelin excavation areas were not sampled as part of the basin cleanup verification effort. These areas will be sample and verified clean as part of the effluent pipeline remediation efforts.

Excavated Material:

Quantity: 201,519.00
Unit Type: Metric Tons
Disposition: Environmental Restoration Disposal Facility

Sampling:

Sampling Region: Verification Samples
Constituent List: Hexavalent Chromium, Stronium-90, PCBs, Gamma Spec, Ni-63, Isotopic Pu

Institutional Controls:

Institutional control (IC) information has been revised as directed by the U. S. DOE letter, 05-AMRC-0078, 1/4/05, following a review of the Institutional Controls (ICs) in the WIDS. For some sites, including this one, WIDS had shown that no IC restrictions were required but the sites were remediated with deep zone criteria s that ICs actually were required. The 2005 evaluation determined that contamination was found in the deep zo so Intuitional Controls to prevent uncontrolled drilling and excavation are required.

Statement Of Protectiveness:

As demonstrated in this verification package, the RAGs for direct exposure, groundwater protection, and surfa water protection (including protection of the Columbia River) have all been achieved. Because the RAGs have been achieved, the RAOs have also been met. Materials that contain COCs at concentrations that exceed the RAGs have been excavated, sampled, analyzed, and where required, the materials were removed and shipped to ERDF. The remaining soil has been sampled, analyzed, and modeled to show that no residual COC concentrations in vadose zone soils pose a threat to human health, groundwater, or the Columbia River. The 116-DR-9 site is thus verified to be remediated and no longer poses a threat to human health or the environment.

Images:

Pathname: //mapweb.rl.gov/widsimg/100d/0056/0056_01.jpg **Date Taken:**
Description:

References:

1. 10/4/1996, Design Basis for the Remedial Actions for the 100 D Area, Group II Waste Sites, 0100D-DB-G0001.
2. 1/4/2005, Institutional Controls Data Revisions in WIDS, 05-AMRC-0078.
3. K.A. Bergstrom, T.H. Mitchell, 5/15/1996, Geophysical Investigations in the Group II Sites, 100 D Area, BHI-00786.
4. 1/30/1991, WIDS Data Modification, 116-DR-9.
5. RD Stenner, KH Cramer, DA Lamar, 10/1/1988, Hazard Ranking System Evaluation of CERCLA Inactive Waste Sites at Hanford, PNL-6456 Vol 1, 2, 3.
6. Dorian and Richards, 5/26/1978, Radiological Characterization of the Retired 100 Areas, UNI-946.
7. R. W. Carpenter, 9/20/1993, 100-D Area Technical Baseline Report, WHC -SD-EN-TI-181, Rev 0.
8. U.S. Department of Energy, 1/1/1995, Proposed Plan for Interim Remedial Measures at the 100-DR-1 Operable Unit, DOE/RL-94-100.
9. Department of Energy, 1/1/1994, 100-DR-1 Operable Unit Focused Feasibility Study Report, DOE/RL-94-61 Appendix G.
10. Cleanup Verification Package for the 116-DR-9 Retention Basin, CVP-99-00006, Rev 0.
11. U. S. Environmental Protection Agency, Interim Action Record of Decision for the 100-BC-1, 100-DR-1, 100-HR-1 Operable Units, Hanford Site, Benton County, Washington, EPA, 1995.
12. S.G. Weiss, 1/1/1996, Mitigation Action Plan for Liquid Waste Sites in the 100-BC-1, 100-DR-1, and 100-HR-1 Operable Units, DOR/RL-96-19.
13. Scott Kitts to Nancy Homan, 4/17/1990, 100N updates for WIDS, DSI.

10/18/2012

Waste Information Data System
General Summary Report

Site Code: 118-DR-2:2 **Site Reclassification Status: Interim Closed Out**

Site Names: 118-DR-2:2; 105-DR Reactor Below-Grade Structures and Soil

Site Type: Reactor
Status: Inactive
Hanford Area: 100D
OU/WMA: TBD

Start Date:
End Date:
Pipe Type: Not Specified

Site Description:

This subsite has been remediated and Interim Closed Out. For remediation purposes, the waste site was divided into five Zones and three decontamination areas.
Zone 1 consisted of the Fuel Storage Basin (FSB), storage and transfer area, storage area, and the transfer bay; and the soils underlying the FSB, collectively referred to as the FSB area. The FSB area was located on the east side of the 105 DR Reactor building and served as an underwater collection, storage, and transfer facility for the irradiated fuel elements discharged from the reactor. This zone was located entirely within the deep zone.
Zone 2 consisted of the valve pit that received wastewater from the reactor building. Zone 2 was entirely within the deep zone.
Zone 3 consisted of the solids feed area, the north water tunnel, and the trench under the accumulator room. The below-grade rooms, tunnel, and trench have been wetted by isolated spills and standing rainwater that may have acted as a hydraulic driver for potential contamination. Zone 3 was within the shallow zone
Zone 4 consisted of the gas tunnel, exhaust plenum, gas recirculation tunnel, and the instrument room. Similar to Zone 3, these rooms and tunnels would have been wetted by isolated spills and standing rainwater, which may have acted as a hydraulic driver for potential contamination. Zone 4 was entirely within the deep zone.
Zone 5 consisted of the side slope soils around the FSB, the south effluent pipeline, and the soil under the slab. Also included in Zone 5 was a section of 105-DR process effluent pipeline located adjacent to the south side of the FSB. This area was included in Zone 5 because of its proximity to the side slopes of the FSB. Zone 5 was within the shallow zone.
The three decon areas were located around the reactor for the purpose of equipment decontamination. The northwest decon area was approximately 8.0 meters by 8.8 meters (26 feet by 29 feet). The northeast decon area was approximately 12 meters by 9.8 meters (39 feet by 32 feet), and the south decon area was approximately 16 meters by 17 meters (52 feet by 56 feet).

Associated Structures:

This waste site is associated with 100-D-49:4 (North Effluent Pipe Tunnel).

Closure Group:

Closure Group Name: CG 118-DR-2:2 and 100-D-49:4
Type: Interim
Reclassification Status: Prepared
Reclassified On: 1/15/2004
Excavation Start Date: 9/1/98
Excavation Completed Date: 9/1/2001

Remediation Action:

The Cleanup verification package CVP-2003-00016 documents completion of removal action for 118-DR-2:2 Below Grade Structures and Underlying soils and the 100-D-49:4 pipeline in support of the 105-DR Reactor Interim Safe Storage Project. The 100-D-49:4 region consisted of the north effluent pipe tunnel, which has been removed. The soil beneath the floor and the side slopes were sampled for cleanup verification purposes. A portion of the 100-D-49:3 pipelines, located adjacent to the 105-D building, were also part of this remedial activity. The remedial activity was divided into five Zones, the north effluent pipeline and three decontamination

areas. The three decontamination areas were also part of this remediation.
Removal and disposal activities at the 105-DR site began on September 1998 and concluded in September 2001. Excavation of the site involved removing the overburden materials, building structure, debris, and underlying contaminated soil. The 105-DR D&D activities resulted in removal of above-grade structures and below-grade structures outside of the 105-DR Reactor core shield walls, to 1 meter (3 ft) below surrounding grade, with the exception of the Fuel Storage Basin (FSB). The FSB structure was removed to 4.6 meters (15 ft) below the surrounding grade.
An individual calculation of contaminated material removed for cleanup of the pipeline area was not provided in the CVP. A total of approximately 7,220 cubic meters (25,500 cubic feet) of contaminated materials were disposed at the ERDF. The results of this effort indicated that the materials from the site containing COCs at concentrations exceeding RAGs have been excavated and disposed at the ERDF.

Excavated Material:

Quantity: 7,220.00

Unit Type: Bank Cubic Meters

Disposition: Environmental Restoration Disposal Facility

Cleanup Verification:

The COCs for subsite 100-D-49:4 included: americium-241, barium-133, carbon-14, cobalt-60, cesium-137, europium-152, europium-154, europium-155, nickel-63, plutonium 238, plutonium-239/240, strontium-90, technitium-99, uranium-234, uranium-235, uranium-238, hexavalent chromium, lead, mercury and polychlorinated biphenyls. Sixteen samples were collected in July 2000. Soil samples were collected from the floor and side slopes of the pipe tunnel excavation.
The COCs for subsite 118-DR-2:2 included: americium-241, barium-133, carbon-14, cesium-137, cobalt-60, europium-152, europium-154, europium-155, nickel-63, plutonium-238, plutonium-239/240, strontium-90, technetium-99, tritium, uranium 233/234, uranium 235, and uranium 238. For cleanup verification, designated Zones were based on the type of deposition, depth, and/or type of use. Samples were collected over several months, from July 1999 through September 2001. The samples collected included concrete and soil.

Sampling:

Sampling Region: Verification Samples

Constituent List: Cesium-137, Hexavalent Chromium, Stronium-90, PCBs, Mercury, C-14, Ni-63, Isotopic Pu, Isotopic U, Tritium, Americium-241, Lead, technetium-99, Cobalt 60, Europium 152, 154, 155

Statement Of Protectiveness:

This CVP demonstrates that removal action at the 105-DR Reactor site has achieved the removal action objectives established in the Action Memorandum (EPA et al. 1998a) and has achieved corresponding RAGs established in the RAWP (DOE-RL 2002a), the 105-DR SAP (DOE-RL 2000), and in the 100 Area RDR/RAWP (DOE-RL 2002b). The remaining soils and concrete at the 105-DR Reactor site have been sampled, analyzed and modeled. The results of this effort indicate that the materials from the 105-DR Reactor site containing COCs at concentrations exceeding RAGs have been excavated and disposed at the ERDF. These results also indicate that residual concentrations in the shallow zone will support future land uses that can be represented (o, bounded) by a rural-residential scenario, and that residual concentrations throughout the site pose no threat to groundwater or the Columbia River. The 105-DR Reactor site is verified to be remediated in accordance with the Action Memorandum (EPA et al. 1998a) and can be backfilled.

References:

1. Cleanup Verification Package for the 118-DR-2:2, 105-DR Reactor Below-Grade Structures and Underlying Soils, and the 100-D-49:4 Reactor Cooling Water Effluent Underground Pipeline, CVP-2003-00016, Rev 0.
2. 1/1/2000, Sampling and Analysis Plan for the 105-F and 105-DR Phase III Below-Grade Structures and Underlying Soils, DOE/RL-99-35, Rev 1.

Attachment 1

WCH Costs Provided for Additional 31 100-D/H Waste Sites

Table Att-1. WCH Costs Provided for Additional 31 100-D/H Waste Sites

Waste Site ID	Operable Unit	WIDS Site Name	Classification/ Reclassification Status (June 2012)	"FS Category"	Interim Action Decision Document	Soil COPCs Based on Process Knowledge	Suggested Estimated RTD Cost	Cost Basis	Other comments
100-D-98:1	100-DR-1	Active electrical substations at 100-D Area	Accepted	"Waste Site Remaining for Remedial Action"	2009 ESD for the Remaining Sites ROD	No additions to Table 8-1.	$1.5 million per site	Per previous cost estimate.	100-D-98 is already included in the RI/FS document - this change is only to address the nuance of consistent handling for the site having been divided into two subsites.
100-D-98:2	100-DR-1	Inactive electrical substations at 100-D Area	Accepted	"Waste Site Remaining for Remedial Action"	2009 ESD for the Remaining Sites ROD	No additions to Table 8-1.			
100-D-105	100-DR-1	100-D/DR-Area Pipelines Discovered During Remediation	Accepted	"Waste Site Remaining for Remedial Action"	Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011	No additions to Table 8-1.	$5.78 million	Potential RTD quantities/parameters are similar to those used for 100-B-22:1.	
100-D-106	100-DR-2	1607-D1 Influent Pipelines	Accepted	"Waste Site Remaining for Remedial Action"	Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011	No additions to Table 8-1.	$495,800	Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011	
100-D-107	100-DR-1	Soil beneath the 1713-DA Essential Materials Warehouse	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.	$224,600	Combined estimated RTD costs for the 100-F-64 and 100-F-65 sites in the CY 2011 "Plug-In" fact sheet.	Potential Cr(VI) site. OU assignment has not been finalized. Site expected to be included in draft 2012 Remaining Sites "Plug In" fact sheet.
100-H-51:6	100-HR-1	Carbon steel pipe	Accepted	"Waste Site Remaining for Remedial Action"	2009 ESD for the Remaining Sites ROD	No additions to Table 8-1.	$495,800	2011 Fact Sheet estimate for 100-D-106	Please note this is an addition of one subsite only - other 100-H-51 subsites are already included in the RI/FS.
100-H-54	100-HR-1	100-H Shoreline Survey Unplanned Release	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.	$1.97 million	Special consisderations for site location and general dimensions of potential RTD are similar to 100-D-10.	OU assignment has not been finalized. Site expected to be included in draft 2012 Remaining Sites "Plug In" fact sheet.
100-H-56	100-HR-1	100-H Area Miscellaneous Pipelines	Accepted	"Waste Site Remaining for Remedial Action"	Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011	No additions to Table 8-1.	$5.78 million	Potential RTD quantities/parameters are similar to those used for 100-B-22:1.	
100-H-59	100-HR-1	100-H Area Railroad Track Soil Contamination Area	Accepted	"Waste Site Remaining for Remedial Action"	Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011	No additions to Table 8-1.	$109,400	Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011.	
600-380	100-HR-2	Segment 4 Unknown Cylinder	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.	$120,159	General analogy to the RTD cost listed for many small IU-6 sites (including debris sites) in the 2009 ESD for the Remaining Sites ROD.	OU assignment has not been finalized. Site expected to be included in draft 2012 Remaining Sites "Plug In" fact sheet.
600-381	100-HR-2	Segment 4 Underground Structure with Wooden Air Vents	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.	$120,159	General analogy to the RTD cost listed for many small IU-6 sites (including debris sites) in the 2009 ESD for the Remaining Sites ROD.	OU assignment has not been finalized. Site expected to be included in draft 2012 Remaining Sites "Plug In" fact sheet.
600-382:1	100-HR-2	Segment 4 Oil Stain and Filter Area #3a	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.	$120,159	General analogy to the RTD cost listed for many small IU-6 sites (including oil stain sites) in the 2009 ESD for the Remaining Sites ROD.	OU assignment has not been finalized. Site expected to be included in draft 2012 Remaining Sites "Plug In" fact sheet.
600-382:2	100-HR-2	Segment 4 Oil Stain and Filter Area #3b	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-382:3	100-HR-2	Segment 4 Oil Stain and Filter Area #3c	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-382:4	100-HR-2	Segment 4 Oil Stain and Filter Area #3d	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-382:5	100-HR-2	Segment 4 Oil Stain and Filter Area #3e	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			

Table Att-1. WCH Costs Provided for Additional 31 100-D/H Waste Sites

Waste Site ID	Operable Unit	WIDS Site Name	Classification/ Reclassification Status (June 2012)	"FS Category"	Interim Action Decision Document	Soil COPCs Based on Process Knowledge	Suggested Estimated RTD Cost	Cost Basis	Other comments
600-383:1	100-HR-2	Segment 4 Battery Remnant Area #2a	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.	$120,159	General analogy to the RTD cost listed for many small IU-6 sites (including battery sites) in the 2009 ESD for the Remaining Sites ROD.	OU assignment has not been finalized. Site expected to be included in draft 2012 Remaining Sites "Plug In" fact sheet.
600-383:2	100-HR-2	Segment 4 Battery Remnant Area #2b	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-383:3	100-HR-2	Segment 4 Battery Remnant Area #2c	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-383:4	100-HR-2	Segment 4 Battery Remnant Area #2d	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-383:5	100-HR-2	Segment 4 Battery Remnant Area #2e	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-383:6	100-HR-2	Segment 4 Battery Remnant Area #2f	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-383:7	100-HR-2	Segment 4 Battery Remnant Area #2g	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-383:8	100-HR-2	Segment 4 Battery Remnant Area #2h	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-383:9	100-HR-2	Segment 4 Battery Remnant Area #2i	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-383:10	100-HR-2	Segment 4 Battery Remnant Area #2j	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-384:1	100-HR-2	Segment 4 Stained Soil Area #3a	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.	$120,159	General analogy to the RTD cost listed for many small IU-6 sites (including stain sites) in the 2009 ESD for the Remaining Sites ROD.	OU assignment has not been finalized. Site expected to be included in draft 2012 Remaining Sites "Plug In" fact sheet.
600-384:2	100-HR-2	Segment 4 Stained Soil Area #3b	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-384:3	100-HR-2	Segment 4 Stained Soil Area #3c	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-384:4	100-HR-2	Segment 4 Stained Soil Area #3d	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-384:5	100-HR-2	Segment 4 Stained Soil Area #3e	Accepted	"Waste Site Remaining for Remedial Action"	None	No additions to Table 8-1.			
600-385	100-HR-2	Segment 4 Transite, Concrete, and Metal Debris Area	Accepted	"Waste Site Remaining for Remedial Action"	Fact Sheet: 100 Area "Plug-In" and Candidate Waste Sites for Calendar Year 2011	No additions to Table 8-1.	$120,159	General analogy to the RTD cost listed for many small IU-6 sites (including debris sites) in the 2009 ESD for the Remaining Sites ROD.	Site has unique considerations.