DOE/RL-2009-30
Revision 0

300 Area Remedial Investigation/Feasibility Study Work Plan for the 300-FF-1, 300-FF-2, and 300-FF-5 Operable Units

* Prepared for the U.S. Department of Energy
Assistant Secretary for Environmental Management

U.S. DEPARTMENT OF ENERGY

Richland Operations Office

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Concurrence

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Signature ____________________ Date 4-8-2010

U.S. Environmental Protection Agency

Signature Larry Gadbois ____________________ Date April 8 2010

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Executive Summary

This document presents the work plan for a remedial investigation/feasibility study (RI/FS) to support final remedy selection under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA)[1] for the 300 Area at the Hanford Site. The CERCLA RI/FS results also are intended to address *Resource Conservation and Recovery Act of 1976*[2] (RCRA) corrective action requirements of areas of RCRA concern. This document explains the RI/FS project background and presents detailed plans for investigation of contaminated U.S. Department of Energy (DOE) sites in the 300 Area. To assist in investigation of the sites, the DOE has combined groundwater contamination, soil contamination sites, and facilities in individual geographic areas to enable a more comprehensive look at the contamination and associated risk. The 300 Area includes 300-FF-1, 300-FF-2 and 300-FF-5 Operable Units. It is one of the areas (Figure ES-1) defined for the River Corridor. The River Corridor also includes 100-BC, 100-K, 100-D 100-H, 100-N, and 100-F combined with 100-IU-2/6. The 100 Area work plan was developed as a separate stand-alone document with addenda for each area. These areas and the groundwater, which are contaminated from releases and spills of radiological and/or chemical constituents, encompass the 100 and 300 Areas National Priorities List sites.

This Work Plan implements the approach designed to reach final remediation decisions on the 300 Area Operable Units. Included in the work plan is a description of key features of the planning process that supports the implementation of the approach and important regulatory considerations and risk assessment uncertainties common to the 300 Area. The work plan documents the development of the site-specific conceptual model, areas of uncertainty that require resolution to support decisions, and DOE/RL-2009-45, *300 Area Remedial Investigation/Feasibility Study Sampling and Analysis Plan for the 300-FF-1, 300-FF-2 and 300-FF-5 Operable Units*[3] that when implemented will direct the collection of new information to address these uncertainties.

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1 *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, 42 USC 9601, et seq. Available at: http://www.epa.gov/oecaagct/lcla.html#Hazardous%20Substance%20Responses.

2 *Resource Conservation and Recovery Act of 1976*, 42 USC 6901, et seq. Available at: http://www.epa.gov/epawaste/inforesources/online/index.htm.

3 DOE/RL-2009-45, 2009, *Sampling and Analysis Plan for the 300 Area Decision Unit Remedial Investigation/ Feasibility Study*, Draft A, U.S. Department of Energy, Richland Operations Office, Richland, Washington. Available at: http://www5.hanford.gov/arpir/?content=findpage&AKey=0910271277.

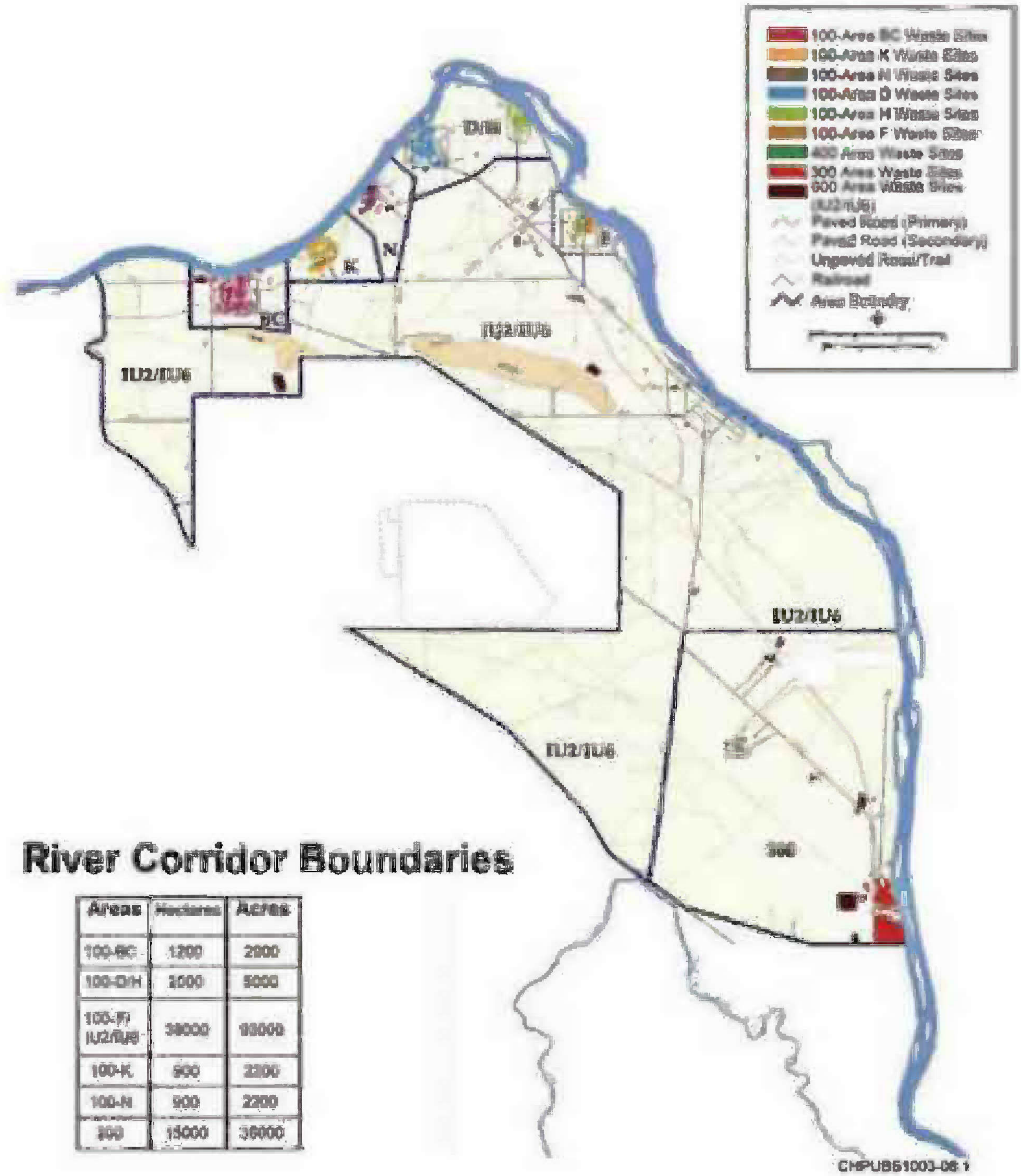

Figure ES-1. River Corridor Area Boundaries

This work plan marks the initiation of the approach leading to final remediation of the 300 Area. Much of the information necessary to support remediation decisions and final records of decision that will protect human health and the environment exists based on the work that already has been accomplished. This work plan identifies the areas of uncertainty that remain. This work plan also further identifies data or information needed to address those uncertainties and the corresponding actions to obtain that information. This approach will result in the final documents and decisions that are necessary to define final remediation plans to provide permanent protection for the public and ecological resources.

A systematic planning process was used to develop a program for data collection and analysis to support final remediation decisions in the 300 Area. The following sections discuss key elements that were identified during this systematic planning process.

Site Background and Environmental Setting

Collected information includes operational history of the facilities (with an emphasis on disposal operations), the known nature and extent of groundwater and soil contamination, known geohydrologic information, source and groundwater remedial actions and their effectiveness, and the results of any treatability and characterization studies.

Uranium contamination is the primary risk driver in the 300 Area; however, other groundwater plumes exist. Chapter 2 and Appendix B present maps of the facilities source sites, and groundwater plumes. As of November 5, 2008, 94 sites, including the major liquid waste disposal sites, have been dispositioned in accordance with EPA/ROD/R10-01/119, *Declaration of the Interim Record of Decision for the 300-FF-2 Operable Unit*.[4] While the "interim closed out" remedial actions satisfied the interim action record of decisions, they may not satisfy final CERCLA remediation and/or RCRA corrective action requirements due to vadose zone and/or groundwater contamination remaining after the interim action record of decision removal action. There are 109 sites remaining in the operable unit to be dispositioned in accordance with EPA/ROD/R10-01/119.

[4] EPA/ROD/R10-01/119, 2001, *Declaration of the Interim Record of Decision for the 300-FF-2 Operable Unit*, U.S. Environmental Protection Agency, Washington State Department of Ecology, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.epa.gov/superfund/sites/rods/fulltext/r1001119.pdf.

Conceptual Site Models

The conceptual site model (CSM) is a description of the site that organizes the available information and provides a summary of the site conditions. The CSM is developed to depict what is known about the site history (including process history), levels and location of contamination, and information needed to support decisions on remediation. The CSM is used to identify data and information gaps, establish data needs, and design a field program to address the gaps.

For this work plan, the unit has been divided into three subregions: 300 Area, 400 Area, and 600 Area. The 300 Area subregion consists of the buildings, facilities, waste disposal sites, process units, and impacted groundwater. The 300 Area subregion contains the industrial complex located north of Richland, Washington, where the majority of uranium fuel production and research and development activities took place. The 400 Area subregion consists of the Fast Flux Test Facility, associated facilities, and groundwater potentially impacted by releases from those facilities. For the purposes of this work plan, the 600 Area subregion contains the 618-10 and 618-11 Burial Grounds, the former 316-4 Crib, various burial grounds not categorized as being within the 300 Area (industrial complex) or 400 Area, along with groundwater that may have been impacted by releases from those waste sites.

300 Area

Sources of contamination in the 300 Area originated with the years of uranium fuel production operations and various research and development activities focused on improving uranium fuel production methods and improving the plutonium extraction operations carried out in the 200 Area. During 300 Area operations, there were intentional releases of waste materials to the environment, most notably in the form of process liquids discharged to the large, unlined infiltration ponds and trenches. Additionally, there were several unplanned releases of both solids and liquids to the soil below and around the uranium production laboratories and waste handling facilities.

Uranium, as both the metal and its isotopes, is the contaminant of greatest concern in the 300 Area because of its persistence as a dissolved form in groundwater. Uranium is a toxic chemical notable for kidney and other impacts, and uranium isotopes have radiological impacts. Although a variety of other chemical and radiological constituents were present in the waste effluents released to the soil, uranium continues to persist in environment pathways, while other constituents have dispersed. Other contaminants of potential concern in 300 Area groundwater include hexavalent chromium, cis-1,2-dichloroethene, trichloroethene; gross alpha and gross beta activity also exceed regulatory standards. Nitrate contamination from offsite agricultural activities migrates into the 300 Area subregion from sources to the southwest.

The conceptual model for features and processes associated with uranium contamination in the subsurface beneath the 300 Area suggests that the preponderance of contamination initially entered environmental pathways by liquid wastes infiltrating through engineered facilities, such as process ponds and trenches. Additional contamination was introduced via unplanned releases (e.g., leakage from the process and radiological sewers; spills). Uranium was retained in the vadose zone beneath these sites by sorption-to-solids processes and as residual, contaminated moisture. A large fraction likely reached groundwater as essentially saturated flow beneath the disposal site, causing a plume in groundwater. The widespread groundwater plume during the 1940s through the early 1970s was subjected to large seasonal variations in the water table elevation. Contaminated groundwater would be moved upward into the uncontaminated vadose zone in areas well away from the liquid waste disposal facilities during the period of seasonal high water table conditions, which related to seasonal high river discharge. As the water table subsequently receded, uranium would remain sorbed to sediment, and some as residual moisture. Three subsurface regions are potential sources for resupplying uranium to the groundwater plume:

1. The vadose zone directly beneath the principal liquid-waste-disposal sites.
2. A more widespread zone bounded laterally by the extent of the uranium plume and vertically by the range in elevation of the current water table.
3. A similar widespread zone that extends vertically higher than the current high water table limit.

The third zone is included because during the fuels production years, the historical water table elevation extended much higher than the current range.

Because waste disposal to the ground and leaks/spills associated with fuels fabrication have long since ended, the contamination that remains today represents the following:

- Residual amounts from past operations.
- Contamination that has migrated into the 300 Area aquifer from upgradient sources.

- Recently introduced contamination because of current activities, such as remediation of waste sites and deactivation, decommissioning, decontamination, and demolition associated with buildings and other facilities.

The bulk of mobile contaminants introduced to environmental pathways has long since dispersed, primarily via groundwater flow and discharge to the river.

400 Area

The operations associated with the Fast Flux Test Facility did not result in any documented incidents of contamination being released to the environment. None of the 400 Area waste sites appears to provide a significant threat of widespread release to environmental pathways, and no groundwater plumes are identified as being the result of 400 Area operations. The current conceptual model for contamination in environmental pathways at the 400 Area does not indicate the need for additional characterization activities as part of this work plan.

600 Area

The operational history of the burial grounds located in the 600 Area is tied to the waste management practices conducted in the 300 Area industrial complex. The most significant potential sources of contamination in the 600 Area are two solid waste burial grounds (618-10 and 618-11) and a liquid waste disposal facility (316-4 Crib). Additional burial grounds grouped within the 600 Area constitute the remaining 33 sources. There is potential for contamination to be transported to the vadose beneath the burial grounds.

Historical records indicate contents of the 618-10 and 618-11 Burial Grounds include potentially high level and transuranic (TRU)[5] wastes, and uranium-tributyl phosphate soil contamination was measured in the soil beneath the excavated 316-4 Crib site. Tritium release from materials buried in the 618-11 Burial Ground has been identified based on soil gas analyses at sites adjacent to the facility, and on groundwater monitoring near the burial ground.

[5] Radioactive waste as defined in DOE G 435.1-1, *Implementation Guide for Use with DOE M 435.1-1*.

Data Gaps and Needs

Data gaps, or statements of uncertainty, were identified as part of the systematic planning process. These data gaps included recognition of the need for additional information to better define the following:

- Potential effects of residual soil contamination following remedial action on human health, groundwater, and the environment.
- Extent of contamination in the unconfined aquifer.
- Horizontal and vertical dimensions of the uranium contamination in the deep vadose and periodically rewetted zones that are potential source areas for resupplying the groundwater plume.
- Continued persistence of contamination in the groundwater in areas of the 300 Area.
- Hydraulic properties of the aquifer and river interaction.

Each data gap is defined by a data need that, when filled, provides information to reduce or eliminate the uncertainty associated in the data gap to the degree needed to make a final cleanup decision.

A summary of the data gaps and needs, as well as the specific work proposed for the 300 Area work plan, is presented in Table ES-1. Figure ES-2 is an index map for the proposed locations for characterization boreholes in the 300 Area, each of which will be completed subsequently as a monitoring well. An important consideration in Table ES-1 is that several ongoing programs (e.g., facility demolition, waste site remediation, and research studies) are expected to provide data that will resolve many of the uncertainties identified for the 300 Area. DOE/RL-2009-45 identifies only those data collection activities that these ongoing programs will not address. Therefore, the RI/FS report developed for the 300 Area will take full advantage of data and information developed by ongoing remediation programs.

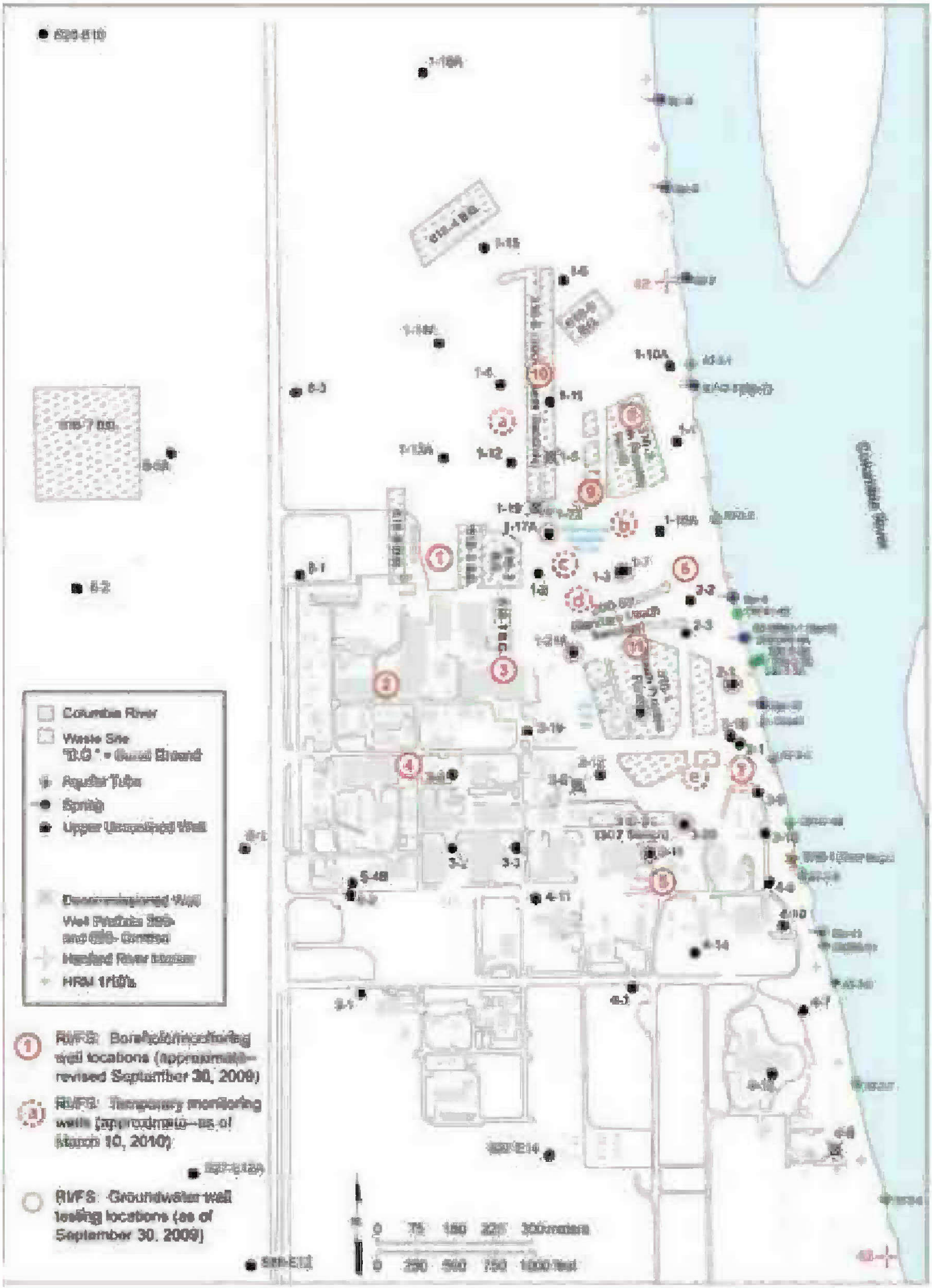

Figure ES-2. Index Map for Proposed Locations for Characterization Boreholes in the 300 Area

Approach

Chapter 4 summarizes current risk assessment activities that have been evaluated to help develop the characterization scope for the work plan. In addition, this chapter presents preliminary information related to remedial action objectives, remediation goals, assessment of applicable or relevant and appropriate requirements, and remedial actions that will be fully developed in the course of completing the RI/FS process.

The DOE also used the *National Environmental Policy Act of 1969*[6] (NEPA) process to assess environmental impacts of cleanup actions. Under DOE O 451.1B,[7] *National Environmental Policy Act Compliance Program*, Section 5.a.(13), DOE will "…incorporate NEPA values, such as analysis of cumulative, off-site, ecological, and socioeconomic impacts, to the extent practicable, in DOE documents prepared under the Comprehensive Environmental Response, Compensation, and Liability Act." Projects under CERCLA must adhere to the public participation and administrative record requirements of 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan."[8] Separate review of the environmental impact under NEPA is not required. These NEPA values include, but are not limited to, cumulative, ecological, cultural, historical, and socioeconomic impacts, and irreversible and irretrievable commitments of resources. For the 300 Area, the NEPA value analysis will be documented in conjunction with the CERCLA criteria in (1) each feasibility study specific to an operable unit and (2) in the resulting CERCLA decision document.

RI/FS Tasks

Chapter 5 describes the tasks and processes that will be used during the RI/FS. These descriptions incorporate remedial investigation site characterization tasks, data evaluation methods, analyses of remedial alternatives, reporting, and the preliminary determination of tasks to be conducted after site characterization. As part of the remedial investigation process, continued implementation of interim cleanup actions during the RI/FS process has been ongoing at the Hanford Site for the past 15 years.

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[6] *National Environmental Policy Act of 1969*, 42 USC 4321, et seq. Available at: http://www.gc.energy.gov/NEPA.

[7] DOE O 451.1B, *National Environmental Policy Act Compliance Program*, U.S. Department of Energy, Washington, D.C. Available at: https://www.directives.doe.gov/pdfs/doe/doetext/neword/451/o4511bc1.pdf.

[8] 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*. Available at: http://www.access.gpo.gov/nara/cfr/waisidx_08/40cfr300_08.html.

An integrated cleanup program is implemented in the River Corridor with a primary objective of protecting the Columbia River. Elements of the integrated cleanup program include deactivation, decommissioning, decontamination, and demolition of contaminated and excess facilities; placing shutdown reactors in interim safe storage; removal of contaminated soil and debris from waste sites; and cleanup or immobilization of contaminants in groundwater. Implementation of these cleanup actions in the River Corridor has reduced risk and produced large quantities of information and data that are valuable to guide development of the RI/FS work plan. Continued implementation of these cleanup actions throughout the RI/FS process will produce additional information to address many of the current data gaps and provide opportunities for refinement of site knowledge. These activities continue to be efficient and cost-effective approaches for addressing the additional information needed to complete the RI/FS process.

Project Schedule

The schedule was developed to meet the potential Ecology et al. 1989a, *Hanford Federal Facility Agreement and Consent Order*[9] (Tri-Party Agreement) milestones and goals for the 300 Area. Chapter 6 presents the project schedule for activities discussed in this work plan.

Project Management Considerations

Chapter 7 presents project organization, project coordination, change control, and dispute resolution processes. The U.S. Department of Energy, Richland Operations Office (RL) is responsible for Hanford Site cleanup of the River Corridor. The RL contractors implement the cleanup for RL and are responsible for planning, coordinating, and executing the RI/FS activities. The lead regulatory agency authorizes the work scope in accordance with the Tri-Party Agreement and oversees the work for regulatory compliance.

[9] Ecology, EPA, and DOE, 1989a, *Hanford Federal Facility Agreement and Consent Order*, 2 vols., as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington. Available at: http://www.hanford.gov/?page=91&parent=0.

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
300 Area Sources						
Unidentified sources of contamination may exist within and in the soils adjacent to engineered facilities and structures.	1	Identify new waste sites and potential sources of contamination in the 300 Area.	Complete OSE process in the 300 Area (industrial complex).	No	Complete OSE process in the 300 Area (industrial complex). Data need will be fulfilled as part of the OSE process.	The OSE and waste site discovery processes are performed to identify new waste sites and sources that are not currently included in CERCLA decision documents. Remediation decisions associated with this data need include determination of waste site classification after discovery (Section 2.2) (i.e., accepted, rejected, or no action).
The significance of contaminant uranium remaining in the vadose zone and periodically rewetted zone (current and historical) in areas directly beneath and in the immediate vicinity of remediated waste sites is not fully understood with respect to the persistence of the groundwater plume.	2	The inventory and mobility characteristics of contaminant uranium beneath and immediately adjacent to remediated waste sites, and of the current geochemical and hydrologic processes potentially acting to resupply uranium to the groundwater plume, require additional investigation to fully evaluate conditions relative to protection of groundwater from contaminant input.	Two drilling programs will be used to address this data need. (1) Drill four boreholes within the footprints of former liquid waste disposal facilities (No. 8, No. 9, No. 10, and No. 11 on Figure 3-5). Samples of sediment and pore water will be collected to determine the contaminant content and contaminant mobility characteristics at various depths in the vadose zone. (2) Drill five boreholes at increasing distances from the footprints of the waste sites (Nos. a through e on Figure 3-5) to develop transects along potential uranium migration routes.	Yes	Field sampling: Collect sediment and pore water samples from the water table zone above the groundwater plume. • Four borehole locations (two in North Process Pond; one in South Process Pond; one in 300 Area Process Trenches). • Five borehole locations in the vicinity of the seasonal uranium hot spot just south of the 300 Area Process Trenches and North Process Pond. • Complete the four characterization boreholes as monitoring wells; complete the five additional locations as temporary monitoring wells. See Table 3-5 for drilling sampling details.	The leaching characteristics of uranium in the lower vadose zone are known from only a few locations near to or within the footprints of former liquid waste disposal sites. Additional field and laboratory data are needed during the feasibility study to refine estimates for the amount and characteristics of residual contamination that potentially could affect groundwater. More complete characterization of these features and processes will contribute to informed decisions regarding appropriate monitoring strategies and selection of a remedial action alternative, including screening, testing, and implementing a remedial technology.
The potential exists for contaminant uranium to sequester on sediment near the Columbia River because of river-induced changes in geochemical conditions. The magnitude of this phenomenon and its potential to act as a continuing source for resupplying the groundwater plume has not been determined.	3	Additional sediment and water samples are needed from the subsurface zone impacted by Columbia River water to determine the contaminant uranium inventory of contaminant uranium and to perform laboratory studies on the mobility characteristics of that uranium.	Drill two boreholes near the Columbia River (No. 6 and No. 7 on Figure 3-5). Collect sediment and water samples to determine contaminant content and contaminant mobility characteristics at various depths in the vadose zone and aquifer.	Yes	Field sampling: Collect sediment and pore water samples from the near river zone where groundwater interacts with river water. • Drill two new borehole locations close to river (east of former sanitary leach trenches and east of Well 399-3-9). See Table 3-5 for drilling sampling details.	The change in geochemical conditions near the river, mixing river water and groundwater, may cause dissolved uranium to be preferentially adsorbed onto sediment, so the near-river zone could be implicated in the persistence of the plume. Such information applies to 1) evaluating the risk associated with the level of contaminant discharge to the Columbia River, and 2) to the FS focused on potential ways to reduce the concentration of uranium in groundwater. If remedial action within this zone becomes part of a proposed plan, additional detailed information will be required to design an effective remedy for this dynamic environment.
The source is unknown for the original VOC(s) that have degraded to cis-1,2-dichloroethene near Well 399-1-16B, and there is the possibility that a dense, nonaqueous-phase liquid remains undetected.	4	Identify the original VOC(s) and the pathways leading to the cis-1,2-dichloroethene observed at Well 399-1-16B.	(1) Perform computer simulations of the release of tetrachloroethene similar to historical releases. (2) Collect additional measurements of VOC concentrations in groundwater under conditions of withdrawal at Well 399-1-16B. Hydraulic parameters to be determined as part of withdrawal operations. Include analyses for VOCs for water samples from equivalent aquifer horizons in characterization boreholes (Nos. 6, 8, and 9 shown in Figure 3-5).	Yes	Field sampling: Perform groundwater withdrawal test in Well 399-1-16B that includes monitoring water quality changes as pumping proceeds and hydraulic pump testing; include analyses for VOCs for samples from wells in the North Process Pond and 300 Area Process Trenches. Collect and analyze water samples from Well 399-1-16B water quality parameters (volatile organic compounds, major anions and cations [including nitrate and nitrite under the major anions category], total organic carbon, and uranium [total, unfiltered sample]; field parameters*, temperature, pH, turbidity, specific conductance, dissolved oxygen, and microbiological activity). See Table 3-5 for drilling sampling details.	Information is not available to fully evaluate whether an undetected source for VOC contamination remains in the lower portion of the vadose zone, and/or at depth in the unconfined aquifer (i.e., at stratigraphic horizon monitored by several "-B" series wells). A more complete understanding of origin will help in developing estimates for how long this contamination is likely to persist.

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
The trichloroethene origin in the finer grained interval of Ringold Formation is not known in sufficient detail to support the technical basis for a proposed plan.	5	Additional information is needed on the potential origin(s) for the VOC contamination observed in an interval of finer grained sediment within the unconfined aquifer.	Searches of historical records for the 300 Area have not revealed hard evidence that would help explain the origin of this contamination. Additional source remedial actions in the 300 Area may reveal information that would point to a source. No specific investigations to identify a source are warranted for the RI.	No	No field work is planned to resolve this data need.	Information is not available as of January 2010 to fully evaluate (1) the potential extent, (2) the possible presence of a dense, nonaqueous-phase liquid, and (3) the processes leading to the persistence of this contamination in the environment. A complete understanding of where, when, and what was introduced to the vadose zone would reduce uncertainties in the current conceptual model. Identification of the source responsible for VOC contamination in this sediment interval would play a role in the FS of an engineered solution to lowering the level of contamination.
Distribution of Contaminants – 300 Area						
The extent of contaminant uranium in the shallow vadose zone beneath and adjacent to 300 Area facilities and waste disposal sites is not defined for waste sites not yet remediated.	6	Conduct sampling to characterize the extent of contamination in the sediment adjacent to and beneath the sites during remedial actions at future waste sites.	The current strategy for interim remedial actions at waste sites will be continued. The strategy has been efficient in obtaining the necessary data during remediation using the observational approach. Data will continue to be obtained that document the extent of residual contamination following completion of the interim remedial action.	No	Complete contaminated soil removal and sampling of the waste sites within the 300 Area subregion. The data need will be fulfilled as part of the ongoing interim action.	The known extent of uranium contamination at remediated waste sites is needed to assess the protectiveness of remedial action regarding human health and the underlying groundwater. Protectiveness levels will be developed as part of the proposed plan for future remedial actions and long-term evaluation of the effectiveness of the remedies selected.
The uranium contamination beneath the high volume, liquid waste disposal sites in the vadose zone between the bottom of the excavations and the periodically rewetted zone is known from a limited number of characterization boreholes. The possibility exists that localized zones of relatively high concentrations of contaminant uranium have gone undetected.	7	Laboratory analytical results for sediment and groundwater samples from boreholes drilled through the footprints of former liquid waste disposal facilities and adjacent areas along contaminant migration routes.	See resolution for Data Need No. 20. Two drilling programs will be used to obtain field and laboratory data to resolve this Data Need.	Yes	See scope of work for Data Need 2. Collect and analyze sediment. See Table 3-5 for drilling sampling details.	Information on the inventory of uranium potentially available in the vadose zone beneath the high-volume, liquid waste disposal sites will be used to evaluate protectiveness relative to groundwater impact. The exchange between dissolved and solid forms of uranium is a complex process and requires additional data on subsurface conditions be obtained to reduce uncertainties to an acceptable level for remediation decisions. For example, additional data will allow an update to the "box model" that provides estimates for uranium in various subsurface regions (Data Need No. 17). Data from characterization drilling beneath these waste sites will provide information essential for the FS.
Data to describe the lateral distribution of uranium in the deeper portion of the vadose zone away from remediated waste sites are very limited. The information available is based primarily on an understanding of historical conditions during the fuels fabrication years, and not on direct observation from characterization boreholes.	8	Analyses of vadose zone sediment samples from borehole locations away from the footprints of principal liquid waste disposal sites will be used to refine estimates for the distribution of contaminant uranium.	Drill five boreholes in the west and southwest portions of plume (Figure 3-5): No. 1, No. 2, No. 3, No. 4, and No. 5. Collect sediment and water samples to determine contaminant content and contaminant mobility characteristics at various depths in the vadose zone and aquifer. Data from boreholes No. 6 and No. 7 will also contribute to resolving this data need, as will information from the five transect wells, a to e, from Data Need No. 2.	Yes	Collect and analyze sediment and pore water samples. See Table 3-5 for drilling sampling details. Collect and analyze vadose zone sediment and pore water from temporary well locations (a) through (e) shown in Figure 3-5. Collect and analyze sediment samples from future excavations that penetrate to depths of historical high water tables conditions.	The distribution and concentration of the labile (extractable) uranium in sediments of the lower portion of the vadose zone outside the high volume, liquid waste disposal site footprint are needed to estimate the potential area targeted for remedial action as part of the FS. During periods of flood river stage (e.g., late 1940s through the early 1960s), the water table beneath the 300 Area occasionally raised to an elevation that approached and possibly reached the bottoms of the North Process Pond, South Process Pond, and 307 Process Trenches. The consequences included groundwater interacting with the waste effluent high in the vadose zone, which may have enhanced sorption with sediment, and lateral spreading with subsequent uranium deposition in the vadose zone well above the current periodically rewetted zone. Additional samples from the proposed boreholes will provide data to refine estimates for the distribution of contaminant uranium in the vadose zone, including refinements to the box model (Data Need No. 17).

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Although the distribution of uranium contamination in the aquifer from the existing monitoring well and aquifer tube networks is well described in general terms, details on the vertical distribution are not available.	9	Discrete measurements of uranium concentrations at various depths in the unconfined aquifer under varying water table conditions.	Perform vertical profiling at existing and new wells. The methods proposed to respond to this data need include various tests at a subset of the current monitoring network, and new wells completed as part of this RI. Methods include groundwater sampling at discreet depths in the well bore and use of probes to characterize water movement in the well bore. Recent investigation results from the IFRC site are providing additional insight on the best methods to resolve this data need.	Yes	Field sampling: • Select approximately eight well locations for tests, including subsets that represent (1) locations that show an increase in uranium concentrations when the water table is high, (2) locations that show a decrease in uranium concentrations when the water table is high, and (3) locations where uranium concentrations remain relatively constant (i.e., typically, the perimeter areas of the plume). Perform depth-discrete sampling to provide a vertical profile of uranium concentrations at 1 m (3-ft) intervals throughout the open interval of the well. • At wells near the river where river water intrusion is expected during high river stage conditions, measure specific conductance and temperature by lowering a probe into the well before water sample collection. • For wells at locations where uranium concentrations rise significantly when the water table is elevated, capture water samples at the water table during the June sampling event (approximately four inland well locations and four near-river locations). Laboratory analyses: Analyze all collected water samples in accordance with DOE/RL-2002-11.	Additional field measurements are needed to test hypotheses regarding resupply of contaminant uranium to the groundwater plume. If high water table conditions remobilize contamination sorbed in the lower vadose zone, discrete water samples near the top of the unconfined aquifer (i.e., at the water table) should reveal evidence in the form of higher concentrations. A more detailed characterization of the vertical concentration patterns within the plume will contribute to design of an effective long-term monitoring strategy. The improved understanding will lead to refined targeting of the remedy and sample collection protocols for regulatory compliance purposes.

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Monitoring well coverage of the hydrologic unit presumed to contain the bulk of uranium contamination is uneven, with principal weaknesses in coverage at the footprints of former liquid waste disposal sites and near the perimeter of the plume, especially the west and southwest portions.	10	Fill coverage gaps in the groundwater monitoring network for the uranium plume by completing monitoring wells at each of the 11 characterization borehole sites.	Complete each of the 11 characterization boreholes (Figure 3-5) as a groundwater monitoring well. Unless other than expected conditions are encountered during characterization, well screens will be positioned to monitor the uppermost hydrologic unit, i.e., saturated Hanford formation sediment. New wells include two in the North Process Pond; one in South Process Pond; one in 300 Area Process Trenches, five in the west and southwest portions of uranium plume, and two near the Columbia River.	Yes	Field sampling: Install new monitoring wells to cover the uppermost hydrologic unit in the unconfined aquifer. • Install 11 new monitoring locations (same as for vadose zone characterization boreholes) (i.e., 2 in North Process Pond; one in South Process Pond; 1 in 300 Area Process Trenches; 5 in west and southwest portions of plume and 2 near the Columbia River). • Conduct quarterly sampling of each new monitoring well for the first year, with a reduction in frequency for subsequent years if warranted. Laboratory analyses: • Use initial analysis of samples to establish baseline conditions at each new monitoring well. Methods are specified in DOE/RL-2002-11, *300-FF-5 Operable Unit Sampling and Analysis Plan*, Rev. 2, or its most recent update). • Radiological contamination uranium (total, unfiltered sample), gross alpha, and gross beta. • Chemical contamination chromium, nitrate, trichloroethene, tetrachloroethene, cis-1,2-dichloroethene, and vinyl chloride. • Basic water chemistry, including major anions and cations. • Additional laboratory analyses based on site specific conditions, as warranted.	The network of wells used to monitor the uranium plume needs to be sufficiently comprehensive to describe the level of contamination with an uncertainty acceptable to decision makers. Data from the expanded monitoring network will permit estimates for the level of contamination, such as, volume of plume; mass of dissolved uranium; concentrations at exposure locations, and how the level changes with time. These estimates are information needed to evaluate natural attenuation and to define the extent of the environment potentially subject to remedial action.
The extent of VOC contamination to the north and northwest of Well 399-1-16B, is not clearly defined by the current monitoring well network.	11	Additional field observations of water quality in groundwater from the lower portion of the unconfined aquifer near Well 399-1-16B, particularly upgradient from the well and within the flow path from potential sources.	Evaluate groundwater quality within horizons immediately above and equivalent to the contaminated horizon observed at Well 399-1-16B during drilling at characterization borehole locations near that well (Figure 3-5).	Yes	Collect groundwater samples during drilling at characterization borehole locations No. 6, No. 9, and No. 10 as drilling proceeds. Analyses to include VOCs, uranium, major anions, including nitrate and nitrite, and cations, and field parameters (temperature, pH, turbidity, specific conductance and dissolved oxygen). Use rapid turnaround VOC analysis to help select screen interval for completing monitoring wells at the three borehole locations. See Table 3-5 for drilling sampling details.	Data from additional monitoring locations will reduce the uncertainty in describing the extent of this contamination and its possible source location. Additional field observations will improve estimates for the level of contamination and changes with time, which is information for the FS analysis of remedial action alternatives.

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
The lateral extent of the contaminated portion of the finer-grained interval of Ringold Formation sediment is based on a limited number of observation locations that do not cover the potential extent beneath the 300 Area and exposure locations in the Columbia River.	12	Additional analytical results for groundwater collected from the finer-grained interval from areas beneath the 300 Area where data do not currently exist, and from the adjacent Columbia River substrate.	New information on the contamination extent will be provided by the characterization drilling, proposed for 11 locations as part of this work plan (Figure 3-5; Table 3-5), and by work in progress under the RCBRA (DOE/RL-2008-11). Information from geophysical research activities that focus on defining areas where groundwater preferentially discharges from the aquifer to the riverbed (DOE-sponsored research using fiber optic cables to reveal temperature anomalies) will contribute to identifying riverbed locations where this contamination may be released.	No	N/A	Current estimates for the extent of this contamination are based on the coverage provided by the LFI and VOC investigation boreholes, used to establish general limits (PNNL-17666). The vertical extent is known in general terms based on several samples collected at each previous characterization borehole. The eastern extent to which contamination extends, i.e., beneath the Columbia River, is not known but data from aquifer tubes provide the most easterly positioned results. Identifying the easterly extent of contamination in this interval is part of the CSM, especially with regard to ecological receptors in the Columbia River. The boundaries for the areal extent are needed to evaluate the feasibility of an engineered solution to reducing the level of contamination.
Fate and Transport of Contaminants – 300 Area						
The physical, geochemical, and hydrogeologic characteristics of the vadose zone sediment beneath the high volume, liquid waste disposal sites between the bottom of the excavations and the periodically rewetted zone are not sufficiently characterized to understand the transport mechanisms for uranium. These sites were remediated as part of EPA/ROD/R10-96/143, but the uncertain relationship between residual amounts of uranium at the bottom of the excavations to dissolved concentrations in the underlying groundwater remains.	13	Additional sediment samples from beneath remediated high volume, liquid waste disposal sites, extending from the bottom of the excavation to groundwater. Additional evaluation of physical properties, geochemical properties, and the hydraulic characteristics, with particular emphasis on the region near the periodically rewetted zone.	See Resolution of Data Need 2. Drill four (two in North Process Pond, one in South Process Pond, and one in 300 Area Process Trenches) boreholes and collect samples for analysis of sediment.	Yes	See Scope of Work for Data Need 2. Collect and analyze sediment and pore water from newly installed wells beneath the North Process Pond, South Process Pond, and 300 Area Process Trenches. See Table 3-5 for drilling sampling details.	The uranium transport mechanisms and the unsaturated flow characteristics beneath the high volume, liquid waste disposal sites remediated as part of EPA/ROD/R10-96/143 (i.e., the North and South Process Ponds, and the 300 Area Process Trenches) need to be known to develop computer simulations of uranium transport through the vadose zone and subsequent potential impacts to groundwater. The simulations outputs will strengthen the conceptual model for explaining the persistence of the groundwater plume, and will provide information that is fundamental to the FS of alternatives for remediation.
The hypothesis that labile or extractable uranium is present in the vadose zone away from the footprints of the remediated high volume, liquid waste disposal sites is not well tested, yet those subsurface areas may play a role in the long-term resupply of the groundwater plume. The physical, geochemical, and hydrogeologic characteristics of the vadose zone sediment that influence transport away from the liquid waste disposal sites are inferred, but direct observational data are limited.	14	Additional sediment analyses collected from the deeper portions of the vadose zone, especially the historic periodically rewetted zone, away from waste sites, including borehole logging using geophysical methods.	Collect samples from characterization boreholes and other subsurface penetrations as the opportunity arises. Perform laboratory analyses of sediment collected from same locations identified for groundwater characterization and monitoring within the 300 Area (complex). Laboratory analyses of sediment samples are intended to reveal the exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected to persist in the subsurface at the 300 Area.	Yes	Collect and analyze vadose zone sediment and pore water from characterization borehole locations inland of the former liquid waste disposal facilities (Locations No. 1 through No. 4 shown in Figure 3-5). Collect and analyze sediment and pore water from samples collected during drilling at temporary well locations (a) through (e) shown in Figure 3-5). Collect and analyze sediment samples from future excavations that penetrate to depths of historical high water table conditions. See Table 3-5 for drilling sampling details.	Uranium may have been deposited laterally in the vadose zone sediment outside the high volume, liquid waste disposal site footprint during the historical periods of high river stage (i.e., during the peak fuels production years [1950s and 1960s]). It is essential for the evaluation of remedial action alternatives during the FS to understand if residual amounts of contaminant uranium remain in those portions of the vadose zone and if that contamination is capable of acting as a source for resupplying the groundwater plume.

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Assumptions inherent in the conceptual model used to predict future levels of uranium contamination in the vadose zone and groundwater were based on very limited observational information, resulting in large uncertainty in the predictions based on computer simulation of future conditions.	15	Additional observational information on the inventory, geochemical environment, and potential transporting medium for uranium contamination.	An evaluation of all new analytical results that have become available since 2002 will be done to test the assumptions presented in BHI-01667 that are associated with protectiveness levels for remedial actions at waste sites. The evaluation will include new information on deeper portions of the vadose zone, the current and historical water table zones, and the zone of groundwater/river interaction near the river. New information includes results from laboratory leaching analyses for uranium in sediment samples collected under the LFI (PNNL-16435) and VOC investigations (PNNL-17793). Additional investigations of uranium in the 300 Area sediment has been conducted under DOE's Office of Science programs, leading to a better understanding of the form and geochemical environment of sediment. New insights were gained through the bench-scale tests and field implementation testing using polyphosphate to immobilize hexavalent uranium. Finally, new laboratory analytical results for uranium distribution and transport in sediment from the vadose zone (including the water table zone) will be available from work proposed in this work plan.	No	Review assumptions made and input parameters used during the analysis of protectiveness levels presented in BHI-01667 in light of new information that has become available since ~2002. Provide conclusions and recommendations regarding protectiveness levels for contaminant uranium remaining in environmental pathways.	Analysis of contaminant uranium levels that could remain in place at former waste disposal sites included assumptions regarding the mobility characteristics of uranium in the vadose zone. A sediment concentration of 267 pCi/g has been deemed protective of groundwater (BHI-01667), assuming the ground surface is revegetated and infiltration of moisture from natural sources. The field data, laboratory analyses of sediment, and computer simulation of contaminant migration under expected hydrologic conditions were limited in scope for this evaluation, thus leading to large uncertainties in the assumptions regarding the connection between residual uranium in the vadose zone and groundwater. A stronger technical basis is needed to support a proposed plan for remediation decisions involving uranium.
Lithologic characteristics, stratigraphic contact data, and hydraulic head measurements define the spatial framework through which groundwater flows. The coverage throughout the extent of the 300 Area uranium plume is incomplete.	16	Additional descriptions of sediment characteristics that will fill gaps and expand the current model domain for the 300 Area. Additional hourly hydraulic head measurements at strategic locations for flow model validation.	Collect sediment characteristics and head data to better characterize the flow model.	Yes	Field sampling: Install and operate additional pressure transducers at 10 wells throughout the domain of the model and monitor throughout the investigation period. Computer simulation: Incorporate into the spatial framework new information from drilling associated with recent investigations. Validate the flow model being used with hourly data for water levels at multiple locations and throughout at least one seasonal hydrologic cycle.	A groundwater flow simulation is used to infer conditions between locations of direct observation and to predict future conditions. This capability supports evaluation of remediation alternatives, development of monitoring strategies, and evaluation of the performance of a remedial action. It also can be used to investigate future land use scenarios.

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Current inventory estimates of contaminant uranium in the vadose zone and aquifer are based on limited observational data, including numerous assumptions and inferences. The estimates can be refined by incorporating new information from sampling at remedial action sites, research activities at the IFRC, and characterization associated with treatability testing sites.	17	Update inventory box model and investigate how the inventory might vary under the influence of seasonal groundwater conditions.	Data collected from the RI wells and other ongoing work will produce the data to update inventory in box model and to evaluate how the inventory varies in the groundwater during seasonal influences.	Yes	Field sampling: Collect groundwater samples from the water table during periods of high water table conditions, along with additional samples from discrete depths below the water table. • Laboratory analyses: See laboratory analysis for samples from boreholes identified for source and distribution data needs. • Update the conceptual box model for where contaminant uranium remains in the subsurface (PNNL-17034).	An understanding of the locations and amounts of contaminant uranium in the subsurface available to act as a long-term source for affecting groundwater is an essential element of the conceptual model. This understanding provides the explanation for the persistence of the uranium plume, a technical basis for evaluating remedial action alternatives, and information to evaluate potential risk to human health and the environment. The cause for the persistence of the uranium plume in groundwater beneath the 300 Area remains unexplained at the level of detailed required to support a proposed plan.
The amount of uranium lost from the plume to the river by groundwater discharge through the riverbed, and by withdrawal at Well 399-4-12, have been estimated using limited observational data and several significant assumptions, which create uncertainty.	18	Reduce the uncertainty in estimates for the removal of dissolved uranium from the groundwater plume by discharge to the Columbia River and withdrawal at a water supply well.	Revise the groundwater flow model as new data become available from a variety of investigations underway at the 300 Area, including characterization drilling conducted as part of the RI. Run the model to provide updates on the rate of groundwater discharge to the river. Incorporate withdrawal rate data for Well 399-4-12 and discharge data for the Life Sciences Building aquariums into the estimates. Incorporate results from the RCBRA as they become available (DOE/RL-2008-11). Provide estimates for the rate of uranium loss from the groundwater plume in the RI/FS report, using the most up-to-date input parameters.	Yes	Update the computer simulation model for groundwater flow beneath the 300 Area. Refine estimates for uranium removal from the groundwater plume via withdrawal at Well 399-4-12. Maintain awareness of information developed by other projects in progress at the 300 Area.	An understanding of the exchange of uranium mass among the various subsurface compartments along environmental pathways provides FS focus for evaluating remedial action alternatives. An estimate for the rate of uranium flux to the Columbia River is needed to provide insight on potential impacts to river water quality, and as a guide to the amount that must be resupplied from a vadose zone source. Analysis of the mass balance in the system reveals the amount of uranium to be addressed by remedial action in order to reduce the concentration of dissolved uranium in groundwater.
Existing simulation of uranium transport through the vadose zone and aquifer pathways is based on limited observational information, and can be refined using new information developed under this work plan, the IFRC, and from experience gained during treatability tests (Section 3.1.4.4).	19	Refined simulation input parameters for (1) inventories of labile contaminant uranium in various subsurface regions; (2) exchange rates between dissolved and solid forms; and (3) the form, capacity, and timing of a transporting medium (e.g., infiltration of moisture). Also, consensus on appropriate modeling algorithms, especially with regard to model assumptions.	Three-dimensional groundwater flow and uranium transport modeling involving the vadose zone and uppermost aquifer at the 300 Area is under development as part of the Hanford IFRC project (PNNL-SA-58090). Additional detailed modeling for this purpose is not proposed as part of this work plan.	No	Three-dimensional groundwater flow and contaminant transport modeling being developed as part of the Hanford IFRC project (PNNL-SA-58090).	The capability to simulate the behavior of contaminant uranium in environmental pathways beneath the 300 Area supports the technical basis for remediation decisions presented in a proposed plan. Simulations provide estimates for contaminant levels in areas not readily described with field data, predictions for contaminant transport, and estimates for the time period during which contamination persists. Simulations are an essential part of comparing remedial action alternatives during the FS.

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
The cause for the persistence of cis-1,2-dichloroethene contamination in the lower portion of the unconfined aquifer at Well 399-1-16B is uncertain. A remote possibility is that a continuing subsurface source has not yet been identified by drilling. Circumstantial evidence suggests that the persistence is related to the absence of geochemical and/or microbiological conditions that would allow further degradation of the chlorinated hydrocarbon beyond cis-1,2-dichloroethene.	20	Additional geochemical and microbiological data for groundwater samples, to include oxygen levels, organic carbon and nutrients from the contaminated interval at Well 399-1-16B.	Continue to collect and analyze groundwater samples from the deeper portion of the unconfined aquifer near Well 399-1-16B, per the objectives described in the 300-FF-5 Operations and Maintenance Plan (DOE/RL-95-73) for characterizing VOC contamination and trends.	Yes	Collect groundwater samples from Well 399-1-16B and any newly constructed wells that have open intervals in the hydrologic unit that is continuous with Well 399-1-16B. Laboratory analyses: • Conduct analyses of water chemistry to characterize the geochemical environment in the contaminated hydrologic unit at Well 399-1-16B per the analytical suite described in DOE/RL-2002-11, as periodically amended. During the course of the RI, at least three rounds of sampling will include dissolved oxygen levels, total organic carbon, and nutrients conducive to microbial activity. • Microbiology cultures to identify organisms responsible for the degradation of chlorinated hydrocarbons to cis-1,2-dichloroethene. An estimate for the potential for this compound to degrade further to vinyl chloride will be developed.	The potential for a reduction in the level of contamination in the near future appears limited based on historical monitoring. However, additional data on the geochemical and microbiological characteristics near the well screen will provide additional support for the selection of a remedial action alternative for this occurrence.
The processes by which VOC contaminants have been transported from potential source(s) to sequestration in the finer grained interval of Ringold Formation are not known, although some limits can be placed on the possibilities (PNNL-17666). Contaminant movement within the finer grained interval of sediment and release from the interval to overlying and underlying sediments are not well characterized.	21	Rates of lateral movement of VOC contamination through the finer grained interval of Ringold Formation sediment, and rates of release from the finer grained interval to the overlying saturated Hanford formation sediment.	A comprehensive evaluation of the various possibilities for VOC movement within, and release from, the finer grained interval of Ringold Formation can be acquired by additional analyses of existing and newly acquired information from characterization boreholes (11 locations listed in Table 3-5). Groundwater monitoring will continue to include VOC analyses for wells and aquifer tubes samples whose screens are positioned close to the contaminated portion of the finer-grained interval. Computer simulation(s) of groundwater movement and contaminant migration/degradation can be used to infer future conditions. Results from the RCBRA field activities in the Columbia River will contribute to conclusions regarding the fate of this contamination in the RI report.	No	A more comprehensive evaluation of the various possibilities for VOC movement within and release from the finer grained interval of Ringold Formation sediment may reduce the uncertainty in the conclusions presented in PNNL-17666.	Understanding the processes leading to contamination in this stratigraphic interval, and how it is currently evolving with regard to degradation and migration, is needed to prepare estimates for future trends in the contamination level.

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Initial tests using a polyphosphate solution to immobilize uranium in the aquifer have not revealed an optimal method for delivering the solution. While tests are underway during FY 2010 and FY 2011 for immobilizing uranium in the periodically rewetted zone, it is anticipated that a variety of methods may be needed for delivery in other subsurface compartments.	22	Laboratory and field-scale testing of methods to deliver uranium-immobilizing solutions to the vadose zone and unconfined aquifer.	New information on the distribution and characteristics of contaminant uranium in various subsurface regions as developed under this work plan will be used to anticipate the type of delivery mechanism most likely to result in reducing mobility. If necessary, additional bench and field-scale tests will be performed to augment results from tests already underway or planned. Experience gained at other sites contaminated by uranium will be factored into the analysis of appropriate delivery methods.	Yes	Bench- and field-scale tests associated with implementing remedial action technologies intended to reduce uranium concentrations in the 300 Area groundwater plume.	Method(s) for delivery of a chemical that immobilizes contaminant uranium in subsurface compartments may vary depending on the compartment targeted. For example, infiltration of solutions using widespread irrigation at the surface may be suitable for uranium remaining in shallow vadose zone regions, while injection via boreholes may be more appropriate for contamination in the deep vadose zone and aquifer. Information on the potential delivery methods is needed as part of the feasibility analysis, especially with regard to estimates for the cost of treatment and for the period needed to achieve remedial action objectives.
Testing of in situ methods to immobilize contaminant uranium in the subsurface environment is in progress at other waste sites. Knowledge acquired at sites other than Hanford Site can contribute to the technical basis for selecting a remediation alternative for uranium at the 300 Area.	23	Technical information from research activities and remedial action experience at sites contaminated by uranium.	A search for activities separate from Hanford Site activities will be maintained during the duration of the RI/FS, to identify solutions developed for similar problems. Potential contributors include research involving uranium in the environment at sites in Rifle, Colorado, and Oak Ridge, Tennessee under the DOE's Integrated Field-Scale Research Challenge program (Note: The Hanford Site 300 Area is also part of this program). Cleanup experience gained under the Uranium Mill Tailings Remedial Action program will also be reviewed.	No	Review work conducted at other sites where uranium has contaminated environmental pathways. Incorporate appropriate information obtained in interpretations and conclusions presented in the RI/FS Report.	Conclusions presented in the FS report will be based on all available information at the time of report preparation, including information developed under this work plan, and on information derived from activities at other sites contaminated by uranium.
Technology evaluation, screening, and selection activities associated with contaminant uranium beneath the 300 Area have been conducted to the extent allowed by available information (DOE/RL-2008-36). However, new information generated by the RI activities described in this work plan could be used to validate and potentially update the detailed analysis of remediation technology alternatives completed thus far.	24	Incorporate new information on the distribution and mobility characteristics of contaminant uranium in various subsurface regions beneath the 300 Area into the FS process as related to uranium.	Revisit the technology evaluation, screening, and selection activities performed, to incorporate new information obtained during the RI activities, including treatability testing. Apply computer simulation models to evaluating the effectiveness of alternative technologies as directed toward individual subsurface compartments. Timeframes for reducing levels of uranium contamination to meet applicable or relevant and appropriate requirements under natural environmental processes will be estimated using models. New information developed at other sites contaminated by uranium will be considered as it becomes available.	No	Re-evaluate conclusions presented in earlier uranium cleanup technology screening reports, and strategies developed for reducing uranium concentrations in groundwater, in light of new information developed under this Work Plan. Conduct computer simulation runs for various remedial action alternatives.	Selection of appropriate remedial action(s) depends on the amount and mobility of the contaminant. As new information is developed on uranium in various subsurface compartments, the strategy for addressing uranium contamination can be revisited and the technical basis for conclusions strengthened. (Related Data Needs: No. 2, No. 3, No. 7, and No. 8; see Table 3-5.)

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Existing groundwater flow and uranium transport simulations are not sufficiently developed to (a) simulate the performance of various remedial action alternatives, (b) predict timelines for achieving remedial action objectives, and (c) evaluate post-remediation land-use and environmental scenarios.	25	Computer simulation runs to evaluate remedial action alternatives, especially with regard to the effectiveness at reducing uranium concentrations in groundwater and the period required to do so.	Using the products resulting from fulfilling Data Need No. 16 (groundwater flow simulation) and Data Need No. 19 (uranium transport simulation), existing computer code for simulating groundwater movement and uranium transport will be refined. New spatial information on the hydrogeologic framework; on the distribution of uranium; and on the rates of exchange between dissolved and solid forms of uranium will play a key role in refining existing models.	No	Refine existing computer code for groundwater flow and uranium transport in the subsurface at the 300 Area.	A FS of remediation alternatives and remedial action technologies includes a discussion of the effectiveness, costs, and timeframes associated with each alternative. Anticipating conditions in areas not available for direct observation via monitoring, and future conditions under various environmental and land-use scenarios, can only be accomplished through simulation activities.
Information on the lateral and vertical distribution of contaminant uranium in various subsurface compartments, and the mobility and potential transport processes, is insufficient to complete the engineering design and cost estimating aspects for the FS.	26	Updated information on the mass and mobility characteristics of contaminant uranium in various subsurface compartments.	New information on the lateral and vertical distribution of contaminant uranium is likely to come from characterization drilling at eleven locations during the RI (see Data Needs No. 2, No. 3, and No. 8, and Table 3-5). Particularly significant for the FS analysis will be to fill in details on the mass of uranium and mobility characteristics in each subsurface compartment where contaminant uranium may be found, as these details influence the type of chemical solutions to be used to immobilize uranium and the methods by which the solutions are deployed.	Yes	Incorporate new information on the inventory and mobility characteristics of contaminant uranium in the subsurface at the 300 Area into the FS evaluation of remedial action alternatives.	As discussed in Sections 3.1.1, 3.1.2, and 3.1.3, considerable uncertainty exists in the location, mass, and mobility potential for uranium in subsurface regions beneath the 300 Area. Until those uncertainties are reduced during the course of the RI, it will be difficult to provide sufficient technical data for engineering design and credible estimates for cost.
400 Area Sources						
Unidentified sources of contamination may exist within and in the soils adjacent to engineered facilities and structures.	27	Identify new waste sites and potential sources of contamination in the 400 Area.	Complete OSE process in the 400 Area.	No	Complete OSE process in the 400 Area. The data need will be fulfilled as part of the OSE process.	The OSE and waste site discovery process are performed to identify new waste sites and sources that are not in CERCLA decision documents.
Distribution of Contaminants – 400 Area						
The nature and extent of contamination in the shallow vadose zone beneath and adjacent to 400 Area facilities and waste disposal sites are needed to assess groundwater protection.	28	Characterize below unremediated waste sites to assess nature and extent of contamination in the vadose zone.	Continue interim remedial actions because they have demonstrated to be efficient in obtaining the necessary data during remediation using the observational approach. Obtain data documenting the remaining residual contamination following completion of interim remedial action.	No	Complete contaminated soil removal and sampling of the waste sites within the 400 Area subregion. The data need will be fulfilled as part of the ongoing interim action.	Remediation is needed to protect human health and the environment.
600 Area Sources						
Unidentified sources of contamination may exist within the soils adjacent to engineered facilities within the 600 Area.	29	Identify new waste sites and potential sources of contamination in the 600 Area.	Complete OSE process in the 600 Area.	No	Complete OSE process in the 600 Area. The data need will be fulfilled as part of the OSE process.	The OSE and waste site discovery site process are performed to identify new waste sites and sources that are not in CERCLA decision documents.

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Distribution of Contaminants – 600 Area						
There is uncertainty associated with the contents of the 618-10 and 618-11 Burial Grounds. Operational records and history associated with past waste disposal practices of 300 Area waste streams are incomplete.	30	Characterize contents of the 618-10 and 618-11 Burial Grounds. Complete planned nonintrusive and intrusive sampling of the burial ground disposal sites.	N/A	No	The data need will be fulfilled as part of DOE/RL-2008-27.	Characterization of the burial ground contents will be performed under the current SAP process. The characterization activities prescribed will provide data and information needed for planning future intrusive characterization activities (if required) and/or remediation strategies for the vertical pipe units, caissons, and trenches located in these burial grounds. Planning for intrusive characterization and/or remediation requires additional understanding of the quantity and condition of the material deposited in the 618-10 and 618-11 Burial Grounds.
The nature and extent of contamination in the shallow vadose zone beneath and adjacent to unremediated 600 Area waste disposal sites are not well defined. This includes the 618-10, 618-11, 618-7, and 618-13 Burial Grounds and the 316-4 Crib site.	31	Characterize below unremediated waste sites to assess nature and extent of contamination in the vadose zone.	Continue interim remedial actions because they have demonstrated to be efficient in obtaining the necessary data during remediation using the observational approach.	No	Complete contaminated soil removal and sampling of the waste sites within the 600 Area subregion. The data need will be fulfilled as part of the ongoing interim action.	Remediation is needed to protect human health and environment.
The distribution of contamination in the deep vadose zone beneath the 618-10 and 618-11 Burial Grounds and the 316-4 Crib excavation site is not well understood.	32	Following excavation of the sites during the interim remedial action, drill and collect soil samples from beneath engineered facilities (bottom of excavation) to groundwater. Perform laboratory and field analyses to determine the nature and extent of contamination beneath the remediated waste sites from the bottom of the excavation to groundwater. Elevated tritium in the groundwater near the 618-11 Burial Ground may require further evaluation after characterization and remediation.	Drill characterization boreholes and perform laboratory analysis of sediments collected from boreholes drilled from bottom of excavations, following interim remedial actions, to groundwater. Conduct soil gas sampling at site excavations. Exact locations for boreholes to be drilled within the footprints of the 618-10 and 618-11 Burial Grounds, and the 316-4 Crib will be determined following excavation activities performed as part of remediation of the waste sites.	Yes	Collect sediment and soil gas samples. Conduct sampling in the soil beneath site excavations for tritium and VOCs; radiological screening of sediment samples including gross beta/gamma, low level gamma, high level gamma, and neutron detection; presence of VOC vapors with use of a portable detector. Borehole sampling requirements (e.g., number of samples and collection intervals) are proposed in Table 2-5, but may be modified as approved by EPA following review of characterization and verification data collected during the remedial action. Soil gas sampling may be performed at 618-11 Burial Ground with the purpose of determining the nature, extent, and persistence over time of tritium in the aquifer beyond the boundary of the excavated waste site after the potential sources are removed as part of the remedial activities. Remediation of the 618-10 and 618-11 Burial Grounds, and 316-4 Crib will occur after the period of work outlined in this work plan and further planning will be required to correlate the drilling of boreholes and soil gas sampling with remediation activities. This planning should be performed as part of the 300 Area Remedial Design Report/Remedial Action Work Plan.	Some uncertainty remains with the distribution of contamination below the 618-10 and 618-11 Burial Grounds, and the 316-4 Crib site. Elevated tritium concentrations in the groundwater near the 618-11 Burial Ground and in the soil gas near the 618-10 and 618-11 Burial Grounds constitute the need for further characterization of the vadose zone beneath the excavated sites, from the bottom of the excavation to groundwater. These data will be collected in addition to the verification sampling. In addition, the soils contaminated with uranium bearing tributyl phosphate liquid wastes beneath the 316-4 Crib site constitute the need for further characterization of the vadose zone, from the bottom of the excavation following the interim remedial action to groundwater.

Table ES-1. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Existing groundwater data sets and the strategies currently in place to monitor groundwater conditions do not meet the RI needs for determining spatial and temporal risk uncertainty for potential human and ecological receptors.	33	Ground water samples from a subset of wells selected to provide representative samples of aquifer conditions throughout the 300 Area; laboratory analysis of the samples to include COPCs as identified in Section 4.5.2 of the work plan; and multiple rounds of sampling to characterize the temporal variability in aquifer conditions.	The groundwater database available for risk assessment activities will be augmented by: • Identifying a subset of monitoring wells in the 300 Area that will provide spatially representative samples of current conditions • Collecting samples from those wells during at least three rounds of sampling that encompass seasonal variability in water table and Columbia River conditions, and • Analyzing those samples for constituents deemed to be of potential concern for human and ecological receptors (Section 4.5.2) The wells selected for this activity are listed in the 300 Area SAP (DOE/RL-2009-45). The periods recommended for sampling are May to mid-June, mid-September to mid-October, and either March through April or July through August.	Yes	Sample a subset of groundwater wells in the 300 Area for three rounds of sampling that correlate with different phases of the seasonal river stage cycle. A proposed list of wells is presented in Tables 3-3 and 3-4 of the SAP. Analyze the groundwater samples for constituents identified in Section 4.5.2.	Additional groundwater sampling will help to reduce uncertainties identified in the existing baseline risk assessments for human health exposures. These uncertainties include the possibilities that a) contaminants may have been overlooked by current groundwater monitoring programs, b) sampling frequencies used in the past may have biased interpretations of current conditions, especially near the Columbia River where conditions change rapidly, and c) conditions have changed since the initial qualitative risk assessment. Reducing uncertainties associated with the baseline human health risk assessment will strengthen the basis for analyses of remedial action alternatives during the FS process.

Notes:

* Field parameters are defined as taking groundwater measurements for pH, turbidity, specific conductance, temperature, and dissolved oxygen content.

BHI-01667, *Protection of 300 Area Groundwater from Uranium-Contaminated Soils at Remediated Sites*.

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq.

DOE/RL-2002-11, *300-FF-5 Operable Unit Sampling and Analysis Plan.*

DOE/RL-2008-11, *Remedial Investigation Work Plan for Hanford Site Releases to the Columbia River.*

DOE/RL-2008-27, *Sampling and Analysis Plan for 618-10 and 618-11 Nonintrusive Sampling.*

DOE/RL-2008-36,*Remediation Strategy for Uranium in Groundwater at the Hanford Site 300 Area, 300-FF-5 Operable Unit.*

DOE/RL-2009-45, *Sampling and Analysis Plan for the 300 Area 300-FF-1, 300-FF-2 and 300-FF-5 Operable Units Remedial Investigation/Feasibility Study.*

EPA/ROD/R10-96/143, Declaration *of the Record of Decision for the 300-FF-1 and 300-FF-5 Operable Units, Hanford Site, Benton County, Washington.*

PNNL-16435, *Limited Field Investigation Report for Uranium Contamination in the 300-FF-5 Operable Unit at the 300 Area, Hanford Site, Washington.*

PNNL-17034, *Uranium Contamination in the Subsurface Beneath the 300 Area, Hanford Site, Washington.*

PNNL-17666, *Volatile Organic Compound Investigation Results, 300 Area, Hanford Site, Washington.*

PNNL-17793, *Uranium Contamination in the 300 Area: Emergent Data and Their Impact on the Source Term Conceptual Model.*

PNNL-SA-58090, *Multi-Scale Mass Transfer Processes Controlling Natural Attenuation and Engineered Remediation: An IFC Focused on Hanford's 300 Area Uranium Plume.*

DOE	=	U.S. Department of Energy	OSE	=	orphan site evaluation
FS	=	feasibility study	RCBRA	=	River Corridor Baseline Risk Assessment
FY	=	fiscal year	RI	=	remedial investigation
IFRC	=	Integrated Field-Scale Subsurface Research Challenge	SAP	=	sampling and analysis plan
LFI	=	limited field investigation	VOC	=	volatile organic compound

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Terms

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	*Code of Federal Regulations*
COC	contaminant of concern
COPC	contaminant of potential concern
CSM	conceptual site model
CVP	cleanup verification package
D4	deactivation, decontamination, decommissioning, and demolition
DOE	U.S. Department of Energy
DOH	Washington State Department of Health
DQO	data quality objective
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESD	Explanation of Significant Difference
FFTF	Fast Flux Test Facility
FMEF	Fuels and Materials Examination Facility
FS	feasibility study
FY	fiscal year
HHRA	human-health risk assessment
HWSA	hazardous waste storage area
IFRC	Integrated Field-Scale Subsurface Research Challenge
LFI	limited field investigation
LLBG	low-level burial ground
MASF	Maintenance and Storage Facility
MCL	maximum contaminant level

MDL	method detection limit
NCP	"National Oil and Hazardous Substances Pollution Contingency Plan" (40 CFR 300)
NEPA	*National Environmental Policy Act of 1969*
OSE	orphan site evaluation
OU	operable unit
PCB	polychlorinated biphenyl
PNNL	Pacific Northwest National Laboratory
PPSS	Process Pond and Sewer System
PRG	preliminary remediation goal
PRTR	Plutonium Recycle Test Reactor
PUREX	Plutonium-Uranium Extraction (Plant or process)
QRA	qualitative risk assessment
R&D	research and development
RAG	risk assessment guideline
RAO	remedial action objective
RCBRA	River Corridor Baseline Risk Assessment
RCRA	*Resource Conservation and Recovery Act of 1976*
RCW	*Revised Code of Washington*
RECUPLEX	Recovery of Uranium and Plutonium by Extraction (Plant or process)
REDOX	Reduction-Oxidation (Plant or process)
RESRAD	RESidual RADioactivity (dose model)
RFBP	Retired Filter Backwash Pond
RI	remedial investigation
RI/FS	remedial investigation/feasibility study
RL	U.S. Department of Energy, Richland Operations Office
RLWS	Radioactive Liquid Waste Sewer
ROD	record of decision
RRLWS	Retired Radioactive Liquid Waste Sewer
RSVP	remaining sites verification package

RTD	removal, treatment, and disposal
SAP	sampling and analysis plan
SIS	Stewardship Information Systems
TBC	to be considered
Tri-Parties	DOE, EPA, and Ecology
Tri-Party Agreement	Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order*
Tri-Party Agreement Action Plan	Ecology et al., 1989a, *Hanford Federal Facility Agreement and Consent Order Action Plan*
TRU	Transuranic radioactive waste as defined in DOE G 435.1-1, *Implementation Guide for Use with DOE M 435.1-1*
TSCA	*Toxic Substances Control Act of 1976*
UMTRA	Uranium Mill Tailings Remedial Action
VOC	volatile organic compound
VPU	vertical pipe unit
WAC	*Washington Administrative Code*
WATS	Waste Acid Treatment System
WIDS	Waste Information Data System

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1 Introduction

This document presents the work plan for a remedial investigation/feasibility study (RI/FS) to support final remedy selection under *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) for the 300 Area at the Hanford Site. This document explains the RI/FS project background and presents detailed plans to investigate U.S. Department of Energy (DOE) contaminated sites in the Hanford Site's 300 Area. The DOE has combined groundwater contamination, soil contamination sites, and facilities in individual geographic areas to support a comprehensive look at the contamination and associated risk. The 300 Area is defined as part of the River Corridor, which encompasses approximately 570 km^2 (220 mi^2) adjacent to the Columbia River. To date, significant remediation has occurred along the River Corridor through remedial actions as authorized under interim action records of decision (RODs), *Resource Conservation and Recovery Act of 1976* (RCRA) corrective actions, treatability tests, and other activities. Integral with these cleanup activities were data collected and analyzed regarding the nature and extent of residual contaminants. This work plan proposes additional field work, analyses, and studies to develop a proposed plan for remediation activities in the 300 Area.

This RI/FS work plan contains the shared elements basic to the 300 Area. This RI/FS work plan provides the overall RI/FS project background, investigation rationale, and environmental setting common to the 300 Area, along with the project planning and management organization to be used. This document also includes a general overview of the investigation and remediation accomplishments in the 300 Area.

The 300 Area is located north of the city of Richland, Washington, and consists of the Hanford Site 300 and 400 Areas, remote Burial Grounds 618-10 and 618-11, and the Energy Northwest power generating facility (Figure 1-1) separated by large areas of vacant land (Figure 1-2).

The 300 Area extends from north of Energy Northwest to south of the 300 Area and from the west bank of the Columbia River to the west to Horn Road. There are three areas with facilities and waste sites related to Hanford Site operations. For this work plan, the area is divided into three subregions: 300 Area, 400 Area, and 600 Area. The 300 Area consists of the buildings, facilities, and process units located in the industrial complex located north of Richland, Washington, where the vast majority of uranium fuel production and research and development (R&D) activities took place. The 400 Area consists of the Fast Flux Test Facility (FFTF) and associated facilities. For the purposes of this work plan, the 600 Area consists of the 618-10 and 618-11 Burial Grounds, the 316-4 Crib, and various burial grounds not categorized as being within the 300 Area (industrial complex) or 400 Area, plus the groundwater impacted by releases from those waste sites. A major portion of the 600 Area, the large area of historically unused land, is void of known waste sites and facilities and addressed in this work plan during the discussion of orphan site evaluations (OSEs) and other future evaluations.

There are two RODs and three explanations of significant difference (ESDs) associated with the 300 Area. EPA/ROD/R10-96/143, Declaration of the Record of Decision for the 300-FF-1 and 300-FF-5 Operable Units, Hanford Site, Benton County, Washington, was signed in 1996. This ROD described final remediation activities for 300-FF-1 Operable Unit (OU) waste sites and interim remedial actions for 300-FF-5 OU groundwater. In 2000, an ESD was signed (EPA/ESD/R10-00/524, Explanation of Significant Difference for the 300-FF-5 Record of Decision). Also in 2000, a second ESD was signed (EPA/ESD/R10-00/505, USDOE Hanford 300 Area, 300-FF-1 Operable Unit, Hanford Site, Benton County, Washington Explanation of Significant Difference [ESD]) that pertained to the unexpected discovery of lead contamination in a burn pit (Landfill 1D, Waste Information Data System [WIDS] 628-4). In 2001, a ROD for the 300-FF-2 OU was signed (EPA/ROD/R10-01/119, Declaration of the Interim Record of Decision for the 300-FF-2 Operable Unit, Hanford Site, Benton County, Washington).

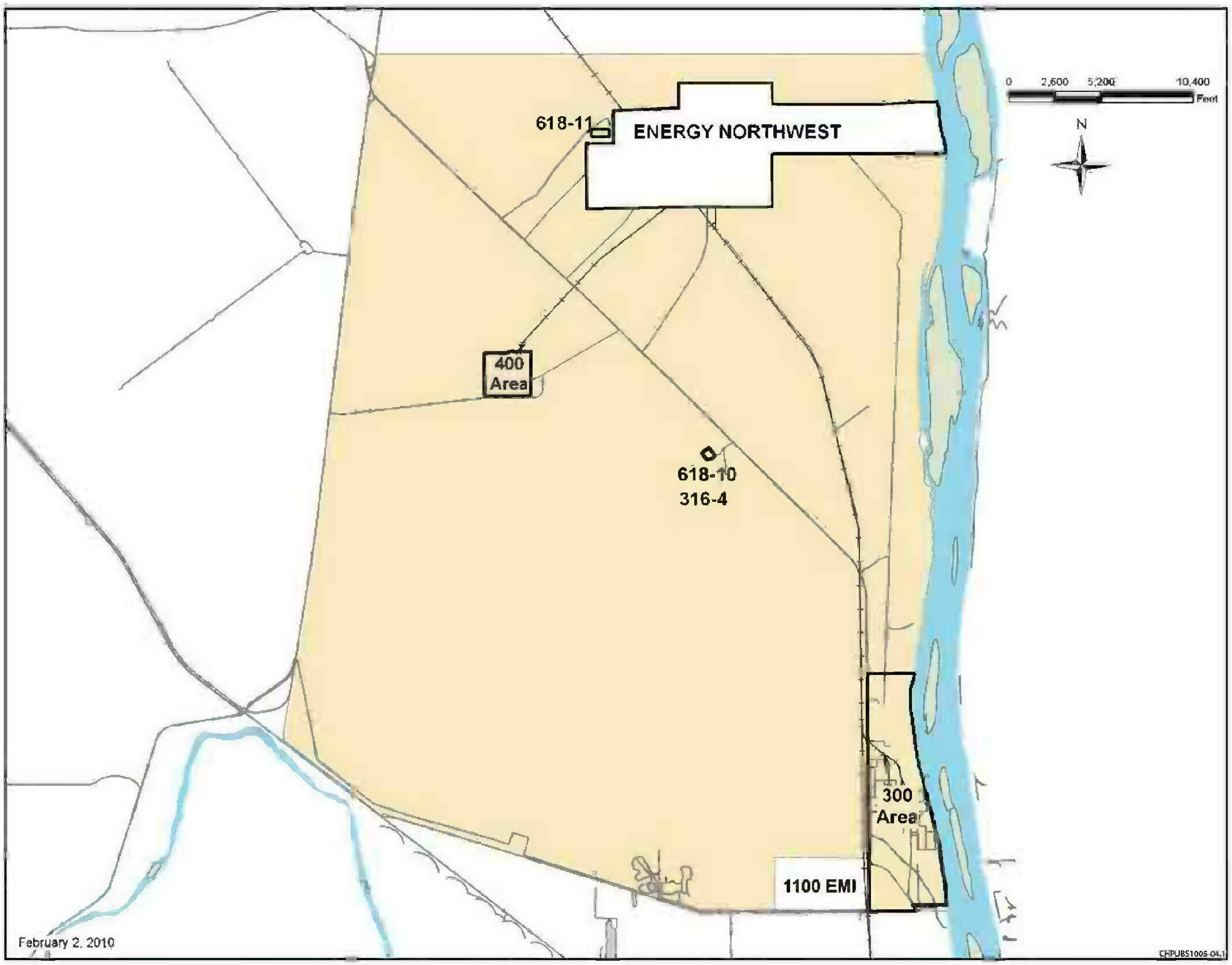


Figure 1-1. Illustration in Plan View Showing 300 Area

Figure 1-2. View of the 300 Area Looking Toward the Northwest

The 300-FF-1 OU contains many of the 300 Area liquid waste disposal units and burial grounds. EPA/ROD/R10-96/143 called for removal of contaminated soil and debris, disposal of contaminated material at the Environmental Restoration Disposal Facility (ERDF), waste sites recontouring and backfilling followed by revegetation, and institutional controls. The 300-FF-2 OU contains waste sites in the 300 Area industrial complex, outlying waste sites, general content burial grounds, and transuranic contaminated burial grounds. EPA/ROD/R10-01/119 called for the following in the 300-FF-2 OU:

- Removal of contaminated soil and debris; treatment as necessary to meet waste acceptance criteria at an acceptable disposal facility.
- Disposal of contaminated material at the ERDF, the Waste Isolation Pilot Plant, or other facility approved in advance by the U.S. Environmental Protection Agency (EPA).
- Recontouring and backfilling of waste sites followed by infiltration control measures (e.g., revegetation).
- Ongoing groundwater and ecological monitoring to ensure effectiveness of the remedial actions and to support the final ROD and remedy reviews (institutional controls).
- Regulatory framework for a "plug-in" or "analogous site" approach for accelerating future remediation decisions.

EPA/ROD/R10-96/143, an interim remedial action ROD for the 300-FF-5 Groundwater OU, imposes restrictions on the use of groundwater until health-based criteria are met for uranium, trichloroethene, and 1,2,-dichloroethene. The selected remedy for the 300-FF-5 Groundwater OU includes continued monitoring and institutional controls to ensure groundwater use is restricted.

EPA/ROD/R10-96/143 addressed groundwater uranium contamination and required monitoring, with the expectation that concentrations would reduce through natural attenuation. Groundwater uranium concentrations beneath parts of the 300 Area remain above the 30 µg/L drinking water standard. Persistence of this plume is not consistent with expectations presented in EPA/ROD/R10-96/143, which assumed significant uranium plume attenuation within 10 years of 1993. DOE/RL-2006-20, *The Second CERCLA Five-Year Review Report for the Hanford Site*, p. 3.18, stated, "For 300-FF-5 Groundwater Operable Unit, the selected remedy of monitored attenuation for the uranium contaminant in the groundwater is not achieving the remedial action objectives established in the ROD."

When the 1993 ROD was issued, the conceptual site model (CSM), was based on available characterization and environmental monitoring data. Since that time, additional characterization and monitoring data have been collected and the CSM has been updated to reflect that new information. Chapter 3 presents the enhanced CSM.

This work plan is prepared in accordance with the following guidance documents:

- EPA/540/G-89/004, *Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA,* Interim Final, OSWER 9355.3-01.
- DOE/EH-94007658, *Remedial Investigation/Feasibility Study (RI/FS) Process, Elements, and Techniques.*
- EPA/240/B-06/001, *Guidance on Systematic Planning Using the Data Quality Objectives Process*, EPA QA/G-4.

1.1 Scope and Objectives

The scope of this work plan includes waste sites (e.g., trenches, pipelines) associated with 300 Area source and groundwater OUs, as identified in Ecology et al., 1989b, *Hanford Federal Facility Agreement and Consent Order Action Plan* (Tri-Party Agreement Action Plan). These OUs are defined as the following:

- **300-FF-1.** Source areas associated with facilities and waste sites mainly represented by the former North Process Pond, South Process Pond, and 300 Area Process Trenches.
- **300-FF-2.** Source areas associated with facilities and waste sites within the 300 Area (complex), the industrial center, the 400 Area, the 618-10 and 618-11 Burial Grounds, and the 316-4 Crib in the 600 Area.
- **300-FF-5.** Groundwater OU associated with these source areas.

The scope of this work plan does not include the decommissioning and demolition of 300 Area buildings, which is addressed under CERCLA removal authority through use of action memoranda.

The objective of this work plan is to identify and capture data gaps through a systematic planning process. These data gaps provide the basis to develop a program for data collection and analysis to support proposed plans for final remediation activities.

1.2 CERCLA Process in the 300 Area

The process to remediate and close the 300 Area consists of the following major activities, as defined by CERCLA guidance:

- Development of an RI/FS work plan
- Implementation and completion of RI/FS work
- Development of a remedial investigation (RI) report, including risk assessment
- Development of a feasibility study (FS) report
- Development of a proposed plan
- Public comment
- Final action ROD
- Development of a final action remedial design/remedial action work plan
- Implementation of the final remedy
- Achieve construction completion status
- Achieve site completion status
- Development of remedial action report
- Development and implementation of a monitoring program (if required)
- Preliminary closeout report
- 5-year review of the effectiveness of the remedy (if required)

The 300 Area CERCLA RI/FS work plan has been developed to identify activities needed to gather additional data (as determined by the systematic planning process) to make an integrated final decision for all media. The work plan will include a sampling and analysis plan (SAP). After the data have been gathered and analyzed, and the CSM has been updated, an FS will be performed to identify and evaluate alternatives. A proposed plan that contains a summary of the investigation and evaluation and includes the preferred remedial alternative will be issued to the public for review and comment. After completion of this review and comment cycle, a final ROD will be developed and approved by DOE and EPA, and concurrence sought from the Washington State Department of Ecology (Ecology). The remedies then will be implemented. Should the remedies leave contamination in place above unrestricted use and unrestricted exposure levels, monitoring requirements will be identified in the monitoring program. The completed remedy *that does not achieve unlimited use/unrestricted exposure* is subject to a 5-year review to verify long-term effectiveness and protection.

1.3 300 Area Restoration Overview

Active deactivation, decontamination, decommissioning, and demolition (D4) of inactive contaminated 300 Area facilities in the 300-FF-2 OU began in 2004 under CERCLA removal authority through action memoranda. To date, 120 facilities have been demolished and 15 removed over the operation life of the 300 Area. The uranium fuel production facilities in the northern portion of the 300 Area (complex) have been demolished. Approximately 40,914 metric tons (45,101 tons) of material went to the ERDF as part of the 300 Area D4 activities between August 2005 and February 2009.

The number of waste sites has increased in the 300 Area with the progression of D4 and characterization activities. In 1996, as a part of EPA/ROD/R10-96/143, 15 waste sites were closed out or classified as no action (Section 2.2). In 2001, as a part of EPA/ROD/R10-01/119, an additional 56 waste sites were indentified in the 300 Area. As of December 2008, 387 waste sites have been identified in the 300 Area.

Two of these waste sites are classified as discovery sites and considered for reclassification to accepted or no-action waste sites. In accordance with EPA/ROD/R10-01/119, additional waste sites may be "plugged-in" to the selected remedy, which is removal, treatment, and disposal under EPA/ROD/R10-01/119. Ninety-four waste sites are closed out or interim closed out in the 300 Area. During the remediation process, about 710,200 metric tons (783,000 tons) of material from the 300 Area waste sites went to the ERDF for subsequent treatment, as necessary, and disposal. Approximately 13,000 samples have been collected and analyzed as part of the closeout and cleanup verification activities since 1995. Section 2.2 provides an overview of the waste sites located in the 300 Area, and Section 2.4, Table 2-10 provides a list of the completed cleanup verification packages (CVPs).

New contaminant information has been acquired since the signing of EPA/ROD/R10-96/143. A limited field investigation (LFI) was conducted during 2006 (PNNL-16435, *Limited Field Investigation Report for Uranium Contamination in the 300-FF-5 Operable Unit at the 300 Area, Hanford Site, Washington*). A volatile organic compound (VOC) investigation was conducted in 2008 (PNNL-17666, *Volatile Organic Compound Investigation Results, 300 Area, Hanford Site, Washington*). A comprehensive description of contaminants of potential concern (COPCs) in groundwater was published in 2005 (PNNL-15127, *Contaminants of Potential Concern in the 300-FF-5 Operable Unit: Expanded Annual Groundwater Report for Fiscal Year 2004*, Chapter 3). An update to the conceptual model for uranium in the subsurface was published in 2008 (PNNL-17034, *Uranium Contamination in the Subsurface Beneath the 300 Area, Hanford Site, Washington*). A polyphosphate treatability test for the saturated zone was completed in 2007 (PNNL-16101, *Experimental Plan: Uranium Stabilization Through Polyphosphate Injection*). Characterization of the groundwater beneath the 618-2 Burial Ground (Figure 1-3) is documented in DOE et al., 2007, "100/300 Area Unit Managers Meeting Minutes, Groundwater, Source Operable Units, Facility (D4 and ISS), and End State and Final Closure." Sediment and water samples collected at various depth intervals were described and analyzed. The analytical data permitted an extensive update to the hydrogeologic framework. This information, coupled with numerous modeling and river studies, was used to develop the CSMs presented in Chapter 3 and revealed data gaps and needs for groundwater.

1.4 Hanford Site Cleanup Framework

River Corridor Cleanup. The River Corridor includes more than 500 km^2 (200 mi^2) of the Hanford Site as shown in Figure 1-4. The River Corridor portion of the Hanford Site includes the 100 and 300 Areas along the south shore of the Columbia River. The 100 Area contains nine retired plutonium production reactors, numerous support facilities, solid and liquid-waste-disposal sites, and contaminated groundwater. The 300 Area, located north of the city of Richland, contains fuels fabrication facilities, nuclear R&D facilities, associated solid and liquid-waste-disposal sites, and contaminated groundwater. As part of this completion strategy, and to ensure cleanup actions address all threats to human and environmental health, the River Corridor includes the contiguous areas that extend from the 100 Areas and 300 Area to the Central Plateau, as shown in Figure 1-5.

Figure 1-3. Drilling in the 618-2 Burial Ground to Collect Groundwater Samples

1.5 Summary of Previous Investigations

To develop an understanding of contamination associated with River Corridor areas, the DOE has thoroughly examined a number of sources of information. Information collected in previous investigations has been combined with the information gathered during the implementation of interim remedial actions and removal actions to provide an understanding of the nature and extent of contamination at each. Results from these activities have differentiated between contaminated and uncontaminated areas throughout the River Corridor.

Early cleanup actions have helped sharpen the focus of data collection efforts in recent years to fine tune remedial actions. Efforts to understand the nature and extent of contamination beyond the areas adjacent to reactors have been extensive and have demonstrated that the focus of early actions on waste sites associated with reactor areas has been instrumental in addressing the highest priority environmental risks.

This work plan proposes collecting additional information for use in developing remediation decisions. When combined with historic data (collected during continued implementation of interim action RODs, routine site monitoring activities, and specific studies to assess the potential applicability of treatment technologies), this new information will be integrated in an RI/FS report to support RODs for final activities for contaminated sites in the River Corridor (Figure 1-6).

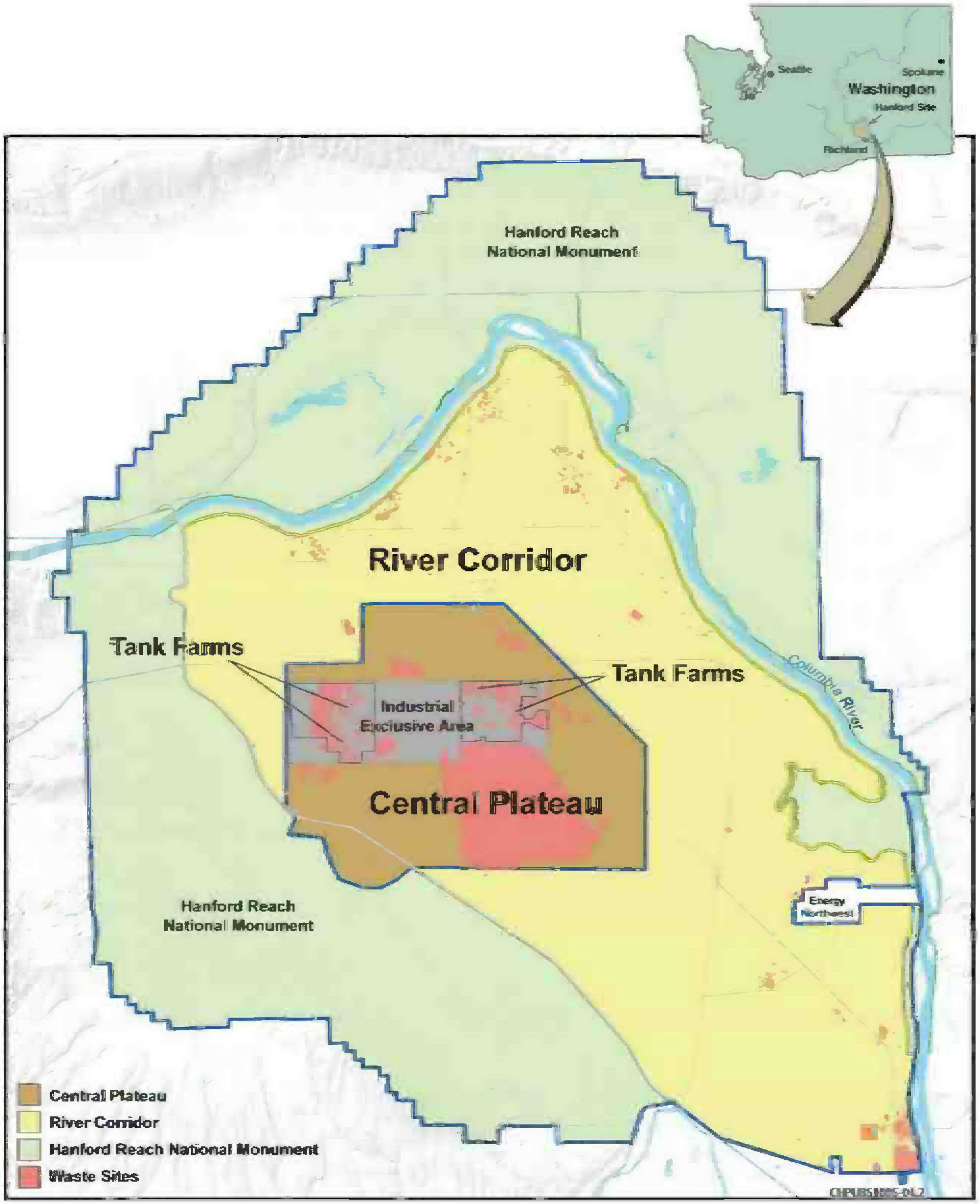
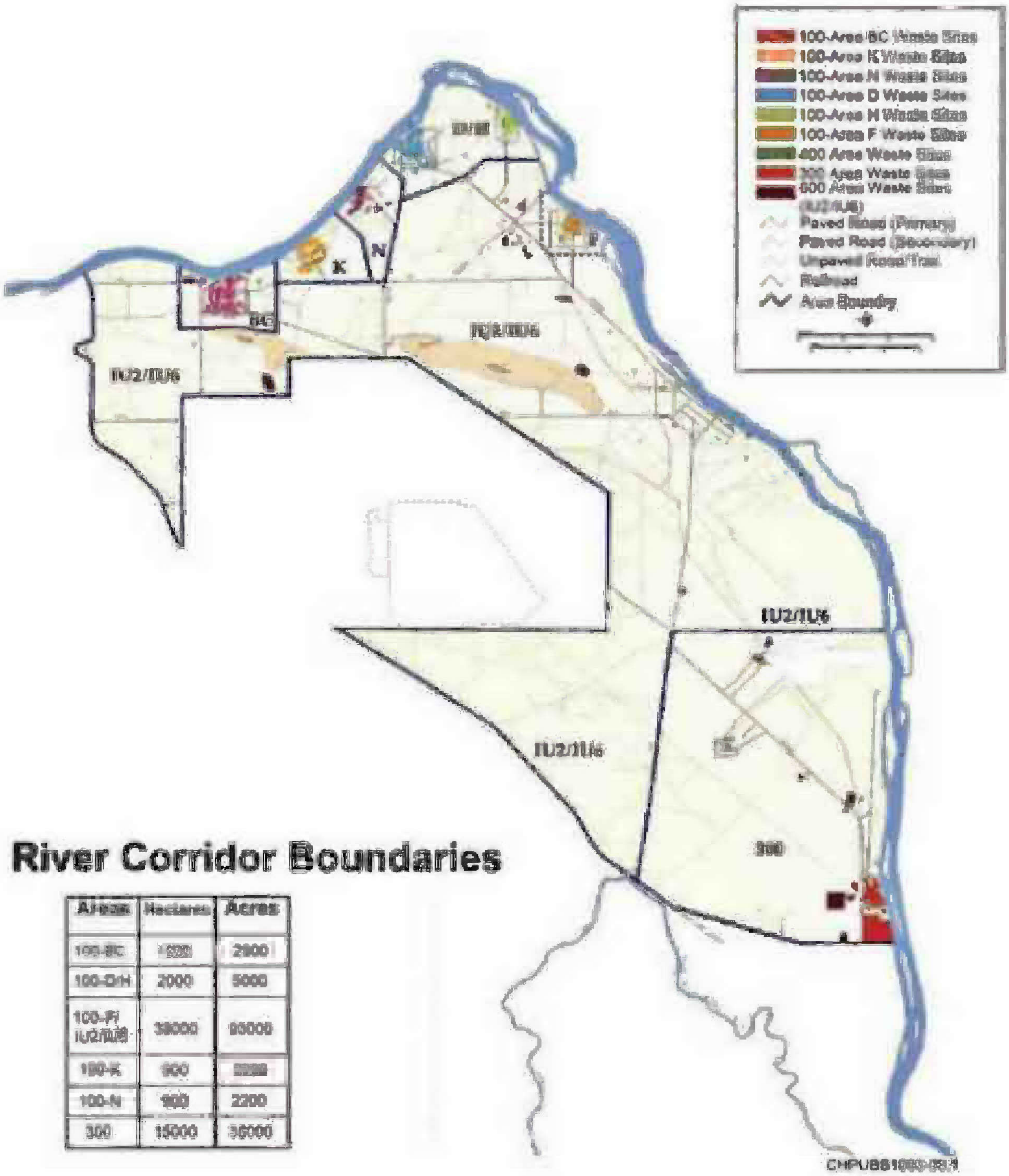


Figure 1-4. Principal Components of Hanford Site's Cleanup Completion Framework: River Corridor, Central Plateau, and Tank Waste



Areas	Hectares	Acres
100-BC	[illegible]	2900
100-D/H	2000	5000
100-F/ IU2/IU6	38000	93000
100-K	900	[illegible]
100-N	900	2200
300	15000	38000

Figure 1-5. River Corridor Area Boundaries

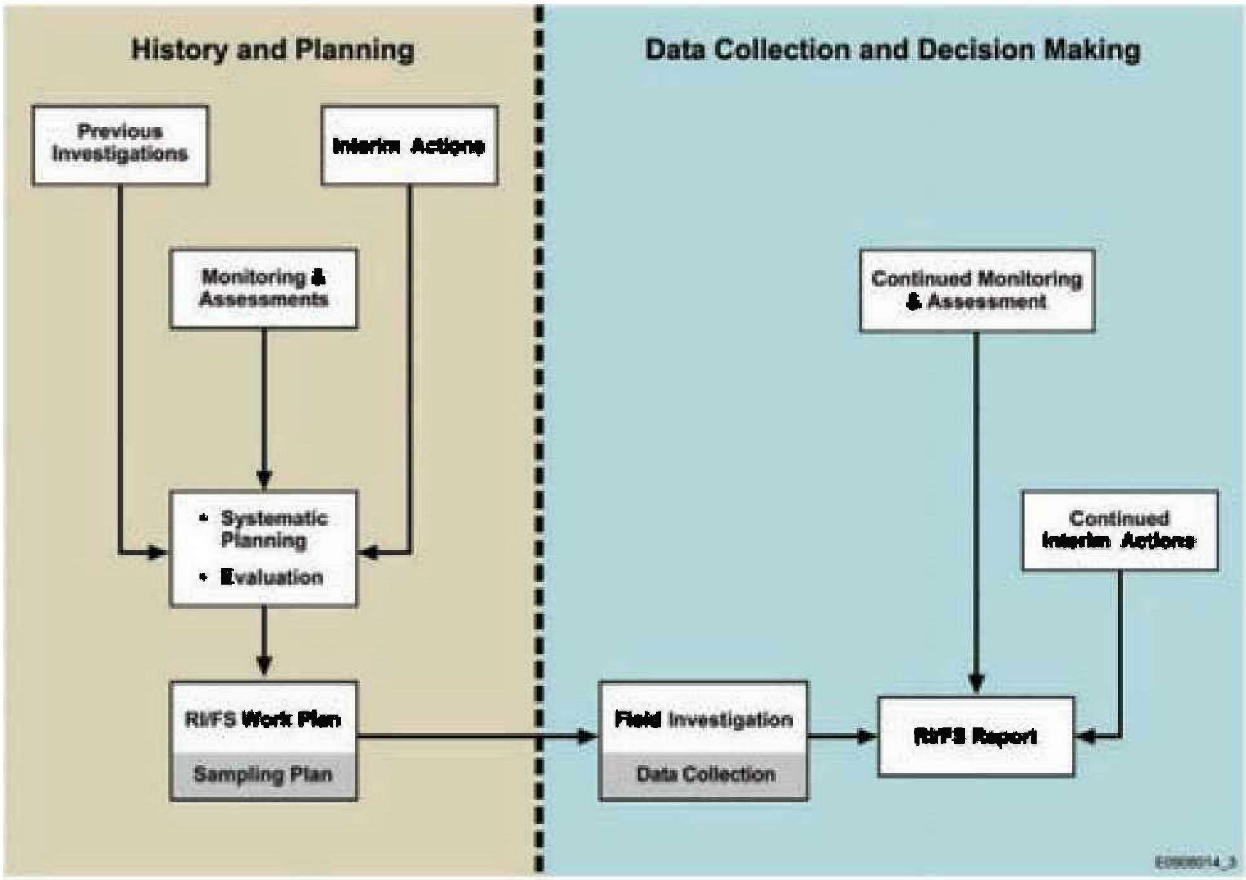


Figure 1-6. Information Sources for Development of the RI/FS

Previous characterization and investigation activities conducted to date under the CERCLA process have helped to develop sound decisions regarding interim remedial actions, and refine CSMs. The results of those activities are as follows:

- Technical baseline reports that summarize historical operations and process information with respect to waste disposal and contamination information.
- Limited field investigation reports that describe the results of focused site investigations to collect additional characterization data and to develop qualitative risk assessments (QRA).
- Remedial investigation and focused FS reports that describe the nature and extent of contamination, and present analyses of remedial action alternatives and screening of potential technologies.

During implementation of interim actions for the 300 Area OUs, additional investigations and monitoring were conducted to evaluate contamination and continue refinement of the information. These investigation and monitoring activities include the following:

- Waste site identification processes
- Environmental monitoring and surveys
- Air emissions evaluations
- River Corridor Baseline Risk Assessment (RCBRA)

- Routine groundwater monitoring and remedy effectiveness monitoring
- Environmental Radiation Monitoring and Assessment Program

1.5.1 Technical Baselines

Technical baseline reports were prepared for each operating area and provided DOE, regulatory agencies, and contractors with a "baseline" of technical information related to operational processes and resulting contaminated waste sites. A report was created for each River Corridor operating area (Table 1-1). The information in the reports was based on the evaluation of numerous Hanford Site reports, drawings, and photographs supplemented by site inspections and employee interviews. No intrusive field investigations or sampling occurred during development of the technical baseline reports.

These technical baseline reports describe the industrial process history and the types of waste streams that resulted from the operations, often including estimates for volumes and masses of contaminants. The reports contain maps and photographs of the facilities, and information on environmental monitoring for each area. The reports also provide a detailed description for each waste site within an area, describing known contamination and condition.

Table 1-1. Technical Baseline Reports

Report Title	Document Number
Data Compilation Task Report for the Source Investigation of the 300-FF-1 Operable Unit Phase I Remedial Investigation	PNL-7241
Addendum to Data Compilation Task Report for the Source Investigation of the 300-FF-1 Operable Unit Phase I Remedial Investigations	EMO-1026
Compilation of Historical Information of 300 Area Facilities and Activities	WHC-MR-0388
300-FF-2 Operable Unit Technical Baseline Report	BHI-00012

The initial work-planning documents also summarized and supplemented the technical baseline information for the purposes of conducting field investigations. Table 1-2 lists the initial work-planning documents for the 300 Area OUs.

Table 1-2. OU Work Plans

Report Title	Document Number
Remedial Investigation/Feasibility Study Work Plan for the 300-FF-1 Operable Unit	DOE/RL-88-31
Remedial Investigation/Feasibility Study Work Plan for the 300-FF-5 Operable Unit	DOE/RL-89-14
Remedial Investigation/Feasibility Study Work Plan for the 300-FF-2 Operable Unit	DOE/RL-94-38

1.5.2 LFIs and QRAs

The LFI reports and initial RI reports consisted of historical data compilation, nonintrusive investigations (e.g., geophysics), intrusive investigations (e.g., boreholes), and aggregate studies (i.e., ecological, river water, and sediment sampling). Table 1-3 lists the completed 300 Area LFI reports.

Table 1-3. LFI Reports

Report Title	Document Number
Limited Field Investigation Report for the 300-FF-2 Operable Unit	DOE/RL-96-42
Limited Field Investigation Report for Uranium Contamination in the 300-FF-5 Operable Unit at the 300 Area, Hanford Site, Washington	PNNL-16435

The 300-FF-2 OU LFI recommended contaminated surface sites for interim remedial action and categorized them as high or low priority. Sites considered high priority have the highest potential to contribute to contamination of groundwater and the Columbia River. The report also provided a preliminary summary of site characterization studies and identified contaminant- and location-specific applicable or relevant and appropriate requirement (ARARs). The data-collection activities associated with the LFI supplemented existing information to support formulation of conceptual models, as well as performance of a QRA. The QRA reports (listed in Table 1-4) included consideration of whether contaminant concentrations pose an unacceptable risk that warrants remedial action. This information was the basis for remedial actions completed to date, as well as for current and future remedial actions identified in the interim action RODs.

Table 1-4. Reports Containing QRAs

Report Title	Document Number
Phase I Remedial Investigation Report for the 300-FF-1 Operable Unit	DOE/RL-92-43
Phase I Remedial Investigation Report for the 300-FF-5 Operable Unit (Chapter 6 presents a baseline risk assessment)	DOE/RL-93-21
Limited Field Investigation Report for the 300-FF-2 Operable Unit	DOE/RL-96-42
Focused Feasibility Study for the 300-FF-2 Operable Unit	DOE/RL-99-40
Current Conditions Risk Assessment for the 300-FF-5 Groundwater Operable Unit	PNNL-16454

The high-priority sites evaluations used the following criteria to help identify those recommended for remedial actions:

- Magnitude of risk identified in the QRA
- Exceedance of a chemical-specific ARAR
- Potential to contaminate groundwater
- Insufficient information for conceptual model
- Multiple exposure pathways
- Expected natural attenuation and radioactive decay

The QRAs established the basis for action for waste sites identified in the 300Area.

1.5.3 Engineering Evaluation/Cost Analysis and Focused FSs

Engineering evaluation/cost analysis s and focused FSs supported selection of interim remedial actions for sites and groundwater. For waste sites, site profiles were developed for the high-priority waste sites (as identified in the LFI reports) and comparative evaluations and analyses of the remedial action alternatives were made. Engineering evaluation/cost analysis and feasibility studies for the 300 Area are listed in Table 1-5.

Table 1-5. Engineering Evaluation/Cost Analysis and FS Reports

Report Title	Document Number
Engineering Evaluation/Cost Analysis #2 for the 300 Area	DOE/RL-2005-84
Engineering Evaluation/Cost Analysis #1 for the 300 Area	DOE/RL-2001-30
Engineering Evaluation/Cost Analysis for the 331-A Virology Laboratory Building	DOE/RL-99-64
Engineering Evaluation of the 618-9 Burial Ground Expedited Response Action	DOE/RL-91-38
Engineering Evaluation/Cost Analysis #3 for the 300 Area	DOE/RL-2005-87
Phase I Remedial Investigation Report for the 300-FF-1 Operable Unit	DOE/RL-92-43
Phase I and II Feasibility Study Report for the 300-FF-1 Operable Unit	DOE/RL-92-46
Phase I Remedial Investigation Report for the 300-FF-5 Operable Unit	DOE/RL-93-21
Phase III Feasibility Study Report for the 300-FF-1 Operable Unit	DOE/RL-94-49
Remedial Investigation/Feasibility Study Report for the 300-FF-5 Operable Unit	DOE/RL-94-85
Focused Feasibility Study for the 300-FF-2 Operable Unit	DOE/RL-99-40

1.5.4 Other Investigations and Monitoring Activities

An inventory of known and potential waste sites has been maintained in the WIDS database since the early 1980s. The process of evaluating old land-based and aerial photographs, historical documentation, and area walkdowns has continued as part of many subsequent projects.

1.5.4.1 Waste Site Identification

The WIDS waste site list has grown to contain more than 2,800 sites. The list contains sites within the areas where plutonium production and research operations occurred and in areas of lower intensity use outside the operational boundaries. Even locations such as known borrow pits that had potential to receive wastes in the past are tracked and evaluated. Cleaned-up sites are not removed from WIDS, but the classification status and information concerning each site are updated.

In 2004, a longer-term study called the orphan site evaluations (OSEs) began. Extensive review of historical records, field walkdowns, interviews with current and former Hanford Site employees, and geophysical investigations are being conducted in the 100 Area and 300 Area operations areas and surrounding lands. This process is anticipated to continue in the coming years for the remaining operations areas and the areas between the reactor areas. New waste sites identified during the OSE process typically include pipelines, dry wells associated with buildings, and dump sites/debris piles/landfills from former decontamination and demolition activities. The WIDS database is updated with the new sites for disposition under the proper remedial authority.

1.5.4.2 Environmental Monitoring and Surveys

Much investigative work has been focused along the Columbia River because of the potential risk of exposure to people and the environment. The DOE has completed routine radiological surveys of the river shore (PNL-3127, *Radiological Survey of Exposed Shorelines and Islands of the Columbia River Between Vernita and the Snake River Confluence*), as well as regular sampling of the riverbank springs and sediment (PNNL-18427, *Hanford Site Environmental Report for Calendar Year 2008*). The annual environmental monitoring reports also document and evaluate surveillance sampling of many media on and off the Hanford Site (e.g., vegetation, terrestrial and aquatic wildlife, air, soil, and water) to quantify potential contaminant concentrations and to assess their environmental and human-health significance.

Aerial radiological surveys were completed (EGG-10617-1062, *An Aerial Radiological Survey of the Hanford Site and Surrounding Area*) to define areas of manmade radioactive contamination. The EGG-10617-1062 survey covered the Hanford Site and the banks of the Columbia River downriver to McNary Dam. The radiation levels over more than 95 percent of the site were reported to be due to normal levels of background radiation. Areas of elevated radionuclide activity outside of operational areas have been investigated and are identified in WIDS. Several slough areas along the Columbia River also showed elevated radioactivity; these areas were sampled and the radionuclide content shown to be only slightly above background (WHC-SD-EN-TI-198, *100 Area Columbia River Sediment Sampling*). This sampling also confirmed that the sensitivity of the aerial radiological survey equipment used was sufficient to detect low levels of radioactivity.

1.5.4.3 Air Emissions Evaluations

In 2005, an evaluation of the releases on the Hanford Site from air emissions stacks located in the 100 Area and 300 Area was made (DOE/RL-2005-49, *RCBRA Stack Air Emissions Deposition Scoping Document*) using previous background soil sampling work, radiological surveys, and an evaluation of the materials (radionuclides and metals) emitted and their amounts. The report concluded that there were no locations of elevated radioactivity or metals in the 100 Area, 300 Area, or associated 600 Area due to aerial deposition, other than those discrete areas already identified as waste sites in WIDS. This information was considered along with soil sampling results to evaluate the sites selected as reference or comparison sites for the baseline risk assessment.

1.5.4.4 RCBRA

Chapter 4 presents a summary of baseline risk assessment and characterization activities.

1.5.4.5 Groundwater Monitoring

The DOE monitors groundwater at the Hanford Site to fulfill a variety of state and federal regulations, including the *Atomic Energy Act of 1954*, RCRA, CERCLA, and the *Washington Administrative Code*. During fiscal year 2008, workers sampled 865 wells and 297 shoreline aquifer tubes to determine the distribution and movement of contaminants. A published annual summary report integrates information from multiple sources. DOE/RL-2008-66, *Hanford Site Groundwater Monitoring for Fiscal Year 2008*, discussed emerging issues, groundwater flow, groundwater monitoring and remediation, shoreline monitoring, well installation, maintenance and monitoring, vadose zone, and continued monitoring.

1.5.4.6 Environmental Radiation Monitoring and Assessment Program

The Washington State Department of Health (DOH), Division of Environmental Health has an oversight program for independently verifying the quality of the DOE monitoring programs at the Hanford Site. The DOH performs this oversight by conducting split, collocated, and independent sampling at locations having the potential to release radionuclides to the environment or location that may be impacted by such releases. The DOH uses the oversight data to assess impacts to the public and to address public concerns related to radiation at the Hanford Site. The DOH publishes an annual Hanford Site environmental oversight program summary report (e.g., DOH 320-050, *Hanford Environmental Oversight Program 2007 Data Summary Report*).

1.6 Integration Activities

The U.S. Department of Energy, Richland Operations Office (RL) integrates the numerous projects on-going in the 300 Area by using the Groundwater/Vadose Zone Executive Council. The Executive Council was established in August 2008 for integration of groundwater and vadose zone work scope. The Executive Council oversees the integration function and provides policy direction for it. The Executive Council prepares, updates, and assesses progress of priorities to guide integration activities. Among the Executive Council responsibilities and authorities is to establish and charter both the Groundwater/Vadose Zone Core Team and the Risk Integration Core Team. In addition, the Groundwater/Vadose Zone Core Team guides the Multi-Project Teams that are specific to geographic areas of the Hanford Site. The 300 Area work scope falls within the River Corridor Multi-Project Team and the Characterization Multi-Project Team charters. Charters for these groups detail the source, science and technology, and groundwater integration roles for work planned and ongoing in the 300 Area.

1.6.1 Integration with Ongoing Cleanup Activities

A feature in the 300 Area CERCLA process is the ongoing ROD remedy selection implementation, and other activities to either remediate contaminated areas or develop more effective remediation methods. Some of these activities include, but are not limited to, soil removal and subsequent treatment, D4 and removal of facilities, and methods testing for in situ uranium treatment.

The activities generate information to provide an improved understanding of the site complexity and support CSM refinement. Remediation and cleanup verification are anticipated parallel activities with the final RI/FS. Site cleanup verification sampling and laboratory analysis will confirm attainment of remedial action goals established under the RODs and, therefore, demonstrate that remedial action objectives (RAOs) for interim site closure have been met.

To ensure that all waste sites are remediated, an OSE process has been identified for "orphan" waste sites through a systematic approach to review land parcels and identify potential waste sites within the River Corridor not currently listed in existing CERCLA decision documents (RODs). Evaluations consist of comprehensive reviews of historical documentation including documents, drawings, maps, photographs, field investigations, and geophysical surveys. Evaluations have been or will be conducted within each reactor/operational area and remaining nonoperational parts of the River Corridor geographical area. Evaluation results are reviewed with RL and the lead regulatory agency (either the EPA or Ecology), and subsequently summarized in an OSE report. Newly identified waste sites are typically added to one of the existing CERCLA decision documents through an ESD or ROD amendment, characterized to determine whether cleanup is required, and addressed in accordance with the selected remedy.

Specific buildings and structures within the 300 Area will remain in use until some future time (Table 2-8 in Section 2.3 and Figure 1-7). Many of these contain CERCLA hazardous substances, and present a potential threat to human health and the environment to the extent that removal actions are warranted. Disposition evaluations for the facilities used an engineering evaluation/cost analysis, and subsequent removal actions were authorized through the release of action memoranda. As the structures disposition in accordance with the D4 process under CERCLA non-time-critical removal actions, confirmatory sampling may be performed on certain candidate sites. The sampling data are evaluated against remedial action goals on a unit-by-unit basis to determine whether a remedy selected in the ROD (e.g., removal, treatment, and disposal) is required or if the site is reclassified as no action.

Note: Building to remain in use for the long term. Photo taken in 1973.

Figure 1-7. 325 Building

Characterization data and information will be available in the administrative record, and data generated will support a final decision through the CERCLA process described in Chapter 5. The RI may identify and evaluate contaminants from outside this area as part of the risk, but required actions will be addressed by the originating OU.

The 300 Area RI/FS process concludes with a summary of the data from all media (i.e., surface soil, vadose zone, groundwater, and surface water). The final remedy selection completes the RI/FS process.

1.6.2 Past and Ongoing Risk Assessment

Risk assessment is used to determine the need for a remedial action and in development of preliminary remediation goals (PRGs). Under the final ROD process, results of the various risk assessments (completed or ongoing) will evaluated and summarized to help make informed risk management decisions. Sources of information for the final RI/FS risk assessment include the following:

- Data collected during implementation of an interim action ROD
- Data packages developed as part of completed soil removal action Sampling conducted specifically for assessment of human health and ecological risk
- New and historic characterization activities
- New and historic groundwater monitoring activities

Previous assessments include the qualitative risk assessment supporting EPA/ROD/R10-96/143 and EPA/ROD/R10-01/119 and the River Corridor baseline risk assessment (DOE/RL-2007-21, *Risk Assessment Report for the 100 Area and 300 Area Component of the River Corridor Baseline Risk Assessment*). These evaluated protection of human health and the environment, including ecological receptors. Further details about these and the ongoing RIs for Hanford Site releases to the Columbia River, are provided in Chapter 4 of this work plan.

1.6.3 Integrating with Ongoing Research

Several investigations are underway in the Hanford Site 300 Area under a program managed by the DOE's Office of Biological and Environmental Research, Environmental Remediation Sciences Division. These investigations include:

- The Hanford Integrated Field-Scale Subsurface Research Challenge (IFRC) Project (PNNL-17067, *300 Area Integrated Field-Scale Subsurface Research Challenge (IFC) Field Site Management Plan*).
- An investigation of subsurface hydrogeologic features using geophysical methods.
- Selected projects that are part of DOE's Scientific Focus Area.

These projects are collaborative efforts among the Pacific Northwest National Laboratory (PNNL), other national laboratories, and universities. While not formally part of the activities proposed in this work plan, the results from the various research projects will be used to interpret and support conclusions presented in the RI/FS report that follows this work plan. The RI/FS report is scheduled for completion by December 31, 2011, under TPA Milestone M-015-72-T01.

The DOE supports several treatability tests involving uranium in the subsurface in the 300 Area under the Office of Environmental Management EM-22 program.[10] The first test involved injecting polyphosphate solution into the aquifer in an attempt to lower uranium concentrations in groundwater by precipitation. Initial results of this test are in PNNL-17480, *Challenges Associated with Apatite Remediation of Uranium in the 300 Area Aquifer*, and the final report on the test is presented in PNNL-18529, *300 Area Uranium Stabilization Through Polyphosphate Injection: Final Report*. Monitoring the impact on aquifer concentrations continues. A second phase of testing using polyphosphate involves infiltrating solutions into the vadose zone, where potentially mobile uranium capable of migrating to groundwater remains. Again, the test is intended to precipitate uranium as an insoluble species, thus preventing future migration. Installing an infiltration gallery of wells is 2009 (DOE/RL-2009-16, *300-FF-5 Groundwater Operable Unit Infiltration Test Sampling and Analysis Plan*).

1.6.3.1 IFRC

Pacific Northwest National Laboratory is leading a field study at the 300 Area to identify new approaches and strategies to resolve questions about the subsurface contaminants movement. The field study is part of the Hanford IFRC, a new project committing multi-investigator teams to perform large, benchmark-type experiments on formidable field-scale science issues[11] (PNNL-17067; PNNL-SA-58090, *Multi-Scale Mass Transfer Processes Controlling Natural Attenuation and Engineered Remediation: An IFC Focused on Hanford's 300 Area Uranium Plume*). The Hanford IFRC started in 2006 and is planned as a 5-year effort.

DOE's Office of Biological and Environmental Research, Environmental Remediation Sciences Division manages the program. The Hanford Site field study involves the development, characterization, and instrumentation of a vadose zone and saturated zone field site. Researchers perform state-of-science field experiments at these sites to resolve the geochemical, hydrophysical, and microbiologic factors controlling the migration of contaminant uranium through the vadose zone (water-unsaturated sediments

[10] The DOE's prime contractor for soil and groundwater remediation, CH2M HILL Plateau Remediation Company, is responsible for remediating the lower vadose zone and groundwater in this area.

[11] The Hanford IFRC Project web site is http://ifchanford.pnl.gov/.

below the soil and above groundwater) and groundwater. The locations are proximal to the Columbia River, and will allow studies of river stage fluctuations influencing contaminant dissipation from the aquifer and discharges to the river.

During the project, researchers will develop field-scale experimental information on subsurface uranium migration processes. This information will allow the development of improved reactive transport models for describing and predicting future uranium fluxes to the Columbia River and the efficacy of proposed remediation strategies. A team of scientists from PNNL, three other DOE laboratories, four universities, and the U.S. Geological Survey are involved.

The principal topics and tests associated with the Hanford IFRC are listed below. Table 1-6 shows the schedule for various experimental campaigns.

- Updated conceptual models for uranium mass transfer in the subsurface beneath the 300 Area, including the following:
  - Uranium fluxes from the vadose zone and periodically rewetted zone to groundwater
  - Scale-dependent mass transfer contributing to dynamics of 300 Area uranium plume
  - Role of mass transfer and microbial processes on uranium remediation strategies
  - Peer-reviewed manuscripts of field campaigns and resulting analyses
- Principal Field Tests:
  - Vadose zone infiltration experiments
  - Field tests to investigate the effects of a fluctuating water table
  - Saturated zone injection experiments with varying bicarbonate and uranium concentrations
  - Passive field tests to monitor seasonal pulses and intrusion of river water
  - Field injections using different polyphosphate, calcium-citrate/phosphate, and organic phosphate with bicarbonate
  - Collaboration with DOE, Office of Environmental Management (EM-22) polyphosphate treatability testing

Table 1-6. Expected Experimental Campaigns

Title/Topic	Expected Period of Performance
Multi-tracer, cold-water injection	March 2009
Passive tests associated with fluctuating water table	May – July 2009
Desorption injection tests	September 2009
Adsorption injection tests	March 2010
Passive tests associated with fluctuating water table	May – July 2010
In situ experiments, microbiologic activity	August 2010 – February 2011
Isotopic exchange investigation	March 2011

1.6.3.2 Geophysical Investigation of Subsurface Features at the 300 Area

An investigation of hydrologic processes in the near-Columbia River environment at the 300 Area is underway using several geophysical survey methods. The specific objectives are as follows.

- Characterize the spatial structure of the hydrogeologic framework within the near-shore and sub-river bed zone at multiple scales appropriate for refining transport models at the site.
- Identify the variability in the lateral extent of the hyporheic corridor (i.e., the distance into the aquifer where the stage in the Columbia River exerts an impact on solute transport).
- Elucidate the temporal variability of groundwater-surface water interaction within the hyporheic corridor driven by daily and seasonal variations in stage level.
- Refine the high-resolution, three-dimensional stratigraphic model for the 300 Area by coupling geophysical data collected in the hyporheic corridor with terrestrial measurements conducted under the Hanford IFRC for this site.

As of early 2009, approximately 3 km (1.86 mi) of the river channel were surveyed, and paleochannels eroded into Ringold Formation Unit E sediment have been tentatively identified. These paleochannels could act as preferential pathways for groundwater flow and transport uranium to the Columbia River. Real-time temperature measurements monitor approximately 1.5 km (0.9 mi) of the 300 Area shoreline riverbed. The measurement results identify areas of preferential groundwater discharge through the riverbed. The third and final year of the project will start in February 2010.

1.6.3.3 PNNL Science Focus Area

The DOE's Science Focus Area work at PNNL involves research associated with multi-scale computer simulation of contaminant fate and transport, use of geophysical methods to characterize subsurface conditions related to contaminant transport, and use of isotopic signatures to identify sources and environmental pathways for radiological contamination and migration.

1.7 Systematic Planning Process

The EPA recommends using a data quality objectives (DQO) process for planning purposes involving environmental data (CIO 2105.0 [formerly EPA Order 5360.1 A2], *Policy and Program Requirements for the Mandatory Agency-Wide Quality System*). DOE contactors are using a systematic planning process for the DQOs, which for this work plan consisted of the following steps.

- Conduct Interviews: Interviews conducted with interested parties include DOE, EPA, and Ecology to generate a list of concerns focused on obtaining a final ROD for the 300 Area.
- Develop CSM: Presentation plates of CSMs identify principal study questions, supporting information, and resulting data gaps requiring further evaluation.
- Select Relevant Data Need/Document Justifications: Data gaps identified through this process were evaluated against existing data, confirmed that each data gap supported the completion of the CERCLA process, and resulted in a specific data need for the RI.
- Develop Plan to fill Data Need: A SAP (DOE/RL-2009-45, *Sampling and Analysis Plan for the 300 Area Remedial Investigation/ Feasibility Study*) was developed to fill each data need.

- Additionally, copper, nickel, selenium, silver, sulfate, thallium, fluoride, lead, manganese and zinc were reported at concentrations above the lowest available ARAR (which is protective of both aquatic and human receptors). This information is necessary to determine whether these metals will actually need to be evaluated and carried forward as final groundwater COPCs in the FS. Currently the groundwater data suggest that each of these metals are indeed COPCs based on the reported concentrations. They were identified using the same technical process used for each of the other operable units, where most of these metals were identified as COPCs for the SAP.

Summary tables (provided in Chapter 3) link the proposed sampling to each data need, and to prioritize the data need. This systematic approach was adapted for the Hanford Site using EPA's guidance on planning (EPA/240/B-06/001). The Tribal Nations, trustees, and stakeholders were informed of progress by traditional mechanisms, such as the Hanford Advisory Board River and Plateau Committee meetings and Natural Resource Trustee Council meetings. The process allowed interested parties to provide input, and the process clearly documented the data needs and linkage between the data needs and the associated sampling approach.

Tables 3-4 and 3-5 present additional data needs and establish links to the sampling approach. Section 4.5 presents the COPC and target analyte development.

2 Site Background and Environmental Setting

This chapter presents a summary description of the 300 Area's site background information and environmental setting, following the guidance presented in EPA/540/G-89/004 (p. 2.7). Since the initial RI/FS activities for OUs were defined for the 300 Area National Priorities List[12] site, new information on contaminant conditions associated with waste disposal sites, facilities, and groundwater has accumulated. This information is readily available to support additional RI/FS activities. Especially useful are the technical baseline reports that describe the history of operations (Section 2.1.1), use of waste disposal facilities (Section 2.1.2), the annual groundwater and environmental monitoring reports, and the CVP reports. The following summary descriptions identify the individual reports and draw heavily from them.

2.1 History of Operations

This section provides a historical summary of site operations and contaminant sources within the 300 Area.

Many programs and activities were conducted in the 300 Area over the span of its operational history (1943 through present day). It is not within the scope of this document to provide a comprehensive discussion of the 300 Area history. A detailed history of 300 Area operational programs and activities can be found in WHC-MR-0388, *Compilation of Historical Information of 300 Area Facilities and Activities.* Other sources include BHI-00012, *300-FF-2 Operable Unit Technical Baseline Report*; EMO-1026, *Addendum to Data Compilation Task Report for the Source Investigation of the 300-FF-1 Operable Unit Phase I Remedial Investigations*; and DOE/RL-96-42, *Limited Field Investigation Report for the 300-FF-2 Operable Unit.* The purpose of this section is to provide a summary of 300 Area operations, with emphasis on those activities and facilities that may have contributed to soil and groundwater contamination.

The 300 Area began operations in 1943 as a nuclear fuels fabrication complex for the graphite moderated plutonium production reactors located in the 100 Areas. Nine reactors built in the 100 Area were supported by the 300 Area from 1943 to 1989. In the early 1950s, the Hanford Laboratories were constructed for R&D. As the Hanford Site production reactors were shut down, fuels fabrication in the 300 Area ceased. Research and development activities were diverse and expanded over the years. Historically, the following five major activities were conducted in the 300 Area:

1. Uranium fuel production.
2. Research and development activities, including test reactor experiments (in support of the 100 Area) and separations experiments (in support of the 200 Area).
3. Economic diversification, including materials testing and isotope production conducted at the FFTF, and various National Aeronautics and Space Administration experiments.
4. Animal and radiobiology experiments conducted at the 331 Laboratory Complex (moved from 100-F when the 331 Building was built in 1970).
5. Deactivation, decontamination, decommissioning, and demolition of 300 Area facilities and environmental cleanup, which mainly constitute the CERCLA process beginning in 1989 with the listing of the 300 Area on the National Priorities List and the initiation of the Tri-Party Agreement.

[12] 40 CFR 300, "National Oil and Hazardous Substances Pollution Contingency Plan," Appendix B, "National Priorities List."

Many of the uranium production facilities and R&D laboratories have been demolished and several other are scheduled for demolition (Section 2.3). Currently, the 300 Area contains a number of support facilities, a few facilities used for R&D, environmental restoration, and D4. Table 2-1 presents a chronology of 300 Area events.

Table 2-1. Chronology of 300 Area Events

Month/Year	Event
March 1943	Construction of 300 Area facilities begins.
1943	Production of uranium fuel elements begins in the 300 Area.
October 1948	The South Process Pond dike fails and an estimated 54.8 million L (14.5 million gal) of uranium contaminated water is released to the Columbia River.
1948	Construction of the North Process Pond.
1948-1956	Uranium bearing liquid waste from the 300 Area is transported and released to the 316-4 Crib, located near the 618-10 Burial Ground.
1954	Lead-dip and molten aluminum-silicon (triple-dip) fuel process methods used for uranium fuel canning.
1954-1967	Solid radioactive and TRU wastes from 300 Area operations transported and disposed in the 618-10 and 618-11 Burial Grounds.
1960s	Zirconium alloy (Zircaloy-2) fuel fabrication method used for fuel rods used in the N Reactor.
Mid-1960s	Hot die size process replaced the aluminum-silicon (triple-dip) fuel fabrication process.
1943-1973	Solid waste and debris from 300 Area operations were disposed in 300 Area (industrial complex area) burial grounds. After 1973, 300 Area solid wastes were transported and disposed in 200 Area burial grounds.
1973	The Waste Acid Treatment System was developed to treat acidified liquid waste before disposal.
1975	Construction of the 300 Area process trenches.
1975-1985	Some of the fuels fabrication liquid waste was trucked to the 183-H Solar Evaporation Basins.
1989	The 300 Area was placed on the National Priorities List.
1943-1994	Liquid wastes were discharged to the South and North Process Ponds, and the 300 Area Process Trenches through the 300 Area process sewer.
1991	Expedited Response Action at the 300 Area Process Trenches to remove contaminated sediment.
1996	ROD for the 300-FF-1 and 300-FF-5 OUs approved.
July 1997	Remediation of the 300-FF-1 OU begins.
April 2001	Approval of 300-FF-2 OU ROD for interim action.
2003	Technical workshops to investigate potential methods for remedial action at the 618-10 and 618-11 Burial Grounds, which contain TRU waste.
August 2004	300-FF-1 OU waste site remedial actions complete.
2004-2008	Renewed feasibility studies for treating uranium in the groundwater at the 300 Area.
2007-present	Field research involving the mobility of contaminant uranium and treatability testing of ways to immobilize uranium in the subsurface.

Notes:

TRU = Transuranic Radioactive waste, as defined in DOE G 435.1-1, *Implementation Guide for Use with DOE M 435.1-1*

The 300 Area waste sites are grouped into the following OUs based on geographic area and common waste sources: 300-FF-1, 300-FF-2, and 300-FF-5. The 300-FF-1 and 300-FF-2 OUs address contaminated soils in the unsaturated vadose zone, structures, debris, and burial grounds. The 300-FF-5 Groundwater OU addresses the groundwater beneath the 300-FF-1 and 300-FF-2 OUs. The 300-FF-1 OU is composed of various solid waste, and contaminated vadose zone soils, plus the high-volume, liquid waste disposal sites (i.e., the North Process Pond, South Process Pond, and the 300 Area Process Trenches). The 300-FF-2 OU is composed of waste sites in the following four general categories: waste sites in the 300 Area industrial complex, outlying waste sites north and west of the 300 Area industrial complex, general content burial grounds, and transuranic- (TRU-) contaminated burial grounds in the 600 Area. Additional waste sites discovered in the 300 Area may be "plugged-in" to the removal, treatment, and disposal (RTD) remedy in accordance with EPA/ROD/R10-01/119. A description and accounting of the 300-FF-1 and 300-FF-2 OU waste sites is provided in Section 2.2.

2.1.1 300 Area (Industrial Complex) Operations and Process History

The operational history of the 300 Area varies greatly, based on Hanford Site missions and multiple support mission changes.

2.1.1.1 Uranium Fuel Production Activities

Over 30 structures were built in the 300 Area as part of the Manhattan Engineering District mission beginning in 1943. The facilities that housed the primary components for uranium fuel production are as follows:

- 313 Metal Fabrication Building
- 314 Press (Metal Extrusion) Building
- 306 Metal Fabrication Development Building
- 333 Fuels Manufacturing Building
- 303A-J Fresh Metal Storage Buildings

Fuel fabrication was conducted primarily in the 313 Metal Fabrication and 314 Press Buildings. Fresh uranium metal arrived in the 300 Area as ingots, which were cut and lathed to billets in the 313 Building. Metallic uranium was fabricated into fuel rods through extrusion and outgassing processes, then machined into cylindrical cores, and encapsulated in protective cladding, also referred to as "jackets" or "cans." The encapsulation was necessary to facilitate heat conduction from the uranium rods to the circulated coolant water in the nuclear reactors to avoid over-heating. The jackets prevented releasing highly radioactive fission products to the reactor cooling water, and prevented uranium metal corrosion by direct contact with water. After the 314 Building's extrusion press arrived and became operational in January 1945, uranium was shipped to the 300 Area as billets. The billets were cropped, extruded into rods, straightened, and outgassed in the 314 Building, then sent to the 313 Building for jacketing or canning. Graphite, uranium, aluminum cans, and process tubes were tested through a quality assurance program conducted in the 305 Test Pile Reactor. Other canning tests and inspections were conducted in the 314 Building, including high temperature autoclave and radiograph (X-ray) testing.

From 1943 through 1960, uranium fuel production in the 300 Area was focused on fuel fabrication for the eight single pass reactors located in the 100 Areas. Originally, the jackets (or cans) were made of aluminum formed cylinders. The uranium rods were heated, and then placed in heated aluminum cans. The ends were machined, and then welded closed with aluminum cap. This original canning process involved the use of an electric heater press, referred to as the "whiz-bang," which was used to heat and bond the uranium fuel cores to the jackets. In 1944, jacketing the uranium fuel cores was a triple-dip method consisting of bathing in molten bronze, tin, and then a molten aluminum-silicon mixture.

A lead-dip process was developed in the early 1950s. The uranium cores were dipped in -molten lead,- followed by molten aluminum and molten aluminum-silicon bath. Approximately 12,000 fuel elements were canned per day between 1955 and 1964. During the peak years of single-pass reactor operations, approximately 39,420,000 fuel elements were canned (WHC-MR-0388, Chapter 1.0).

Before the development of the N Reactor, co-extrusion fabrication process capabilities were developed in the 306 Metal Fabrication Development Laboratory. The 306 Building was built in 1956 with the initial mission to support 313 Building operations and pilot process improvements in the single-pass reactors. An extension was added to the 306 Building in 1960 to support the co-extrusion fabrication process used for N Reactor fuel elements. The 306 Building was split in 1972 into 306 East and 306 West. The mission of the 306 Building remained focused on fabrication and test development work during its history of operation.

The 333 Fuels Manufacturing Building was completed in 1960 as the new fuel-cladding facility with the mission to fabricate fuel elements for the N Reactor with the co-extrusion process. Between 1965 and 1967, the 333 Building was used for autoclave testing on fuel elements, final etching with nitric-hydrofluoric acid, and inspection of lithium aluminate fuel targets. Additionally, enriched (2.1 percent uranium-235 [U-235]) uranium driver fuel elements for tritium (H-3) programs were produced in the 333 Building from 1965 to 1970. In 1973, the Waste Acid Treatment System (WATS) began operation to treat waste acids discharged from 333 Building operations. Fabrication of standard Zircaloy-2 clad uranium fuel elements for the N Reactor, with inspections of these elements before irradiation, continued until 1987 in the 333 Building (WHC-MR-0388, Chapter 3.0, pp. 19-21).

The 303 Fresh Metal Storage Buildings were an integral part of the uranium fuel production process. These nine buildings (A, B, C, D, E, F, G, K, and J) were built during World War II by the Manhattan Engineering District and du Pont de Nemours, Inc. The primary use of these buildings was the storage of unirradiated uranium, chemical storage, and uranium scrap storage (WHC-MR-0388, Chapter 6.0, p. 31).

Uranium fuel production activities focused on producing plutonium stopped in 1987, coinciding with the end of N Reactor operations. Although fuel production had ceased in the 300 Area, several R&D activities continued through the initiation of the CERCLA process and the Tri-Party Agreement in 1989.

2.1.1.2 R&D

In the early 1950s, the mission of the 300 Area expanded to include several R&D activities related to improving fuel fabrication processes, finding alternative nuclear fuel materials, developing commercial applications of nuclear energy, and various other types of research activities. Fuel fabrication research mainly was focused on improving the fuel manufacturing process and developing reuse methods. A large portion of research was dedicated to developing advanced encapsulation methods. During the 1950s and 1960s, the peaceful uses of atomic power became an emphasis with the Eisenhower Administration's Atoms for Peace program in 1953 and the passage of the *Atomic Energy Act of 1954*, which allowed the commercial use of atomic energy. During this period, research was performed to extend and diversify the uranium fuel supply for commercial nuclear reactors with the fabrication of oxide fuel blends. This research involved the fabrication of blended fuels from combinations of plutonium oxide, uranium oxide, and other mixed oxide materials. The 300 Area facilities built for R&D of alternate reactor fuels include the following:

- 305-B Physical Constants Test Reactor and Thermal Test Reactor
- 308 Plutonium Fabrication Pilot Plant
- 309 Plutonium Recycle Test Reactor (PRTR)
- 318 High-Temperature Lattice Test Reactor

Demolition and removal of the 305-B Physical Constants Test Reactor and Thermal Test Reactor was completed in December 2006. The 305-B Facility was a mostly subsurface structure built in 1954 directly south of the 305 Building. Because of the various roles the facility played throughout its 50-year history, the 305-B Building complex was known as the Test Reactor Facility, the Process Engineering Laboratory, and the Hazardous Waste Storage Facility.

The 308 Building was used for fuel development for over 30 years and deactivated in the early 1990s. The main feature of the facility was the Training, Research, Isotopes, General Atomics reactor, housed in an underwater tank in the 308-A Building. Deactivation of the reactor included removing the fuel elements from its core and placing them in racks located in the water-filled pit or reactor pool. Removal of the Training, Research, Isotopes, General Atomics fuel from the 308-A Building to another Hanford Site location was completed in 1995. Following fuel removal, the control rods, other neutron sources, and some instrumentation were removed and transferred to another site location, and the water pool was drained. Most of the large, fixed equipment has been left for future D4 activities, including 50 sealed glove boxes contaminated with plutonium and other actinides.

The PRTR, located in the 309 Building, operated from 1960 to 1968. The 309 Building includes the 309 Building PRTR containment vessel, its connected wings and annexes, the associated below-grade vaults (e.g., ion exchange, brine tank, waste storage, exhaust air filters), and the main exhaust stack. The building has undergone substantial cleanup, but the reactor itself remains below grade, and some ancillary reactor cells still contain contaminated materials. The PRTR and remaining contaminated materials will be removed during D4 of the 309 Building.

The main 318 Building was constructed during 1966 and 1967 to house the High-Temperature Lattice Test Reactor, designed to test high-temperature fuel performance in gas-cooled reactors. The High-Temperature Lattice Test Reactor operated from 1968 to 1972. After 1972, funding was diverted to pursue breeder reactor technology, such as the FFTF project in the 400 Area. In 1973, the irradiated fuel rods were processed through Plutonium-Uranium Extraction (PUREX) processes and the unused fuel was excessed commercially as part of the Hanford Works fuel scraps clean-up program. The reactor, along with the control room computer, was removed between 1978 and 1982.

In addition to R&D activities and fuel fabrication R&D activities, the 300 Area played a major role in the pilot testing and development of the plutonium extraction methods used in the 200 Area. Early experiments designed to improve the untried bismuth phosphate separations process were conducted in the 3706 Radiochemistry Laboratory and the 321 Separations Building. These buildings also were later used to pilot test the more efficient continuous solvent extraction methods: reduction oxidation (REDOX), uranium metal recovery (U Plant), PUREX processes, and recovery of uranium and plutonium by extraction. Figure 2-1 presents an aerial photo of the 300 Area taken in 1944. Note the 321 Building is under construction just south of the 3706 Building. In 1952 through 1953, the following five facilities were built in the 300 Area:

- 325 Radiochemistry Building
- 326 Physics and Metallurgy Building
- 327 Radiometallurgy Building (Post-Irradiation Testing Laboratory)
- 328 Engineering Services Building
- 329 Biophysics Laboratory

Note: The photo shows the 321 Building under construction.

Figure 2-1. Aerial Photo Showing the 300 Area in 1944

As new experimental programs started and existing programs expanded, several modifications were made to some of the 300 Area facilities. Examples of the modifications include the 325-A High-Level Radiochemistry Annex finished in 1960, and four additions to the 327 Building. The 325-A Annex was used for multiple isotope separations campaigns for National Aeronautics and Space Administration programs during the 1960s, and waste verification work in the late 1960s. The most significant addition to the 327 Building included a large hot cell with an inert atmosphere with the capacity to handle the 2.4 m (8-ft-) long fuel rods used in the FFTF.

The 324 Waste Technology Engineering Laboratory was built in 1966 to support fuel examination for the 309 PRTR. After the 309 PRTR operations dwindled, the four hot cells in the 324 Laboratory's chemical sector were used for waste verification, and the metallurgical sector, known as the Shielded Materials Facility, was used for FFTF fuels examination.

The High-Temperature Lattice Test Reactor was removed from the 318 Building between 1978 and 1982, and the building has housed calibration and other "clean" laboratory functions since that time.
The 320 Building continues to be used for chemical analysis and development work, involving small samples of low-activity materials. The sodium loops and sodium work used to support FFTF development were cleaned out of the 335, 336, 337, and 338 Buildings in the early 1990s. Clean mechanical testing, craft, and storage functions occur in these buildings today. In the 331 Life Sciences Building, most of the animal experimental areas were cleaned out when radiobiological funding was cut sharply after 1983.
The building now houses a number of scientific data groups. Several R&D activities continue to the present day, and some of the 300 Area R&D faculties will remain in operation through about 2027 (Section 2.3).

2.1.2 300 Area Waste Streams and Sources of Contamination

Wastes from reactor fuel fabrication activities differ substantially from laboratory wastes in content, form, and volume. Additionally, wastes from the major 300 Area processes were handled in different ways. These past waste handling practices resulted in a complex distribution of clean and contaminated soils and structures within the 300 Area. Waste streams consisted of liquid waste from uranium fuel production operations and laboratory facilities, and solid wastes including contaminated equipment and construction debris from building renovations and expansions. Large volumes of liquid wastes were discharged to open ponds and trenches during much of the operational history. Solid waste streams from 300 Area operations initially were disposed in burial grounds and shallow landfills during the early years (1943 through the 1950s). In later years, highly radioactive wastes (including TRU) and other solid process wastes were disposed in burial grounds located in the 600 Area. A brief description and history of the 300 Area waste streams is outlined below. The amount of detail provided in the descriptions is dependent upon the available historical information and the relevance of the site in context of the CSM outlined in Chapter 3. Sites with a higher potential for contamination to move from the vadose zone to groundwater tend to have a higher degree of detail. Additionally, a breakdown and brief description of all 300 Area waste sites is provided in Section 2.2.

2.1.2.1 Liquid-Waste Practices and Disposal

The disposal of liquid process wastes from 300 Area operations was handled with the use of different systems and facilities over the history of the area. All the 300 Area liquid waste disposal systems and facilities have been designated as, or are associated with, WIDS waste sites under the 300-FF-1 and 300-FF-2 OUs. These systems and facilities, with the WIDS waste site identification numbers, are as follows:

- Process Sewer System (300-15)
- South and North Process Ponds (316-1 and 316-2)
- 300 Area Process Trenches (316-5)
- Sanitary Sewer System (300-276)
- 340 Complex (340 Complex), Retention Process Sewer, Radioactive Liquid Waste System (RLWS), 307 Process Trenches (316-3), and 307 Retention Basins
- 334 Tank Farm (334 TFWAST), 311 Tank Farm, and the WATS (300-224)

A map of the 300 Area high-volume, liquid waste disposal sites (i.e., South and North Process Ponds, 300 Area Process Trenches, and the 307 Process Trenches, is provided in Figure 2-2). A brief history of the 300 Area liquid-waste-disposal systems is provided in the following sections.

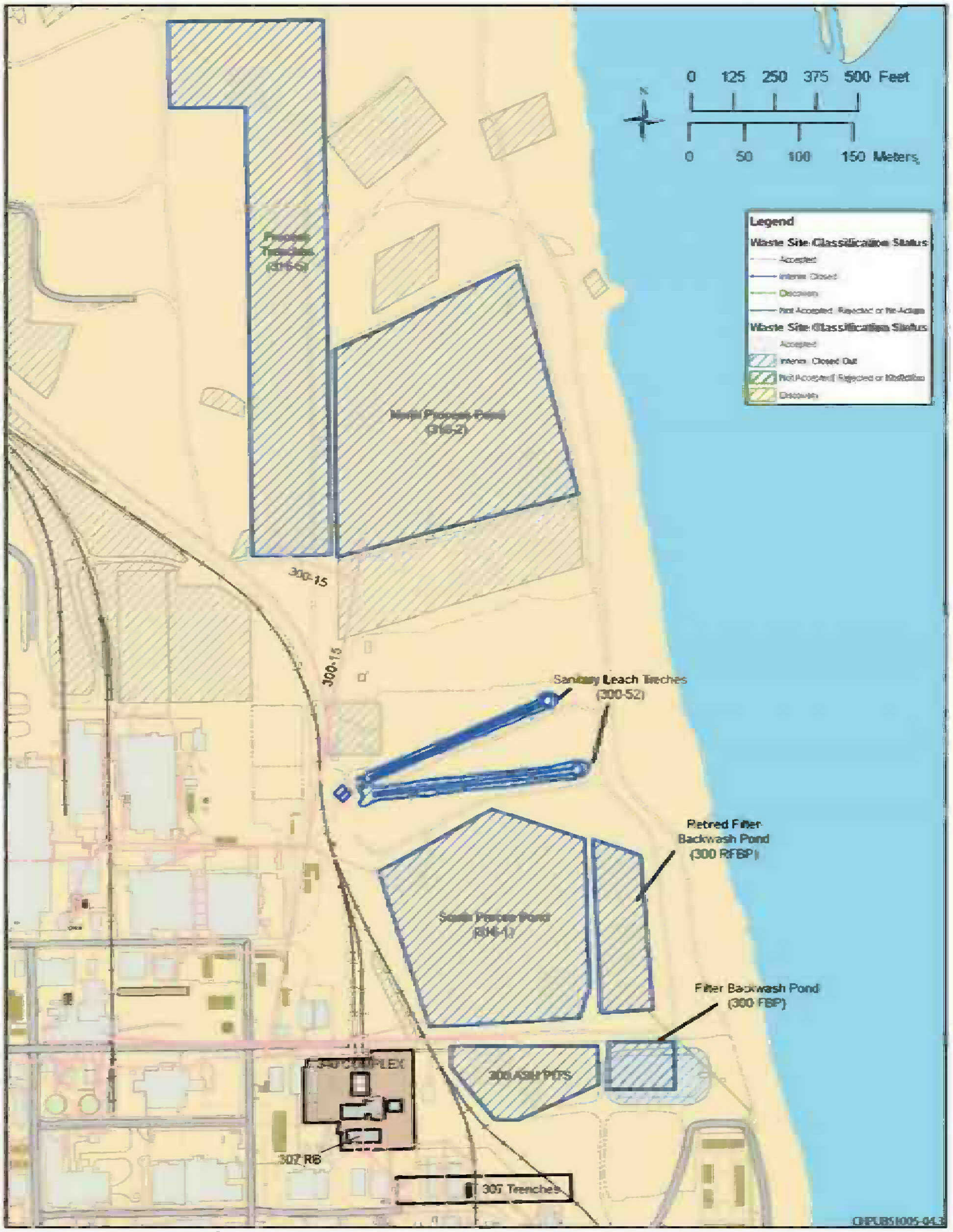


Figure 2-2. 300 Area High-Volume, Liquid Waste Disposal Sites

Process Sewer System (300-15). The Process Sewer System was built by the Manhattan Engineering District and du Pont de Nemours, Inc., during World War II in 1943. The 300 Area Process Sewer System is an extensive system with an estimated 9.6 km (6 mi) of outside lines, and an estimated 40 km (25 mi) of interior building waste pipe. Several failures in the process sewer system components and subsequent releases of contamination have been documented. The original system consisted primarily of 8-in. vitrified clay pipes with acid-proof joints that connected the major 300 Area structures to an 18-in.-diameter vitrified clay pipe with acid-proof joints that ran eastward to the two South Process Ponds, and eventually the North Process Pond, and 300 Area Process Trenches. The 321 Building was connected to this pipe via a combination of 3-in. stainless steel pipes, 8-in. wrought iron pipes, and 6-in. earthenware pipes. All manholes and pipe joints were of acid-proof construction (WHC-MR-0388, Section 31.1, p. 111). The system initially received low-level liquid wastes from the 313 and 314 Buildings, and later the 3706 and 321 Laboratories.

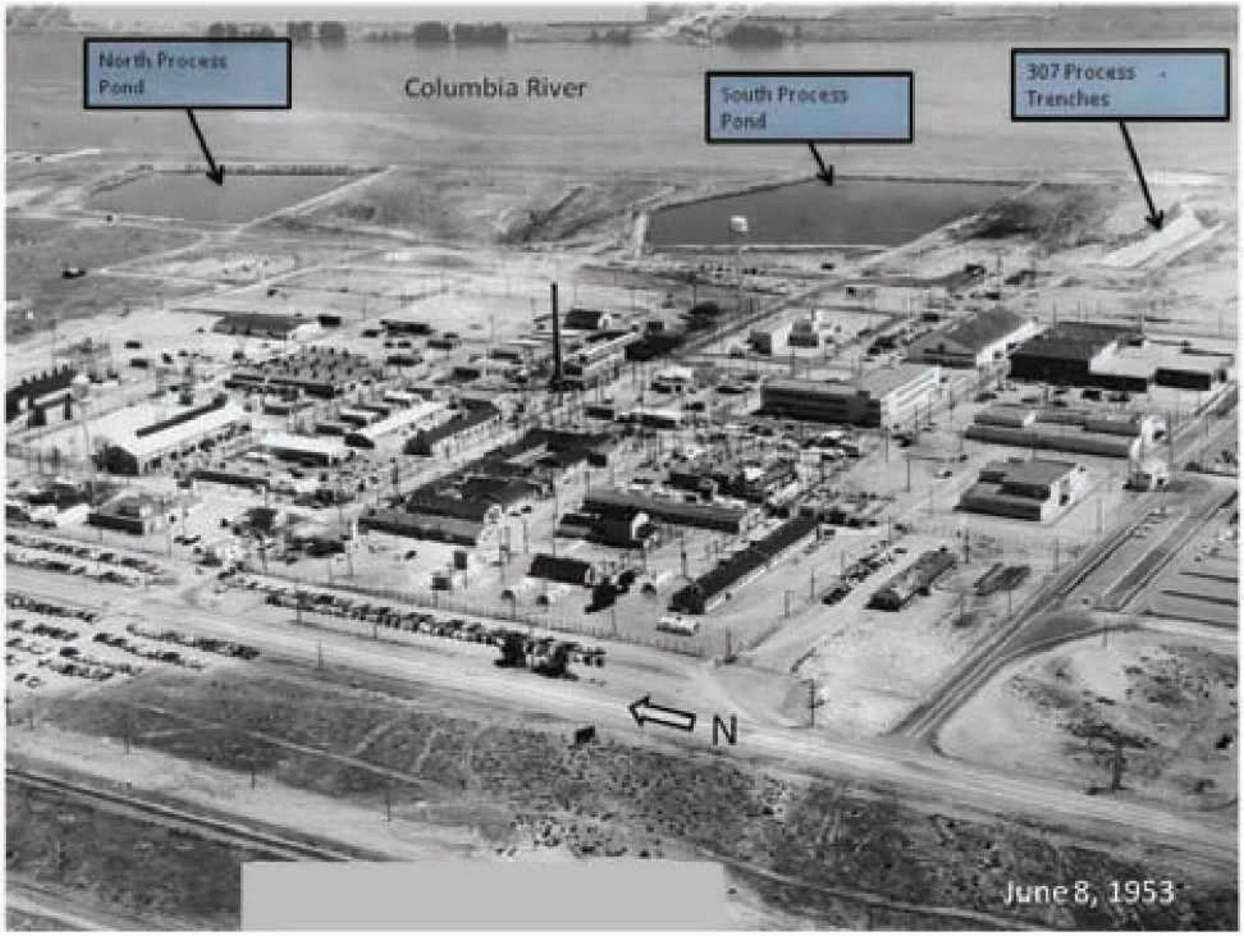
By 1994, the 300 Area Process Sewer serviced more than 50 facilities and was an extensive system having over 9.6 km (6 mi) of outside, underground utility piping and an estimated 40.2 km (25 mi) of interior building waste piping. The distribution network was updated periodically. The materials of construction, in addition to the original vitrified clay, included cast iron, steel, concrete, polyvinyl chloride, and stainless steel (BHI-00012, Section 3.3, p. 3-8).

In 1978, administrative controls were established that required the end-of-pipe discharge to meet drinking water standards. In 1985, additional administrative controls were placed into effect to gain greater control of the wastewater. These controls included discontinuing chemical discharges from chemical and biological laboratories, fuels fabrication, photographic processing, and many maintenance operations. Before 1995, the system discharged to the 300 Area process trenches, which were constructed in 1975. Before 1975, the process sewers discharged to the North and South Process Ponds (WIDS Sites 316-2 and 316-1). Most of the unplanned releases of contaminated liquids to the Process Sewer System since 1975 have been the result of WATS failures or other operational problems. Discharges from the process sewer to the 300 Area Process Trenches ceased in December 1994, and discharges were transferred through a new pipeline to the 300 Area Treated Effluent Disposal Facility for treatment and discharge to the Columbia River.

South and North Process Ponds (316-1 and 316-2). Combined process wastes discharged from the fuel fabrication facilities to the South and North Process Ponds ranged from 1,514,000 to 11,360,000 liters per day (L/d) (400,000 to 3,000,000 gallons per day [gal/d]). The South Process Pond was a large percolation pond located east of the 313 and 314 Buildings along the Columbia River. The original process pond was 45,522 m^2 (490,000 ft^2) and 1.5 m (5 ft) deep (WHC-MR-0388, Section 3.1, p. 111). Early waste streams discharged to the South Process Pond mainly consisted of small quantities of organic wastes containing uranium; water from the fuels processing floor drains; and before 1950, aqueous wastes containing unirradiated uranium from the 3706 and 321 Laboratories. Alpha activity in the pond was attributed to uranium, although small amounts of plutonium occasionally were found in the principal waste lines (Process Sewer System) to the pond. In August 1945, the pond overflowed on the east side (toward the Columbia River), and a crushed rock and earth dike was erected in September 1945. The overflow was the first indication of reduced infiltration caused by aluminum/uranium hydroxide precipitate that prevented liquid infiltration through the bottom of the pond (EMO-1026, Chapter 3.0, p. 3.1). In October 1948, the South Process Pond dike broke on the northwest side, releasing the bulk of the pond's contents to the Columbia River. An estimated 5.4 to 27.7 kg (12 to 61 lb) of uranium was released to the Columbia River. The dike failure was attributed to the accumulation of uranium/aluminum hydroxide precipitate on the pond bottom. The North Process Pond was constructed to fulfill the function of the South Process Pond while repairs were made and the bottom cleared of the precipitate. Following this incident, the regular practice of dredging the South and North Process Ponds was instituted to prevent future dike failures (WHC-MR-0388, Chapter 31.0). Sediments from the dredging were deposited on the surrounding dikes and on the scrapings disposal area. The site has been closed out in accord with EPA/ROD/R10-96/143. Approximately 234,000 metric tons (257,000 tons) of material were removed from the site. The excavation depth was approximately 5.7 m (19 ft).

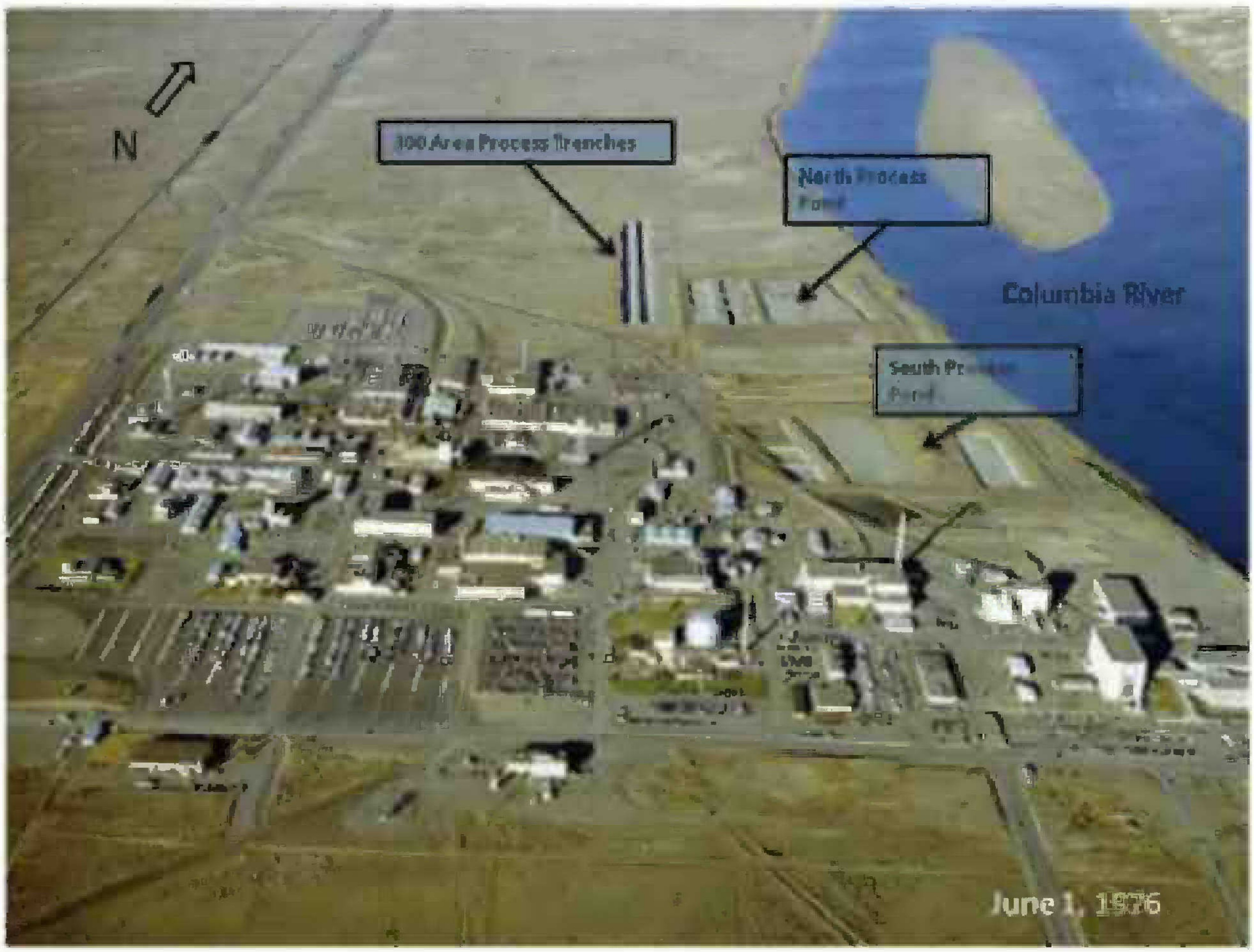
The North Process Pond consisted of seven separate sections separated by 3.7 m (12-ft-) wide dikes, with the entire 40,000 m^2 (10-ac) area surrounded by a dike 4.6 m (15 ft) wide and approximately 3.0 m (10 ft) high. The North Process Pond was constructed and began use in 1948 after a dike failure at the existing South Process Pond. In 1955, the North Process Pond was taken out of service for 14 months because a large amount of uranium bearing sludge had accumulated on the bottom of the pond. An extensive dredging operation recovered 4,672 kg (10,300 lb) of uranium out of the sludge deposits accumulating up to 22.9 cm (9-in.) thick at two locations in the southwest region of the North Process Pond (WHC-MR-0388, Chapter 31.0). It was estimated that an average of 21,955 L (5,800 gal) per month of uranium bearing sodium aluminate (containing 22.7 kg [50 lb] of uranium) was discharged to the South and North Process Ponds before 1954, resulting in a total mass of about 2,722 kg (6,000 lb) of uranium. In addition, an estimated mass of 8,684 kg (19,145 lb) of mostly depleted (U-235) was discharged to the ponds from the 321 Building. By 1956, sodium aluminate was included in the 313 Building waste stream instead of being trucked to the process ponds (EMO-1026, Chapter 3.0, p. 3.3). The South and North Process Ponds were phased out of service between 1974 and 1975. The North Process Pond was closed out under EPA/ROD/R10-96/143. Remediation activities began in May 1998 and were completed in June 1999. Approximately 140,000 metric tons (154,000 tons) of contaminated soil was excavated from the North Process Pond and transported to the ERDF for disposal (BHI-01298, *300-FF-1 Operable Unit, North Process Pond/Scraping Disposal Area Verification Package*, Chapter 1.0, pp. 5-9). Figure 2-3 shows an aerial photo of the 300 Area taken on June 8, 1953. Note the South and North Process Ponds are full and the Columbia River stage is extremely high. The ponds are separated from the river by a single earth dike.

300 Area Process Trenches (316-5). During 1974 and 1975, two process trenches were constructed west of the North Process Pond. The trenches were built to replace the South and North Process Ponds for the percolation of low-level liquid wastes. The 300 Area Process Trenches consisted of two parallel, unlined trenches approximately 468 m (1,535 ft) long, 3 m (10 ft) wide, 3.7 m (12 ft) deep, and spaced 15 m (50 ft) apart. The two parallel trenches run on north-south axis, stretching north of the North Process Pond (Figure 2-2). Like the South and North Process Ponds, the 300 Area process trenches were the disposal point from the Process Sewer System (WHC-MR-0388, Chapter 31.0). The trenches were operated alternately. Wastewater was discharged into one trench until it reached an operationally set level, then the discharge was switched to the other trench. The switching frequency varied from 2 to 6 months. Sediments in the process trenches were sampled and analyzed in 1987 to assist in remedial decisions. The site received approximately 9,800,000 L/d (2,600,000 gal/d) of effluent. In 1991, an expedited response action removed contaminated soil and sludge from the sides and bottoms of the trenches. This was accomplished by excavating contaminated sediments, using them to fill in the north end of the trenches, and immobilizing them in what is referred to as the Process Trench Spoils Area. The excavation covered approximately 0.3 m (1 ft) and 1.3 m (4 ft) of contaminated soil from the sides and bottom of each trench, respectively (BHI-01164, *300 Area Process Trenches Verification Package*, Section 1.2.3, p. 3). Figure 2-4 provides a photograph of the 300 Area in 1976 with the process trenches in use. The 300 Area Process Trenches waste site (316-5) was remediated and closed out under EPA/ROD/R10-96/143. Approximately 34,000 metric tons (37,500 tons) of materials and six 208 L (55-gal) drums of sediment were transported to the ERDF.



Note: The photo shows the South and North Process Ponds full of effluent and the Columbia River at a high stage.

Figure 2-3. Aerial Photo Showing the 300 Area on June 8, 1953



Notes: The photo shows the 300 Area Process Trenches [316-5] in operation.

Figure 2-4. Aerial Photo Showing the 300 Area on June 1, 1976

Sanitary Sewer System (300-276). The original 300 Area Sanitary Sewer System, built during World War II by the Manhattan Engineering District, consisted of vitrified clay sanitary sewer pipes. The system serviced all existing 300 Area Buildings and included one process line from the 313 Building. The system fed into a large septic tank near the northeast edge of the 300 Area, with a connection to a tile drainage field to allow for percolation of liquid to the soil. In 1947 a new tile field, overflow ditch, and connecting ditch were excavated about 61 m (200 ft) from the Columbia River to increase capacity. A failure in the original system during the summer of 1947 was caused by overuse. At this time, uranium contamination was found in the sanitary sewer sludge and water. This contamination likely originated with the everyday use of the Sanitary Sewer System by Hanford Site workers showering and washing after the completion of each shift.

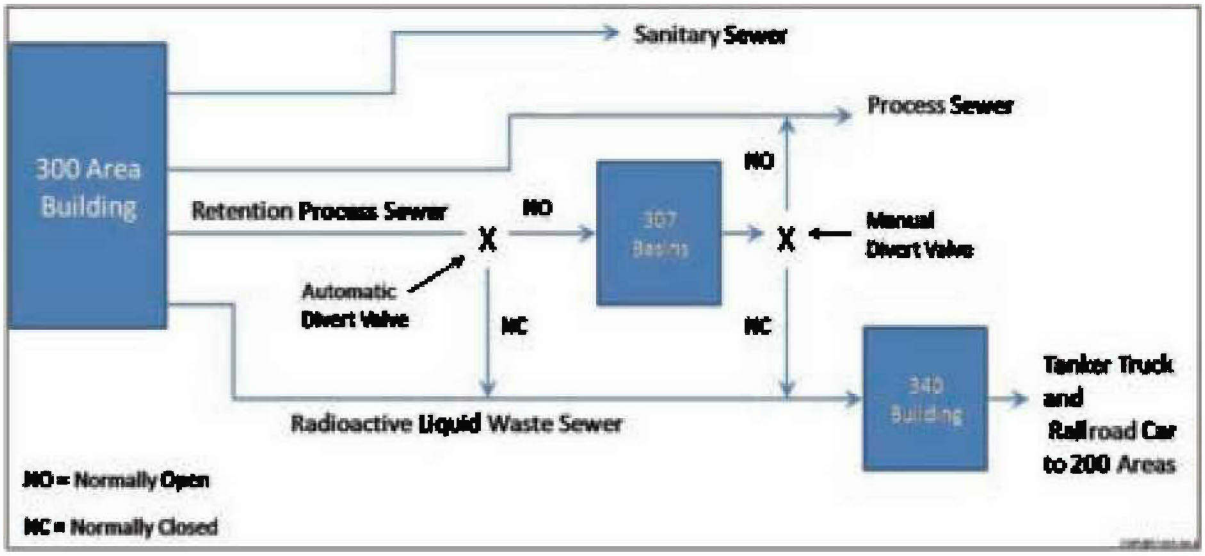
As the number of facilities increased in the 300 Area during the postwar expansion, the Sanitary Sewer System became inadequate. The system was expanded again in 1951 with the addition of two septic tanks and north and south leaching trenches to replace the old tile field. This system remained in service through 1996 when the 300 Area Sanitary Sewer System was tied in with the Richland city municipal water treatment system.

340 Complex (340 Complex), Retention Process Sewer, RLWS, 307 Process Trenches (316-3), and 307 Retention Basins. The 340 Complex, Retention Process Sewer, RLWS, and the 307 facilities were constructed to support the large defense production expansion and construction of the 325, 326, 327, and 329 Buildings, which occurred between 1951 and 1953. These systems were built to relieve pressure on the South and North Process Ponds and provide a means to dispose potentially contaminated "retention" waste liquids from the sumps, sinks, and drains of the new laboratories in a modern, controlled manner. These retention waste liquids were collected and transported through the Retention Process Sewer line to the 307 Retention Basins, which consisted of four 95,000 L (25,000-gal) open concrete receiving basins coupled in to 190,000 L (50,000-gal) pairs used alternatively as short-term holding facilities. The liquid wastes were sampled in the 307 Retention Basins. When the radioactivity was below the set limit, the liquid wastes were discharged to the 307 Trenches for infiltration to the soil. The location of the 307 Trenches is shown in Figure 2-2. When the radioactivity exceeded the specified limits, the retention waste liquids were transferred to one of two 57,000 L (15,000-gal) collection tanks housed in the 340 Building, then hauled by tanker truck or rail car to the 200 Area for disposal, usually in cribs. Allowable activities discharged to the basins originally were 4 grams per liter (g/L) gross beta and 0.5 g/L plutonium. The limit later changed to an activity of 50,000 pCi/L. Acid wastes was neutralized with sodium hydroxide (EMO-1026, Section 3.2, p. 3.8).

The RLWS was used to collect liquid process wastes from the laboratories and transfer the wastes directly to the collection tanks in the 340 Building. The liquids collected through the RLWS were trucked to the 200 Area for disposal. Several other buildings were connected to the RLWS including, but not limited to, the 308, 309, and 324 Buildings. A diagram showing the working concept of the 340 Complex, Retention Process Sewer, RLWS, and the 307 facilities is shown in Figure 2-5. The 307 Trenches were in operation between 1953 and 1963. One billion liters of uncontaminated low-level radioactive waste waters were received from the 307 Retention Basins after the waste streams were determined to be below discharge limits. The 307 Trenches were removed from service in 1963. After this time, waste liquids below discharge limits were sent to the process sewer and disposed in the process ponds. The 307 Trenches were excavated and most of the contaminated soil removed to the 618-10 Burial Ground. In 1965, the trenches were backfilled with 7,645 m^3 (10,000 yd^3) of uranium contaminated sediments from the South Process Pond and coal fly ash, likely from the 300 Area Power House (384 Building) (EMO-1026, Section 3.2, p. 3.9).

During the 340 Complex operations, there were leaks from holding and sampling tanks at transfer points in the garage/truck load-out area (built in 1961) of the 340 Building, and at the 340-B rail load-out facility (built in 1965). In 1976, a leak test of the single-walled RLWS network demonstrated a widespread pattern of leaks. Consequently, the system was replaced with double-walled, stainless steel pipes; a leak-detection system; and other system parts. During the replacement, which occurred from 1978 to 1979, many segments of contaminated soil surrounding the old piping network were removed, but the RLWS piping itself was abandoned in place, along with some areas of soil contaminated with lower levels of radioactivity (WHC-MR-0388, Section 33.3, p. 126).

311 Tank Farm, 334 Tank Farm (334 TFWAST), and the WATS (300-224). The 311 and 334 Tank Farms were used to store process chemicals used in and waste solutions generated from the fuel fabrication processes including nitric acid, sulfuric acid, sodium hydroxide, tetrachloroethene, trichloroethene, and methanol. The 311 Tank Farm and Building were built in 1954 and consisted of four aboveground chemical storage tanks, two belowground methanol storage tanks, and the 311 Methanol Still House (311 Building). Methanol was used as a final rinse in the older triple-dip and lead-dip fuel fabrication processes. The 311 Building was used to distill methanol for reuse and operated until 1971 when the last single-pass reactor closed (WHC-MR-0388, p. 37). The 334 Chemical Handling Building and Tank Farm were built in 1960 at the same time as the 333 Building. The 334 Building was used to house the controls for the facility acid system. The 334 Tank Farm consisted of four 22,700 L (6,000-gal) aboveground tanks (WHC-MR-0388, p. 25). Numerous leaks from the 311 and 334 tanks and the associated valves and piping occurred during the operational history (WHC-MR-0388, Chapters 4.0 and 8.0).

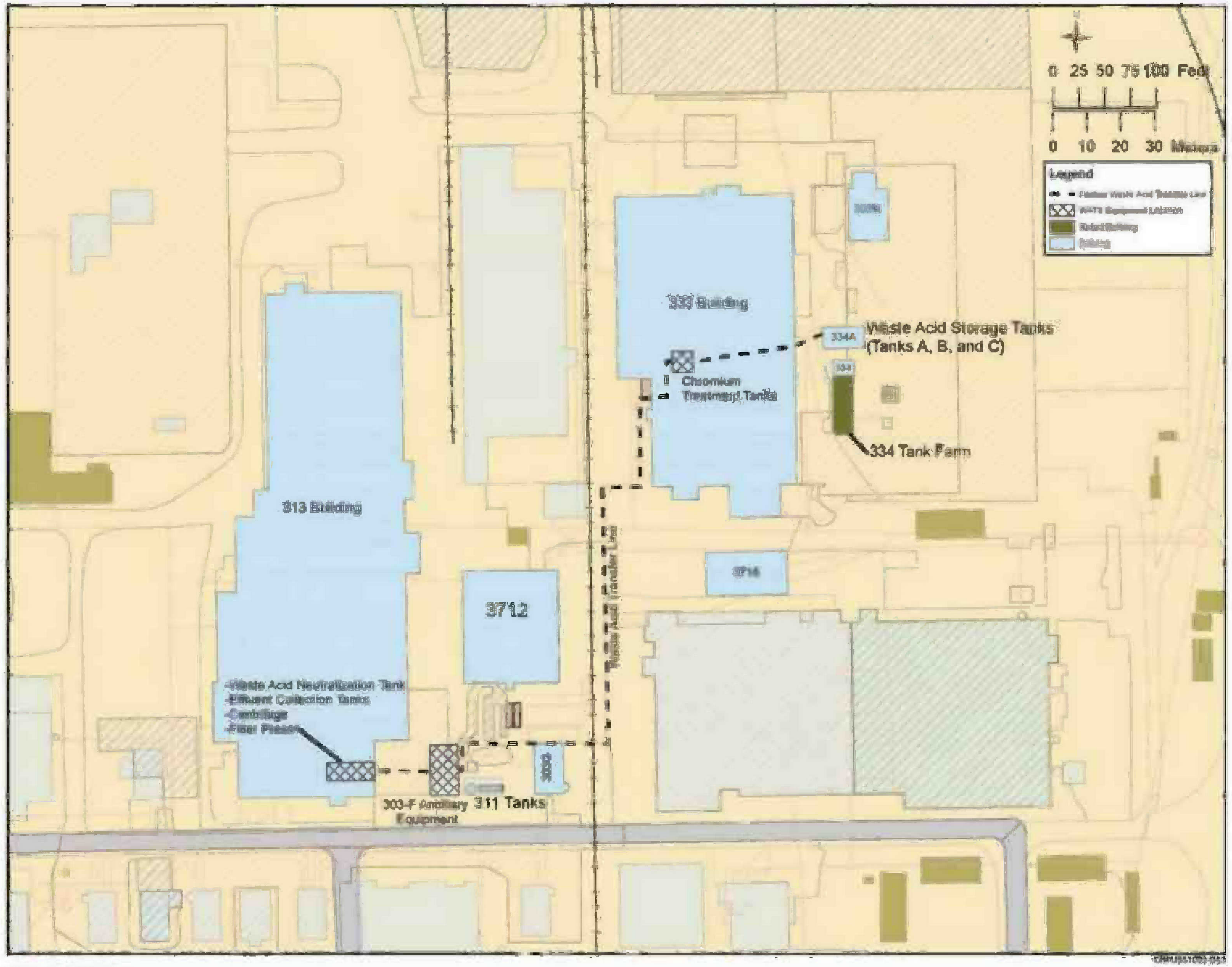


Source: EMO-1026.

Figure 2-5. Operational Concept of the 340 Complex, Retention Process Sewer, and Radioactive Liquid-Waste Sewer

The 311 and 334 Tank Farms, 303-F Building, and newly installed 334-A Building were used in the WATS, which was designed to treat and neutralize acidified waste liquids from the fuel fabrication operations at the 333 and 313 Buildings before being discharged to the 300 Area Process Sewer. The WATS process began partial operation in 1973 and became operational in January 1975 (WHC-MR-0388, p. 27). A schematic of the WATS is provided in Figure 2-6.

In the WATS process, waste acids were collected in the 334-A Building tanks, then pumped to the 313 Building for sodium hydroxide neutralization, the target pH being between 10 and 12. Wastes containing recoverable quantities of uranium were routed directly from the 333 Building to the 313 Building. These uranium bearing waste liquids were not treated with the WATS. Waste acids containing non-recoverable quantities of uranium were pumped to the 313 Building (Tank 2) for neutralization. Before 1985, filter press and centrifuge effluent from the 313 Building operations was pumped to the 311 Tank Farm for storage and transport to the 183-H Solar Basins for evaporation. Beginning in 1985, these wastes were centrifuged in the 313 Building to remove solids, and the solids placed in drums for transfer to the 303-K Radioactive Mixed Waste Storage Facility or the Central Waste Complex for disposal. Tank 50 was added to the 311 Tank Farm in 1985 and used to hold waste effluents before transfer to the 340 Complex and eventual transport to the 200 Area for disposal. The 303-F Building was used as a pumping station for the various liquid and slurry wastes transferred in the WATS. The waste acids treated by the WATS included nitric, sulfuric, hydrofluoric, uranium-bearing acids, Zircaloy-2 components, copper, beryllium, and other materials (WHC-MR-0388, Chapter 5.0, pp. 27-28).



Source: EMO-1026.

Figure 2-6. 300 Area 311 Tank Farms, 334 Tank Farms, and WATS

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2.1.2.2 300 Area Solid Wastes

Solid waste management activities conducted in the 300 Area primarily involve the burning and disposal of unwanted wastes in burial grounds and trenches. During the 300 Area operational history, both contaminated and uncontaminated solid waste was burned or buried in pits and trenches. The practice of using burial grounds for waste disposal began in 1943 and continued through 1973. Little information is available on the inventory, locations, and history of early burial grounds because of national security surrounding the Manhattan Project and the undeveloped knowledge base associated with radioactive waste management. The 300 Area burial grounds were located in both the 300 Area (industrial complex) and the 600 Area. A history of the burial grounds located in the 300 Area (industrial complex) is provided in this section, and history of the burial grounds located in the 600 Area is covered in Section 2.1.5. The burial grounds and disposal areas contained in the 300 Area (industrial complex) include those listed below.

300-7 Burial Ground – Undocumented Solid Waste Burial Ground Adjacent to 618-8, Possible Early Burial Ground Site. The site contains solid construction debris, such as concrete, metallic waste, asbestos, and uranium contamination. Surface debris piles are visible and subsurface disturbances identified with ground-penetrating radar. Currently, the site is covered with natural vegetation.

300-9 Burial Ground – Possible Early Burial Ground Sites North of 618-8, Solid Waste Burial Ground. The location of the site referred to as the Early Burial Ground is not well documented. Uranium contaminated aluminum shavings are scattered on the surface of the site. Other surface contaminants may include aluminum-silicon alloy and beryllium-contaminated aluminum. Actual burial inventory is unknown. Process knowledge suggests the waste would consist of the uranium-contaminated waste from early 300 Area experimental processes.

300-10 Burial Ground – Burial Trench West of Process Trenches. The site was expected to consist primarily of soil mixed with clean and contaminated metal shavings. The northwest corner terminates near a dirt road that intersects the midpoint of the west 300 Area Process Trenches. A field walk down done on November 18, 1994, reported the site appeared as a soil-covered field with natural vegetation. Remediation of the 300-10 waste site was authorized by EPA/ROD/R10-96/143. Soil in the 300-10 Burial Ground was excavated to a depth of 1.5 m (5 ft) until radiological survey results indicated no contamination.

618-1 Burial Ground – Solid Waste Burial Ground No. 1. The site is an early solid waste burial ground and consists of at least two trenches. It received waste from early 300 Area facility operations, including the 305 Reactor, 3706 Laboratory, and the 3741 Building. The site contained large quantities of uranium (about 14.5 metric tons [16 tons]) from the fuel fabrication activities and small quantities of plutonium and fission products from laboratory operations.

618-2 Burial Ground – Solid Waste Burial Ground No. 2. The waste site consisted of three east-west trenches, and operated between 1951 and 1954. It was used to dispose uranium contaminated equipment and materials, plutonium, and fission products from the 300 Area. The uranium waste typically was solid metallic uranium oxides in the form of metal cuttings from reactor fuel fabrication facilities in the 300 Area. The plutonium and fission products were derived from 300 Area laboratory facilities. Remediation of the 618-2 Burial Ground began in August 1996 and was completed in November 2004. Approximately 71,203 metric tons (78,488 tons) of material was removed and transported to the ERDF for disposal. The site was excavated to approximately 6 m (19.7 ft). A location in the middle trench was excavated to groundwater (between 15 m [49.2 ft] and 11.5 m [37.7 ft] below grade) to remove plutonium mobilized by acid waste. Remediation of the 618-2 Burial Ground was authorized by EPA/ROD/R10-01/119.

618-12 Scraping Disposal Area – North Process Pond Scraping Disposal Area. This site received uranium contaminated soil scraped from the 316-2 Pond (North Process Pond) and soils removed from beneath the 321 Building during excavation for hydraulic core mockup (BHI-01298). Remediation of the 618-12 Burial Ground was authorized by EPA/ROD/R10-96/143 in conjunction with 316-2 North Process Pond.

In addition to disposing unwanted wastes, activities were undertaken to recover raw resources for future use. The most visible was the uranium scrap recovery process. During the early history of the Manhattan Engineering District, there was concern for the availability of uranium supplies and strict policies were enacted governing the reclamation of all usable uranium scraps. Uranium scraps from the early uranium production processes consisted of lathe turnings, rod ends, and rejected cores from the machining and canning operations in the 313 Building. Acid sludges were collected and allowed to evaporate in dumpsters north of the 314 Building and the various small pieces of uranium metal scrap were collected in 19 L (5-gal) cans, washed to remove cutting oils, and stored near the 303 (A-J Metal Storage) Buildings. Beginning in March 1944, scraps were regularly shipped to offsite reclamation processing centers (WHC-MR-0388, Section 1.9, pp. 6 to 7).

A change in the uranium recovery policy occurred in 1946 because large volumes of scraps were accumulating and several can fires occurred, usually caused by chemical residues reacting with the uranium metal to form a combustible gas. This resulted in higher expense and increased fire and security hazards during shipment. A "chip recovery" operation was started in the 314 Building, which involved the collection, sorting, and cleaning of uranium scraps, then pressing them into briquettes for shipment offsite. After several uranium chip fires occurred during processing at offsite facilities, a "melt plant" was established in the 314 Building in 1947. Uranium scraps were processed with "new uranium" in the melt plant and eventually uranium ingots produced that were rolled into uranium rods that were used to make additional fuel rods (WHC-MR-0388, Section 1.10, p. 7).

Another scrap recovery operation called the "oxide burner" began in spring 1946. This operation was conducted in the north side of the 314 Building and involved collecting all uranium bearing dust, particulate matter from fuel fabrication facilities, and tailings or settlings from washes and quenches. These materials were burned to form uranium dioxide powder, which was collected in 19 L (5-gal) buckets for shipment offsite (WHC-MR-0388, Section 1.11, p. 7). It was recognized early in operations that the "oxide burner" treatment method was the cause of surface contamination and out-of-tolerance conditions. Because of operational difficulties and health physics concerns, the melt plant and oxide burner operations were phased out between 1952 and 1954 and uranium recovery operations were changed to sending concreted billets to the Fernald Site for recovery. After a concrete billet fire in the 3712 Building in 1979, however, the concretion process was stopped, and a new state-of-the-art uranium oxidation facility (303-M) was built and began operation in 1983 to treat uranium and Zircaloy-2 metal chips and fines by incineration, which formed a non-ignitable oxide (WHC-MR-0388, Section 1.12, p. 8; BHI-00012, Section 3.6, p. 3-40).

2.1.3 400 Area Operations and Process History

A chronology of the 400 Area events is provided in Table 2-2. The 400 Area is located north of the 300 Area in the southeast part of the Hanford Site, approximately 8.2 km (5 mi) from the Columbia River and 6.2 km (3.8 mi) from the nearest Site boundary. It covers approximately 55 hectares (135 acres). This area contains several major buildings and structures, including the FFTF reactor and its support facilities. The FFTF is a 400-megawatt-thermal, sodium-cooled, low-pressure, high-temperature reactor with a complex of buildings and equipment arranged around a reactor containment building. A map of the 400 Area is provided in Figure 2-7 and a photograph of the FFTF reactor is provided in Figure 2-8.

Table 2-2. Chronology of 400 Area Events

Month/Year	Event
1970	Construction of the FFTF reactor begins.
1980	The FFTF brought online.
April 1982 – April 1992	The FFTF operated as a national research facility to test advanced nuclear fuels, materials, components, systems, nuclear power plant operating and maintenance procedures, and active and passive reactor safety technologies.
December 1993	DOE orders FFTF shut down.
1996	ROD for the 300-FF-1 and 300-FF-5 OUs initiated (EPA/ROD/R10-96/143).
January 1997 – December 2001	DOE issues a decision to maintain the FFTF in a standby condition while an evaluation was conducted to determine the possible role of the facility in the DOE's H-3 production strategy. Several studies and activities were conducted to determine a possible mission for the FFTF, including the production of medical isotopes.
December 21, 2001	DOE announces the decision to permanently deactivate the FFTF.

The FFTF was designed and constructed for irradiation testing of fuels, core components, and target assemblies for liquid-metal fast breeder reactors. Reactor activities later were expanded to include long-term testing and evaluation of reactor components and systems, fusion power materials testing, passive safety testing, producing medical isotopes, space power system research, and many other domestic and international research programs. Additional missions proposed for FFTF included converting radioactive waste to less hazardous materials, nuclear weapons neutralization, materials testing for fusion and space reactors, and generating electricity. None of these proposed missions were implemented (BHI-00012, Section 4.2, p. 4-1, 4-2).

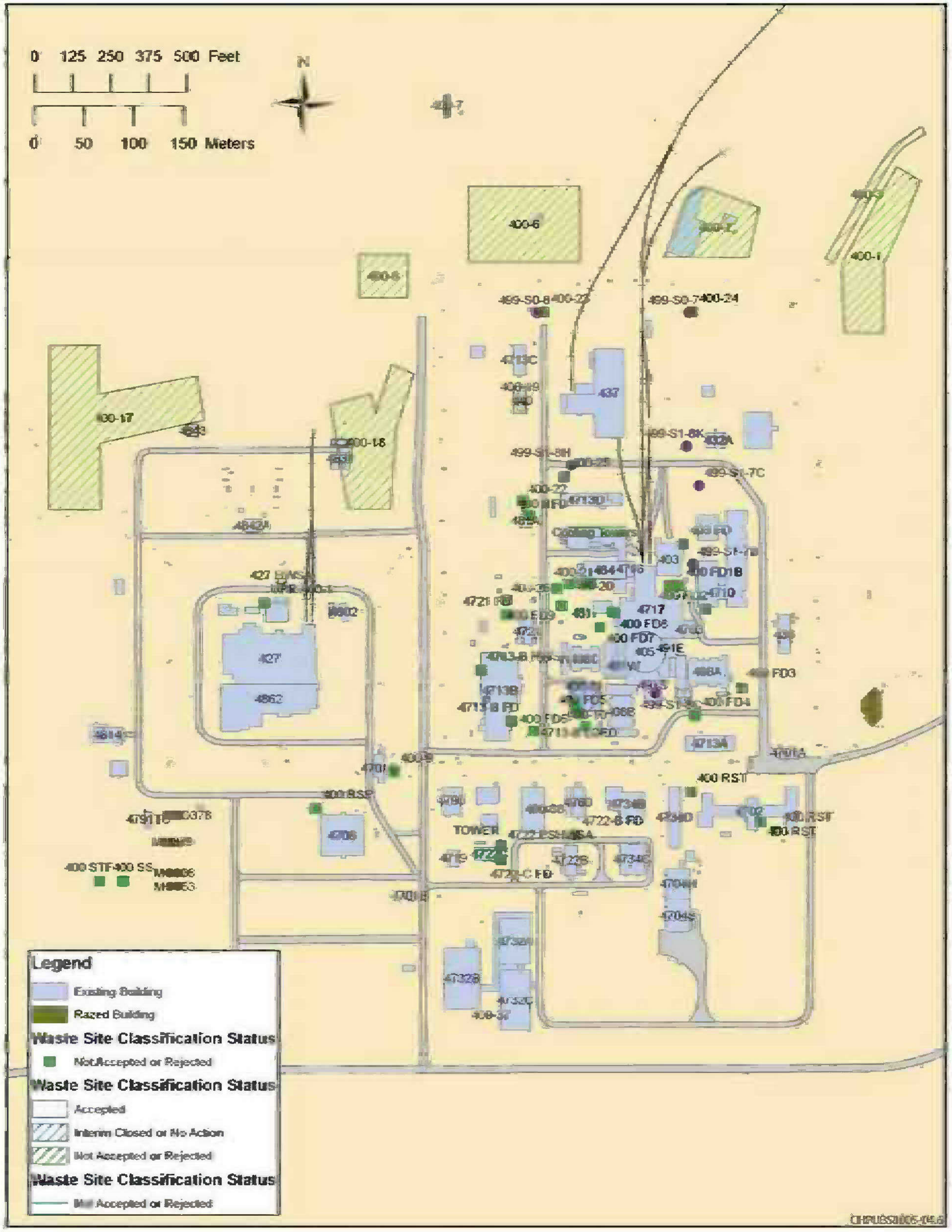


Figure 2-7. 400 Area FFTF and Supporting Structures

Figure 2-8. Aerial Photo Showing the FFTF Reactor Complex

Construction of FFTF began in 1970 and was completed in 1978. The reactor reached initial criticality in February 1980 and began operating at full power in December of that year. The FFTF operated from 1982 through 1992. After an evaluation of several potential long-term missions for FFTF, DOE concluded that justification to continue operating the reactor did not exist and in April 1992, RL directed the FFTF be placed in standby status pending an investigation into potential missions. The plant achieved a steady-state "hot" standby condition in December 1992. After exploring potential missions for FFTF, the Secretary of Energy announced in January 1993 that none was feasible and a 5-year process would be initiated to place the reactor into "cold" standby. After a recommendation from an independent review team, the reactor was placed into a radiologically and industrially safe shutdown condition (BHI-00012, Section 4.2, p. 4-2). The 400 Area FFTF reactor complex is currently in a safe shutdown condition until the final D4 of the facilities can be completed. The deactivation is scheduled to be complete before the scheduled Tri-Party Agreement date of February 2011. After a period of low cost surveillance and maintenance, sodium disposition, decommissioning, and demolition will resume in fiscal year (FY) 2015. The decommissioning and demolition are planned to be complete by the end of FY 2030.

Deactivation was conducted from 1994 through 1996 and included fuel offload to interim dry storage casks, construction of the Sodium Storage Facility, and preparations for sodium drain. In January 1997, DOE ordered FFTF to return to a standby condition while evaluations were conducted for future roles the facility might have in DOE's H-3 production strategy, or support the DOE's nuclear infrastructure and future mission needs. In December 2001, DOE directed that FFTF continue with permanent deactivation. In November 2002, sodium drain and other deactivation activities were again placed on hold due to a court injunction prohibiting irreversible deactivation activities based on potential legal action by the Benton County against the DOE. On April 4, 2003, the injunction was lifted and FFTF proceeded with permanent deactivation.

2.1.4 400 Area Sources of Contamination

The FFTF is not a typical commercial power production nuclear reactor. Because of its design, construction, and operation, the type and extent of contamination present is also unique. Since the reactor is cooled by liquid sodium, all interfacing equipment and systems are sealed in an inert atmosphere to prevent adverse reactions with the liquid sodium. Because of this, the FFTF is radiologically clean. Various systems within the facility were contaminated to some degree because of activation and corrosion products in the primary sodium system (e.g., manganese-54 [Mn-54], sodium-22 [Na-22], and sodium-24 [Na-24]). Fuel assemblies that were run until a cladding failure and subsequent fission products release into the primary systems (e.g., cesium-134 [Cs-134] and cesium-137 [Cs-137]) and destructive examination procedures used within the interim examination and maintenance cell. The interim examination and maintenance cell is a vertical hot cell that is located within the Reactor Containment Building used to examine recently irradiated core components within 50 days of removal from the reactor core. The secondary systems were not exposed to any of these materials, but were slightly contaminated due to the migration of H-3. Many of the more prevalent radionuclides such as Mn-54, Na-22, Na-24, Cs-134, and iron-55 (Fe-55) have decayed since the reactor has not operated since 1992 and no longer present a hazard. Sources of contamination associated with FFTF operations are minimal. The sources of contamination were designated as WIDS sites under the 300-FF-2 OU. The sources classified as accepted WIDS waste sites are listed below with a brief history.

400 Area Process Pond and Sewer System (400 PPSS). The 400 Area PPSS nonhazardous and nonradioactive liquid-waste-disposal site is located within and north of the 400 Area. This system is commonly known as the 400 Area Process Pond and Sewer System. It consists of underground piping (known as the 4904 Process Sewer System), a control structure (known as the 4608-B Control Structure and Process Sewer Sampling Station), and two percolation ponds. The process pond and sewer system began operation in 1979 to receive wastewater from cooling systems and non-sanitary drains and sumps in the 400 Area. In the original system design, effluent wastewater enters the process sewer system from the FFTF and Fuels and Materials Examination Facility cooling towers (BHI-00012, Section 4.10.13, pp. 4-62).

Storage Tank (400-37). The site is an underground fuel oil tank. The tank supplied diesel fuel to a standby electric generator. The generator powered fans that inflated a temporary equipment storage facility used during the construction of the FFTF. The inflatable building was removed in the early 1980s. The tank is located near the southeast corner of the 4732-B Building. There is no visual evidence of the tank on the surface. It is possible the tank has been filled with sand or removed, but documentation has not been found.

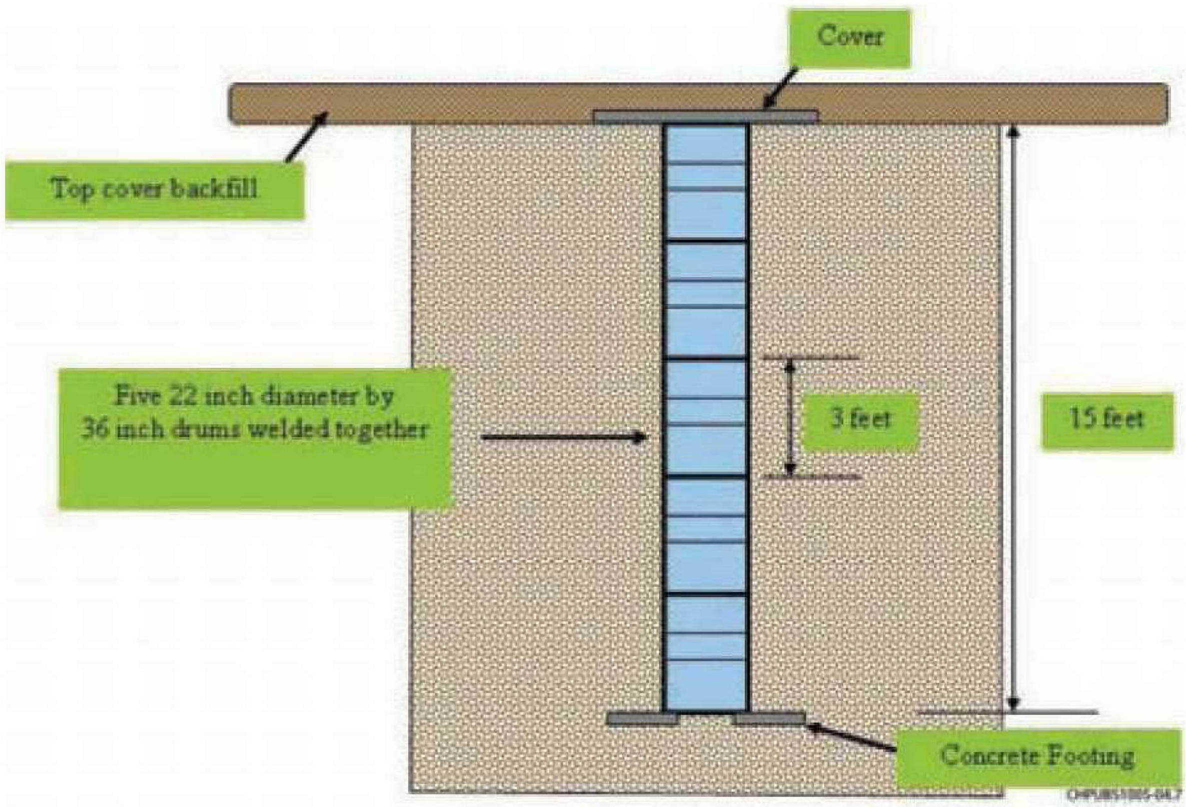
Storage Tank (400-38). The site is an underground fuel tank that supported the 4722-A Building. The tank is located east and slightly south of the centerline of the cement pad where the 4722-A Building had been located. There is no visual evidence of the tank on the surface. It is possible the tank has been filled with sand or removed, but documentation has not been found.

437 Maintenance and Storage Facility (437 MASF). The MASF consists of a main building and a two-story service wing. The MASF is a multipurpose service center that supports the specialized maintenance and storage requirements of the 400 Area facilities. This facility currently is used for the decontamination of radioactive and/or sodium-contaminated FFTF equipment, the repair of contaminated manipulators from the FFTF Reactor Containment Building, the staging of large pieces of equipment to be stored, repaired, or tested; and the temporary storage of low-level radioactive solid and liquid wastes before shipment.

2.1.5 600 Area Sources of Contamination

The operational history of the burial grounds located in the 600 Area is tied to the waste management practices conducted in the 300 Area industrial complex. The main source locations for contamination that has the potential to spread via environmental pathways in the 600 Area are the 618-10 and 618-11 Burial Grounds, and the former 316-4 Crib. A brief history of each is provided below.

618-10 Burial Ground. The 618-10 Burial Ground operated from March 1954 to March 1962 and from October 1962 to September 1963. It reopened in 1962 to support waste-disposal activities while vertical pipe units (VPUs) were installed in the 618-11 Burial Ground and closed for the final time after the 618-11 Burial Ground was operational. The first VPU was installed in September 1954. The 618-10 site consists of 12 trenches and 94 VPUs. Each VPU consists of five 208 L (55-gal) drums with tops and bottoms removed (Figure 2-9). The drums were stacked vertically, tack welded together, and placed on a concrete footing with the bottom being left open to the soil column. The VPUs were used to dispose of containers holding moderate- to high-activity solid wastes.



Source: WCH-125, 600 Area Remediation Design Solution Waste Volume and Inventory.

Figure 2-9. Design for VPUs

From a review of radiological survey records obtained during an extensive records search, the primary buildings and their percent contributions were identified as follows:

- 327 Building – 51.6 percent
- 325 Building – 29.9 percent
- 3706 Building – 6 percent
- 329 Building – 4.4 percent

The remaining 17 buildings contributed less than 4 percent total. None of the radiological surveys from these additional buildings indicate the waste disposed from these buildings would be a significant contributor to the radiological inventory (all low dose rate, low contamination level) (WCH-125, *600 Area Remediation Design Solution Waste Volume and Inventory*, Section 2.1, pp. 1-2).
The examination of available records indicates that the 618-10 Burial Ground wastes included radiologically contaminated laboratory instruments, bottles, boxes, filters, aluminum cuttings, irradiated fuel element samples, metallurgical samples, electrical equipment, lighting fixtures, barrels, laboratory equipment and hoods, and low- and high-level liquid waste sealed in containers (DOE/RL-2008-27, *Sampling and Analysis Plan for 618-10 And 618-11 Nonintrusive Sampling*, Section 1.3.1, p. 1-2).
The site is expected to contain mixed low-level radioactive waste and TRU[13] waste. The total estimated TRU waste volume contained in the 618-10 Burial Ground trenches is 417 m^3 (14,888 ft^3) (WCH-125, Section 3.1.1, p. 14).

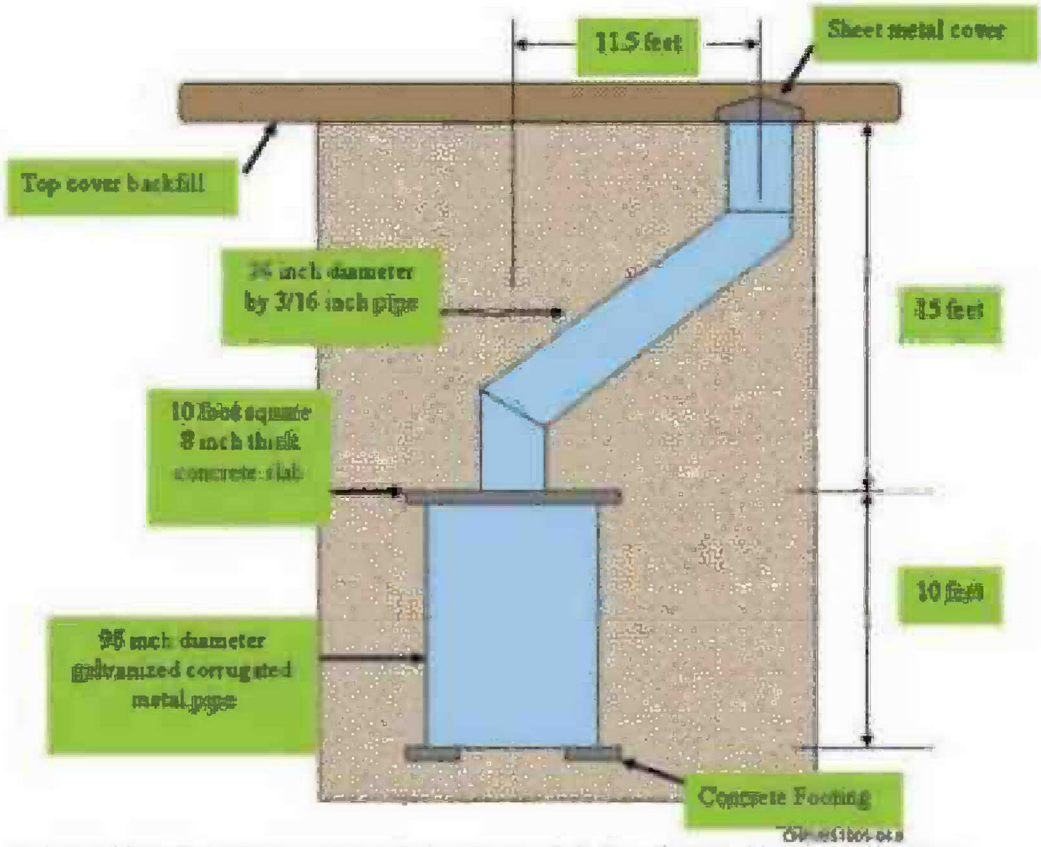
618-11 Burial Ground. The 618-11 Burial Ground operated from March to October 1962 and from September 1963 until the end of 1967, when it closed. Vertical pipe units were installed during the October 1962 to September 1963 closure period. Vertical pipe units were for disposing high-dose-rate waste in the 618-11 Burial Ground until late 1964 or early 1965, when caissons were installed for high-dose-rate materials. The 618-11 Burial Ground consists of 3 slope-sided trenches, 3 to 5 large caissons, and 50 VPUs. The five caissons located in the 618-11 Burial Ground are constructed of a 2.4 m (8-ft) diameter by 3.1 m (10-ft) tall, corrugated metal cylinder, and buried 4.6 m (15 ft) deep. A 0.9 m (3-ft) diameter angled chute extends from grade to the top of the caisson through a concrete slab lid (Figure 2-10). Like the 618-10 Burial Ground, VPUs were used to dispose containers holding moderate- to high-activity solid wastes.

From a review of radiological survey records, the following primary buildings and their percent contributions were identified:

- 327 Building – 60.1 percent
- 325 Building – 24.1 percent329 Building – 3.3 percent

The remaining 14 buildings contributed less than 3 percent total. Similar to the 618-10 Burial Ground, none of the radiological surveys from these additional buildings indicates the waste disposed from these buildings would be a significant contributor to the radiological inventory (all low dose rate, low contamination level) (WCH-125, Section 2.2, p. 3).

[13] Radioactive waste as defined in DOE G 435.1-1, *Implementation Guide for Use with DOE M 435.1-1*.



Source: WCH-125, *600 Area Remediation Design Solution Waste Volume and Inventory*.

Figure 2-10. Design for Caissons at the 618-11 Burial Ground

The 618-11 Burial Ground contains a broad spectrum of low-level radioactive waste including fission products, byproduct waste (thorium and uranium), and plutonium, similar to the 618-10 Burial Ground. It was used for the disposal of 300 Area laboratory solid wastes. Low- to high-activity wastes were received from the 305, 306, 309, 313, 315, 317, 324, 325, 325-A, 325-B, 326, 327, 329, 340 Complex, 1171, 3700, 3706, 3707-C, 3708, 3718, and 3730 facilities. These facilities handled radioactively contaminated, or potentially contaminated, waste from operations or laboratory areas, including hot cells.

Moderate- and high-activity (remote-handled) wastes were received from the 327 Building (radiometallurgy) hot cells, 325-A hot cells, the 325-B (analytical) hot cells, occasionally from the 309 PRTR, and later from 324 Building hot cells (DOE/RL-2008-27, Section 1.3.2, pp. 1-6). The site is expected to contain mixed low-level radioactive waste and TRU waste. The total estimated TRU waste volume contained in the 618-11 Burial Ground trenches is 499 m^3 (15,393 ft^3) (WCH-125, Section 3.1.2, p. 14).

316-4 Crib. The 316-4 Crib is an inactive, liquid, radioactive, mixed waste site located approximately 8 km (5 mi) north-northwest of the 300 Area adjacent to the 618-10 Burial Ground. The site began operation in 1948 and reportedly closed between 1955 and 1956. There is some evidence waste was received in 1962. The 316-4 Crib consisted of two inverted, bottomless, 0.64 cm (0.25-in.) stainless steel tanks (Figure 2-11). The tanks had concrete footings and sit on a bed of gravel. They were 2.1 m (7 ft) high and 2.4 m (8 ft) in diameter and approximately 3 m (10 ft) below grade. One tank had an inlet line and a vent riser. The two tanks were 0.61 m (2 ft) apart and were connected by a 5 cm (2-in.) stainless steel overflow pipe. From 1948 to 1955/1956, the site received hexone-bearing uranium wastes and limited amounts of other types of uranium bearing waste from the 321 Building R&D activities (BHI-00012, Section 3.6.33, pp. 3-69).

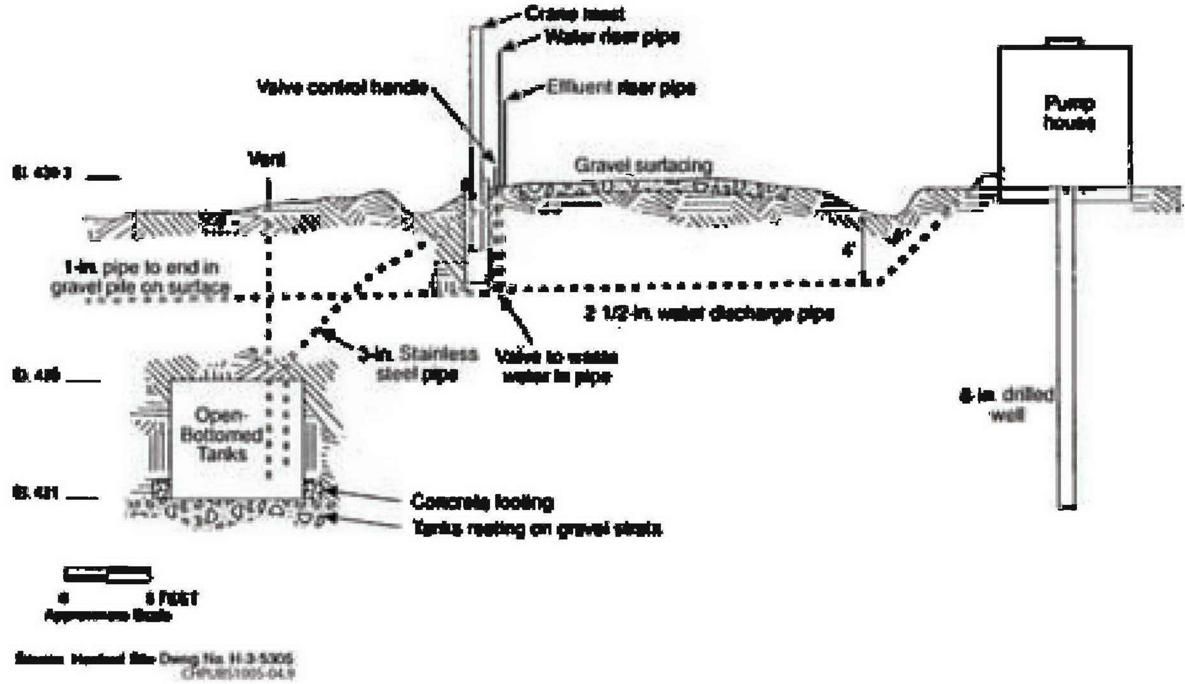


Figure 2-11. Design for 316-4 Crib

In September 1995, groundwater radioactive contamination was identified in Well 699-S6-E4A during well improvement activities. The well is located adjacent to the 316-4 Crib. Sample analysis of the contamination identified hydrocarbons and uranium. Remediation of the site began in 2004 and the planned excavation completed in April 2005. Further remediation of the site is planned (Section 2.6).

Other burial grounds located in the 600 Area (300-FF-2 OU) include those listed below.

618-3 Burial Ground – Solid Waste Burial Ground No. 3. The burial ground operated between 1954 and 1955 and consisted of uranium contaminated dry waste, primarily building materials from the remodeling of the 313 Building and waste materials from the 303-J and -K upgrades. The 618-3 Burial Ground consists of one north-south trench approximately 105.2 m (345 ft) long, 30.5 m (100 ft) wide, and 4.6 m (15 ft) deep. In 1986, the volume of contaminated soil was estimated to be 12,549 m^3 (443,160 ft^3), with 12,643 m^3 (446,480 ft^3) of overburden. Remediation of the 618-3 Burial Ground was authorized by EPA/ROD/R10-01/119. Approximately 30,878 metric tons (34,037 tons) of material from the site were removed and transported to the ERDF for disposal (CVP-2006-00005, *Cleanup Verification Package for the 618-3 Burial Ground*).

618-4 Burial Ground – Solid Waste Burial Ground No. 4. It is believed that the 618-4 Burial Ground operated between 1955 and 1961. Remediation of the 618-4 Burial Ground was authorized by EPA/ROD/R10-96/143. Excavation and associated waste-disposal operations at the 618-4 Burial Ground, completed in two phases between 1998 and 2003. The total excavation covered an area approximately 7,342 m^2 (79,043 ft^2) and had a maximum depth of approximately 11 m (36 ft) below the surrounding grade. Approximately 46,585 metric tons (51,360 tons) of bulk soil and debris were excavated, transported, and disposed at the ERDF. Additionally, 786 drums containing depleted uranium in oil were excavated and transported to the ERDF.

618-5 Burial Ground – Solid Waste Burial Ground No. 5, Regulated Burning Ground. The site was one large (single) pit and received 300 Area waste from 1945 through 1962. It also was used as a burn pit. HW-39076, *Unconfined Underground Radioactive Waste and Contamination in the 300 Area and Miscellaneous Areas Not Included in Other Reports,* states the area was a burning trench as well as a storage area for aluminum silicate containing 17 percent uranium and bronze crucibles with maximum radiation levels of 200 mrem/h. The site was used for the disposal of uranium bearing trash. Characterization test pits dug in 1992 encountered radiologically contaminated lead bricks, steel pipes, wood fragments, and other garbage. Remediation of the 618-5 Burial Ground was authorized by EPA/ROD/R10-01/119. Excavation of the 618-5 Burial Ground was conducted between March and August 2003. At completion of the excavation approximately 46,300 metric tons (50,930 tons) of bulk soil and debris were removed from the site and transported to the ERDF. The maximum excavation depth was 7.5 m (24.6 ft).

618-7 Burial Ground – Solid Waste Burial Ground No. 7. The burial ground consisted of two east-west oriented trenches and one V-shaped pit. Most of the waste in this burial ground originated from the 313 and 333 Buildings. Miscellaneous contaminated equipment and hundreds of 114 L (30-gal) drums of zircaloy chips contaminated with moderate amounts of beryllium and uranium were buried in the trenches from 1960 to 1973 (BHI-00012).

618-8 Burial Ground – Solid Waste Burial Ground No. 8, Early Solid Waste Burial Ground. The site is assumed to have been used for the disposal of uranium contaminated construction debris from the remodeling of the 313 Building. The site was in operation between 1943 and 1954. Remediation of the 618-3 Burial Ground was authorized by the EPA/ROD/R10-01/119. Remedial activities for the 618-8 Burial Ground were conducted from November 2004 through September 2005. Approximately 6,462 metric tons (7,125 tons) of material were removed from the site and transported to the ERDF (CVP-2006-00006, *Cleanup Verification Package for the 618-8 Burial Ground*).

618-9 Burial Ground – 300 West Burial Ground, Dry Waste Burial Site No. 9. The site was a burial ground composed of a single trench. In 1991, this burial ground was excavated. Approximately 2,600 L (700 gal) of methyl isobutyl ketone, otherwise known as hexone, and 3,400 L (900 gal) of kerosene solvent were recovered from 120 drums in the trench's western end. Severely corroded drums also were found at the eastern end of the trench. Approximately 39.6 m^3 (1,400 ft^3) of debris also was found, including more than 80 empty drums, a wheelbarrow, scrap process equipment, construction debris, two breached bags of ammonium nitrate, unidentified white powders, and several lead bricks (DOE/RL-91-38, *Engineering Evaluation of the 618-9 Burial Ground Expedited Response Action*).

618-13 Burial Ground – 300 North Solid Waste Burial Ground. The unit consists of a mound of soil. The site was originally a single-use disposal site for contaminated soil removed from the 303 Building perimeter in 1950. It is believed that the mound of soil later served as a safety shield (blast shield) for drums of hexone stored in buildings on the west side of the berm before being buried in the 618-9 Burial Trench in 1954. This site received uranium-contaminated topsoil removed from around the 303 Building. Total activity buried in the site is not known.

Discussion of the nature and extent of contamination associated with the 600 Area burial grounds and the 316-4 Crib is provided in Section 2.6.

2.2 Waste Site Descriptions

Past operations, waste-disposal practices, spills, intentional releases, and unplanned releases resulted in contamination of facility structures, underlying soil, and eventually underlying ground water in the 300 Area. The areas of contamination in the soil and remaining structures following D4, such as pads or foundations, are classified as waste sites in accordance with the Tri-Party Agreement. The purpose of this section is to provide an overall description of the waste sites located in the 300 Area. A description of the specific waste sites posing a high risk to the contamination of groundwater and are relevant to the description of the CSM are discussed in Section 2.6. The description and brief history of the 300 Area waste sites are summarized in Appendix A. Waste sites can be organized into primary and secondary sites, depending on the source and nature of contamination. Primary waste sites consist of contaminated buildings, structures, and sewer lines that resulted directly from laboratory and fuel processing activities (Section 2.1). The 300 Area uranium fuel manufacturing and other mission support activities resulted in numerous liquid and solid waste streams intentionally discharged or leaked to the soil column. The secondary waste sites consist of the waste sites that received these waste streams. Some of these secondary waste sites include South and North Process Ponds (316-1 and 316-2); 307 and 300 Area Process Trenches (316-3 and 316-5); and solid waste burial grounds (618-1, 618-2, 618-3, 618-4, 618-7, 618-8, 618-9, 618-10, 618-11, 618-12, and 618-13).

Waste sites in the 300 Area are located in three separate geographical locations. These include the 300 Area (Appendix B), the 400 Area (Figure 2-7), and the 600 Area, which includes the 618-10 (Figure 2-12) and 618-11 Burial Grounds (Figure 2-13), and 316-4 Crib (Figure 2-12). As of January 2010, there were 504 waste sites within the 300 Area. Table 2-3 provides a breakout of the waste sites by OU. A complete list and brief description of waste sites located in the 300 Area is provided in Appendix A. Waste site classifications are defined in accordance with RL-TPA-90-0001, *Tri-Party Agreement Handbook Management Procedures*, Guideline Number TPA-MP-14, "Maintenance of the Waste Information Data System (WIDS)." The WIDS definitions are used throughout this document in reference to the state and classification of the different waste sites. Initially WIDS waste sites are classified as accepted or not accepted. After assessment and/or remedial action, the WIDS waste sites are reclassified.

The waste sites classified and/or reclassified as follows:

- **Discovery:** This is the initial classification of a newly discovered WIDS site based on evidence of a potential site where the assessment is not complete.
- **Accepted:** The WIDS site is a waste management unit as defined in the Tri-Party Agreement Action Plan, Section 3.1.
- **Not accepted:** A classification status indicating an assessment was made that a WIDS site is not a waste management unit and, therefore, is outside the scope of the Tri-Party Agreement Action Plan (Ecology et al., 1989b, Section 3.1). This classification requires lead regulatory agency approval.
- **Interim Closed Out:** A reclassification status indicating that a waste management unit meets cleanup standards specified in an interim action ROD or action memorandum due to actions taken, but for which a final ROD has not been issued.
- **Closed Out:** A reclassification status, based on actions taken, indicating a waste management unit meets applicable cleanup standards or closure requirements.

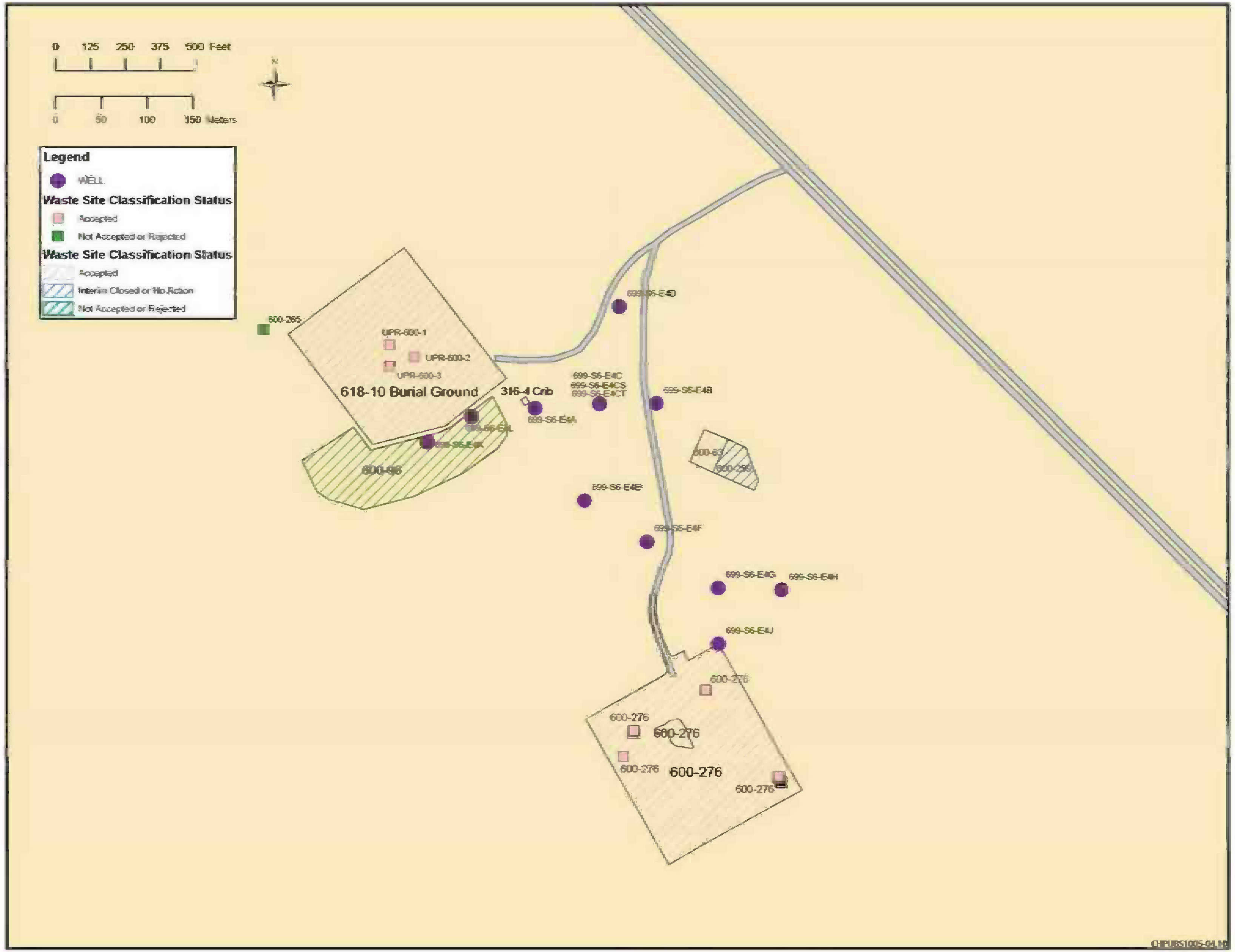


Figure 2-12. 600 Area – 618-10 Burial Ground, 316-4 Crib, and Associated Waste Sites

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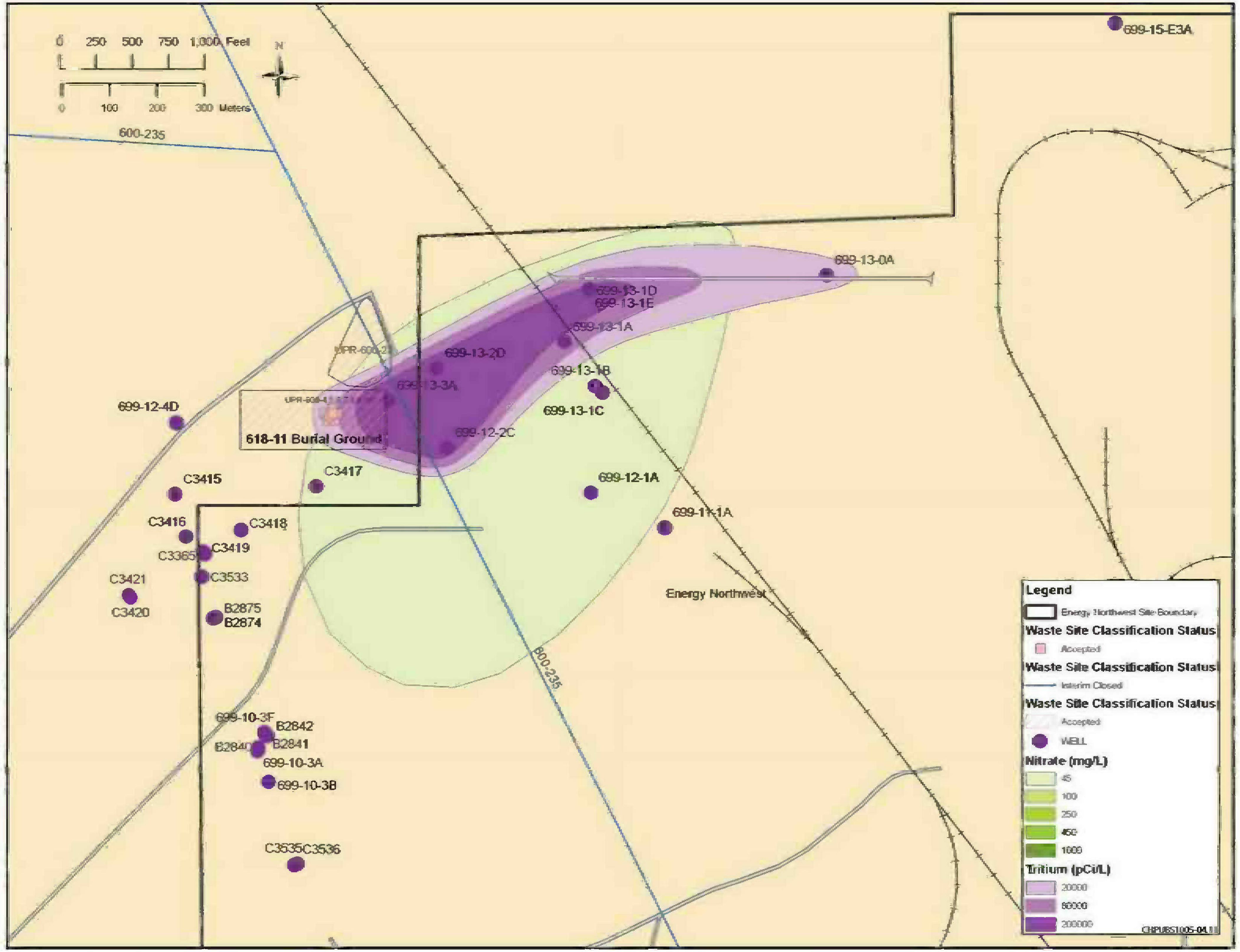

Figure 2-13. 600 Area – 618-11 Burial Ground and Associated Waste Sites

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- **No action:** A reclassification status based on an assessment of quantitative data collected for the waste site indicating that the site does not require further remedial action under RCRA corrective actions, CERCLA, or other cleanup standards.
- **Consolidated:** A reclassification status indicating that a WIDS site is a duplicate of, physically located within, or adjacent to another WIDS site and will be dispositioned as part of the other WIDS site. A consolidated WIDS site requires no further updates after reclassification. All updates are limited to the WIDS site into which it was consolidated.
- **Rejected:** A reclassification status indicating a waste site does not require remediation under CERCLA, or other cleanup standards based on qualitative information such as a review of historical records, photographs, drawings, walk downs, ground penetrating radar scans, and shallow test pits. Such investigations do not include quantitative measurements.

Table 2-3 presents a summary of the WIDS classification and reclassification status for waste sites identified in the 300, 400, and 600 Areas as documented in Stewardship Information Systems (SIS). Tables 2-4, 2-5, and 2-6 show the individual waste reclassification status for all 300 Area waste sites.

Table 2-3. Summary of Waste Sites in the 300 Area

OU	Total Number of Waste Sites[a]	Closed Out[b]	Interim Closed Out[b]	No Action[b]	Not Accepted[b,c]	Accepted[b]	Consolidated[b]	Discovery[b]
300-FF-1	38	33	1	4	0	0	0	0
300-FF-2	347	40	4	4	179	89	30	1
Total 300 Area	385	73	5	8	179	89	30	1
300-FF-1	0	0	0	0	0	0	0	0
300-FF-2	69	5	0	1	59	4	0	0
Total 400 Area	69	5	0	1	59	4	0	0
300-FF-1	3	2	0	1	0	0	0	0
300-FF-2	47	3	8	1	14	10	10	1
Total 600 Area	50	5	8	2	14	10	10	1
Total in 300 Area	504	83	13	11	252	111	40	2

Notes:

Additional information for waste sites is provided in Appendix A.

Source: SIS, December 31, 2009.

a. Total number of sites includes discovery sites.

b. WIDS classification status categories are described in Section 2.2.

c. Includes Rejected sites.

Table 2-4. Reclassification Status of 300 Area (Industrial Complex) Waste Sites

Reclassification Status[a]	Waste Site(s)	Total
	300-FF-1 OU	
Closed Out	300 ASH PITS, 300 RFBP, 300-44, 300-49, 300-50, 316-1, 316-2, 316-5, 332 SF, 618-12, UPR-300-15, UPR-300-19, UPR-300-20, UPR-300-21, UPR-300-22, UPR-300-23, UPR-300-24, UPR-300-25, UPR-300-26, UPR-300-27, UPR-300-28, UPR-300-29, UPR-300-30, UPR-300-32, UPR-300-33, UPR-300-34, UPR-300-35, UPR-300-36, UPR-300-37, UPR-300-47, UPR-300-8, UPR-300-9, UPR-300-FF-1	33
Interim Closed Out	300-275	1
No Action	300 FBP, 300-3, 300-51, 300-52	4
Not Accepted	None	0
Rejected	None	0
Consolidated	None	0
Discovery	None	0
	300-FF-2 OU	
Closed Out	300 SE, 300-10, 300-19, 300-223, 300-23, 300-231, 300-262, 300-272, 300-35, 300-37, 300-45, 300-53, 300-57, 303-K CWS, 304 CF, 304 SA, 305-B SF, 311 MT1, 311 MT2, 311-TK-40, 311-TK-50, 313 CENTRIFUGE, 313 FP, 313 MT, 313 URO, 313-TK-2, 333-TK-11, 333-TK-7, 334 TFWAST, 334-A-TK-B, 334-A-TK-C, 3718-F BS, 3718-F SF, 3718-F TT1, 3718-F TT2, BTTF, PCTTF, TTTF, UPR-300-41, UPR-300-7	40
Interim Closed Out	300 VTS, 300-18, 300-275[b], 300-8, 618-2	5
No Action	300-1, 300-253, 300-29, 331 LSLDF	4
Not Accepted	300 SSS, 300-100, 300-103, 300-104, 300-107, 300-108, 300-111, 300-115, 300-12, 300-127, 300-128, 300-129, 300-13, 300-130, 300-17, 300-180, 300-184, 300-190, 300-191, 300-204, 300-205, 300-206, 300-207, 300-208, 300-209, 300-21, 300-210, 300-217, 300-220, 300-225, 300-240,300-241, 300-242, 300-243, 300-244, 300-250, 300-36, 300-42, 300-47, 300-63, 300-72, 300-73, 300-74, 300-77, 300-79, 300-87, 300-93, 300-94, 300-97, 300-98, 313 CRO, UPR-300-18, UPR-300-31	53
Rejected	300 IFBD, 300 PHWSA, 300-101, 300-102, 300-105, 300-106, 300-112, 300-113, 300-114, 300-116, 300-117, 300-118, 300-119, 300-120, 300-122, 300-124, 300-125, 300-126, 300-14, 300-151, 300-152, 300-153, 300-154, 300-155, 300-156, 300-157, 300-158, 300-159, 300-160, 300-161, 300-162, 300-163, 300-164, 300-165, 300-166, 300-167, 300-168, 300-169, 300-170, 300-171, 300-172, 300-173, 300-174, 300-176, 300-177, 300-178, 300-179, 300-181, 300-182, 300-183, 300-185, 300-186, 300-187, 300-188, 300-189, 300-192, 300-193, 300-194, 300-195, 300-196, 300-197, 300-198, 300-199, 300-200, 300-201, 300-202, 300-203, 300-211, 300-212, 300-213, 300-215, 300-222, 300-226, 300-227, 300-228, 300-230, 300-235, 300-236, 300-237, 300-238, 300-239, 300-248, 300-26, 300-261, 300-266, 300-267, 300-27, 300-271, 300-30, 300-55, 300-56, 300-58, 300-59, 300-60, 300-61, 300-62, 300-64, 300-65, 300-66, 300-67, 300-68, 300-69, 300-70, 300-71, 300-75, 300-76, 300-78, 300-85, 300-86, 300-88, 300-89, 300-90, 300-91, 300-95, 300-96, 300-99, 315 RSDF, 331-C WHSA, 335 & 336 RSDF, 340 CHWSA, 350 HWSA, 3713 PSHWSA,3713 SSHWSA, 3746-D SR, 618-6, UPR-300-43	126

Table 2-4. Reclassification Status of 300 Area (Industrial Complex) Waste Sites

Reclassification Status[a]	Waste Site(s)	Total
Accepted	300 RLWS, 300 RRLWS, 300-109, 300-11, 300-110, 300-121, 300-123, 300-15, 300-16, 300-175, 300-2, 300-214, 300-218, 300-219, 300-22, 300-224, 300-24, 300-249, 300-25, 300-251, 300-255, 300-256, 300-257, 300-258, 300-259, 300-260, 300-263, 300-264, 300-265, 300-268, 300-269, 300-270, 300-273, 300-274[c], , 300-276, 300-28, 300-32, 300-33 300-34, 300-39, 300-4, 300-40, 300-41, 300-43, 300-46, 300-48, 300-5, 300-6, 300-7, 300-80, 300-9, 303-M SA, 303-M UOF, 307 Retention Basins, 309-TW-1, 309-TW-2, 309-TW-3, 309-WS-1, 309-WS-2, 309-WS-3, 313 ESSP, 316-3, 323 TANK 1, 323 TANK 2, 323 TANK 3, 323 TANK 4, 325 WTF, 331 LSLT1, 331 LSLT2, 333 ESHWSA, 333 WSTF, 340 COMPLEX, 3712 USSA, 600-117, 600-117:1, 618-1, 618-1:1, 618-1:2, UPR-300-1, UPR-300-10, UPR-300-11, UPR-300-12, UPR-300-17, UPR-300-2, UPR-300-38, UPR-300-39, UPR-300-4, UPR-300-40, UPR-300-42, UPR-300-45, UPR-300-46, UPR-300-48, UPR-300-5	93
Consolidated	300-131, 300-132, 300-133, 300-134, 300-135, 300-136, 300-137, 300-138, 300-139, 300-140, 300-141, 300-142, 300-143, 300-144, 300-145, 300-146, 300-147, 300-148, 300-149, 300-150, 300-81, 300-82, 300-83, 300-84, 300-92, 333 ESHTSSA, 333 LHWSA, UPR-300-13, UPR-300-14, UPR-300-44	30
Discovery	300-277	1

Notes:

Additional information for 300 Area wastes sites is provided in Appendix A. Mobile Offices were not considered.

Source: SIS, December 31, 2009.

a. WIDS classification status categories are described in Section 2.2.

b. Waste site 300-275 is a potential landfill located within the boundaries of the 300-FF-1 OU, but has been "plugged-in" to the 300-FF-2 OU ROD through the "plug-in" or "analogous sites" approach (EPA/ROD/R10-01/119).

c. Waste site 300-274 has been remediated and is awaiting the completion of the RSVP process.

BS = Burn Shed
BTTF = Biological Treatment Test Facility
CF = Concretion Facility
CHWSA = Complex Hazardous Waste Storage Area
CRO = Copper Remelt Operations
CWS = Contaminated Waste Storage
ESHTSSA = East Side Heat Treat Salt Storage Area
ESHWSA = East Side Hazardous Waste Storage Area
ESSP = East Side Storage Pad
FBP = Filter Backwash Pond
FP = Filter Press
HWSA = Hazardous Waste Storage Area
LHWSA = Laydown Hazardous Waste Storage Area
LSLDF = Life Sciences Laboratory Drainfield
LSLT = Life Sciences Laboratory Trench
MT = Methanol Tank
PCTTF = Physical and Chemical Treatment Test Facility
PSHWSA = Paint Shop Hazardous Waste Satellite Area
RFBP = Retired Filter Backwash Pond
RRLWS = Retired Radioactive Liquid Waste Sewer
RSDF = Retired Sanitary Drain Field
SA = Storage Area
SF = Storage Facility
SR = Silver Recovery
SSHWSA = Sign Shop Hazardous Waste Satellite Area
SSS = Sanitary Sewer System
TFWAST = Tank Farm Waste Acid Storage Tank
TTTF = Thermal Treatment Test Facility
UOF = Uranium Oxide Facility
URO = Uranium Recovery Operations
VTS = Vitrification Test Site
WSTF = West Side Tank Farm

Table 2-5. Reclassification Status of 400 Area Waste Sites

Reclassification Status*	Waste Sites	Total
	300-FF-2 OU	
Closed Out	400-31, 400-5, 427 HWSA, 4831 LHWSA, 4843 Building	5
Interim Closed Out	None	0
No Action	400-36	1
Not Accepted	400 FD10, 400 FD10A, 400 RFD, 400 SBT, 400-10, 400-15, 400-2, 400-20, 400-21, 400-22, 400-26, 400-28, 400-29, 400-3, 400-34, 400-35	16
Rejected	400 FD1A, 400 FD1B, 400 FD2, 400 FD3, 400 FD4, 400 FD5, 400 FD6, 400 FD7, 400 FD8, 400 FD9, 400 RSP, 400 RST, 400 SS, 400 STF, 400-1, 400-11, 400-12, 400-13, 400-14, 400-16, 400-17, 400-18, 400-19, 400-23, 400-24, 400-25, 400-32, 400-33, 400-39, 400-4, 400-6, 400-7, 400-8, 400-9, 403 FD, 4713-B FD, 4713-B HWSA, 4713-B LDFD, 4721 FD, 4722 PSHWSA, 4722-B FD, 4722-C FD, UPR-400-1	43
Accepted	400 PPSS, 400-37, 400-38, 437 MASF	4
Consolidated	None	0
Discovery	None	0

Notes:

Additional information is provided in Appendix A. Mobile Offices were not considered.

Source: SIS, December 31, 2009.

* WIDS classification status categories are described in Section 2.2.

FD = French Drain
HWSA = Hazardous Waste Storage Area
LDFD = Loading Dock French Drain
LHWSA = Laydown Hazardous Waste Storage Area
PSHWSA = Paint Shop Hazardous Waste Satellite Area
RFD = Retired French Drain
RST = Retired Septic Tank
SBT = Sand Bottom Trench
RSP = Retired Sanitary Pond
STF = Sanitary Tile Field

Table 2-6. Reclassification Status of 600 Area Waste Sites

Reclassification Status*	Waste Sites	Total
	300-FF-1 OU	
Closed Out	618-4, 628-4	2
Interim Closed Out	None	0
No Action	UPR-600-15	1
Not Accepted	None	0
Rejected	None	0
Accepted	None	0

Table 2-6. Reclassification Status of 600 Area Waste Sites

Reclassification Status*	Waste Sites	Total
Consolidated	None	0
Discovery	None	0
	300-FF-2 OU	
Closed Out	600-278, 600-46, 618-9	3
Interim Closed Out	600-243, 600-259, 600-259:1, 600-259:2, 600-47, 618-13, 618-3, 618-5, 618-7, 618-8	10
No Action	600-22	1
Not Accepted	600-155, 600-210, 600-244, 600-245, 600-248, 600-255, 600-265, 600-64, 600-96, 600-97	10
Rejected	600-1, 600-246, 600-247, 600-249	4
Accepted	316-4, 600-276, 600-58, 600-59, 600-60, 600-62, 600-63, 618-10, 618-11, UPR-600-22	10
Consolidated	UPR-600-1, UPR-600-10, UPR-600-2, UPR-600-3, UPR-600-4, UPR-600-5, UPR-600-6, UPR-600-7, UPR-600-8, UPR-600-9	10
Discovery	600-290	1

Notes:

Additional information is provided in Appendix A. Mobile Offices were not considered.

Source: SIS, December 31, 2009.

* WIDS classification status categories are explained in Section 2.2.

2.3 Description of 300 Area Facilities

Over the history of the 300 Area, 266 facilities were constructed in the 300 Area (industrial complex) and the 400 Area. A total of 253 of these facilities were buildings, utilities, sewer systems and pipeline components, and various mission support structures. The majority of the 300 Area facilities are located in the 300 Area (industrial complex) with a smaller number located in the 400 Area. No 300 Area facilities were built in the 600 Area. The 400 Area consists of the FFTF and supporting facilities (DOE/RL-94-38, *Remedial Investigation/Feasibility Study Work Plan for the 300-FF-2 Operable Unit*, p. 2-2). Table 2-7 shows the status of facilities in the 300 Area. Summary information for each of the 300 Area facilities is presented in Appendix C, Table C-2.

Table 2-7. Summary Information on the Status of 300 Area Facilities

Area	Total Number of Facilities	Demolished	Removed	Active	Inactive	Planned Construction	Status TBD[a]
300	228	141	11	45	31	2	0
400	38	2	2	13	21	0	0
600[b]	0	0	0	0	0	0	0
Total in 300 Area	266	143	13	58	52	2	0

Notes:

Mobile Offices were not considered.

Source: SIS, current as of January 2010.

a. The status of these facilities is TBD; project is in process to determine status.

b. No 300 Area facilities were constructed in the 600 Area.

TBD = to be determined

2.3.1 300 Area (Industrial Complex) Facilities

Facilities located in the 300 Area (industrial complex) included mainly technical and production support facilities related to the manufacturing of uranium fuels, which constituted the major function of the 300 Area beginning with the Manhattan Engineering District mission in 1943. A description of the operational and process history associated with the facilities constructed in the 300 Area (industrial complex) is provided in Section 2.1.1. Appendix B presents a series of maps showing the facilities and waste sites located in the 300 Area (industrial complex).

The 300 Area facilities have a status of active, inactive, removed, and demolished. A total of 141 facilities have been demolished. Thirty-one inactive facilities are awaiting demolition and 45 facilities are currently active. Several buildings and supporting utilities will remain active in the 300 Area through at least 2011 (WCH-181, *300 Area Building Retention Evaluation Mitigation Plan*, Chapters 1 and 2). Table 2-8 lists the buildings and supporting facilities that will remain in the 300 Area, including delayed facilities (potentially 2011), and long-term facilities and utilities (potentially 2027).

Table 2-8. Facilities Remaining in the 300 Area

Facility	Responsibility	Disposition
312 River Pumphouse	PNNL	Retained long term (~2027)
318 Laboratory Complex	PNNL	Retained long term (~2027)
318-BA Boiler Annex	Mission Support Alliance, LLC	Retained long term (~2027)
3220 Telecommunications Hub	Mission Support Alliance, LLC	Retained long term (~2027)
325 Laboratory Complex	PNNL	Retained long term (~2027)
325-BA Boiler Annex	PNNL	Retained long term (~2027)
331 Life Sciences Laboratory	PNNL	Retained long term (~2027)
331 Complex Boiler Annex	Mission Support Alliance, LLC	Retained long term (~2027)
339-A Hanford Local Area Network Hub	Mission Support Alliance, LLC	Retained long term (~2027)
350 Maintenance Shop	PNNL	Retained long term (~2027)
3507 Microwave Tower	Mission Support Alliance, LLC	Retained long term (~2027)
3508-T1, -T2, T3 Sirens	Mission Support Alliance, LLC	Retained long term (~2027)
351-A and B Electrical Station	Mission Support Alliance, LLC	Utilities/services retained long term (~2027)
352-F Electrical Substation	Mission Support Alliance, LLC	Utilities/services retained long term (~2027)
3614A River Monitoring Station	PNNL	Utilities/services retained long term (~2027)
3709A Fire Station	Mission Support Alliance, LLC	Retained long term (~2027)
3709B Fire Equipment Storage	Mission Support Alliance, LLC	Retained long term (~2027)
3790 Security Office Building	Mission Support Alliance, LLC	Delayed (potentially 2011 or later)
3906 B Lift Station	River Corridor Closure	Retained long term (~2027)
3906 C Monitoring Station	River Corridor Closure	Retained long term (~2027)
326	PNNL	Delayed (potentially 2011 or later)
326-BA	PNNL	Delayed (potentially 2011 or later)
329	PNNL	Delayed (potentially 2011 or later)
320	PNNL	Delayed (potentially 2011 or later)
320-BA	PNNL	Delayed (potentially 2011 or later)

Sources:
WCH-181, 300 Area Building Retention Evaluation Mitigation Plan.
WIDS, as of January 2010.

2.3.2 400 Area Facilities

There are a total of 38 facilities in the 400 Area. The area contains several major buildings and structures, including the FFTF reactor and its support facilities. A brief description of the operational and process history associated with the 400 Area FFTF is provided in Section 2.1.3. The active status 437 MASF is being used for the decontamination of radioactive and/or sodium-contaminated FFTF equipment. All other facilities in the 400 Area are scheduled for demolition by FY 2030.

2.4 Remediation Actions

This section describes the remediation actions that have occurred within the 300 Area as part of the CERCLA process. The description is separated into activities that have occurred prior to approximately January 2010 and those that are ongoing or planned. For groundwater, remediation actions thus far have involved continued monitoring and characterization as part of the RI process, and include actions that have been or are currently being conducted under three groundwater OUs: 300-FF-5, 200-PO-1, and 1100-EM-1. Contaminants associated with each of these three OUs have co-mingled in the groundwater beneath the 300 Area. Treatability testing of potential remedial action technologies to immobilize uranium in the subsurface also has been initiated in the 300 Area industrial complex.

2.4.1 Past Remediation Actions

The description of past remediation actions starts with facilities, progresses through waste sites, and ends with groundwater. Progress at the 300 Area in removing liquid and solid waste disposal sites, and former fuels fabrication facilities, is illustrated in before and after photographs in Figure 2-14. Section 4.6.1 presents a discussion of the remedial action process followed for contaminated source locations. That discussion includes a description of protectiveness levels for direct exposure to soils, and for groundwater.

2.4.1.1 D4 (Past Actions)

Active D4 of contaminated 300 Area facilities has been in operation since 2004. As of January 2010, 141 facilities have been demolished and 11 removed over the operation life of the 300 Area (Table 2-7).

300 Area Facilities

Several primary source facilities have been demolished to foundations and building pads. The primary source facilities constitute those with the greatest potential to release contaminants to the environment based on process history and unplanned releases of process and waste materials. A list of the demolished primary source facilities with demolition dates is provided in Table 2-9. All of the uranium fuel production facilities located in the northern portion of the 300 Area (industrial complex) have been demolished. Figure 2-15 shows an aerial photo of the 300 Area in 2004 before site remediation and D4 activities. Figure 2-16 shows a recent aerial photo of the 300 Area and an insert of a photo showing the many building labels that were removed from the demolished buildings and posted along the western boundary fence of the 300 Area along Stevens Drive. Approximately 40,914 metric tons (45,101 tons) of material was transported to the ERDF as part of the 300 Area D4 activities between August 2005 and February 2009. This is equivalent to 3,469 loads transported by a standard 10-wheel dump truck.

400 and 600 Area Facilities (Past Actions)

As of January 2010, in the 400 Area two facilities have been demolished, the 401 FFTF Visitor's Center and the 4722-D Carpenter Shop, and one mobile office removed. Sections 2.3 and 2.4.2.1 provide information regarding the future D4 activities in the 400 Area. There were no 300 Area facilities constructed in the 600 Area.

Figure 2-14. Aerial Photos Showing the 300 Area in (a) 1950 and (b) 2008

Table 2-9. List of Demolished Primary Source Facilities in the 300 Area

Facility	Demolition Date	Status of Building Site
313 Nuclear Fuels Manufacturing Support Building	2005	313 Building foundation/slab remains with waste site UPR-300-38, uranium-contaminated soil beneath building foundation
314 Press Building (Metal Extrusion Building)	2005	314 Building foundation/slab in process of being removed with waste site 300-218, contaminated soils beneath the 314 and 314A Buildings foundation
306 East Fabrication and Testing Laboratory and 306 West Metal Fabrication Development Building	2007	306-E and 306-W Building foundations/slab removed with waste sites 300-33, contaminated soil around and beneath the 306W Building foundation; and 300-256, contaminated soil around and beneath the 306E Building foundation
333 Fuels Manufacturing Building	2006	333 Building foundation/slab removed with waste site 300-32, remaining contaminated components of the former 333 Building
334 Chemical Handling Facility and Tank Farm, and 334-A Building and WATS	2005	334 Building foundation/slab removed. Site is located near waste site 300-224, a subsurface, concrete pipe trench with sections that allowed piping connections to be made between process operations in the 313 Building, 303-F Building, 311 Tank Farm, 333 Building, 334-A Building, and 334 Tank Farm
303 A-J Fresh Metal Storage Buildings	2006	Building foundations/slabs remain
303-M	2006	Building foundations/slab remains
304 Uranium Scrap Concentration Storage Facility	2006	Building foundation/pad remains
311 Tank Farm and 311 Building	2006	Foundations/pads remain
321 Separation Building and 321-A (323) Metals Creep Laboratory	2007	321 Building foundation/basement remains with UPR-300-4, contaminated soil beneath and south of the 321 Building
3706 Radiochemistry Laboratory	2007	3706 Building foundation/slab remains with waste site 300-46, contaminated soils around and beneath the 3706 Laboratory Building

Source: SIS, January 2010.

Figure 2-15. Aerial Photo of Central 300 Area in 2004 Showing Facilities Before D4 Activities

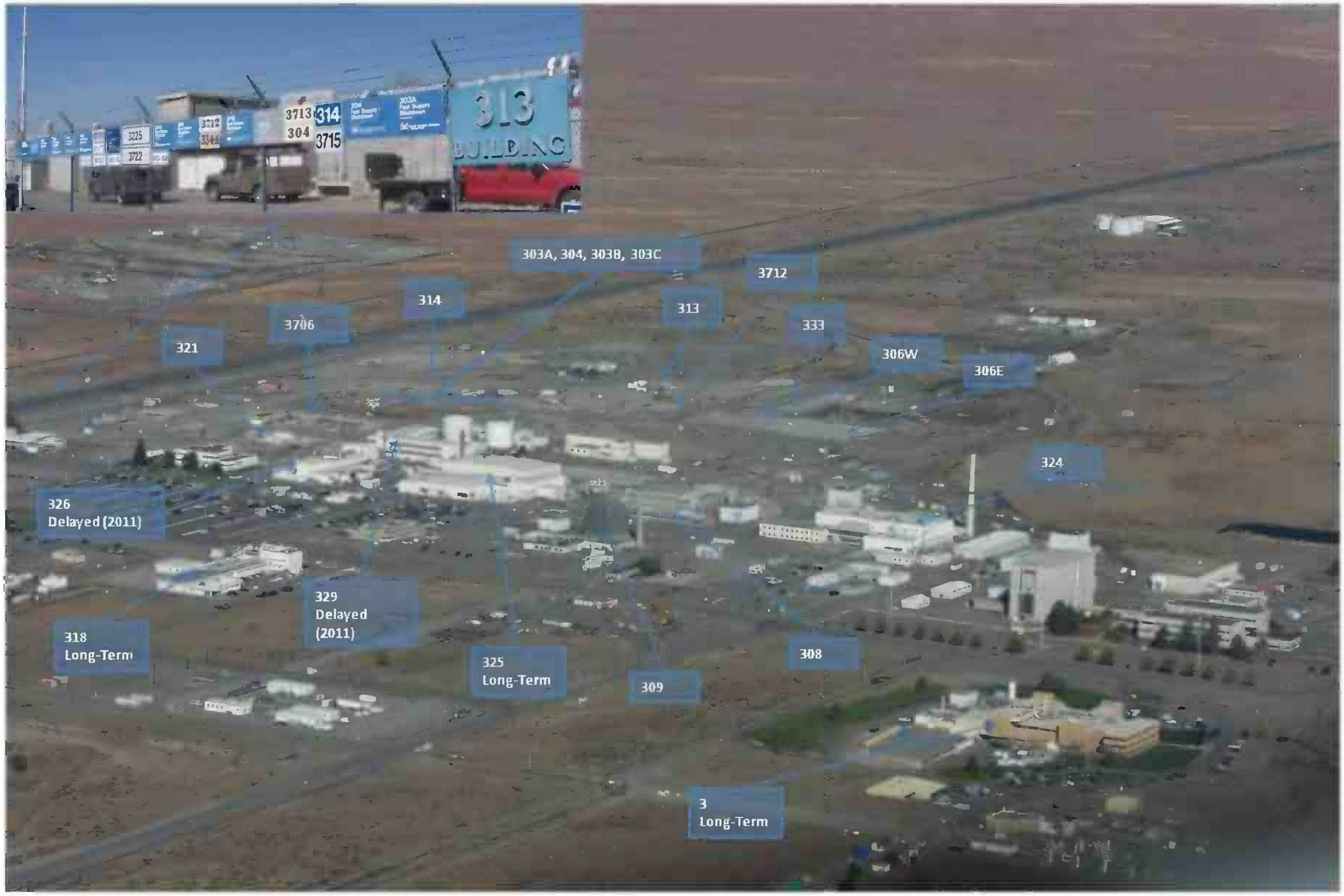


Figure 2-16. Aerial Photo of Central 300 Area in 2008 Following D4 Activities for Some Major Facilities

2.4.1.2 Remediation of Waste-Disposal Sites (Past Actions)

In 1996, as a part of EPA/ROD/R10-96/143, 15 waste sites were identified in the 300 Area. These waste sites consisted mainly of the high-volume, liquid waste disposal sites in the 300 Area (e.g., South Process Pond [316-1], North Process Pond [316-2], and 300 Area Process Trenches [316-5]), and 618-4 Burial Ground and 628-4 Landfill (1d) located in the 600 Area. The original 15 300-FF-1 OU waste sites have been closed out or classified as no action (Section 2.2).

In 2001, as a part of EPA/ROD/R10-01/119, an additional 56 waste sites were indentified in the 300 Area. A total of 40 of these waste sites were located in the 300 Area (industrial complex), 7 waste sites were located in the outlying areas north and west of the 300 Area industrial complex, and 9 waste sites were located in the 600 Area. As of January 2010, 504 waste sites have been identified in the 300 Area (Table 2-3). Two of these waste sites are classified as discovery sites that will be considered for reclassification to accepted or no-action waste sites.

As of January 2010, 96 waste sites have been closed out or interim closed out in the 300 Area (Table 2-3). During the remediation process, about 710,200 metric tons (783,000 tons) of material was removed from the 300 Area waste sites and transported to the ERDF for disposal. This mass is equivalent to 60,230 standard 10-wheel dump truck loads of soil. Approximately 13,000 samples have been collected and analyzed as part of the closeout and cleanup verification activities in the 300 Area since 1995. A list of the completed CVPs is provided in Table 2-10.

300 Area WIDS Sites (Past Actions)

By January 2010, 78 waste sites have been closed out or interim closed out in the 300 Area (industrial complex). Table 2-4 provides a complete list of the 300 Area (industrial complex) waste sites and the corresponding WIDS reclassification status.

400 Area WIDS Sites (Past Actions)

As of January 2010, five waste sites have been closed out in the 400 Area:

- 400-31, Sodium Storage Facility, 402 Building
- 400-5, Septic Tank or Cistern
- 427 HWSA, 427 Building Fuel Cycle Plant Hazardous Waste Storage Area
- 4831 LHWSA, 4831 Laydown Hazardous Waste Storage Area
- 4843 Building, 4843 Alkali Metal Storage Facility

Table 2-5 provides a complete list of the 400 Area waste sites and the corresponding WIDS reclassification status.

Table 2-10. CVPs for Closed Out and Interim Closed Out Waste Sites in the 300 Area

CVP Document Number	CVP Title	WIDS Waste Sites
	300-FF-1 OU	
BHI-01132	*Verification Package for the 300-FF-1 Operable Unit Ash Pits (WIDS 300 Ash Pits)*	300 Ash Pits, 300 Area Ash Pits
BHI-01135	*300-FF-1 Waste Site 300-44 Verification Package*	300-44, UPR-300-FF-1

Table 2-10. CVPs for Closed Out and Interim Closed Out Waste Sites in the 300 Area

CVP Document Number	CVP Title	WIDS Waste Sites
BHI-01164	*300 Area Process Trenches Verification Package*	316-5, 300 Area Process Trenches UPR-300-8, 50% sodium hydroxide solution UPR-300-9, uranium bearing nitric acid UPR-300-15, uranium bearing acid UPR-300-19, nitric, sulfuric, and chromic acid, followed by ammonium bifluoride and sodium hydroxide UPR-300-20, uranium bearing nitric and sulfuric acid UPR-300-21, nitric acid UPR-300-23, nitric and sulfuric acid UPR-300-24, nitric and hydrofluoric acid UPR-300-25, uranium bearing nitric and sulfuric acid UPR-300-26, 50% sodium hydroxide solution UPR-300-27, uranium-bearing nitric and sulfuric acid UPR-300-28, hydrofluoric, nitric, and sulfuric acid with copper, uranium, and zirconium in solution UPR-300-29, hydrofluoric, nitric, sulfuric, and chromic acid with copper, uranium, and zirconium in solution UPR-300-30, hydrofluoric, nitric, sulfuric, and chromic acid UPR-300-47, 38% ethylene glycol solution
BHI-01298	*300-FF-1 Operable Unit, North Process Pond/Scraping Disposal Area Verification Package*	316-2, 300 Area North Process Pond 618-12, Scraping Disposal Area
CVP-2000-00020	*Cleanup Verification Package for Landfill 1A (WIDS Site 300-49)*	300-49, Landfill 1A, UPR-300-FF-1
CVP-2000-00021	*Cleanup Verification Package for Landfill 1B (WIDS Site 300-50)*	300-50, Landfill 1B, UPR-300-FF-1
CVP-2003-00001	*Cleanup Verification Package for Landfill 1D (WIDS Site 628-4)*	628-4, Landfill 1D
CVP-2003-00002	*Cleanup Verification Package for the South Process Pond (WIDS Site 316-l), the Retired Filter Backwash Pond (WIDS Site 300 RFBP), 300-262 Contaminated Soil, and Unplanned Release Sites UPR-300-32, UPR-300-33, UPR-300-34, UPR-300-35, UPR-300-36, UPR-300-37, and UPR-300-FF-l*	316-1, 300 Area South Process Pond 300 RFBP, 300 Area Retired Filter Backwash Pond UPR-300-32, Acid Leaks at the 333 Building UPR-300-33, Waste Leak at the 333 Building UPR-300-34, Release to the Process Pond UPR-300-35, Leak at the 333 Building UPR-300-36, Acid Leak at the 333 Building UPR-300-37, 333 Building Leaks UPR-300-FF-1, 300-FF-1 Hot Spots, Surface Radiation Survey for 300-FF-1
CVP-2003-00020	*Cleanup Verification Package for the 618-4 Burial Ground*	618-4, Burial Ground No. 4

Table 2-10. CVPs for Closed Out and Interim Closed Out Waste Sites in the 300 Area

CVP Document Number	CVP Title	WIDS Waste Sites
	300-FF-2 OU	
BHI-01134	*300-FF-2 Waste Site 300-10 Verification Package*	300-10, Burial Trench West of Process Trenches
BHI-01136	*300-FF-2 Waste Site 300-45 Verification Package*	300-45, Surface Contamination Area
BHI-01298	*300-FF-1 Operable Unit, North Process Pond/Scraping Disposal Area Verification Package*	UPR-300-7, Oil Spill at 384 Building
CVP-2003-00002	*Cleanup Verification Package for the South Process Pond (WIDS Site 316-I), the Retired Filter Backwash Pond (WIDS Site 300 RFBP), 300-262 Contaminated Soil, and Unplanned Release Sites UPR-300-32, UPR-300-33, UPR-300-34, UPR-300-35, UPR-300-36, UPR-300-37, and UPR-300-FF-I*	300-262, Contaminated Soil West of South Process Pond
CVP-2003-00021	*Cleanup Verification Package for the 618-5 Burial Ground*	618-5, Burial Ground No. 5
CVP-2005-00004	*Cleanup Verification Package for the 300-18 Waste Site*	300-18, Surface Contaminated Area
CVP-2005-00005	*Cleanup Verification Package for the 600-47 Waste Site*	600-47, Dumping Area North of 300-FF-1
CVP-2005-00007	*Cleanup Verification Package for the 300-8 Waste Site*	300-8, Aluminum Recycle Storage Area
CVP-2005-00008	*Cleanup Verification Package for the 600-259 Waste Site*	600-259, Inactive Lysimeter Site East End and Special Waste Form Lysimeter
CVP-2005-00009	*Cleanup Verification Package for the 300 VTS Waste Site*	300 VTS, 300 Area In-Situ Vitrification Test Site
CVP-2006-00005	*Cleanup Verification Package for the 618-3 Burial Ground*	618-3, Solid Waste Burial Ground No. 3
CVP-2006-00006	*Cleanup Verification Package for the 618-8 Burial Ground*	618-8, Solid Waste Burial Ground No. 8
CVP-2006-00010	*Cleanup Verification Package for the 618-2 Burial Ground*	618-2, Solid Waste Burial Ground No. 2

600 Area WIDS Sites (Past Actions)

Through January 2010, 15 waste sites have been closed out or interim closed out in the 600 Area:

- 618-4, Burial Ground No. 4
- 628-4, Landfill 1D
- 600-259, Inactive Lysimeter Site East End
- 600-259:1, Grout Lysimeter Site

- 600-259:2, Grout Lysimeter Site
- 600-278, Bioremediation Pad Within Gravel Pit 9, Oil-Contaminated Soil
- 600-46, Cutup Oil Dump
- 600-47, Dumping Area North of the 300-FF-1 OU
- 618-13, 303 Building Contaminated Soil Burial Site
- 618-3, Solid Waste Burial Ground No. 3
- 618-5, Burial Ground No. 5
- 618-7, Solid Waste Burial Ground No. 7
- 618-8, Solid Waste Burial Ground No. 8
- 618-9, 300 West Burial Ground
- 600-243, Petroleum Contaminate Soil Bioremediation Pad

Table 2-6 provides a complete list of the 600 Area waste sites and the corresponding WIDS reclassification status.

2.4.1.3 Groundwater Remediation Activities (Past Actions)

Active removal and/or in situ treatment of contamination in the aquifer beneath the 300 Area under CERCLA or RCRA programs has not taken place to date. CERCLA decisions for interim action have primarily involved continuing the RI process to characterize contamination in the aquifer, and institutional controls on the use of groundwater. Under the CERCLA program, three OUs are associated with groundwater contamination in the 300 Area:

- 300-FF-5, which covers groundwater impacted by sources in the 300 and 600 Area subregions.
- 200-PO-1, which is defined by the extent of the groundwater plume created by releases from 200 East Area sources and includes groundwater beneath the 400 Area subregion.
- 1100-EM-1, which covers groundwater affected by sources to the southwest of the 300 Area subregion, principally the inactive Horn Rapids Landfill, and non-Hanford Site facilities and activities.

The following sections summarize remediation decisions currently in place and interim actions concerning these OUs.

300-FF-5 Groundwater OU

The 1996 ROD for interim actions in the 300-FF-5 Groundwater OU (EPA/ROD/R10-96/143)[14] calls for the following:

- Continued monitoring of groundwater that is contaminated above health-based levels to ensure that concentrations continue to decrease
- Institutional controls to ensure that groundwater use is restricted to prevent unacceptable exposures to groundwater contamination

The technical basis for this ROD is contained in DOE/RL-94-85, *Remedial Investigation/Feasibility Study Report for the 300-FF-5 Operable Unit.* Implementation of the interim action was described in an initial operations and maintenance plan (DOE/RL-95-73, *Operation and Maintenance Plan for the*

[14] The initial ROD was expanded geographically to include groundwater beneath the 618-11 and 618-10 Burial Grounds in 2000; however, there were no changes in the specified interim actions (EPA/ESD/R10-00/524).

300-FF-5 Operable Unit, Rev. 0), which included groundwater and surface water sampling and analysis tasks.

In 2001, the first 5-year review of this ROD included an action item to update and expand the original operations and maintenance plan for the OU by adding (1) more requirements for monitoring along the river shoreline, and (2) an assessment of natural attenuation processes as a remedy (EPA/ROD/R10-01/119, p. 300-17). The expanded operations and maintenance plan was released in 2002 (DOE/RL-95-73, Rev 1, Draft B), along with a new SAP (DOE/RL-2002-11, *300-FF-5 Operable Unit Sampling and Analysis Plan*). An assessment of the natural attenuation remedy, along with a description of trends for COPCs, subsequently was released in 2005 (PNNL-15127, pp. 5.1, and pp. 2.1 to 2.50, respectively).

Prepared in 2004, Tri-Party Agreement Milestone M-016-04-05 contained new initiatives to refine the conceptual model for uranium and investigate candidate technologies for remedial action (PNNL-17034, p. 2.10). The associated Tri-Party Agreement milestone (M-016-68) had deliverables due by March 31, 2005, which resulted in:

- A work plan for a Phase III FS for uranium in the 300 Area:
  - DOE/RL-2005-41, *Work Plan for Phase III Feasibility Study, 300-FF-5 Operable Unit*
  - DOE/RL-2005-47, *300-FF-5 Operable Unit Limited Field Investigation Plan*
- An expanded groundwater report for FY 2004, to include a description of the conceptual model for uranium:
  - PNNL-15121, *Uranium Geochemistry in Vadose Zone and Aquifer Sediments from the 300 Area Uranium Plume*
  - PNNL-15127

In 2006, the second 5-year review of this ROD included an action item to complete an FS for uranium in 300 Area groundwater, to provide better characterization of the uranium contamination, an updated conceptual model, validation of ecological consequences, and evaluation of treatment alternatives for uranium (DOE/RL-2006-20, p. 3.17). The action item also requested testing of polyphosphate injection into the aquifer as a means to immobilize uranium. Progress in response to the second 5-year review action item for renewed FSs associated with uranium includes:

- Improved characterization of contaminant uranium in the subsurface:
  - PNNL-16435
  - PNNL-17031, *A Site-Wide Perspective on Uranium Geochemistry at the Hanford Site*
  - PNNL-17793, *Uranium Contamination in the 300 Area: Emergent Data and Their Impact on the Source Term Conceptual Model*
- Updated conceptual model for uranium contamination:
  - PNNL-17034
  - Yabusaki et al., 2008, "Building Conceptual Models of Field-Scale Uranium Reactive Transport in a Dynamic Vadose Zone-Aquifer-River System"

- Validation of ecological consequences:
  - PNNL-16454, Current Conditions Risk Assessment for the 300-FF-5 Groundwater Operable Unit
  - PNNL-16805, Investigation of the Hyporheic Zone at the 300 Area, Hanford Site
  - DOE/RL-2007-21
  - DOE/RL-2008-11, Remedial Investigation Work Plan for Hanford Site Releases to the Columbia River
- Evaluation of treatment alternatives for uranium:
  - PNNL-16761, *Evaluation and Screening of Remedial Technologies for Uranium at the 300-FF-5 Operable Unit, Hanford Site, Washington*
  - DOE/RL-2008-36, *Remediation Strategy for Uranium in Groundwater at the Hanford Site 300 Area, 300-FF-5 Operable Unit*
- Testing of polyphosphate injection into the aquifer to immobilize uranium:
  - PNNL-16571, *Treatability Test Plan for 300 Area Uranium Stabilization Through Polyphosphate Injection*
  - PNNL-17480
  - PNNL-18529
  - DOE/RL-2009-16

During the LFI for uranium in 2006, VOCs were unexpectedly encountered in the unconfined aquifer in an interval of Ringold Formation sediment not previously sampled or monitored. A work plan was prepared for additional drilling in 2007 to characterize that contamination (SGW-32607, *Sampling and Analysis Instructions for TCE Characterization, 300-FF-5 Operable Unit, Fiscal Year 2007*).

The results provided additional information on the nature and extent of the contamination, and on uranium contamination:

- Trichloroethene in an interval of finer grained Ringold Formation Unit E sediment (PNNL-17666)
- Contaminant uranium associated with sediment collected during drilling (PNNL-17793)

200-PO-1 Groundwater and 1100-EM-1 OUs

These two areas, 200-PO-1 and 1100-EM-1 OUs have large plumes that impact, or overlap upon the 300 Area, are discussed below and mentioned in this work plan because of those impacts.

200-PO-1 Groundwater

A ROD has not yet been developed for the 200-PO-1 Groundwater OU. The initial RI activities for the 200-PO-1 Groundwater OU were conducted as part of a RCRA facility investigation and corrective measures study (DOE/RL-95-100, *RCRA Facility Investigation Report for the 200-PO-1 Operable Unit*; DOE/RL-96-66, *RCRA Corrective Measure Study for the 200-PO-1 Operable Unit*). Groundwater characterization activities are now conducted as part of the CERCLA RI/FS process, and a work plan for those activities was released in early 2008 (DOE/RL-2007-31, *Remedial Investigation/Feasibility Study Work Plan for the 200-PO-1 Groundwater Operable Unit*). Two groundwater SAPs are associated with the work plan: the first is a SAP for routine groundwater monitoring throughout the OU (DOE/RL-2003-04, *Sampling and Analysis Plan for the 200-PO-1 Groundwater Operable Unit*) and the second provides for a 2-year groundwater characterization study that will support groundwater remediation decisions (DOE/RL-2007-31, Appendix A). The latter plan is the product of the DQO process for groundwater remediation work that was conducted during FY 2006 and reported in FY 2007 (SGW-34011, *Data Quality Objectives Summary Report Supporting the 200-PO-1 Groundwater Operable Unit*).

1100-EM-1 OU

The 1100 Area waste sites were removed from the EPA's National Priorities List in 1996 (61 FR 51019, "National Oil and Hazardous Substances Pollution Contingency Plan; National Priorities List Update"). For groundwater in the 1100 Area, (i.e., the 1100-EM-1 OU, the selected remedy as described in EPA/ROD/R10-93/063, *Record of Decision for the USDOE Hanford 1100 Area Final Remedial Action*, pp. i to ii) included:

- Capping the Horn Rapids Landfill
- Offsite disposal of PCB-contaminated soil
- Offsite incineration of soils contaminated with bis(2-ethylhexyl)phthalate
- Natural attenuation of groundwater that currently exceeds maximum contaminant levels and monitoring for compliance
- Continuation of institutional controls for groundwater and land use at the Horn Rapids Landfill

The technical basis for this ROD is provided in DOE/RL-92-67, *Final Remedial Investigation/Feasibility Study-Environmental Assessment Report for the 1100-EM-1 Operable Unit, Hanford*. Implementation of the remedy is described in PNNL-12220, *Sampling and Analysis Plan Update for Groundwater Monitoring – 1100-EM-1 Operable Unit*.

The second 5-year review of the ROD (DOE/RL-2006-20, pp. xiii) produced an action item to modify groundwater monitoring for the OU by reducing the number of wells and frequency of sampling. This action was completed in June 2007 and is documented in Tri-Party Agreement Change Notice 163.

2.4.2 Ongoing Remediation Actions

The following sections describe remediation actions that were in progress as of March 2010. Other contractors with ongoing projects in the 300 Area will require certain facilities and support infrastructure remain, which will interfere with access to some identified WIDS sites and preclude remedial actions on those sites (see Plate 1, [Draft, White Paper in process] 300 Area Facilities and Waste Sites to be De-Scoped, which shows all interfered waste sites [by location and WIDS ID number] resulting from long-term retained facilities). The white paper will be provided to the EPA when finalized, with the intent to support decision making for interfered waste sites in the final 300-FF-2 Record of Decision.

2.4.2.1 D4 (Ongoing)

The D4 of facilities in the 300 Area is ongoing. Approximately 40 percent of the facilities scheduled for D4 in the 300 Area (industrial complex) have been demolished or removed.

300 Area Facilities (Ongoing)

Several of the facilities in the 300 Area (industrial complex) are on a delayed demolition plan or long-term use schedule and will not be demolished until around 2027 (Table 2-8). Many of the source facilities in the 300 Area have been demolished and many of the remaining facilities scheduled for demolition are not associated with soil contamination.

400 Area and 600 Area Facilities (Ongoing)

The 400 Area FFTF reactor complex is currently in a safe shutdown condition until the final D4 of the facilities can be completed. The deactivation is scheduled to be complete before the scheduled Tri-Party Agreement date of February 2011. Completion of D4 activities in the 400 Area is scheduled for FY 2030.

There were no 300 Area facilities constructed in the 600 Area.

2.4.2.2 Remediation of Waste-Disposal Sites (Ongoing)

The following sections describe ongoing remediation actions at waste disposal sites that were in progress as of January 2010.

300 Area Waste Sites (Ongoing)

As of January 2010, there are 89 waste sites classified as accepted in the 300 Area that are scheduled for remediation. None of these waste sites is located in the 300-FF-1 OU and the remaining waste sites are located in the 300-FF-2 OU. One new discovery site was located in the 300 Area (300-277, 300 Area Queue Contamination). Remediation of the 300 Area (industrial complex) waste sites is ongoing and is scheduled to continue through FY 2015.

400 Area Waste Sites (Ongoing)

There are four waste sites classified as accepted waste sites in the 400 Area that are scheduled for remediation:

- 400 PPSS, 400 Area Process Pond and Sewer System
- 400-37, Fuel Oil Tank South of 4732-B
- 400-38, Fuel Oil Tank East of 4722-A Building Pad
- 437 MASF, 400 Area MASF

Remediation of these sites is scheduled to begin during FY 2012 and continue through FY 2014.

600 Area Waste Sites (Ongoing)

Within the 600 Area there are 10 waste sites classified as accepted that are scheduled for remediation and one new discovery site (600-290, Contamination Found Near 618-13). Remediation of these sites is ongoing and is scheduled to continue through FY 2015.

Additional remedial activities in the 600 Area include the development of a nonintrusive characterization SAP for the 618-10 and 618-11 Burial Grounds (DOE/RL-2008-27). The SAP was approved, and nonintrusive characterization sampling began in October 2009 at the 618-10 Burial Ground. The characterization activities prescribed in this SAP will provide data and information needed for planning future intrusive characterization activities (if required) and/or remediation strategies for the VPUs, caissons, and trenches located in these burial grounds.

2.4.2.3 OSE Process

The OSE process is a systematic approach to review land parcels and identify potential waste sites within the River Corridor that are not currently listed in existing CERCLA decision documents, such as RODs. The scope of an OSE includes conducting historical reviews and field investigations; identifying information gaps; conducting integrations activities, which includes briefing RL and the lead regulatory agency; completing the TPA-MP-14 process; and issuing a summary report. New waste sites identified through the OSE process may be added to the 300-FF-2 ROD through a fact sheet, characterized to determine whether cleanup is required, and addressed in accordance with the selected remedy.

An orphan site is a manmade feature, item, or activity area within the river corridor that (1) meets the TPA-MP-14 criteria for waste site identification, (2) is not identified for characterization or cleanup within the existing CERCLA decision documents, and (3) has been presented to and accepted by RL and the lead regulatory agency (EPA or Ecology). A potential orphan site is a manmade feature, item, or activity area identified within the river corridor during the historical review or field investigation activities evaluated because it has the potential to be a contaminated site.

The OSE for the 300-FF-1 OU started in FY 2004 and was completed in April 2005. The historical review identified additional components of the 300-276, 3607 Sanitary Sewer System waste site that required attention. The field walk down identified two new waste sites: 300-275, Potential Landfill on River Edge and 300-274, 300-FF-1 Scattered Surface Debris. Although these newly discovered waste sites are physically located within the boundary of the 300-FF-1 OU, the sites were addressed with the 300-FF-2 OU scope. The OSE process for the 300-FF-2 OU started in October 2008 and is ongoing.

2.4.2.4 Groundwater Remediation Activities (Ongoing)

Interim actions under the 1996 ROD (EPA/ROD/R10-96/143) and 2000 ESD (EPA/ESD/R10-00/524) for groundwater contamination in the 300 Area involve continued monitoring of conditions in groundwater associated with the 300-FF-5 OU while natural processes act on the level of contamination in groundwater. Changes in the “level” of contamination, such as changes in contaminant concentrations, areas contaminated, and mass of contaminants, may occur as the result of human activities and natural processes.

Groundwater withdrawal has occurred at various locations within the 300 Area to provide potable and/or utility water for facilities (e.g., 400 Area facilities; Energy Northwest facilities), and to provide water for use in aquariums at the 331 Building in the 300 Area. The latter withdrawal involves a volume of groundwater that is significant in terms of the groundwater balance for the 300 Area and includes groundwater contaminated by uranium. Initial estimates for the mass of uranium withdrawn from the well suggested an average rate of approximately 20 kg/yr (44 lb/yr) since 1982 (PNNL-15127, p. 2.3), although flow-rate data for recent years reveal a rate of approximately 10 kg/yr (22 lb/yr). Where groundwater is extracted for use as potable water for Hanford Site facilities, radiological water quality parameters are monitored under PNNL’s Drinking Water Project and other water quality parameters are monitored by the Hanford Site’s water compliance organization, Fluor Hanford, Inc., during 2008; PNNL-17603, *Hanford Site Environmental Report for Calendar Year 2007* (Section 10.6, pp. 10.55 to 10.59).

The primary natural process that reduces the level of contamination in the aquifer is groundwater discharge from the unconfined aquifer to the Columbia River. Some contaminants are currently at concentrations that exceed human health based levels at near-river monitoring wells and aquifer tubes beneath the shoreline. Estimates for the uranium removal rate from the aquifer beneath the 300 Area suggest an average rate of about several hundred kilograms per year (PNNL-17034, p. 3.25). However, based on recent three-dimensional computer simulations of groundwater movement through the unconfined aquifer (PNNL-17708, *Three-Dimensional Groundwater Models of the 300 Area at the Hanford Site, Washington State*, Table 5.1, p. 5.6), an assumed average concentration for the uranium plume of 60 µg/L, and a width of 1,200 m (3,940 ft) at the shoreline, the current uranium plume actually may be discharging a smaller amount, perhaps about several tens of kilograms per year.

The following paragraphs summarize the level of effort for groundwater monitoring that is in place during the period of interim action in the 300 Area. Multiple uses of individual wells occurs to support the three OUs involved, and coordination of sampling is done as part of the Soil and Groundwater Remediation Project’s scheduling process to avoid duplication of effort.

300-FF-5 Groundwater OU

Approximately 46 wells monitor the 300 Area, along with sampling at 8 aquifer tube sites along the 300 Area shoreline (DOE/RL-2008-01, *Hanford Site Groundwater Monitoring Report for Fiscal Year 2007*, Table A.14, pp. A.22 to A.24). Analyses for radiological contaminants include gross alpha, gross beta, uranium, and H-3; and for chemical contaminants (e.g., VOCs and nitrate). Major anions and cations also are monitored, along with other water quality indicators such as alkalinity and pH.

At the 618-11 Burial Ground subregion, six wells are in service to monitor groundwater impacts related to potential releases from the burial ground (DOE/RL-2008-01, Table A-15, p. A.25). Radiological contaminants monitored include gross alpha, gross beta, technetium-99 (Tc-99), H-3, and uranium. Basic water quality parameters also are monitored.

At the 618-10 Burial Ground subregion, six wells also are in service to monitor potential releases from the burial ground and past releases from the adjacent site of the former 316-4 Crib (DOE/RL-2008-01, Table A-16, p. A-26). Analyses include radiological and chemical contaminants that might indicate releases from the two waste sites (e.g., gross alpha, gross beta, uranium, and various chlorinated hydrocarbons).

200-PO-1 Groundwater OU

Approximately 122 wells and 6 aquifer tube sites currently are monitored in the OU for a variety of radiological and chemical contaminants (DOE/RL-2008-01, Table A.13, pp. A.18 to A.21). In the "far-field" portion of the OU, where the OU overlaps with the 300 Area, contaminants of concern (COCs) monitored are iodine-129 (I-129), nitrate, and H-3. Additional analyses for major anions and cations, and other radiological contaminants (e.g., Tc-99 and uranium), also are conducted. Three wells at the 400 Area are monitored. Most sampling is conducted annually or triennially, with the next triennial event scheduled for 2010.

1100-EM-1 OU

Under the original monitoring plan, 15 wells were monitored annually, with analyses for major anions and VOCs (DOE/RL-2008-01, Table A.17, p A.27). During 2007, the level of monitoring was reduced to sampling at three wells annually (Tri-Party Agreement Change Notice 163).

2.5 Environmental Setting

This section presents a description of the environmental setting for the 300 Area. The description includes characteristics of surface and subsurface features and processes that are relevant to planning an RI.

The descriptions that follow in Sections 2.5.1 through 2.5.3 are for various aspects of the natural environment for the 300 Area, and Sections 2.5.6 and 2.5.7 are for environmental resources and human/cultural resources, are extracted from a document that describes the environmental setting of the Hanford Site (PNNL-6415, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, pp. 4.1 to 4.13 and 4.25 to 4.35), unless otherwise cited. That document has been prepared to provide consistent descriptions of the Hanford Site environment for use in documents associated with the *National Environmental Policy Act of 1969* (NEPA); RCW 43.21C, "State Government—Executive," "State Environmental Policy" (Washington State Environmental Policy Act); and CERCLA.

Sections 2.5.4 and 2.5.5 are developed in greater detail than the other sections, because they pertain more directly to the environmental pathways that are significant in dispersing contaminants away from waste sites.

2.5.1 Physiography and Topography

The physiographic setting of the Hanford Site is relatively low-relief, the product of river and stream sedimentation filling synclinal valleys and basins between the anticlinal ridges. Surface topography has been dramatically modified within the past several million years by Pleistocene cataclysmic flooding, Holocene eolian (i.e., wind) activity, and landsliding. The mega-scale cataclysmic floods during the Pleistocene eroded sediments and scoured basalt bedrock, forming the "scabland" topography that is visible to the north of the Hanford Site. Branching flood channels, giant current ripples, ice-rafted erratics, and giant flood bars are among the landforms created by the floods and readily seen on the Hanford Site. Since the end of the Pleistocene (about 10,000 years ago), winds have locally reworked the flood sediments, depositing dune sands in the lower elevations and windblown silt around the margins of the geologic basin within which the Hanford Site is situated. Under current climate conditions, most sand dunes have been stabilized by vegetation, although active dunes do exist north of the 300 Area.

The southeastern portion of the Hanford Site within which the 300 Area resides is characterized by relatively flat topography, with land surface elevations ranging between 115 and 118 m (377 and 387 ft) at the 300 Area, and between 135 and 137 m (443 and 449 ft) at the 618-11 Burial Ground subregion and Energy Northwest complex. The elevation of the Columbia River as it flows past the 300 Area typically falls in the range of 104 to 108 m (341 to 354 ft).

2.5.2 Climate and Meteorology

The Hanford Site lies within the semiarid shrub-steppe Pasco Basin of the Columbia Plateau in south-central Washington State. The region's climate is greatly influenced by the Pacific Ocean and the Cascade Mountain Range to the west, and other mountain ranges to the north and east. The Pacific Ocean moderates temperatures throughout the Pacific Northwest, and the Cascade Range generates a rain shadow that limits rain and snowfall in the eastern half of Washington State. The Cascade Range also serves as a source of cold air drainage, which has a considerable effect on the wind regime on the Hanford Site. Mountain ranges to the north and east of the region shield the area from the severe winter storms and frigid air masses that move southward across Canada.

As measured at the Hanford Meteorological Station in the central portion of the Hanford Site, typical seasonal temperatures range from an average low of 2 °C (35 °F) in December to an average high of 36 °C (96 °F) in July. Extremes include -31 °C (-23 °F) in February 1950 and 45 °C (113 °F) in July 2006. Relative humidity at the Hanford Meteorological Station averages 76 percent during the winter months and 36 percent in the summer. Average annual precipitation at the Hanford Meteorological Station is 17 cm (6.8 in.), with extremes of 31.3 cm (12.3 in.) in 1995 and 7.6 cm (3 in.) in 1976. Most precipitation occurs during the late autumn and winter. Snowfall typically occurs during December and January, and rapid snowmelts are relatively common. Severe weather events are rare, although periods of strong winds create blowing dust hazards. About 10 thunderstorms per year occur near the Hanford Meteorological Station.

Six meteorological monitoring stations are located within the 300 Area boundaries: stations numbered 1, 9, 11, 12, 14, and 30. All record wind speed, wind direction, temperature, and several record additional weather parameters. Throughout the southeastern portion of the Hanford Site, the prevailing wind direction near the surface is from the southwest during most months; winds from the northwest are less common. The highest wind speeds are generally associated with wind from the southwest.

2.5.3 Regional Geologic Setting

The Hanford Site is located in the Columbia Basin of the Pacific Northwest. The Columbia Basin is an intermontane basin between the Cascade Range and the Rocky Mountains. The Columbia Basin forms the northern part of the Columbia Plateau physiographic province and the Columbia River flood-basalt province. Most of the geologic features visible in the Basin occurred during the last 18 million years of the Cenozoic Era, but events as far back as the late Precambrian (2.3 billion years ago) have had significant influence on the Cenozoic history of the area.

The Columbia Basin has four structural subdivisions or subprovinces, two of which are important to the Pasco Basin and the Hanford Site: the Yakima Fold Belt and the Palouse Slope. The Yakima Fold Belt is a series of anticlinal ridges and synclinal valleys in the western part of the Columbia Basin that has predominantly an east-west structural trend. The Palouse Slope is the eastern part of the Columbia Basin and shows little deformation with only a few faults and low-amplitude, long wavelength folds on an otherwise gently westward-dipping paleoslope. The Hanford Site lies within the Pasco Basin, a geologic structural basin situated between the Yakima Fold Belt and Palouse Slope geologic subprovinces. The Saddle Mountains form the northern boundary of the Pasco Basin, while Rattlesnake Mountain forms part of the southern boundary. Ridges and valleys of the Yakima Fold Belt are to the west of the Basin and more gentle features of the Palouse Slope to the east.

The regional hydrogeologic setting for the 300 Area is described in PNNL-13080, *Hanford Site Groundwater Monitoring: Setting, Sources and Methods* (pp. 3.1 to 3.17), which was prepared as background information for the annual groundwater monitoring reports. Geomorphic features associated with the modern Columbia River as it crosses the Hanford Site are described in detail in the Geologic Atlas Series for the Hanford Reach of the Columbia River (BHI-01648, *Late Pleistocene and Holocene-Age Columbia River Sediments and Bedforms: Hanford Reach Area, Washington, Part 1*). The Wooded Island River Segment includes the eastern boundary of the 300 Area (BHI-01648, pp. 2-73 to 2-89). Appendix A of that report presents a comprehensive primer on the characteristics of fluvial systems, including the relationship between the stream system and adjacent aquifer system, and the kinds of sediment deposits associated with fluvial environments, such as those found beneath the 300 Area.

2.5.4 Hydrogeology

This section describes the geologic and hydrologic characteristics of the subsurface that are relevant to migration of contaminants along environmental pathways in the 300 Area. Pathways of interest are those along which a mobile waste constituent may migrate, given a transporting medium such as waste effluent, infiltrating moisture, or groundwater.

No intentional disposal of significant volumes of hazardous or radiological liquid waste to the ground has occurred in the 300 Area since 1994 and at the 618-10 Burial Ground subregion since 1956; none has occurred at the 618-11 Burial Ground and 400 Area subregions (BHI-00012, Table 2-2, pp. 2-3 to 2-62). Therefore, under current subsurface conditions, contamination that is present is dispersed under relatively natural hydrologic conditions, which are significantly different from conditions that prevailed when large volumes of liquid effluent were being disposed to infiltration facilities such as the North and South Process Ponds (1943 to 1975), and 300 Area Process Trenches (1975 to 1994).

The following subsections describe the stratigraphy and hydrologic characteristics beneath each of the major subregions within the 300 Area.

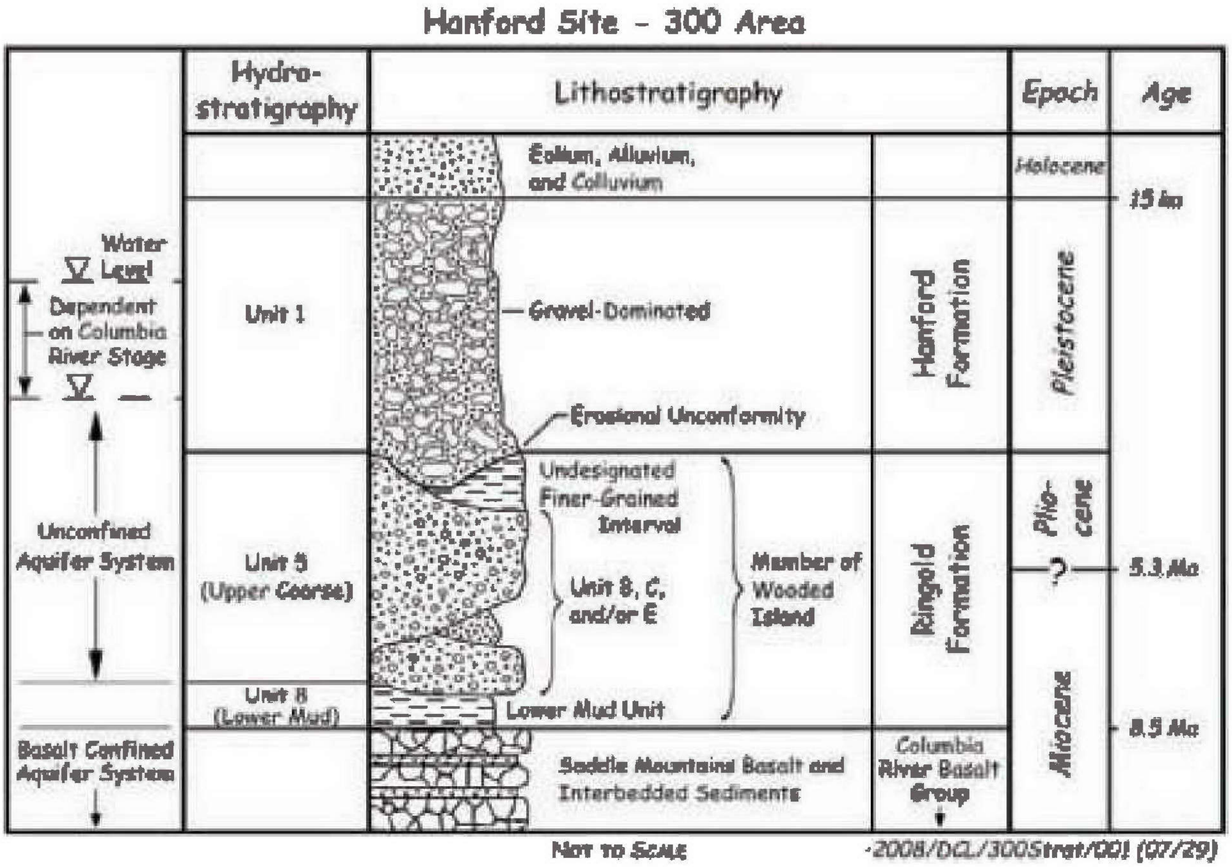
2.5.4.1 300 Area

The principal hydrologic and stratigraphic features beneath the 300 Area are illustrated in Figure 2-17. More detailed descriptions are available in PNNL-16435 (pp. 3.1 to 3.18), and earlier reports, such as PNL-2949, *Geology and Groundwater Quality Beneath the 300 Area, Hanford Site, Washington* (pp. 4-1 to 4-12) and WHC-EP-0500, *Geology and Hydrology of the 300 Area and Vicinity, Hanford Site, South-Central Washington* (pp. 11 to 58). A detailed description of hydrostratigraphic units as used in recent computer simulations of groundwater flow is presented in PNNL-17708 (pp. 2.1 to 2.13). The following brief descriptions of the various stratigraphic intervals are modified after summary descriptions in PNNL-17666 (pp. 2.10 to 2.12), unless otherwise cited. A summary of recent hydraulic test results is shown in Table 2-11; a detailed summary of all available tests for the 300 Area is presented in PNNL-17708 (pp. 2.15 to 2.16).

Surficial Sediment

The most recently deposited sediment contains reworked Hanford formation sandy gravel, eolian silt and sand, and/or anthropogenic backfill of previously excavated sediment or coal plant ash waste. These deposits overlie most of the 300 Area and their typical thickness falls in the approximate range of 1 to 6 m (3.3 to 19.7 ft). However, much of the 300 Area ground surface is covered by pavement and building foundations, so only a portion of the surface is available for infiltration of natural precipitation through surficial sediment. Evapotranspiration limits recharge that could mobilize and leach vadose zone contaminants to a fraction of the annual average precipitation rate.

Estimates for the annual average recharge rate for surficial sediment in the 300 Area come from a site approximately 10 km (6.2 mi) northwest of the 300 Area and near the 618-10 Burial Ground subregion. A value of approximately 62 mm/yr (2.4 in/yr) for disturbed, unvegetated conditions has been reported for that site (PNNL-17841, *Compendium of Data for the Hanford Site (Fiscal Years 2004 to 2008) Applicable to Estimation of Recharge Rates*, pp. 4.1 to 4.11). Estimates at a second location at the northwest corner of the 300 Area, (i.e., at the drill site for Well 699-S20-E10) suggest approximately 2 mm/yr (0.08 in/yr) for *Well 699-S20-E10, 300-FF-5 Operable Unit, Hanford Site, Washington*, pp. 23 to 29). Higher recharge rates may occur locally and episodically during periods of thunderstorms, rapid snowmelt, and discharges associated with facilities and activities (e.g., consolidated runoff from buildings and parking lots; water line breaks; application of dust suppression liquids; irrigation).



Modified for 300 Area after Reidel et al. (1992), Thorne et al. (1993), Lindsey (1995), Williams et al. (2000), DOE-RL (2002)

Source: PNNL-17666, Figure 2.5.

Figure 2-17. Hydrologic and Stratigraphic Features Beneath the 300 Area

Table 2-11. Hydraulic Conductivity Estimates from Recent Drilling Activities

Stratigraphic Formation	Vertical Sequence of Lithofacies Encountered (Typical)	LFI			VOC Investigation			
		399-3-18	399-3-19	399-3-20	399-3-21	399-2-5	399-4-14	399-3-22
Hanford	Sandy gravel		≥2,000	>2,000	568	≥300	≥300	≥400
Hanford	Sandy gravel		2,200		No result			
Ringold	Muddy sandy gravel							
Ringold	Mud							
Ringold	Muddy sand							
Ringold	Sandy mud							
Ringold	Fine sand	0.04						
Ringold	Fine-medium sand	0.36		21.7	1.04			0.61
Ringold	Medium-coarse sand	No result		41.2	No result	1.73	No result	
Ringold	Coarse sand							
Ringold	Silty sandy gravel				0.27		2.85	
Ringold	Silty sandy gravel				0.34			
Ringold	Silty sandy gravel	38.9			2.03		1.12	1.51
Ringold	Silty sandy gravel	3.82			1.47	≥0.01		No result
Ringold	Clayey silt	Aquitard						

Notes:

Hydraulic conductivity values (Kh) in meters per day, as measured using slug tests in individual boreholes. Shading indicates finer-grained interval of concern.

PNNL-16435, Limited Field Investigation Report for Uranium Contamination in the 300-FF-5 Operable Unit at the 300 Area, Hanford Site, Washington.

SGW-36424, Borehole Summary Report for 300-FF-5 Operable Unit TCE Characterization Monitoring Wells C5575, C5706, C5707, and C5708.

PNNL-17439, 300 Area VOC Program Slug Test Characterization Results for Selected Test/Depth Intervals for Wells 399-2-5, 399-3-22, and 399-4-14.

Hanford Formation

The gravel-dominated sediment of the informally defined Hanford formation forms the remainder of the vadose zone and the upper portion of the unconfined aquifer. This stratigraphic interval contains unconsolidated and clast-supported sediment, with pebble- to boulder-sized gravel, and a poorly sorted matrix of fine- to coarse-grained sand. Silt content varies and locally fills most or all matrices between gravel clasts. Occasionally, matrix is missing, which produces an open-framework fabric. The water table is situated within the gravelly, highly permeable sediment of the Hanford formation. The thickness of the Hanford formation typically falls in the range of 13 to 19 m (42.6 to 62.3 ft). An erosional unconformity separates the Hanford formation from the underlying Ringold Formation.

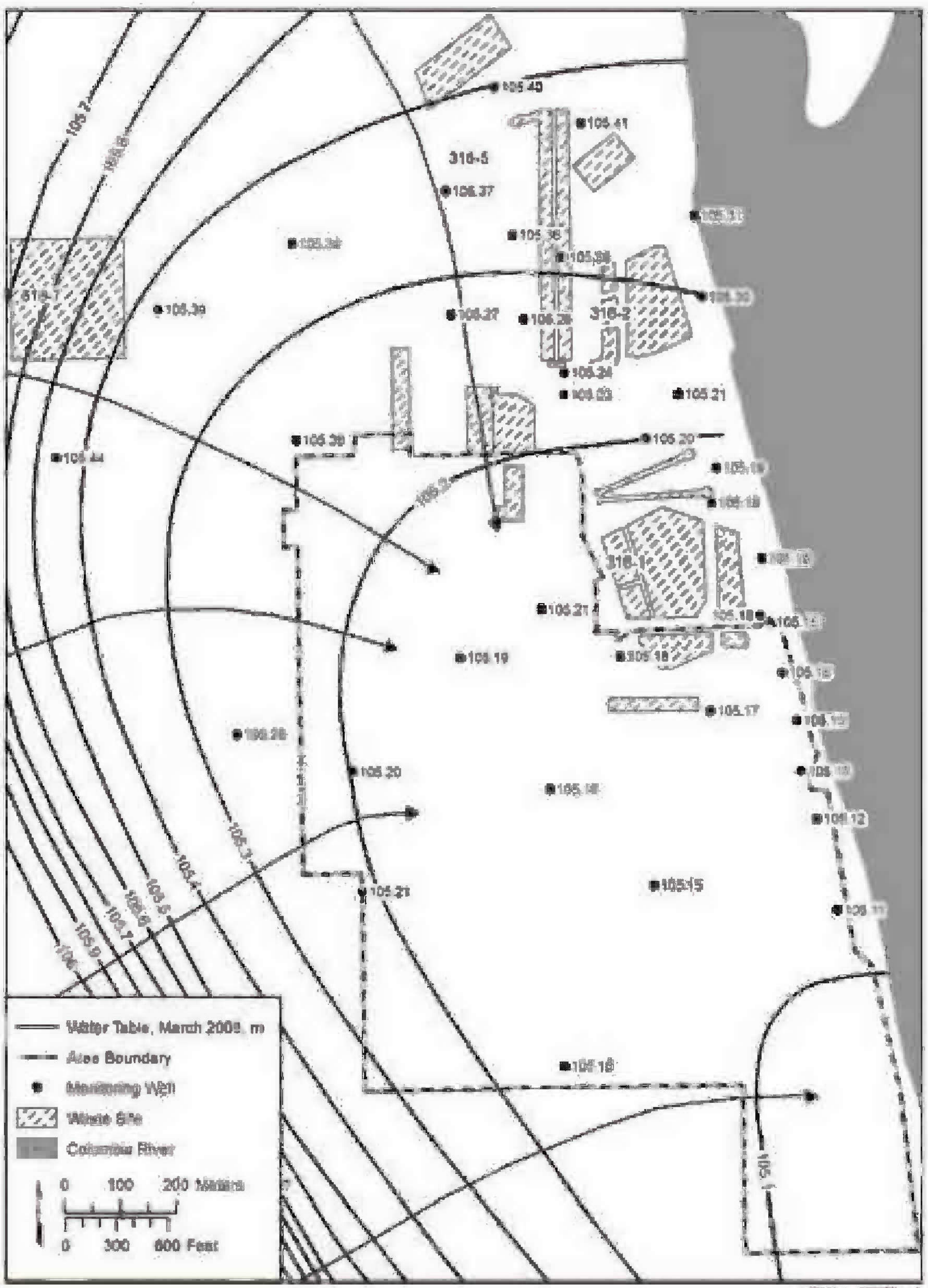
Recent drilling for hydrogeologic characterization of the vadose zone and upper portion of the unconfined aquifer did not reveal easily distinguishable or readily mapped facies/hydrogeologic changes within this formation, at least within central 300 Area locations covered by the boreholes. Within the Hanford formation, there are isolated occurrences of older, reworked Ringold Formation sediment, which is distinguished by its more cohesive sediment structure, color, and/or degree of sorting. The reworked Ringold Formation sediment also may contain zones with higher clay and silt content, and large Ringold rip-up clasts (up to 0.7 m [2.3 ft] in diameter) are occasionally present (PNNL-14834, *Sampling and Hydrogeology of the Vadose Zone Beneath the 300 Area Process Ponds*, pp. 4 to 8).

The saturated portion of the Hanford formation (i.e., portion below the water table) exhibits high permeability characteristics compared to the underlying stratigraphic intervals, with hydraulic conductivity estimates from field tests frequently exceeding 300 m/d (984 ft/d) (Table 2-11). One implication of high permeability in the upper portion of the unconfined aquifer is that if contaminants from the vadose zone enter the aquifer, they are rapidly dispersed laterally, with ultimate discharge to the Columbia River, before there is much opportunity to contaminate deeper intervals in the aquifer. However, because of the variability in hydraulic gradients that result from river stage fluctuations, vertical mixing does occur to some extent, especially in the zone of groundwater/river water interaction near the river.

Groundwater flow patterns for the upper portion of the unconfined aquifer beneath the 300 Area can be inferred from the contours shown in Figure 2-18; flow direction is generally perpendicular to the contours. For most of the year, regional groundwater movement converges into the 300 Area from the northwest, west, and southwest, causing a generally southeasterly or easterly movement beneath the 300 Area. During the seasonal period of high Columbia River discharge in the spring months, flow beneath the 300 Area becomes more southerly (PNNL-17708, pp. 2.14 to 2.21). The rate of movement for groundwater plumes can be relatively high, with a recent tracer test revealing a rate as high as 15 m/d (49 ft/d) (PNNL-17034, pp. 5.17 to 5.19). Several historical contaminant release events have been tracked from their presumed source locations along the downgradient flow path, which also indicates similar relatively high rates for plume movement (PNNL-17666, p. 3.2). Actual groundwater flow velocities within the aquifer can be even higher than the net movement rate revealed by tracking tracers and plumes. This is because plume movement may include a "back and forth" component, caused by changes in Columbia River stage fluctuations and resulting shifts in the orientation of hydraulic gradients.

Most groundwater contamination is contained within the upper portion of the unconfined aquifer and within the saturated sediment of the Hanford formation. The volume of groundwater within this interval varies with the elevation of the water table. Groundwater from the upper portion of the unconfined aquifer ultimately discharges to the Columbia River. In addition, some groundwater is removed on a regular basis at the 300 Area from a water supply well that serves the 331 Life Sciences Building (i.e., Well 399-4-12).

At the 300 Area, Columbia River stage fluctuations create dynamic hydrologic conditions in the unconfined aquifer. Hydraulic gradients change rapidly in steepness and orientation as the river stage fluctuates on daily, weekly, seasonal, and multiyear cycles (PNNL-17708, pp. 2.14 to 2.32). The water table currently moves up and down through a range of several meters, creating a subsurface zone that is alternately saturated and unsaturated with groundwater, some of which contains contamination. Complicating the scene even further, the principal COC, uranium, interacts with sediment, thus forming a zone where contamination is potentially sequestered and slowed in its ultimate transport to the river (PNNL-17034, pp. 3.4 to 3.15; Yabusaki et al., 2008, pp. 21 to 23).



Note: Direction of groundwater flow is generally perpendicular to the contours.

Figure 2-18. Water Table Elevation Contours for the 300 Area

Depending on the geochemical environment, the tendency for dissolved uranium to sorb onto, or be released from sediment, is variable. Changes in geochemical environment in saturated Hanford formation sediment are most pronounced near the Columbia River, where river water intrudes into the aquifer. River water is lower in bicarbonate content than groundwater, resulting in lower ionic strength and enhancing the tendency for uranium to adsorb onto sediment. The magnitude of this exchange and the significance regarding persistence of the plume are not clearly defined, but additional fieldwork proposed in this work plan and research activities being conducted under the Integrated Field-Scale Research Challenge Project will contribute to improved understanding.

Ringold Formation: Coarse Gravel

Cataclysmic flooding throughout the Pasco Basin during the Pleistocene epoch (approximately 1.8 million to 10,000 years before present) caused erosion into Ringold Formation sediments. These erosional channels and depressions were then filled with the much younger, coarse-grained sediment of the Hanford formation. At the 300 Area, one of two principal lithofacies in the Ringold Formation may be present at this unconformable contact: a coarse gravel facies or a relatively finer grained facies of silt and sand. Figure 2-19 shows the elevation of the contact between the Hanford and underlying Ringold formations, and which of the two lithofacies is present at the contact.

The coarse gravel lithofacies of the Ringold Formation is composed of fluvial sediment that ranges from gravel to silty/sandy gravel, with a thickness in the range 11 to 16 m (36 to 52.5 ft). Compared to the overlying Hanford sediment, Ringold gravelly sediment contains fewer basalt fragments, greater consolidation (induration), more rounded and better sorted grains, increased amounts of silt and clay, color differences, and somewhat higher amounts of naturally occurring K-40. The chemistry of the groundwater in the two formations is also different, as revealed by lower specific conductance (electrical conductivity) in the Ringold sediment.

Saturated Ringold gravelly sediment is much less permeable than the overlying saturated Hanford formation sediment because of the greater consolidation of grains, cementation, and matrix material. The highest estimate for hydraulic conductivity in recent testing of the Ringold sediment indicated 39 m/d (128 ft/d), which is lower by at least an order of magnitude than the overlying Hanford sediment (Table 2-11). While no tracer test results or plume-tracking data sets are available, movement in coarse Ringold sediment is expected to be slow compared to the overlying Hanford sediment, and probably significantly slower than 1 m/d (3.2 ft/d).

Ringold Formation: Undesignated Finer Grained Interval

This interval of Ringold Formation sediment contains lithofacies that are predominantly silt or fine-, medium-, and coarse-grained sand. Within this interval, grain size appears to increase with depth. During a recent characterization drilling program in the central portion of the 300 Area (PNNL-17666), the finer grained interval was encountered at or near the Hanford/Ringold contact and the various lithofacies were confirmed by grab and core samples. Where observed, the interval ranges in thickness from 4 to 10 m (23 to 32 ft).

Permeability is similar to or lower than the Ringold gravelly sediment, (i.e., very low to moderate) with the highest value for hydraulic conductivity from recent testing estimated to be 41 m/d (134 ft/d). Some of the attempts to collect groundwater samples from this interval during characterization drilling were met with no yield at all from the sediment. Groundwater movement through this interval is expected to be slow and significantly less than 1 m/d (3.2 ft/d). The interval is incised by the river channel, but groundwater discharge to the river would be small because of the low permeability of the sediment.

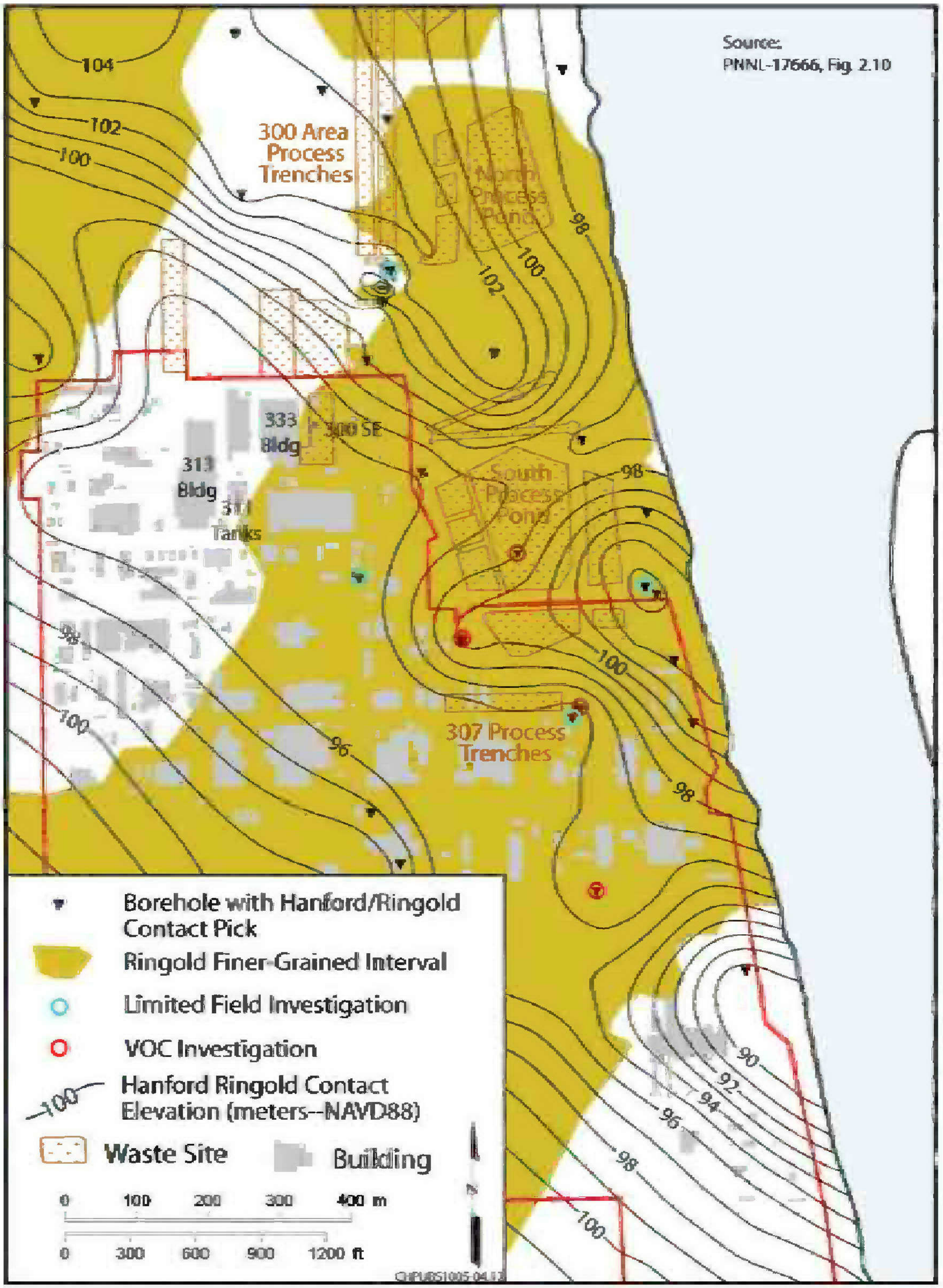


Figure 2-19. Characteristics of the Contact Surface Between the Hanford Formation and Underlying Ringold Formation

Ringold Formation Lower Mud Unit

The Ringold Formation lower mud unit underlies the Ringold Formation gravelly sediment. The unit is an aquitard that forms the lower boundary of the unconfined aquifer system. This aquitard separates the unconfined aquifer from deeper confined aquifers in the underlying Columbia River Basalt Group. The lower mud unit contains silty clay to silty sand sediment, with very low permeability. A sharp, well-defined contact boundary exists between the lower mud unit and the overlying fluvial gravel sediment. The lower mud unit can be distinguished from the overlying sediment by a higher level of natural potassium-40 (K-40) activity, as revealed by geophysical logging.

Vertical Distribution of Hydrogeologic Intervals

Geologic cross sections have been prepared to illustrate the vertical distribution of subsurface hydrogeologic features beneath the 300 Area and their relationship to the Columbia River channel (PNNL-17034, pp. 4.7 to 4.14). The Columbia River channel incises the Hanford formation and upper portions of the Ringold Formation, which may be represented by either the gravelly or finer grained interval lithofacies at the riverbed, depending on location. The cross sections also show the locations of monitoring wells and the vertical extent of open intervals in those wells. Figure 2-20 is an index map to the locations of the cross sections.

Cross section A-A', shown in Figure 2-21, is oriented north-to-south along the 300 Area shoreline of the Columbia River. The thickness of the unconfined aquifer is relatively constant along this section, although the thickness and continuity of individual lithofacies vary. Cross section B-B' shown in Figure 2-22 extends from the northwest corner of the 300 Area southeastward across locations suspected of having been sources for groundwater contamination (i.e., the former 300 Area Process Trenches and South Process Pond). Most monitoring wells have open intervals in the saturated Hanford formation sediment, although several wells have been completed to monitor the lower portion of the unconfined aquifer and a confined, permeable interval beneath the Ringold formation lower mud unit. Cross sections C-C' (Figure 2-23) and D-D' (Figure 2-24) provide information on stratigraphy beneath the central portion of the 300 Area, and their eastern ends extend across the South Process Pond. The cross section shown in Figure 2-25 extends from the southwest corner of the 300 Area northeastward. This cross section extends across a major paleochannel that is filled with permeable Hanford formation sediment; the section also crosses locations that are suspected sources for groundwater contaminants (i.e., 307 Process Trenches; South Process Pond).

2.5.4.2 400 Area

The 400 Area, situated in the west central portion of the 300 Area, contains the FFTF and the Fuels and Materials Examination Facility (FMEF). The hydrogeology beneath the 400 Area facilities is described in a report prepared in 1991 to evaluate the potential impacts on groundwater caused by waste disposal at the 400 Area Ponds (WHC-EP-0587, *Groundwater Impact Assessment Report for the 400 Area Ponds*, pp. 28 to 37). Figure 2-26 is a cross section oriented south to north across the 400 Area that illustrates the principal stratigraphic features associated with the unconfined aquifer. The following summary description is from that report unless otherwise cited.

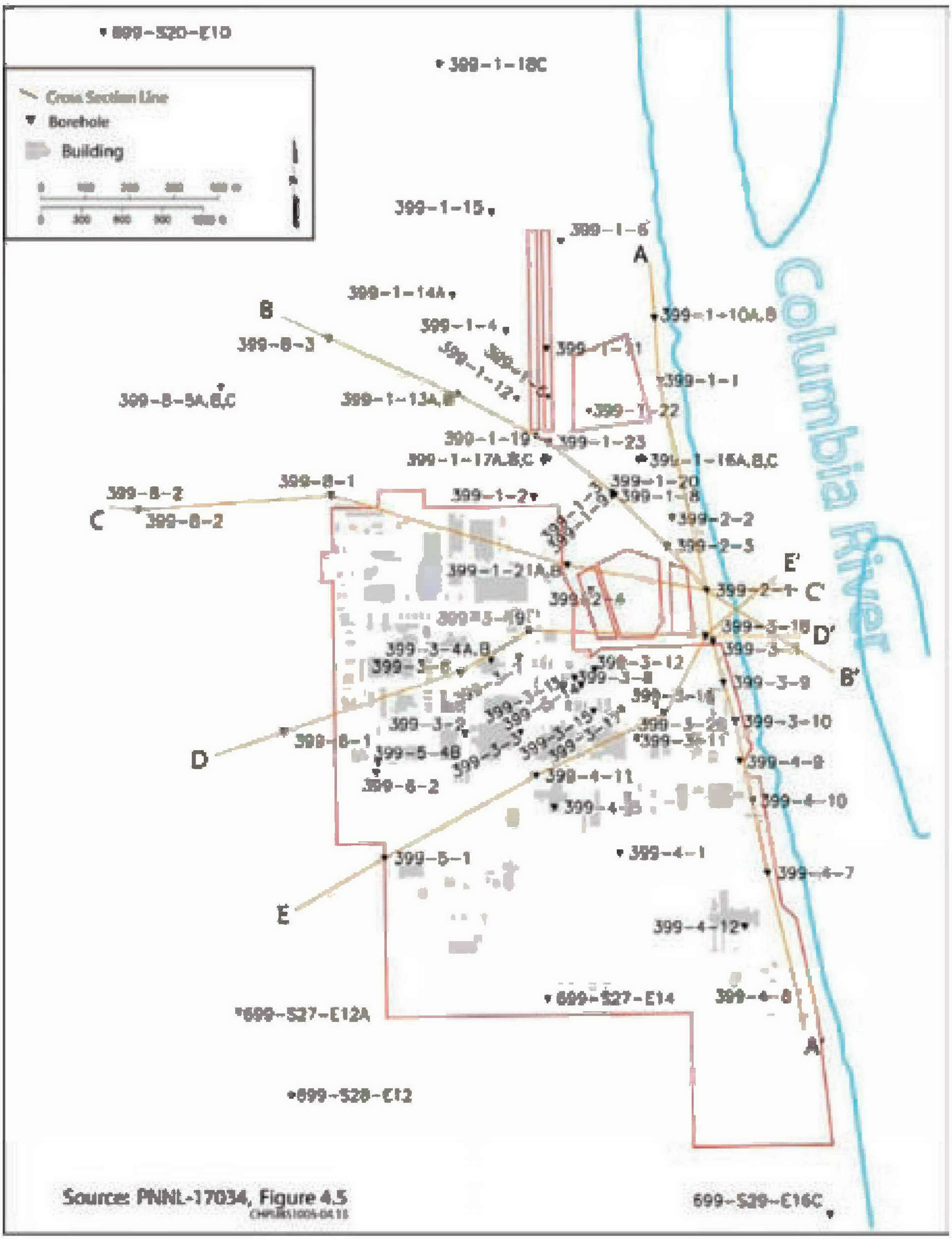


Figure 2-20. Index Map for Cross Sections that Illustrate Stratigraphic Intervals and Monitoring Well Coverage Beneath the 300 Area

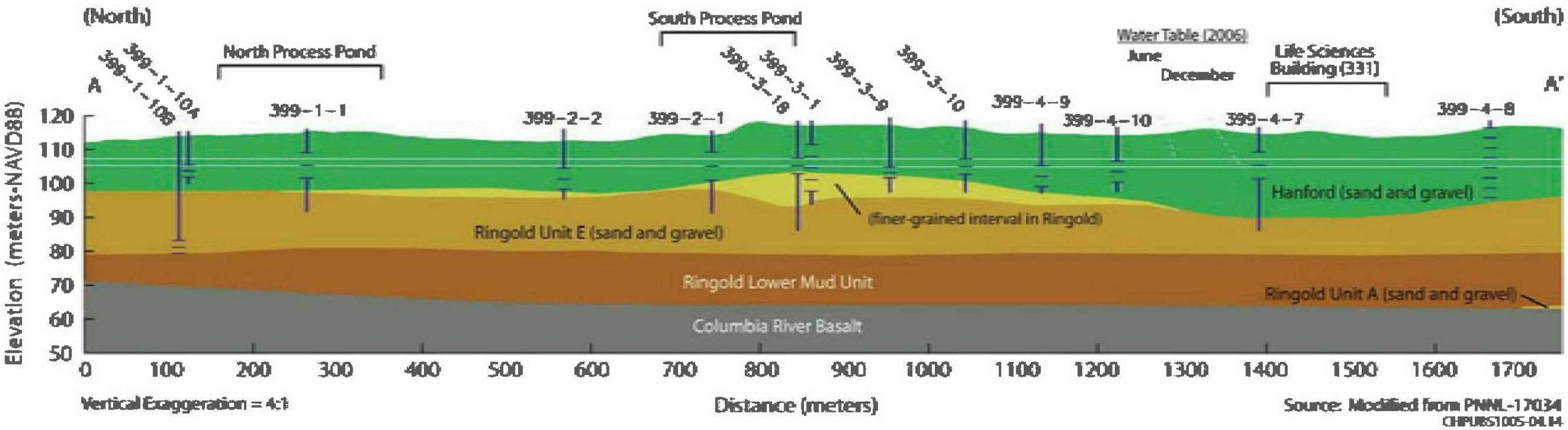


Figure 2-21. Cross Section A-A' Showing Stratigraphic Units and Monitoring Wells at the 300 Area

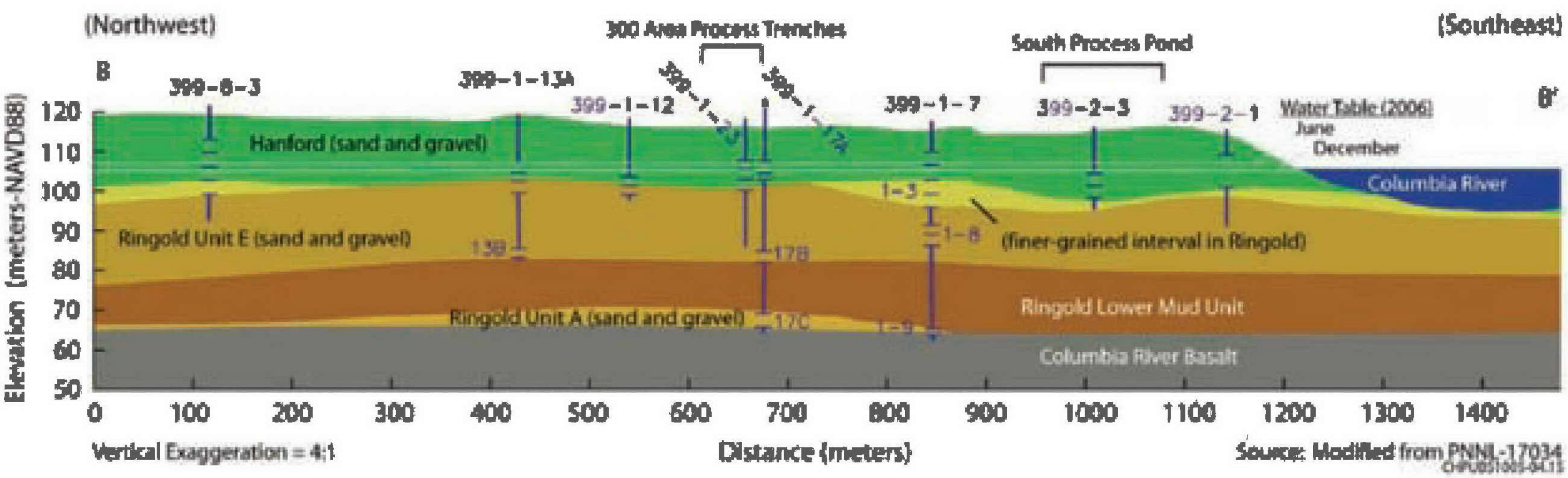


Figure 2-22. Cross Section B-B' Showing Stratigraphic Units and Monitoring Wells at the 300 Area

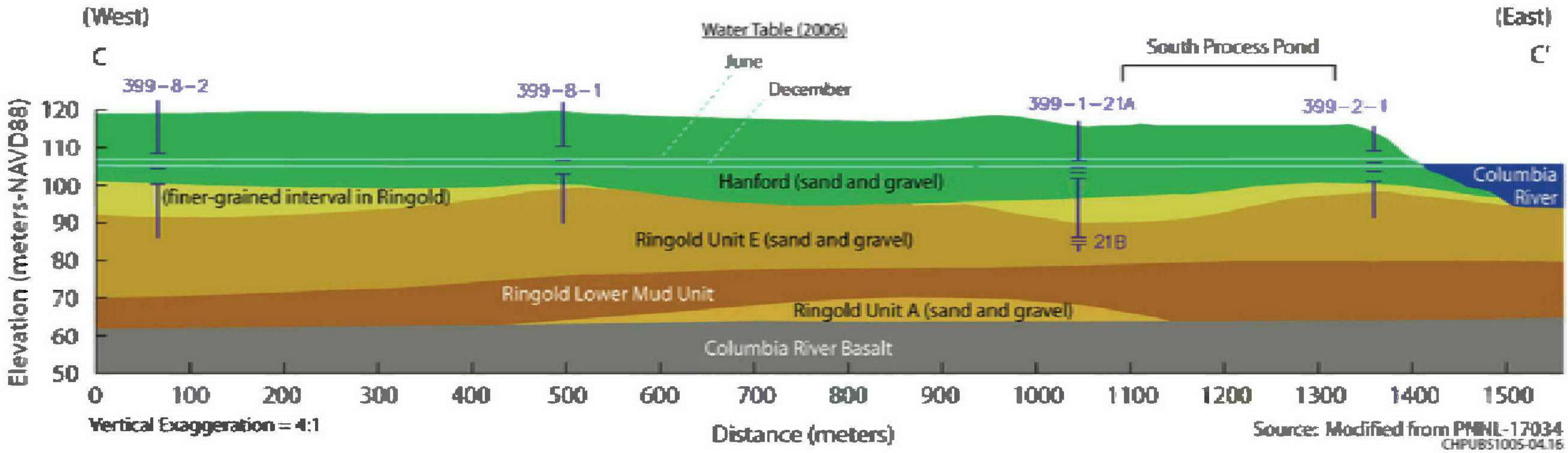


Figure 2-23. Cross Section C-C' Showing Stratigraphic Units and Monitoring Wells at the 300 Area

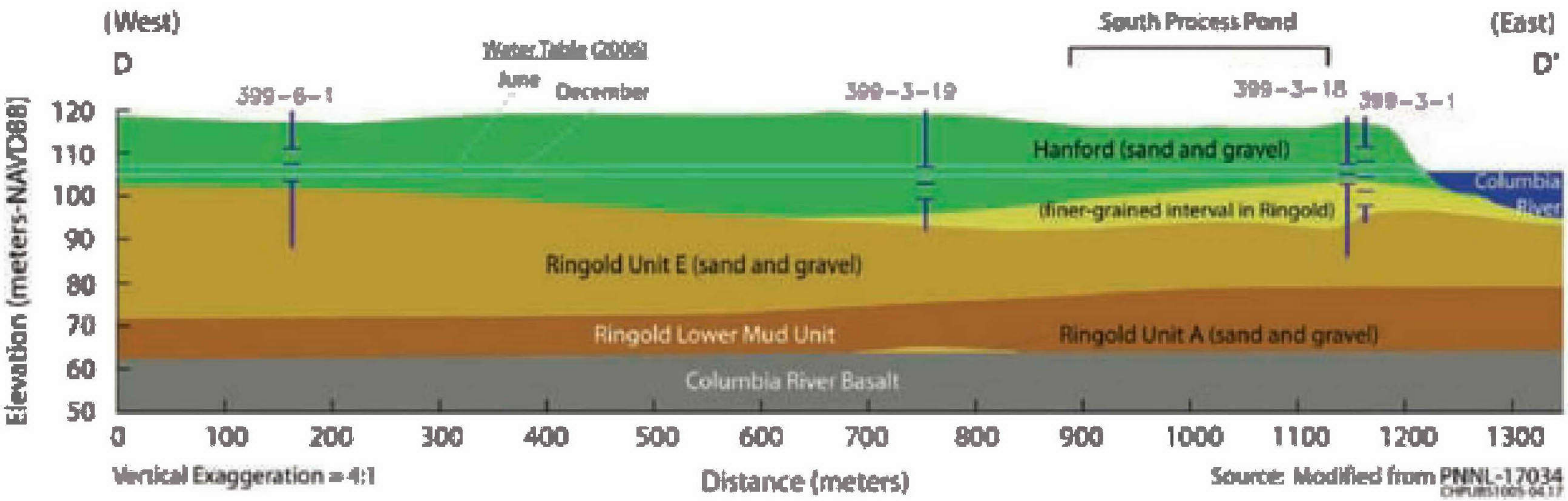


Figure 2-24. Cross Section D-D' Showing Stratigraphic Units and Monitoring Wells at the 300 Area

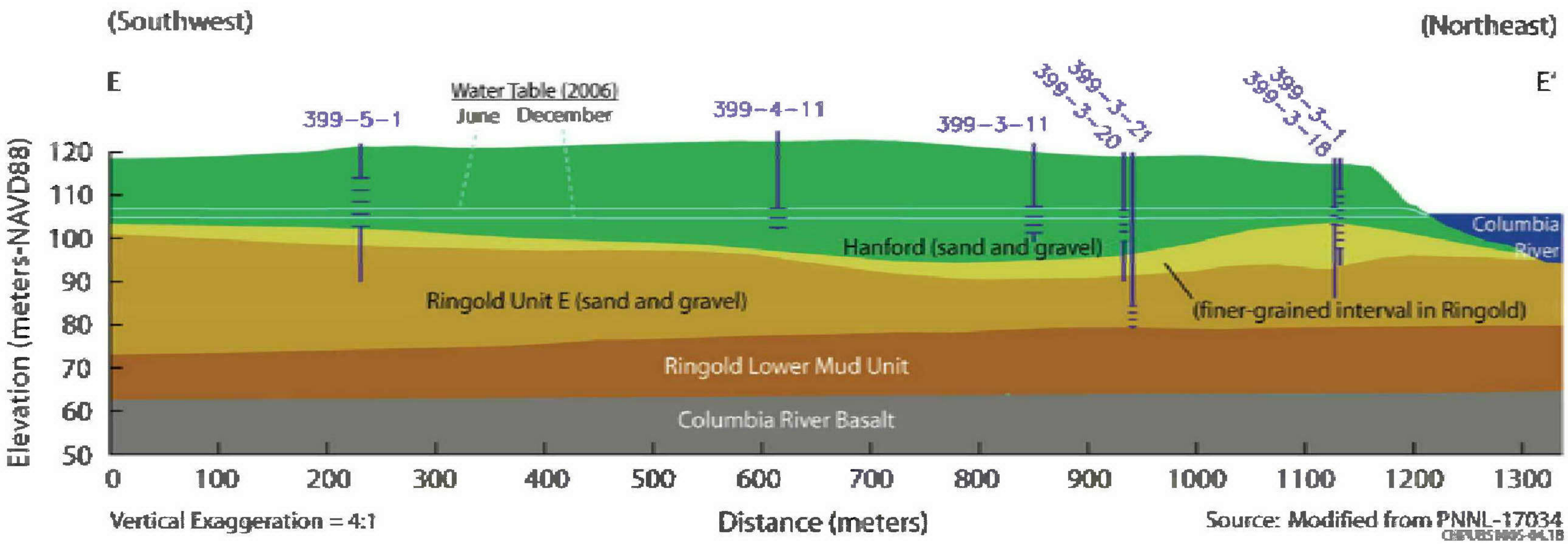
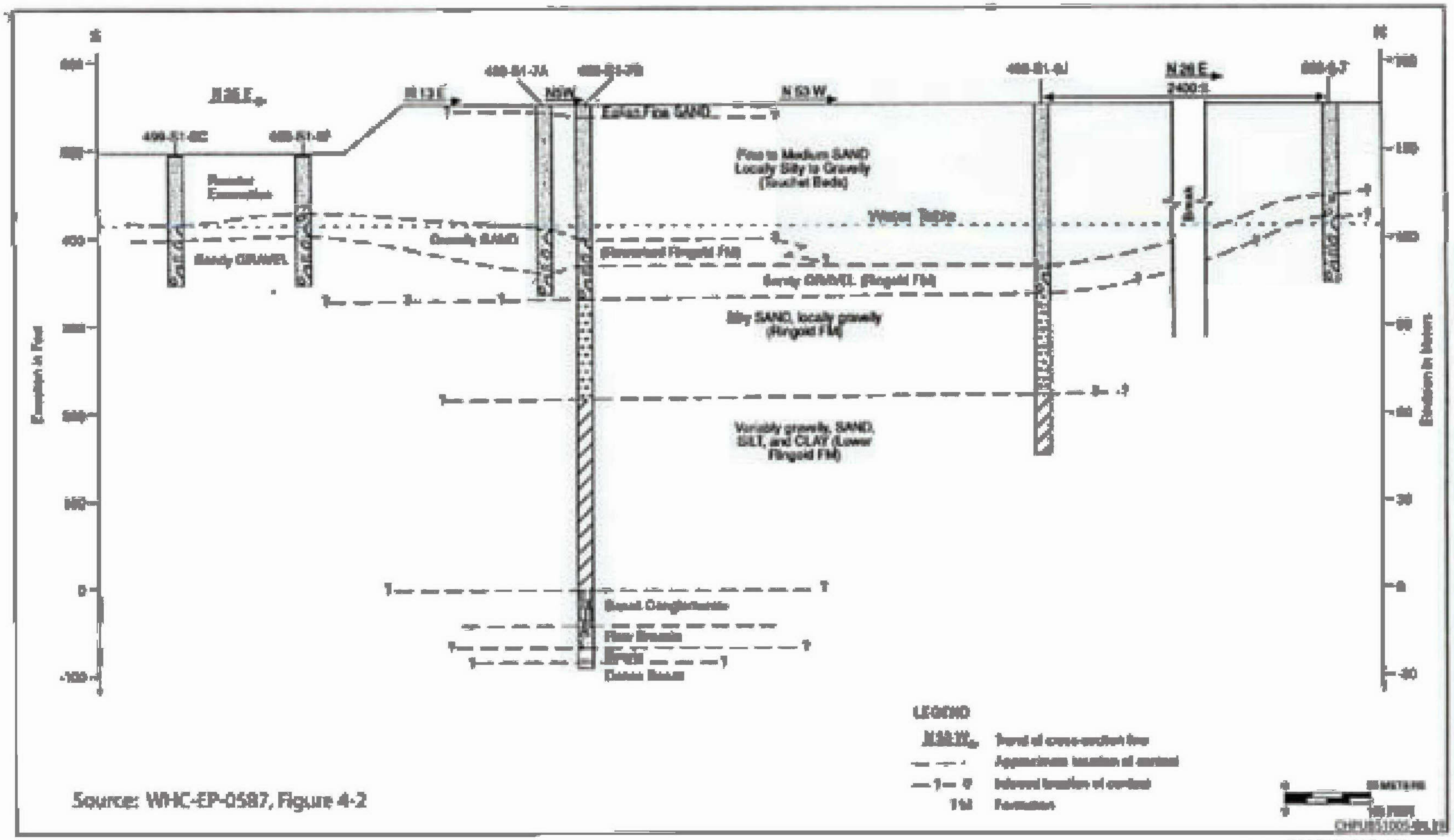


Figure 2-25. Cross Section E-E' Showing Stratigraphic Units and Monitoring Wells at the 300 Area



913 1728R/24215/10-14-92

Figure 2-26. Geologic Cross Section Showing Principal Geologic Units at the 400 Area

The stratigraphic units of interest beneath the 400 Area are similar to those described in detail above for the 300 Area in Section 2.5.4.1, with the exception of the characteristics for Hanford formation sediments. At the ground surface, windblown deposits of fine- to medium-grained sand are present as stabilized dunes where not modified by human activities. The surficial deposits overlie sandy sediments of the Hanford formation that are referred to as the Touchet Beds. These deposits represent a less energetic depositional environment than the coarse-grained, open framework gravelly deposits in the 300 Area. Characteristic features of these dense sands include clastic dikes, which are vertical structures that range in width from several inches to several feet. Their origin is related to the formation of large lakes during periods that alternated with cataclysmic flooding of the Pasco Basin (depositional features associated with Ice Age floods are described in Bjornstad, 2006, *On the Trail of the Ice Age Floods: A Geological Field Guide to the Mid-Columbia Basin*). The current water table resides near the base of the Hanford formation or in the upper portion of gravelly sediments.

The unconfined aquifer system near the 400 Area probably includes all the saturated sediments that lie above the Ringold Formation lower mud unit, as defined in BHI-00184, *Miocene- to Pliocene-Aged Suprabasalt Sediments of the Hanford Site, South-Central Washington*, at Well 699-2-6A (located near Well 699-2-7 as shown in Figure 2-26), although local areas of confined or semiconfined conditions may exist. The thickness of the unconfined aquifer is approximately 100 m (325 ft). Groundwater flow direction at the water table is generally toward the southeast.

2.5.4.3 600 Area

The stratigraphic intervals of interest beneath the several 600 Area subregion waste sites are similar to those described in detail above for the 300 Area in Section 2.5.4.1. Surficial sediment is primarily sandy material present in stabilized sand dunes where not modified by human activities. At each of the two burial grounds, the natural vegetation has been influenced by periodic range fires. The ground surface at each of the burial grounds was stabilized in 1982 and 1983. Sediment at the water table is typically gravelly in nature, but with varying degrees of compactness and cementation, which causes variability in permeability.

618-11 Burial Ground

The hydrogeology in the vicinity of the 618-11 Burial Ground is described as part of an evaluation of the transport and fate of the H-3 plume whose origin involves a release from the burial ground (PNNL-15293, *Evaluation of the Fate and Transport of Tritium Contaminated Groundwater from the 618-11 Burial Ground*, pp. 4.1 to 4.13). An additional gravelly interval referred to as the Cold Creek unit lies between the Hanford formation and underlying Ringold Formation Unit E sediments in some areas near this burial ground. The Cold Creek unit is less permeable than the Hanford sediment, but more permeable than the Ringold sediment. The movement of the H-3 plume whose origin is the burial ground appears to be closely related to the lateral variability in aquifer permeability. The stratigraphic units and coverage by monitoring wells is illustrated in Figure 2-27. Figure 2-13 provides locations of monitoring wells.

618-10 Burial Ground/316-4 Crib

The most recent information on the hydrogeology near the 618-10 Burial Ground and former 316-4 Crib comes from drilling associated with two monitoring wells in 2003. The new wells were drilled to characterize the vadose zone in the vicinity of the two waste sites with regard to radiological contamination (none found), develop a preliminary hydrogeologic model for the subregion, and expand the groundwater monitoring capability.

The land surface in this subregion is similar to most of the inland regions of the 300 Area, in that it consists of stabilized windblown deposits, except where modified by human activities. The origin for the sand is weathering of the uppermost geologic formation, (i.e., Hanford formation sediment, which forms the vadose zone beneath this subregion). The vadose zone sediment is primarily loosely consolidated sand

and gravel. Geologists' descriptions of the stratigraphy encountered and geophysical logs for the two drill sites are presented in PNNL-14320, *Soil Gas Survey and Well Installations at the 618-10 Burial Ground, 300-FF-5 Operable Unit, Hanford Site, Washington* (pp. 9 to 11, and Appendices A, B, and C). These two boreholes did not extend downward to penetrate the entire unconfined aquifer. The water table lies in the uppermost portion of the Ringold Formation Unit E (i.e., just below the contact with the overlying Hanford formation). Each new monitoring well was completed with a screened interval intended to monitor the uppermost portion of the unconfined aquifer. The unconfined aquifer contains various sandy, gravelly units within the Ringold Formation, and the lower boundary for that aquifer is likely to be the Ringold Formation lower mud unit (DOE/RL-95-73, Rev. 1).

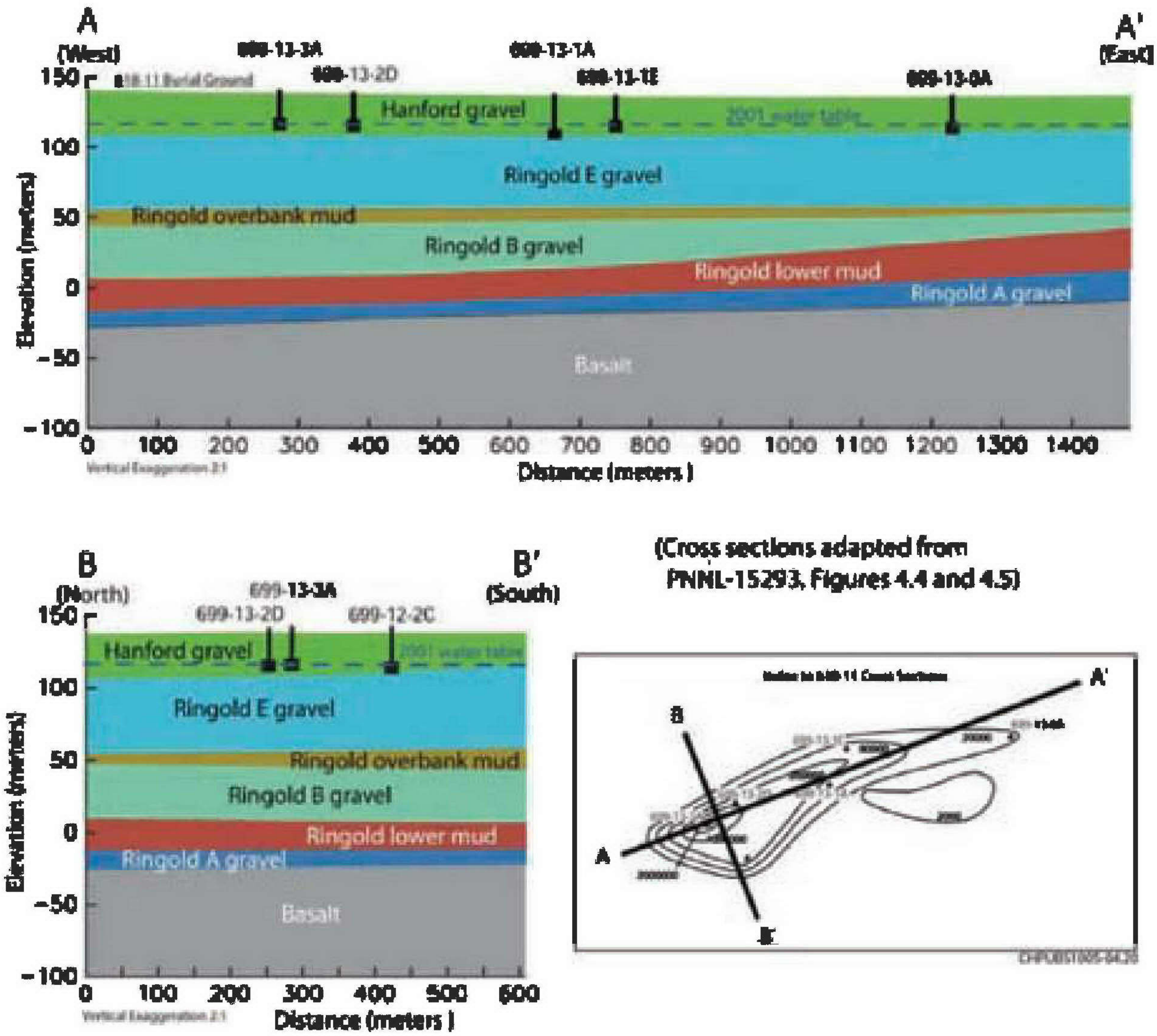


Figure 2-27. Geologic Cross Sections and Monitoring Well Coverage Near the 618-11 Burial Ground

2.5.5 Surface Water Hydrology

The flow of the Columbia River as it passes by the 300 Area is controlled by two primary factors: release of water from Priest Rapids Dam, which is approximately 84 km (52 mi) upstream of the 300 Area, and the elevation of the pool behind McNary Dam, which is approximately 85 km (53 mi) downstream of the 300 Area. The McNary Dam pool, referred to as Lake Wallula, also is influenced by flow from the Yakima and Snake Rivers, which enter the pool downstream of the Hanford Site. Figure 2-28 illustrates the variability in the river stage (i.e., elevation of the river surface) at the 300 Area, as well as the discharge from Priest Rapids Dam, which is due to the following:

- There are no major tributaries to the Columbia River between that dam and the 300 Area.
- The input of groundwater to the river is negligible compared to river discharge. The discharge shown is reasonably representative of discharge as the river flows past the 300 Area.

Water quality characteristics of the Columbia River as it passes across the Hanford Site are monitored by PNNL under the DOE's Public Safety and Resource Protection Program (DOE/RL-91-50, *Environmental Monitoring Plan United States Department of Energy Richland Operations Office, pp IIIA-16 to IIIA-19*). The results of this monitoring are reported annually in the Hanford Site Environmental Report (e.g., PNNL-17603, pp 10.29 to 10.42). The use designations for the various reaches of the Columbia River are contained in WAC-173-201A-602, "Water Quality Standards for Surface Waters of the State of Washington," and for the Hanford Reach, include all types of water supply, recreation activities, aquatic life uses (especially salmonid spawning and rearing habitat), and other uses.

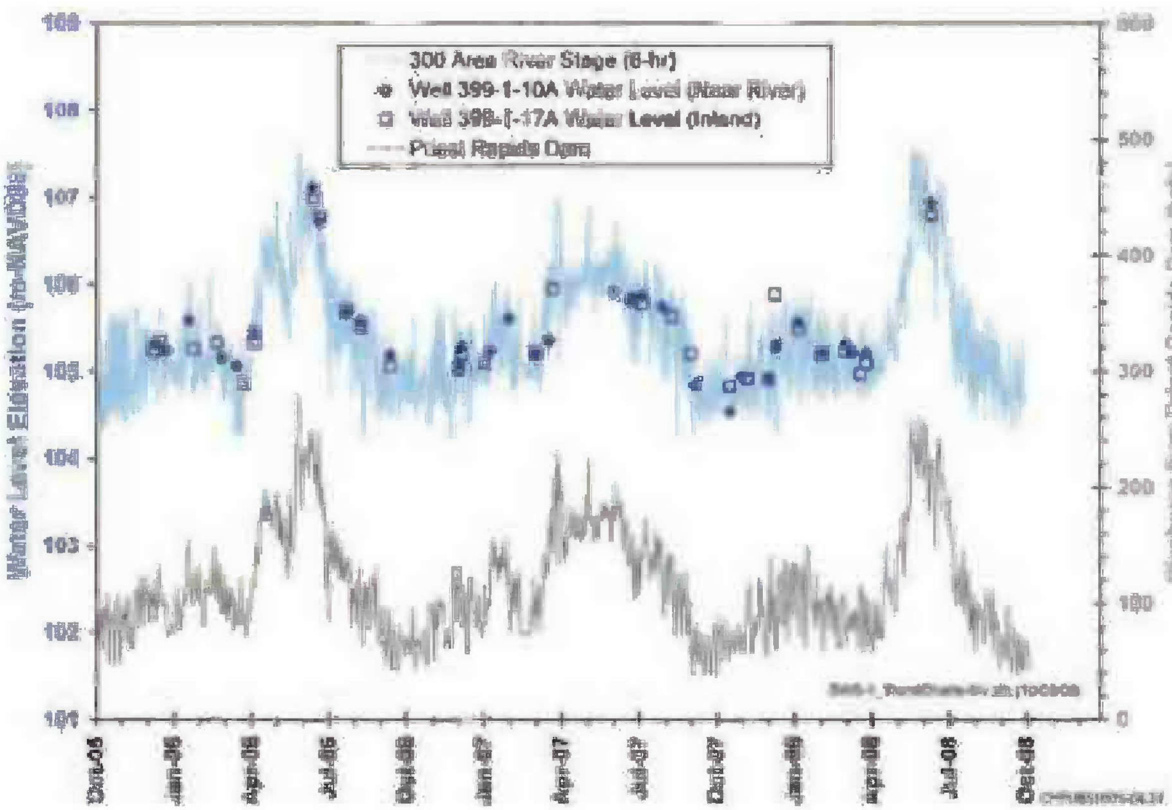


Figure 2-28. Columbia River Hydrograph at the 300 Area (Station SWS-1)

Water quality characteristics of the Columbia River as it passes across the Hanford Site are monitored by PNNL under the DOE's Public Safety and Resource Protection Program (DOE/RL-91-50, *Environmental Monitoring Plan United States Department of Energy Richland Operations Office*, pp. IIIA-16 to IIIA-19). The results of this monitoring are reported annually in the Hanford Site Environmental Report (e.g., PNNL-17603, pp. 10.29 to 10.42). The use designations for the various reaches of the Columbia River are contained in WAC-173-201A-602, "Water Quality Standards for Surface Waters of the State of Washington," and for the Hanford Reach, include all types of water supply, recreation activities, aquatic life uses (especially salmonid spawning and rearing habitat), and other uses.

2.5.5.1 Water Budget for the Groundwater/Columbia River System

The Columbia River is a gaining stream as it crosses the Hanford Site. Additions to the river include discharge from the aquifers on either side of the channel and return of irrigation wastewater at several locations along the Grant and Franklin County sides of the channel (i.e., northern and eastern sides of the channel). A summary of historical and recent estimates for the volumetric groundwater discharge from the Hanford Site aquifer to the river, using various groundwater flow models, is presented in PNNL-SA-56038, "Hanford Site Groundwater and the Columbia River, South-Central Washington" (pp. 14 to 16). Estimates generally fall in the range 36 million to 90 million m^3/yr (40 to 100 ft^3/s). These values can be put into perspective by comparing them to the discharge of the river, which ranges from 35,721 million to 223,254 million m^3/yr (40,000 to 250,000 ft^3/s).

The Columbia River shoreline for the 300 Area extends for approximately 14.5 km (9 mi), which represents approximately 23 percent of the 64 km (40-mi) shoreline length typically cited for the Hanford Site, so groundwater discharge from the 300 Area to the Columbia River may fall in the range 8 million to 20 million m^3/yr (282 million to 706 million ft^3/yr). More detailed estimates have been derived for the 300 Area shoreline as part of efforts to characterize the uranium plume. Based on three-dimensional computer simulation of groundwater flow, the average net annual flux of groundwater to the river is estimated at 315 m^3/yr per meter of shoreline (11,124 ft^3/yr per ft) (PNNL-17708, p. 5.6). For the approximately 1,200 m (3,900 ft) of shoreline impacted by the uranium plume (Section 2.6 provides a description of extent of contamination), the volume of groundwater discharge associated with the plume would be 0.38 million m^3/yr (equivalent to 0.42 ft^3/s) based on the net annual flux.

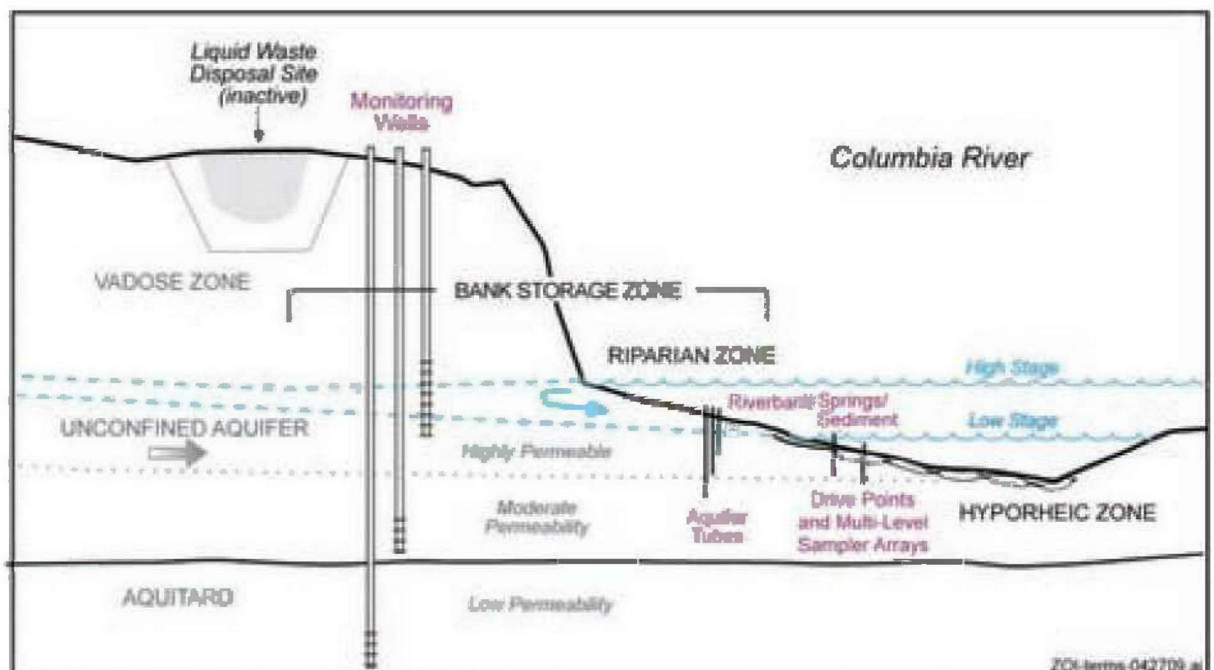
2.5.5.2 Groundwater/Surface Water Interface

The Columbia River channel incises the several stratigraphic intervals of interest within the unconfined aquifer system beneath the 300 Area. In the channel adjacent to the 300 Area, the most contaminated interval (i.e., the saturated sediment of the Hanford formation) is completely incised by the channel, so groundwater discharge from that sediment is potentially exposed over a fairly broad area of riverbed, estimated to be approximately 0.17 km^2 (0.06 mi^2) (PNNL-17034, pp. 4.17 to 4.22). In some areas, a layer of recent alluvium covers the area of potential exposure. Where the riverbed alluvium consists of coarse-grained sediment (gravel, cobbles, boulders), river water is entrained in the pore space.

Figure 2-29 is a schematic cross section that illustrates the various features associated with the unconfined aquifer and the river channel and identifies terminology commonly used to describe the interface. River water in the channel is entrained within the periodically saturated portion of the riverbanks as well as in the continuously submerged riverbed substrate (the subsurface zone beneath a stream channel that is influenced by the stream is often referred to as the "hyporheic zone"). Groundwater meets river water within this zone and the interaction between the two water types can have significant implications with regard to the transport and fate of contaminants. Because the Columbia River stage in the Hanford Reach of the river undergoes substantial cyclic variations (Figure 2-28), hydraulic and water quality conditions in the zone beneath the shoreline can change dramatically and quickly, cycling at some locations between pure groundwater and pure river water during the course of a daily cycle. The lateral intrusion of river water into the riverbank, along with the "damming" of groundwater moving toward the river during periods of high river stage, is referred to as "bank storage."

Sites of potential exposure of contaminants carried by groundwater include the riverbed substrate and riverbank springs that appear during periods of low river stage. Springs regularly appear at several locations along the 300 Area shoreline, and more have been documented to appear on an intermittent basis at additional locations along the entire 300 Area shoreline (PNL-5289, *Investigation of Ground-Water Seepage from the Hanford Shoreline of the Columbia River*, pp. A.1 to A.6; PNL-7500, *1988 Hanford Riverbank Springs Characterization Report*, pp. 24 to 27; WHC-SD-EN-TI-125, *Sampling and Analysis of the 300-FF-5 Operable Unit Springs and Near Shore Sediments and River Water*, pp. A.1 to A.3; PNNL-13692, *Survey of Radiological and Chemical Contaminants in the Near-Shore Environment at the Hanford Site 300 Area*, pp. 3.2 to 3.5). Riverbank springs, along with sediment at the spring and nearshore river water, are monitored under the DOE's Public Safety and Resource Protection Program (DOE/RL-91-50, pp. IIIA-14 to IIIA-20). The results of this monitoring are reported annually in the Hanford Site Environmental Report (e.g., PNNL-17603, pp. 10.47 to 10.54).

An investigation of groundwater discharge through the riverbed adjacent to the 300 Area began in 2008 and involved geophysical surveys of the channel, which are helping to reveal the exposure extent of the various stratigraphic intervals, and the installation of fiber optic cables on the riverbed. These cables record temperature along their length (which may extend to 1 km [0.62 mi^2]) and will expectantly reveal areas of preferential groundwater discharge, as indicated by temperature anomalies.



Note: Modified from PNNL-13674, Figure 1.1.

Figure 2-29. Schematic Cross Section Showing Principal Features of the Aquifer/River Channel Interface

2.5.5.3 Zone of Groundwater/River Water Interaction

The subsurface zone beneath the river shoreline where groundwater and river water meet is dynamic in terms of rapid changes in hydraulic gradients and groundwater movement, and the geochemical environment. Because of the implications for predicting contaminant transport to the Columbia River, several recent investigations have been focused on characterizing this zone. General characteristics of flow and water quality considerations for the zone of interaction at 100 Area locations are described in PNNL-13674, *Zone of Interaction Between Hanford Site Groundwater and Adjacent Columbia River*. That investigation involved a two-dimensional computer simulation of flow through the zone under transient river boundary conditions, and revealed flow paths for groundwater to pass through the zone and enter the riverbed. The investigation also summarized data available to anticipate the amount of contaminant dilution caused by the interaction of groundwater and river water. Many near-river monitoring sites show on the average a reduction of contaminant concentrations to approximately one-half their values in groundwater approaching the river. More recent investigation of contaminant concentration reduction at shoreline sites along the 300 Area indicates slightly less but similar dilution of contaminants before their discharge at riverbed exposure locations (PNNL-17034, pp. 3.12 to 3.15).

Various field methods to monitor the rapid changes in the zone of groundwater/river interaction were investigated and tested during 2006 to 2007 as part of DOE's Remediation and Closure Science Project basic research activities (PNNL-16805). The value of readily available cost-effective methods, such as driven casing and in situ monitoring probes, was demonstrated.

2.5.6 Environmental Resources

A comprehensive description of the terrestrial and aquatic ecosystems associated with the Hanford Site is presented in PNNL-6415, pp. 4.83 to 4.113.

2.5.7 Human Resources (Including Cultural)

Comprehensive descriptions of cultural, archaeological, and historical resources associated with the Hanford Site are presented in PNNL-6415, pp. 4.115 to 4.136, as are descriptions of the socioeconomics, visual resources, and other resources related to human activities (PNNL-6415, pp. 4.137 to 4.172).

2.6 Extent of Contamination

This section provides a description of the extent of contamination in the various subregions of the 300 Area (i.e., 300 Area industrial complex, 400 Area, and 600 Area). The descriptions progress from facilities (process operations) and waste sites, through various environmental pathways. (i.e., the vadose zone) the aquifer, and interface with the Columbia River. An attempt has been made to distinguish between contamination likely to remain within a waste site from contamination with the potential to migrate away from source locations through environmental pathways. The level of detail in the descriptions is intended to be sufficient to support the subsequent discussion of the CSMs and data needs presented in Chapter 3 and the SAP presented in DOE/RL-2009-45.

2.6.1 Waste Sites and Vadose Zone Contamination

Through numerous explorations, investigations, and cleanup activities, chemical and radiological contamination has been identified in soil within the 300 Area at numerous locations. These contaminant source areas have been designated as waste sites (Section 2.2) and can be organized into several groups for describing the extent of contamination. Each group has a different potential for contaminant migration away from the source location. The first grouping describes waste sites, including remaining pads/foundations and structures left from the D4 of primary source facilities, for which removal actions can remove essentially all contamination. Little or no contamination is likely to remain at the site, and that which may remain is immobile under current environmental conditions. These waste sites include structures, facility foundations, and pads left after D4; debris sites; and soils contaminated with dust and small liquid releases.

Next are source locations where contamination remains and there is some potential for migration from the engineered facility, such as pipelines and components of the various liquid transport systems in the 300 Area (industrial complex), to migrate deeper into the vadose zone, but with a low likelihood of affecting groundwater. These include locations of unplanned liquid releases and are mainly represented by locations in the 300 Area where the process and radiological sewer systems failed during the fuel production years. The process sewer was used to transport large volumes of liquid wastes from production and laboratory facilities to the principal liquid waste disposal facilities (i.e., the process ponds and trenches). The solid waste burial grounds fall into a similar grouping, although the potential for contamination migrating deeper into the vadose zone comes from subsequent activities, and not by the actual burial of waste materials. For example, major excavation activities and associated dust suppression/soil fixative application could provide a mechanism for transporting some contamination deeper into the vadose zone.

The final group includes the principal liquid waste disposal sites, which have the greatest potential for contaminants to have migrated from the source facility, through the vadose zone, and into groundwater. The large volumes of liquid effluent provided a driving mechanism for more widespread dispersal of contamination along environmental pathways. Liquid wastes intentionally were discharged to the soil column at ponds, ditches, and trenches.

2.6.2 Resources for Describing the Extent of Soil Contamination

Soil contamination within the 300 Area is addressed under the 300-FF-1 and 300-FF-2 OUs. Remedial actions for the 300-FF-1 OU were initiated in 1997 in accordance with EPA/ROD/R10-96/143 and DOE/RL-96-70, *300-FF-1 Remedial Design Report/Remedial Action Work Plan*. All waste sites in the 300-FF-1 OU have been closed out, with the exception of one, waste site 300-275 (Section 2.2, Table 2-4), which is a potential landfill on the edge of the river. Some contamination may remain at these waste sites in the shallow vadose zone (i.e., within approximately 5 m [15 ft] of the ground surface), and this contamination is documented in the CVPs. The CVPs are the primary resource for inferring the remaining contamination in the 300 Area shallow vadose zone. Other resources include:

- Reports prepared to document the RI process under CERCLA, such as technical baseline reports (PNL-7241, *Data Compilation Task Report for the Source Investigation of the 300-FF-1 Operable Unit Phase I Remedial Investigation*; EMO-1026; BHI-00012)
- LFI reports (DOE/RL-96-42 for the 300-FF-2 OU)
- Focused FS reports (DOE/RL-99-40, Focused Feasibility Study for the 300-FF-2 Operable Unit)
- Remedial design/remedial action work plans (DOE/RL-2001-47, *Remedial Design Report/Remedial Action Work Plan for the 300 Area*, for the 300-FF-2 OU)

For the 300 Area subregion, information on contamination deeper in the vadose zone is found in reports describing several recent characterization borehole investigations in the 300 Area. These investigations include an LFI for uranium (PNNL-16435) and similar characterization drilling associated with trichloroethene (PNNL-17666). Vadose zone samples from those drilling campaigns have undergone extensive laboratory analysis, with some analyses and interpretive work still underway (PNNL-15121 and PNNL-17793). A comprehensive geologic description of vadose zone and aquifer sediments encountered during the two characterization drilling campaigns is presented in PNNL-14834. Near-surface sampling of vadose zone sediments in the North and South Process Ponds and 303-K Building vicinity was performed as part of the 300 Area Uranium Leach and Adsorption Project (PNNL-14022, *300 Area Uranium Leach and Adsorption Project*). Recently, a description of the uranium contamination in the 300 Area subsurface and conceptual model regarding fate and transport was prepared (PNNL-17034). The conceptual model was further refined in PNNL-17793, which describes uranium extraction studies using sediment samples collected during the characterization drilling performed for the trichloroethene investigation (PNNL-17666).

At the outlying 400 and 600 Area subregions, the field data available to characterize contamination in the deeper vadose zone are less extensive than at the 300 Area. Some information is available from drilling near the 618-11 Burial Ground (BHI-01567, *Borehole Summary Report for the 618-11 Burial Ground Tritium Investigation*), although soil samples were not analyzed for contaminants during that activity. At the 618-10 Burial Ground, some information on vadose zone characteristics is available in PNNL-14320, *Soil Gas Survey and Well Installations at the 618-10 Burial Ground, 300-FF-5 Operable Unit, Hanford Site, Washington* (pp. 4 to 8), but only field screening for contamination was conducted in the vadose zone; none was encountered. At each of those burial grounds, soil gas investigations were conducted that collected samples from depths up to 6 m (20 ft) below ground surface (bgs) (PNNL-13675, *Measurement of Helium-3/Helium-4 Ratios in Soil Gas at the 618-11 Burial Ground*, pp. 5 to 11 for the 618-11 Burial Ground; PNNL-14320, pp. 12 to 18, for the 618-10 Burial Ground). Excavation of the former 316-4 Crib, located adjacent to the 618-10 Burial Ground, did encounter soils contaminated by uranium and tributyl phosphate. At the 400 Area, a discussion of potential contaminant movement from disposal sites at the surface to groundwater is presented in WHC-EP-0587, pp. 48 to 51, but no drilling or sampling for characterizing contamination in the vadose zone is known to have been conducted.

2.6.3 Groundwater Contamination

A general description of contamination in groundwater beneath the Hanford Site is prepared each year in the annual groundwater monitoring report for the Hanford Site (e.g., DOE/RL-2008-66 for October 1, 2007 to September 30, 2008). Maps showing where radionuclides and hazardous chemicals are present at concentrations exceeding the EPA drinking water standards are included in the summary for that report, and are reproduced here as Figures 2-30 and 2-31. Descriptions of groundwater contamination in the 300 Area can be found in the annual groundwater reports as follows: 300-FF-5 Groundwater OU (pp. 2.12-1 to 2.12-32), 200-PO-1 Groundwater OU (pp. 2.11-1 to 2.11-47), and 1100-EM-1 Groundwater OU (pp. 2.13-1 to 2.13-10). The descriptions for each groundwater OU are presented by contaminant, and for the 300-FF-5 Groundwater OU, separate descriptions are provided for the 300 Area, the 618-11 Burial Ground, and the 618-10 Burial Ground/316-4 Crib. Contaminants described in the annual groundwater monitoring reports are based on various lists of COCs or COPCs as identified during the early phases of the RI for the 300-FF-5 Groundwater OU. Table 2-12 lists groundwater constituents previously identified as COCs or COPCs. The strategy for updating the target analyte list for soils and the COPC list for groundwater is presented in Chapter 4, Section 4.5.

In addition to contaminants in groundwater identified for the 300-FF-5 Groundwater OU, some groundwater contaminants beneath the 300 Area have origins at locations outside of the 300 Area. These contaminants include those with origins in the 200 East Area (200-PO-1 Groundwater OU) and to the south of the 300 Area (1100-EM-1 Groundwater OU). Groundwater contaminants associated with the 200-PO-1 Groundwater OU include I-129, nitrate, Tc-99, and H-3, while those associated with the 1100-EM-1 Groundwater OU include pesticides, Tc-99, and VOCs. In addition, some contamination migrates into the 300 Area from regions to the southwest that are not part of sources associated with a CERCLA action (e.g., nitrate from agricultural activities).

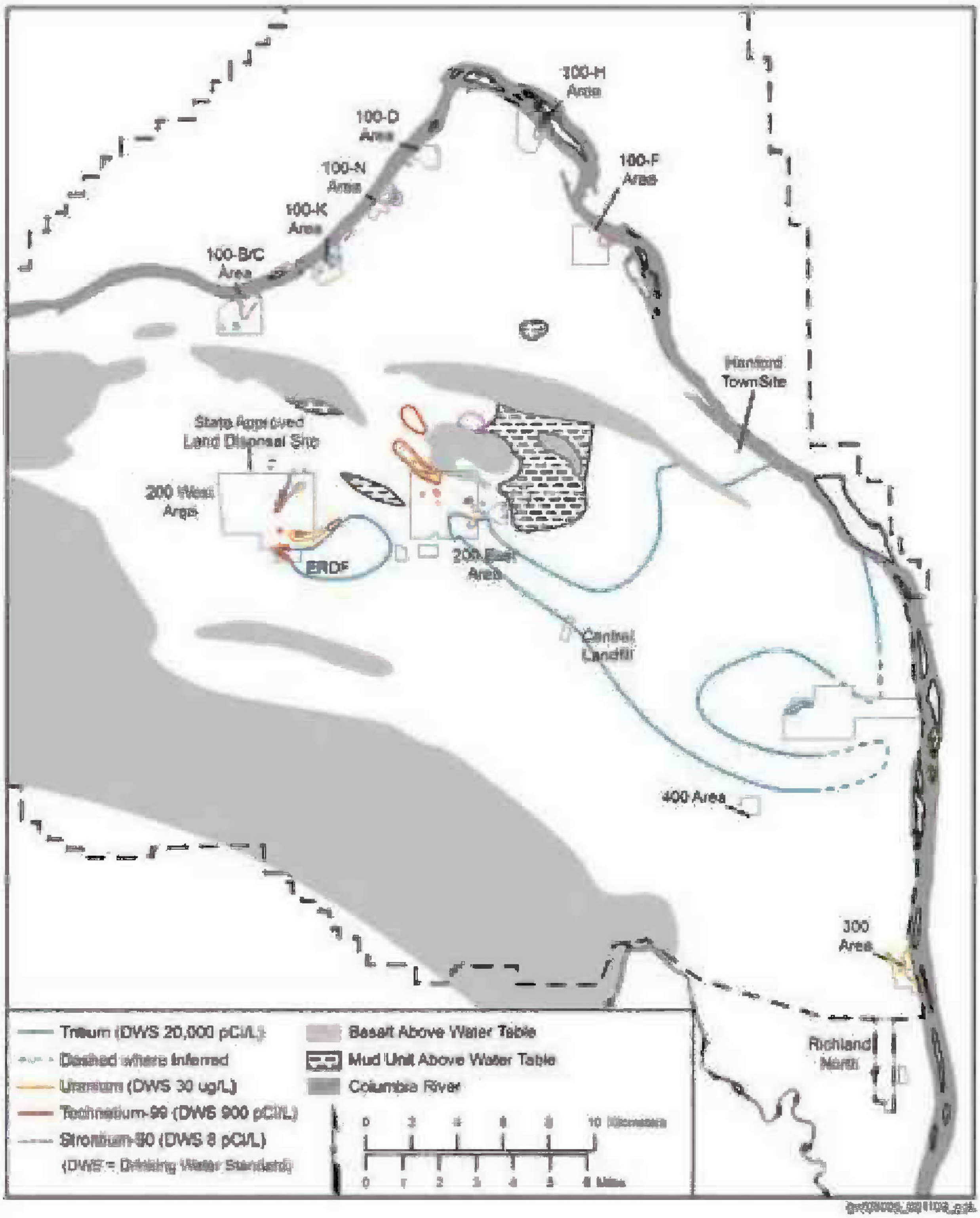


Figure 2-30. Distribution of Radionuclides at Concentrations Exceeding the Drinking Water Standards in Groundwater Beneath the Hanford Site

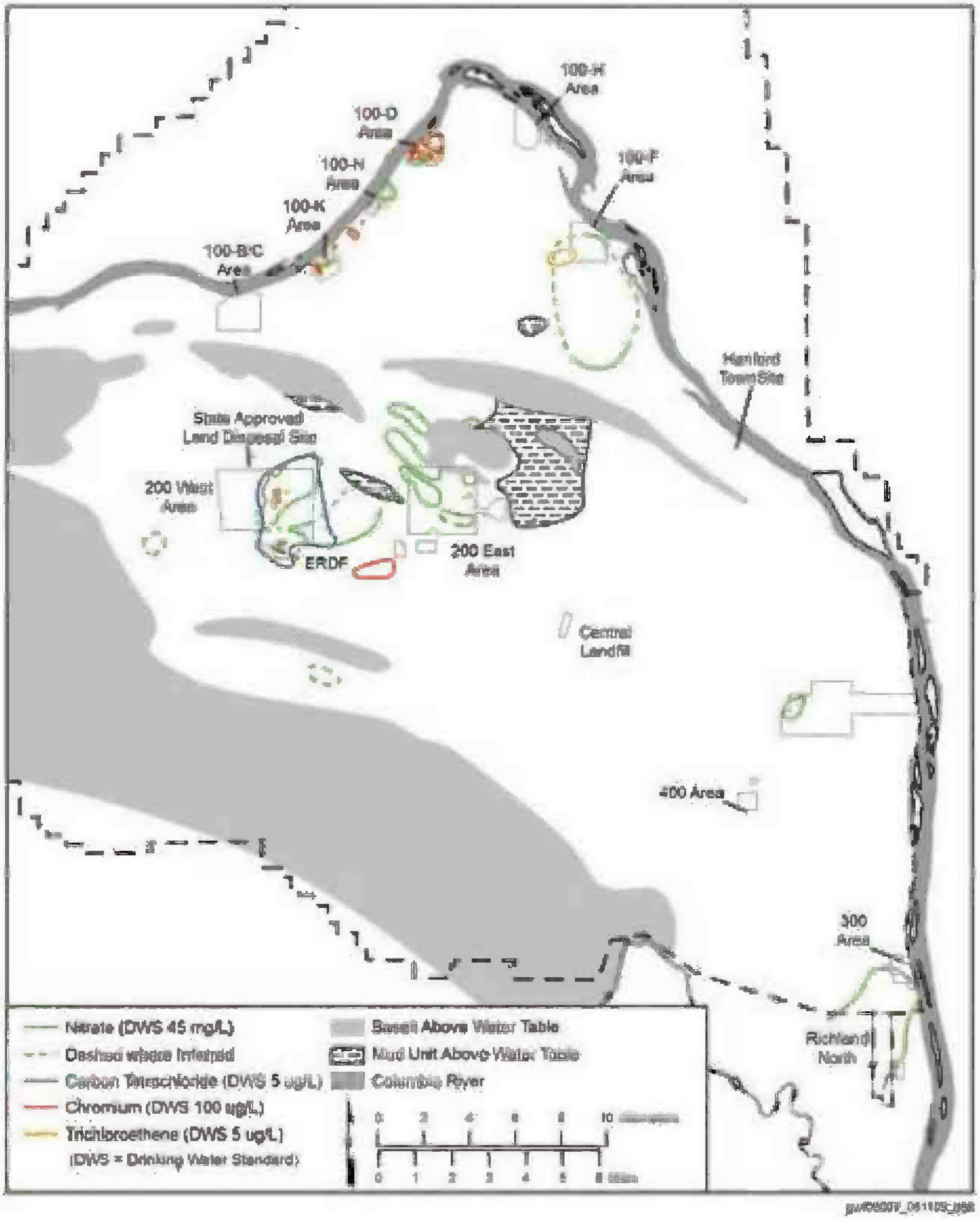


Figure 2-31. Distribution of Hazardous Chemicals at Concentrations Exceeding the Drinking Water Standards in Groundwater Beneath the Hanford Site

Table 2-12. Constituents of Interest Previously Identified for the 300-FF-5 Groundwater OU

Constituent in Groundwater	ROD[a]	ESD[b]			PNNL-15127[c]		
	300 Area	300 Area	618-11	618-10/ 316-4	300 Area	618-11	618-10/ 316-4
Nitrate	—	—	—	—	COPC	COPC	COPC
Uranium	COC	COC	—	COPC	COC	COPC	COPC
cis-1,2-Dichloroethene	COC	COC	—	—	COPC	—	—
Tetrachloroethene	—	—	—	—	COPC	—	—
Tributyl Phosphate	—	—	—	COPC	—	—	COPC
Trichloroethene	COC	COC	—	—	COPC	—	—
Sr-90	—	—	—	—	COPC	—	—
Tc-99	—	—	—	—	—	COPC	COPC
H-3	—	—	COPC	—	COPC	COPC	COPC
U-234	COC[d]	COC[d]	—	COC[d]	COC[d]	COC[d]	COC[d]
U-235	COC[d]	COC[d]	—	COC[d]	COC[d]	COC[d]	COC[d]
U-238	COC[d]	COC[d]	—	COC[d]	COC[d]	COC[d]	COC[d]

Notes:

Source: Modified from PNNL-16454, Current Conditions Risk Assessment for the 300-FF-5 Groundwater Operable Unit, p. 1.4, Table 1.1.

a. EPA/ROD/R10-96/143, Declaration of the Record of Decision for the 300-FF-1 and 300-FF-5 Operable Units, Hanford Site, Benton County, Washington.

b. EPA/ESD/R10-00/524, Explanation of Significant Difference for the 300-FF-5 Record of Decision.

c. PNNL-15127, Contaminants of Potential Concern in the 300 FF 5 Operable Unit: Expanded Annual Groundwater Report for Fiscal Year 2004.

d. Isotopic uranium may be used for risk assessment at locations where uranium is a COC or COPC.

At the Columbia River, contamination in groundwater is monitored under the CERCLA program using samples from near-river wells and aquifer tubes installed beneath the shoreline (DOE/RL-2000-59, *Sampling and Analysis Plan for Aquifer Sampling Tubes*). Results of this monitoring are presented in the annual groundwater report mentioned above and in a separate annual report describing the results of sampling at aquifer tubes (e.g., SGW-35028, *Aquifer Sampling Tube Results for Fiscal Year 2007*, pp. 3.10 and 3.11, for FY 2007). Near-river wells and aquifer tubes are located primarily along the 300 Area shoreline, with more widely spaced sites along the 300 Area shoreline upstream from the 300 Area.

Contamination in riverbank springs (water and sediment), Columbia River water, and aquatic organisms is monitored as part of the Surface Environmental Surveillance Project, a component of the DOE's Public Safety and Resource Protection Program (DOE/RL-91-50, pp. IIIA-1 to IIIA-55). The schedule for environmental surveillance sampling is published annually (e.g., PNNL-18177, *Hanford Site Environmental Surveillance Master Sampling Schedule for Calendar Year 2009*), and includes information on co-sampling conducted as part of oversight roles for the Washington State DOH and the

U.S. Food and Drug Administration. The results of all environmental monitoring activities are described in an annual report (e.g., PNNL-18427 for calendar year 2008).

2.6.4 Contamination in the 300 Area Industrial Complex

The following subsections describe contamination along environmental pathways in the 300 Area industrial complex.

2.6.4.1 Waste Sites, Facilities, and Vadose Zone

Primary sources of contamination in the 300 Area are associated with the uranium fuel production facilities, R&D laboratories supporting uranium fuel production and 200 Area plutonium extraction pilot and laboratory tests, and various other mission-supporting activities (WHC-MR-0388; EMO-1026; PNL-7241; BHI-00012). Materials released to the soil beneath the uranium fuel production facilities may have included the following (WHC-MR-0388, pp. 1 to 24):

- Uranium bearing acid (nitric and sulfuric acid with uranium in solution)
- Neutralized acid waste (typically sodium fluoride, sodium nitrate, sodium dichromate, and sodium sulfate in solution with precipitates of uranium, chromium, copper, and zirconium)
- Etch acids (nitric, hydrofluoric, sulfuric, and chromic acids)
- Tetrachloroethene
- Trichloroethene
- Sodium hydroxide solutions
- Contaminated water

Additionally, the lathing, machining, and other manufacturing processes conducted primarily in the 313 and 314 Buildings spread airborne particulates of uranium, thorium, lead, cadmium, bismuth, aluminum, and barium throughout the northern portion of the 300 Area, resulting in the contamination of soils and facilities. The facilities in the 300 Area that were the primary sources of contamination are listed below with associated waste sites and expected contaminant constituents based primarily on process history.

2.6.4.2 Source Locations with Limited Potential for Extensive Migration of Contaminants

313 Nuclear Fuels Manufacturing Support Building. Associated waste sites include UPR-300-38, uranium-contaminated soil beneath the existing 313 Building foundation; 300-260, lead- and barium contaminated soil west of the 313 Building; 300-270, soil contamination below the 313 Building loading dock (closed out); and UPR-300-44, unplanned release around process sewer line (consolidated with UPR-300-38). Expected contaminants released to the soils beneath and around the 313 Building include radionuclides (uranium-234 [U-234], U-235, U-236, U-238, Tc-99), metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, tin, aluminum, and thorium), acids (phosphoric, hydrofluosilicic, fluosilicic, hydrofluoric acid, and oxalic acids), sulfide, nitrate, PCBs, trichloroethene, and various solvents and degreasers. (WHC-MR-0388, Chapter 1.0).

The extent of contamination beneath the 313 Building has not been determined. Characterization of the soils beneath and around the 313 foundation will be accomplished during the remediation of UPR-300-38, which is scheduled to begin in October 2012.

314 Press Building (Metal Extrusion Building). Associated waste sites include 300-218, contaminated soils beneath the 314 and 314-A Buildings foundation; 300-80, radioactive materials contaminated French drain adjacent to the 314 Building; 300-24, contaminated soil near the 314 Building; 300-16, uranium contamination in asphalt and soil along Ginko Street; and 300-15, 300 Area Process Sewer. Expected contaminants released to the soils beneath and around the 314 Building include radionuclides (U-234, U-235, U-236, U-238, Tc-99), metals (arsenic, barium, cadmium, chromium, lead, mercury, selenium, silver, tin, aluminum), cyanide, sulfide, PCBs, and solvents. (WHC-MR-0388, Chapter 1.0).

The extent of contamination beneath the 314 Building has not been determined. Characterization of the soils beneath and around the 314 foundation will be accomplished during the remediation of 300-218, which is scheduled to begin in October 2013.

306 East Fabrication and Testing Laboratory and 306 West Metal Fabrication Development Building. Associated waste sites include 300-33, contaminated soil around and beneath the 306-W Building foundation; 300-256, contaminated soil around and beneath the 306-E Building foundation; 300-41, 306-E Neutralization Tank and Valve Pit, which was used to neutralize nitric acid bearing waste before discharge to the process sewer; and 300-15, 300 Area Process Sewer. Expected contaminants released to the soils beneath and around the 306-E and 306-W Building include uranium, thorium, and various metals (zirconium, tin, iron, chromium, and nickel; heavy metals; various solvents; reagents; and PCBs [WHC-MR-0388, Section 2.2, p. 16]).

The extent of contamination beneath the 306-E and 306-W Buildings has not been determined. Characterization of the soils beneath and around the 306-E and 306-W foundations will be accomplished during the remediation of 300-33.

333 Fuels Manufacturing Building. Associated waste sites include the following:

- 300-32, the remaining contaminated components of the former 333 Building, including the concrete pad, any subgrade soils and piping
- 333 West Side Tank Farm, Waste Oil Tank
- 300-219, the transfer lines connecting the various components of the 300 Area WATS and the 300 Area Uranium Recovery Operations
- 300-224, a subsurface, concrete pipe trench with sections that allowed piping connections to be made between process operations in the 313 Building, the 303-F Building, the 311 Tank Farm, the 333 Building, the 334-A Building, and the 334 Tank Farm
- UPR-300-17, oily rags and uranium shavings located on the asphalt area near the southeast corner of the 333 Building
- 333 East Side Hazardous Waste Staging Area, an area that contained small quantities of miscellaneous waste oils, cutting lubricants, chemicals, and solvents stored in containers

Expected contaminants released to the soils around and beneath the 333 Building resulting from the uranium fuel fabrication process include the following (WHC-MR-0388, Section 3.3, p. 20):

- Natural and enriched uranium (0.95 percent, 1.25 percent, and 2.1 percent U-235)
- Metals (beryllium, copper, zirconium, tin, iron, chromium, and nickel)
- Acid wastes (nitric, sulfuric, hydrofluoric, and chromic-nitric-sulfuric acids)

- Degreasers (trichloroethene, tetrachloroethene, and 1,1,1-trichloroethane)
- Heat treatment salts (sodium nitrate, sodium and potassium nitrite, and sodium and potassium chloride), and solvent cleansers (alcohols and acetone)

The extent of contamination beneath the 333 Building has not been determined. Characterization of the 333 Building foundation and remaining building features will be accomplished during the confirmatory sampling process of 300-32, which will determine if the site can be closed as no-action under EPA/ROD/R10-01/119, or require remedial action for site closure. Confirmatory sampling is scheduled to be completed in March 2012, based on the current working schedule, which may be subject to change.

334 Chemical Handling Facility and Tank Farm, and 334-A Building and WATS. Associated waste sites include 300-219 and 300-224 described previously. Releases to the soil near the 334 Facility and tank farm would have included the various chemicals and acids used in the fuel fabrication process. A large nitric acid spill in the mid 1960s dissolved some the contents of the nearby 618-1 Burial Ground. Waste and contamination in and beneath the area of the 334-A Building and WATS can be expected to contain all of the waste acids and their constituent solid and solutions (uranium, copper, chromium, Zircaloy-2 components, beryllium, and other fuel fabrication material [WHC-MR-0388, Section 5.3, p. 28]).

The extent of contamination associated with the 334 Building and WATS has not been determined. Characterization of the soils affected by releases from the 334 Building and WATS will be accomplished during the remediation of 300-219 and 300-224. The remediation of 300-224 and 300-219 is in process and scheduled to be completed in 2009, based on the current working schedule, which may be subject to change.

303 A-J Fresh Metal Storage Buildings. Associated waste sites include the following:

- 300-28, contaminated asphalt and soil along Ginko Street
- 300-16, uranium contamination around the base of utility poles
- UPR-300-45, release of liquid to the soil beneath the transfer piping, adjacent to the 303-F Building, containing uranium bearing waste acid identified as nitric and sulfuric with uranium in solution
- 300-15, 300 Area Process Sewer

Expected contaminants beneath and around the 303 A-J Storage Buildings include uranium and solvents such as tetrachloroethene (WHC-MR-0388, Section 6.2, pp. 31 and 32).

The extent of contamination in the soils around the 303 A-J Storage Buildings has not been fully determined. Characterization of the soils that may have been contaminated during the operation of these storage buildings will be assessed during the remediation of waste sites 300-28 and 300-16, which are scheduled to begin in June 2013 and October 2012, respectively.

304 Uranium Scrap Concentration Storage Facility. Associated waste sites include 300-249, residual radioactive (uranium) contamination in the 304 Building; 300-43, uranium-contaminated soil from operation of the 304 Concretion Facility and Storage Area; and 300-15, 300 Area Process Sewer. Expected contamination around and beneath the 304 Facility is primarily uranium (WHC-MR-0388, Section 7.1, p. 35).

The extent of contamination in the soil around and beneath the 304 Building has not been determined. Characterization of the soils around and beneath the 304 Building will be assessed during the remediation of 300-43, which is scheduled to begin in January 2013.

303-K Fresh Metal Storage Building. Associated waste sites include 300-251, unplanned release outside the 303-K Building; and 303-K Contaminated Waste Storage. Expected contamination in the soil beneath and around the 303-K Building is primarily uranium. The 303-K Building was demolished in 2001. The rubble and excavated soil were designated and disposed of as low-level waste at the Hanford Site Low-Level Burial Grounds. After the site inspection, the soils were compacted and the site was backfilled with gravel. In 2002, the 303-K Contaminated Waste Storage waste site was reclassified as closed out.

Additional sampling by PNNL near the 303-K Building showed elevated sediment uranium concentration in the near surface. Sediment samples yielded average U-238 values of 287.4, 562.9, and 988.8 mg/kg (96, 188, and 330 pCi/g), for three different analytical methods (PNNL-14022, Table 4.7, p. 4-6). Further characterization of the soil beneath and around the 303-K Building will be performed during the remediation of 300-215, which is scheduled to begin in February 2013.

311 Tank Farm and 311 Building. Associated waste sites include 300-224, described previously; UPR-300-39, release of caustic solution (50 percent sodium hydroxide) adjacent to the caustic storage tank in the 311 Tank Farm; UPR-00-40, soil between the 311 Tank Farm and 303-F Building; and UPR-300-45, uranium bearing acid release beneath the transfer piping, adjacent to the 303-F Building. Expected contaminants in the soils beneath the 311 Tank Farm and 311 Building include uranium, methanol, trichloroethene, and tetrachloroethene (WHC-MR-0388, Section 8.1, p. 37).

The extent of contamination in the soil around and beneath the 311 Tank Farm and 311 Building has not been determined. Contamination in the soil resulting from the operations will be fully characterized during the remediation of the waste sites associated with the 311 Tank Farm and 311 Building.

321 Separation Building, and 323 Building and Tanks. Associated waste sites include the following:

- UPR-300-4, contaminated soil beneath and south of the 321 Building
- 323 TANK 1, 323 TANK 2, 323 TANK 3, and 323 TANK 4, tanks that received neutralized uranium contaminated water and/or basic aluminum cladding waste solutions from reprocessing R&D activities in the 321 Building and the 3706 Building
- 300-15, 300 Area Process Sewer

Contaminants in the soil around and beneath the 321 and 323 Buildings would include any components of the several chemical processes tested in the 321 and 323 Facilities. Expected contaminants may include plutonium and uranium, metals (thorium, strontium, cesium, aluminum, iron, copper, zinc), compounds used in the various plutonium/uranium extraction pilot tests (tributyl phosphate, normal paraffin hydrocarbon, and methyl isobutyl ketone), acids (nitric, phosphoric, hydrofluoric, oxalic), ammonium fluoride, ammonium nitrate, sodium fluoride, sodium hydroxide, carbon tetrachloride, trichloroethene, acetone, and 2-butanone (WHC-MR-0388, Section 20.4, pp. 76 to 78).

The extent of contamination in the soil around and beneath the 321 Building, including the 323 Building and associated Tanks 1-4, has not been fully determined. Characterization of the soil around and beneath the 321 Building and 323 Tanks will be performed during the remediation of UPR-300-4, which is scheduled to begin in December 2013, and remediation of Tanks 1-4, which is scheduled to begin in May 2013.

3706 Radiochemistry Laboratory. Associated waste sites include 300-46, contaminated soils around and beneath the 3706 Laboratory Building; and 300-15, 300 Area Process Sewer. Expected contaminants around and beneath the 3706 Building would include any of the components used in the bismuth phosphate, REDOX, PUREX, and recovery of uranium and plutonium by extraction processes along with laboratory cleansers, reagents, plutonium, uranium, thorium, and beryllium. Because the processes conducted in the 3706 Radiochemistry Laboratory and the 321 Building were similar, the list of expected contaminants is the same as those listed above under the 321 Building (WHC-MR-0388, Section 22.4, pp. 85 to 86).

The extent of contamination in the soil around and beneath the 3706 Laboratory has not been fully determined. Characterization of the soil around and beneath the 3706 Laboratory will be performed during the remediation of 300-46, which is currently in progress and scheduled to be complete in March 2010.

324 Waste Technology Engineering Laboratory. Associated waste sites include 300-25, the 324 Laboratory Building and existing features including development laboratories, maintenance shops, and service areas; and 300-265, the pipe trench between the 324 and 325 Laboratory Buildings, which contained the high-level waste transfer line. Chemical wastes generated in the 324 Laboratory Building were varied and included the components of multiple laboratory processes. A number of significant contamination events occurred throughout the history of the 324 Building. In most cases, radioactive contamination was confined to the building and not spread to the environment (WHC-MR-0388, Section 4.10, p. 215). Further evaluation of the contamination beneath the 324 Laboratory Building will be evaluated during D4 and close-out processes for waste site 300-25, which are scheduled to begin in September 2013 after the D4 activities have been completed in May 2011.

325 Radiochemistry Building (Applied Chemistry Laboratory). Associated waste sites include the following:

- UPR-300-10, an unplanned release to the soil beneath the northwest corner of the 325 Building from the radioactive waste sewer line that served the 325-B Hot Cells
- UPR-300-11, a release to the soil around and below a leaking flanged-tee that connected the Retired Radioactive Liquid Waste Sewer to the 340 Vault
- UPR-300-12, a release in the basement floor of the 325-A Building that migrated through cracks in the floor to the soil beneath the building
- UPR-300-48, release of radioactive liquid from a leak in the process sewer drain pipe
- 325 Waste Treatment Facility, used to treat radioactive mixed wastes generated in R&D activities

Soil samples collected around UPR-300-11 yielded fission products (BHI-00012, Section 5.7, pp. 5 to 9). Radionuclides measured in the soils beneath the 325 Building include cobalt-60 (Co-60), Mn-54, ruthenium-106 (Ru-106), antimony-125 (Sb-125), and Cs-134/137 (WHC-MR-0388, Section 34.7, p. 141). Manganese-54, Ru-106, Sb-125, and Cs-137 have half-lives less than 3 years and will have decayed until they are now undetectable. The 325 Building is scheduled to remain in service through about 2027 (Section 2.3). Further evaluation of the contamination in the soil beneath the 325 Building will be performed during the remediation of UPR-300-10.

327 Radiometallurgy Building (Post-Irradiation Testing Laboratory). Associated waste sites include 300-264, the 327 Building, and features related to the examination of fuel elements and fuel cladding materials. The 327 Building is in a stabilization and deactivation phase, where radioactive material and contamination are being removed and cleaned to allow for future D4 activities. Contamination to the soil from the 327 Building can be attributed to various liquid leaks from hot cells, drains, and waste piping. Waste liquids were released to the soil from the RLWS because of corroded cast iron piping. Expected contaminants released to the soil beneath the 327 Building include various fission products (radionuclides), carbon tetrachloride, acetone, ethanol, and kerosene (WHC-MR-0388, Section 36.6, p. 156).

The extent of contamination in the soil around and beneath the 327 Building has not been fully determined. Characterization of the soil around and beneath the 327 Building will be performed during the remediation of 300-264, which is scheduled to begin in January 2014.

2.6.4.3 Source Locations with Some Potential for Contamination to Migrate Deeper into the Vadose Zone

340 Retention and Neutralization Complex. Associated waste sites include the following:

- The 340 Complex, consisting of the 340, 340-A, 340-B, and 3707-F Buildings and two office trailers
- UPR-300-1, a release to the soil in the area between the 307 Retention Basins and the 340 Building
- UPR-300-2, multiple releases from ongoing decontamination and waste-handling activities starting in January 1954
- UPR-300-41, a release of hazardous waste liquid from a drum situated on an asphalt pad, resulting in the contamination of the asphalt pad and an area of soil next to the pad

The 340 Complex received and processed some of the highest level liquid and solid radioactive wastes generated in the 300 Area. Because of the functions associated with the 340 Complex and the many leaks and spills during operation, wastes deposited in the pipes, tanks, and soils surrounding the complex and the RLWS/retention process sewer network are extensive. Radioactive liquid wastes transported by the RLWS/retention process sewer and processed at the 340 Complex include radiochemical solutions from the 324, 325, 326, and 329 Buildings, along with radiometallurgical fines and metal bearing solutions from the 327 Building (WHC-MR-0388, Section 33.5, pp. 127 to 129).

The extent of contamination in the soil around the 340 Retention and Neutralization Complex has not been fully determined. Characterization of the soils resulting from the operation of the 340 Complex will be performed during the remediation of the 340 Complex waste site and other associated waste sites outlined above. Remediation of the 340 Complex waste site is scheduled to begin in April 2013. Waste site UPR-300-2, covering the releases at the 340 Complex during operation, will begin the confirmatory sampling process in October 2011, which will determine whether the waste will be classified as an accepted or a not accepted WIDS site.

307 Retention Basins. Associated waste sites include the following:

- The 307 Retention Basins, the retention process sewer line, and the 307 Retention Basin systems, which were installed to collect potentially contaminated liquids from the sinks, drains, and sumps of the laboratory facilities
- 300 RLWS, which consists of a network of underground, double encased stainless steel pipe (encased in reinforced fiberglass or plastic pipe as secondary containment) draining to the 340 Complex
- The 300 Area Retired Radioactive Liquid Waste Sewer, which received radioactive wastes from various 300 Area facilities including the fuel fabrication and R&D laboratories
- 300-214, an underground carbon steel and polyvinyl chloride pipeline connecting the 300 Area laboratory facilities (308, 324, 325, 326, 327, and 329 Buildings) to the 307 Retention Basins

- UPR-300-1, a release to the soil in the area between the 307 Retention Basins and the 340 Building
- 300-15, 300 Area Process Sewer
- 307 Process Trenches, which received wastes from the 300 Area laboratory expansion facilities (329, 327, 324, 326, and 329)
- 300 Area Process Trenches, which served as the discharge site for the 300 Area Process Sewer system

Waste streams reflect the liquid wastes discharged to the 307 Retention Basins from the 300 Area laboratory facilities. Expected contaminants in the soil near the 307 Retention Basins include Ru-103/106, cesium-144 (Cs-144), promethium-147 (Pm-147), strontium-90 (Sr-90), Cs-137, and rare earth elements (WHC-MR-0388, Section 33.5, p. 128).

A long-duration leak was discovered in the transfer line from the 307 Retention Basins to the 340 Complex during the transfer of liquid from one of the 307 Retention Basins. The leak permitted highly contaminated liquid waste to percolate into the soil beneath a section of corroded underground carbon steel pipe section. The results of a study (BNWL-CC-2617, *Failure of 307 Basin Transfer Line and Resultant Ground Contamination*) issued after the leak was detected estimated the release to be approximately 900 Ci of relatively short-lived radionuclides, including 10 Ci each of Sr-90 and Cs-137. It was estimated that more than 90 percent of the contamination was confined within a cylindrical section of earth approximately 7.62 m (25 ft) deep and 3.7 m (12 ft) in diameter. It was speculated that groundwater contamination was minimal because 300 Area groundwater sample results showed no detectible concentrations of the radionuclides found in the soil. Further characterization of the soil around the 307 Retention Basin will be performed during the remediation of the 307 Retention Basin waste site and UPR-300-1. The remediation of the 307 Retention Basin is scheduled to begin in March 2013 and the remediation of UPR-300-1 is scheduled to begin in March 2014.

300 Area Sanitary Sewer System. Associated waste sites include 300-276, which includes the surface and subsurface sewer system. Contamination in the sewer system is attributed to uranium, thorium, and other contaminants carried by the hair, shoes, hands, and clothing of workers who used the 300 Area change houses, lunchrooms, sanitary restrooms, and First Aid Station (WHC-MR-0388, Section 30.2, p. 109).

The extent of contamination in the soil resulting from the use of the 300 Area Sanitary Sewer System has not been fully determined. Characterization of the soil beneath the 300 Area Sanitary Sewer System will be performed during the remediation of 300-276, which is scheduled to begin in November 2014.

300 Area Process Sewer System. Associated waste sites include 300-15, 300 Area Process Sewer; and 300-219, which includes the transfer lines connecting the various components of the 300 Area WATS and the 300 Area Uranium Recovery Operations. Contamination in the process sewer would have included all metallic and chemical components used in the fuel fabrication process, all separations process chemicals and solutions (particularly uranyl nitrate) used in 3706 and 321 Buildings tests of bismuth phosphate, REDOX, metal recovery, PUREX, and recovery of uranium and plutonium by extraction processes (WHC-MR-0388, Section 31.4, p. 114).

The extent of contamination in the soil resulting from the use of the 300 Area Process Sewer System has not been fully determined. Characterization of the soil beneath the 300 Area Process Sewer System will be performed during the remediation of 300-15, which is scheduled to begin in May 2013.

300-131, 300-132, 300-133, 300-134, 300-135, 300-136, 300-137, 300-138, 300-139, 300-140, 300-141, 300-142, 300-143, 300-144, and 300-145 (Consolidated WIDS Sites). These French drains received steam condensate. When the site was active, the flow rate was less than 0.19 L/min (0.05 gal/min) of steam condensate only. The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area. Further evaluation of the extent of contamination in the soil resulting from the use of these French drains will be determined during the remediation of the 300-46, which is scheduled to begin in October 2012.

300-146, 300-147, 300-148, 300-149, and 300-150 (Consolidated WIDS Sites). The site is a French drain that received steam condensate. The French drain is a concrete pipe covered with perforated metal lid. When the site was active, the flow rate was less than 0.038 L/min (0.01 gal/min) of steam condensate only. The site falls within WIDS Site 300-46, which includes estimates of the extent of uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area. Further evaluation of the extent of contamination in the soil resulting from the use of this French drain will be determined during the remediation of 300-46, which is scheduled to begin in October 2012.

Solid Waste Burial Grounds

300-10 Burial Ground. Remediation of the 300-10 waste site was authorized by EPA/ROD/R10-96/143. Following remedial excavation activities, verification sampling was conducted for the COCs total uranium (U-234, U-235, and U-238), Co-60, arsenic, thallium, benzo(a)pyrene, chrysene, and PCBs. Verification sample results were determined to be below the cleanup criteria for direct exposure, groundwater protection, and protection of the Columbia River (BHI-01134, *300-FF-2 Waste Site 300-10 Verification Package*).

618-2 Burial Ground. Remediation of the 618-2 Burial Ground was authorized by EPA/ROD/R10-01/119. After completing the excavation activities, verification samples were collected and analyzed for the COCs arsenic, barium, cadmium, chromium, lead, selenium, silver, tin, uranium (total), americium-241 (Am-241), Cs-137, Co-60, europium-152 (Eu-152), Eu-154, Eu-155, nickel-63 (Ni-63), H-3, plutonium-238 (Pu-238), Pu-239/240, Pu-241, Sr-90, U-233/234, U-235, and U-238. All risk assessment guidelines (RAGs) for radionuclides and nonradionuclides were achieved for direct exposure, groundwater protection, and river protection under an industrial land-use scenario. In addition to the verification samples, nine biased samples were collected to provide confidence for the absence of "hot spots" (or distinct points of contamination) in residual soil beneath locations that had visual stains, buried liquid wastes, large inventories of hazardous wastes, or areas where characterization for radiological survey results showed elevated contamination levels. The biased samples were analyzed for the nonradionuclides arsenic, barium, cadmium, chromium, lead, selenium, silver, tin, uranium (total), Aroclor-1254; and radionuclides Am-241, Cs-137, Pu-238, Pu-239/240, Pu-241, Sr-90, U-233/234, U-235, and U-238. All maximum results were below the cleanup standards established for direct exposure and groundwater protection. RESRAD (RESidual RADioactivity dose assessment model) results predict uranium will reach groundwater within 1,000 years at concentrations below the groundwater protection RAG for total uranium (30 µg/L = 21.2 pCi/L). Residual uranium (total) concentrations for statistical (95 percent upper confidence level) verification samples were measured at 339 mg/kg in the deep vadose zone (greater than 4.6 m [15 ft]), while the maximum uranium (sum of isotopic) concentration was 148 mg/kg in the biased samples (CVP-2006-00010, *Cleanup Verification Package for the 618-2 Burial Ground*).

618-12 Scraping Disposal Area. Description of the remediation activities associated with 618-12, including known nature and extent of contamination, will be covered with the description of the North Process Pond (WIDS 316-2).

618-1 Burial Ground. Radiological readings conducted at the site indicate 6,000 d/m alpha and 15 mrem/h beta/gamma. The remediation activities for the 618-1 Burial Ground are in progress and are scheduled to be completed in January 2010. The residual contamination in the soil beneath the 618-1 Burial Ground will be determined as a part of the cleanup verification sampling process.

300-7 Burial Ground. Confirmatory sampling for 300-7 was completed and a partial remaining sites verification package was issued in July 2006 (WCH, 2006a, "300-7 Partial Remaining Site for Remedial Action, Attachment: Partial Remaining Sites Verification Package for the 300-7 Undocumented Solid Waste Burial Ground"). The site was recommended for remedial action and reclassification in accordance with guidelines outlined in TPA-MP-14 because isotopic uranium results exceeded the RAGs for direct exposure, groundwater protection, and river protection. The maximum concentrations for U-234, U-235, and U-238 were measured at 2,340, 21.8, and 2,470 pCi/g, respectively. The extent of contamination beneath the site will be determined during waste site remediation.

300-9 Burial Ground. Confirmatory sampling for 300-9 was completed and a partial remaining sites verification package was issued in July 2006 (WCH, 2006b, "300-9 Partial Remaining Site for Remedial Action Attachment: Partial Remaining Sites Verification Package for the 300-9 Possible Early Solid Waste Burial Ground"). The site was recommended for remedial action and reclassification in accordance with guidelines outlined in TPA-MP-14 because isotopic uranium results for U-235 and U-238 exceeded the RAGs for direct exposure, groundwater protection, and river protection. Maximum concentrations for U-235 and U-238 were measured at 14.1 and 267 pCi/g. No contamination associated with the possible early burial ground was identified, so remediation will be limited to the near surface.

Source Locations with High Potential for Impacting Vadose Zone and Groundwater

High-volume, liquid waste disposal sites in the 300 Area include the South Process Pond (1943 to 1975), North Process Pond (1948 to 1975, 307 Process Trenches (1953 to 1963), the 300 Area Process Trenches (1975 to 1994), and the various process pipelines including the 300 Area process sewer (300-15). Several millions of liters per day (gallons per day) of uranium bearing liquid waste, along with small amounts of plutonium and other metals, were discharged to the process ponds and trenches through the process sewer during fuels fabrication at the 300 Area. These high-volume, liquid waste disposal sites have the greatest potential for deep contamination in the vadose zone and the underlying groundwater. The South Process Pond began operation in 1943. The North Process Pond was constructed and activated in 1948, following a dike failure at the existing South Process Pond. Both ponds were in operation until 1975, when the 300 Area Process Trenches replaced the facilities. All of these disposal facilities in the 300-FF-1 OU were remediated to remove the bulk of residual uranium contamination between the years 1995 and 2004.

Historical data are not adequate to assess the exact amount of wastes discharged to the process ponds and trenches. Extrapolations from existing data show approximate amounts of waste material released to the Process Ponds as follows:

- 112 metric tons (124 tons) uranium
- 8,900 metric tons (9,800 tons) (combined) sodium, sodium hydroxide, sodium aluminate, and sodium silicate
- 3,700 metric tons (4,100 tons) (combined) nitrates and nitric acid
- 16,300 metric tons (18,000 tons) nickel
- 6,100 metric tons (6,700 tons), zinc
- 2,000 metric tons (2,200 tons) trichloroethene
- 1,800 metric tons (2,000 tons) silver

- Unknown quantities of aluminum, beryllium, zirconium, tin, iron, chromium, silicon, and other substances

Lesser amounts of waste materials were discharged to the 300 Area Process Trenches because of the change in policy to divert high-level and above-discharge-limit wastes to the WATS (WHC-MR-0388, Section 31.4, p. 114). A brief description of each of the 300 Area liquid-waste-disposal sites is outlined below.

Several characterization studies have been performed as a part of the effort to develop a conceptual model for uranium contamination in the subsurface at the 300 Area. One part of the effort has been focused on determining the location of the uranium inventory in the vadose zone, with particular emphasis on the three high-volume, liquid waste disposal sites (South Process Pond, North Process Pond, and the 300 Area Process Trenches), where large volumes of liquid effluent containing uranium were disposed during fuel fabrication operations.

Estimates made in 2007 for the inventory of uranium in the subsurface at the 300 Area are described in PNNL-17034 (pp. 6.15 to 6.38) using a "box model." The estimates are based on published analytical results for the relatively few field measurements available, and on assumptions regarding the volumes for each compartment in the box model.

The model breaks the 300 Area subsurface into the following 10 compartments (Chapter 3, Figure 3-4 provides an illustration):

- Compartment A – Vadose Zone Sediments Above the High River Stage Within Footprints of Inactive Disposal Facilities
- Compartment B – Vadose Zone Pore Water Above the High River Stage Within Facility Footprint
- Compartment C – Vadose Zone Sediments Above High River Stage Outside Facility Footprints
- Compartment D – Vadose Zone Pore Water Above High River Stage Outside Facility Footprints
- Compartment E – Sediments in Intermittently Wetted "Smear" Zone Below Facility Footprints
- Compartment F – Pore Water in the "Smear" Zone Below Facility Footprints
- Compartment G – Sediments in Intermittently Wetted "Smear" Zone Outside Facility Footprints
- Compartment H – Pore Water in the "Smear" Zone Outside Facility Footprints
- Compartment I – Aquifer Sediments that are Always Below Water Table
- Compartment J – Uranium Plume (Groundwater in the Aquifer Above 30 µg/L uranium concentration)

The uranium inventory (kilogram) for each of the "box" compartments is presented in PNNL-17034 (Table 6.5, pp. 6.17-18 and schematic representation in Figure 6.4, p. 6.19). One primary source for the uranium inventories used in the box model is the waste stream analysis (NUV-06-21106-ES-001-DOC, *Identification and Classification of the Major Uranium Discharges and Unplanned Releases at the Hanford Site using the Soil Inventory Model (SIM Rev. 1 Results*). The estimates provided in the box model contain uncertainties related to the representativeness of the samples available and the mobility characteristics for the uranium for each compartment. The latter is particularly significant for evaluating protectiveness levels for groundwater, in that the presence of contaminant uranium does not directly imply a potential impact to groundwater. Evaluating the protectiveness of residual uranium contamination from past waste disposal operations also requires an understanding of the current and likely future geochemical and hydrologic conditions, which control migration of uranium along environmental pathways.

More recent laboratory analysis of sediment samples collected during several recent drilling campaigns in the 300 Area provided new data for refining the 2007 box model. This characterization effort sought to (1) provide additional information regarding the extent of uranium contamination in the 300 Area vadose zone, and (2) quantify the leachable (labile) concentration of the uranium in sediment samples (less than 2 mm [0.08 in.] size fraction) collected from boreholes recently drilled in the 300 Area (PNNL-16435; PNNL-17793). Concentrations of uranium resulting from water extractable, acid extracts, and microwave digestions of sediment samples collected along the length of the boreholes (i.e., shallow vadose zone, deep vadose zone, and saturated zone) were quite dilute. The peak uranium concentration from the microwave digestions, the method expected to yield the highest uranium concentration, ranged from 3.04 to 5.50 µg/g (less than 2 mm [0.08-in.] size fraction). All three methods found the highest concentrations of uranium in sediments collected within the deep vadose zone and capillary fringe. The dilute uranium concentrations, particularly from the borehole located in the South Process Pond, were unexpected and in contrast with the box model outlined in PNNL-17034, which attributed a large portion of uranium inventory to the vadose zone directly beneath known liquid waste disposal sites. The results from uranium extraction study suggest the vadose zone directly beneath disposal sites (Compartments A and B) is a less likely source, and the rewetted deep vadose zone beneath the 300 Area affected by the rise and fall of the river (Compartments C through H) is the most likely source for uranium contamination.

Using a two-source model, as suggested in PNNL-17793, Chapter 6.0, p. 6.6, can describe the uranium contamination in the vadose zone. The first source is represented by the widespread region in the deep vadose zone and capillary fringe affected by the fluctuation in river stage. This region is expected to yield uranium concentrations ranging between 3 and 10 µg/g from sediment. The second source is represented hot spots located at various positions within the 300 Area vadose zone ranging near the surface to the deep vadose zone.

South Process Pond (WIDS 316-1). The site originally received cooling water and low-level liquid wastes from the fuel fabrication facilities and early laboratories (313, 314, 3706, and 321 Buildings). Contaminants from these facilities included uranium, copper, cobalt, small amounts of plutonium, and PCBs. The total mean inventory of uranium disposed to the process 300 Area South Process Pond is 26,166 kg (57,686 lb) (NUV-06-21106-ES-001-DOC).

The site has been closed out under EPA/ROD/R10-96/143. After completion of the excavation activities, 37 verification samples were collected and analyzed for the COCs Co-60, U-233/234, U-235, U-238, and PCBs. Radionuclide and PCB results from the verification samples with RESRAD modeling indicate that applicable RAGs were achieved for direct exposure, groundwater protection, and Columbia River protection. Uranium-233/234, U-235, and U-238 are predicted to reach groundwater at concentrations below the maximum contaminant level. The site post excavation maximum predicted (RESRAD) groundwater concentration for total uranium is 8.69 pCi/L, which is less than the groundwater protection maximum contaminant level of 21.2 pCi/g (CVP-2003-00002, *Cleanup Verification Package for the South Process Pond (WIDS Site 316-1), the Retired Filter Backwash Pond (WIDS Site 300 RFBP), 300-262 Contaminated Soil, and Unplanned Release Sites UPR-300-32, UPR-300-33, UPR-300-34, UPR-300-35, UPR-300-36, UPR-300-37, and UPR-300-FF-1*, pp. 1 to 8).

Table 2-13 provides a list of the three maximum verification sample isotopic uranium values measured following site excavation. These sample locations are near the southwest corner of the 316-1 South Process Pond, which was the primary inlet point of the 300 Area Process Sewer to the pond. The verification sample locations and measured uranium (total) concentrations are shown in Figure 2-32.

A complete list of the verification samples and results for the South Process Pond is found in Appendix A of CVP-2003-00002 (units of picocuries/gram). Additionally, the verification data are presented by PNNL-17034 in units of milligram/kilogram.

Table 2-13. Maximum Residual Isotopic Uranium Results from Three Cleanup Verification Samples Collected Near the Southwest Corner of the South Process Pond (316-1)

Hanford Environmental Information System Sample Number	U-234 (pCi/g)	U-235 (pCi/g)	U-238 (pCi/g)	Total Uranium (pCi/g)
B0R3R1	55.0	7.3	48.0	110.3
B0R3R5	32.0	2.1	30.0	64.1
B0L888 (Trench 6)	40.8	1.87	40.6	83.27

Additional sampling within the South Process Pond was performed and documented in PNNL-15121. Samples were collected and analyzed for uranium from two trenches excavated with a backhoe through the bottom of the excavated (remediated) soil in the South Process Pond. One trench was located in the southwest corner near the liquid waste inlet, the other in the northeast corner of the remediation site footprint in the Retired Filter Backwash Pond. The results are summarized in PNNL-15121, Table 2.3. Uranium concentrations retrieved from the sediment (less than 2 mm [0.08-in.] fraction) collected from the southwest corner ranged from 7.3 to 12.2 mg/kg (2.5 to 4.1 pCi/g U-238), measured at 1.2 m and 3.7 m bgs (4 and 12 ft bgs), respectively, over a depth interval between 1.2 and 6.7 m bgs (4 and 22 ft bgs). Uranium concentrations decreased to less than 5.3 mg/kg (1.78 pCi/g U-238) below 3.7 m bgs (12 ft bgs), and increased to 10.2 mg/kg (3.43 pCi/g U-238) at 6.7 m (22 ft) bgs. Uranium concentrations retrieved from the sediment (less than 2 mm [0.08-in.] fraction) collected from the Retired Filter Backwash Pond ranged from 6.2 to 13.6 mg/kg (2.3 to 4.6 pCi/g U-238) measured at 6.7 and 4.9 m bgs (22 and 16 ft bgs), respectively, over the depth interval between 1.2 and 6.7 m bgs (4 and 22 ft bgs). Uranium concentrations decreased with increasing depth below 4.9 m bgs (16 ft bgs) for samples collected from the Retired Filter Backwash Pond. In general, uranium concentrations tended to decrease with increasing depth.

North Process Pond (WIDS 316-2). The site originally received cooling water and low-level liquid process wastes from the fuel fabrication facilities and the early laboratories (313, 314, 3706, and 321 Buildings). Between 1948 and 1969, the basins were periodically dredged to improve infiltration when sludge in the bottom of the pond slowed the percolation rate. The sludge contained large amounts of uranium and copper and was deposited on the pond dikes and put in the Scraping Disposal Area or put into Landfill 1B (300-FF-1 OU, WIDS site 300-50) just north of the pond. The estimated total mean inventory of uranium disposed to the North Process Pond was 19,391 kg (42,750 lb) (NUV-06-21106-ES-001-DOC).

The site has been closed out under EPA/ROD/R10-96/143. Following excavation activities, 26 verification samples were collected and analyzed for the COCs U-234, U-235, U-238, Co-60, and PCBs. Results from the verification samples indicated the RAGs for direct exposure, groundwater protection, and protection of the Columbia River were achieved, and the remaining soil in the North Process Pond was found to be below cleanup standards (BHI-01298, Section 1.0, p. 1). Figure 2-33 shows the North Process Pond with verification sample locations and measured uranium (total) concentrations. A complete list of the verification samples and results for the South Process Pond is found in BHI-01298, Appendix C, in units of picocuries/gram. Additionally, the verification data were presented by PNNL-17034, p. 6.20, in units of milligrams per kilograms.

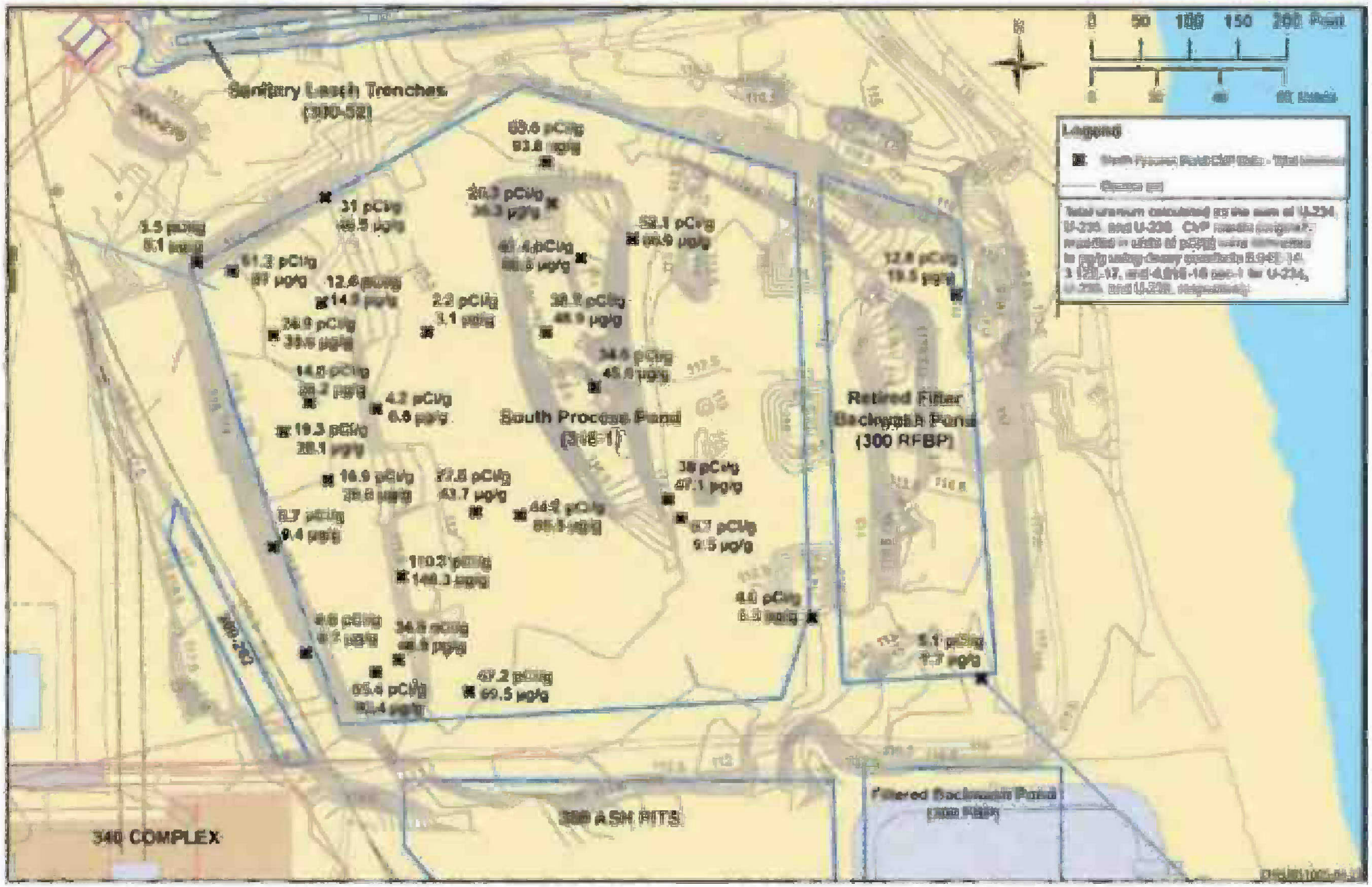


Figure 2-32. Map Showing Locations and Measured Uranium Concentrations for Excavation at the South Process Pond (316-1)

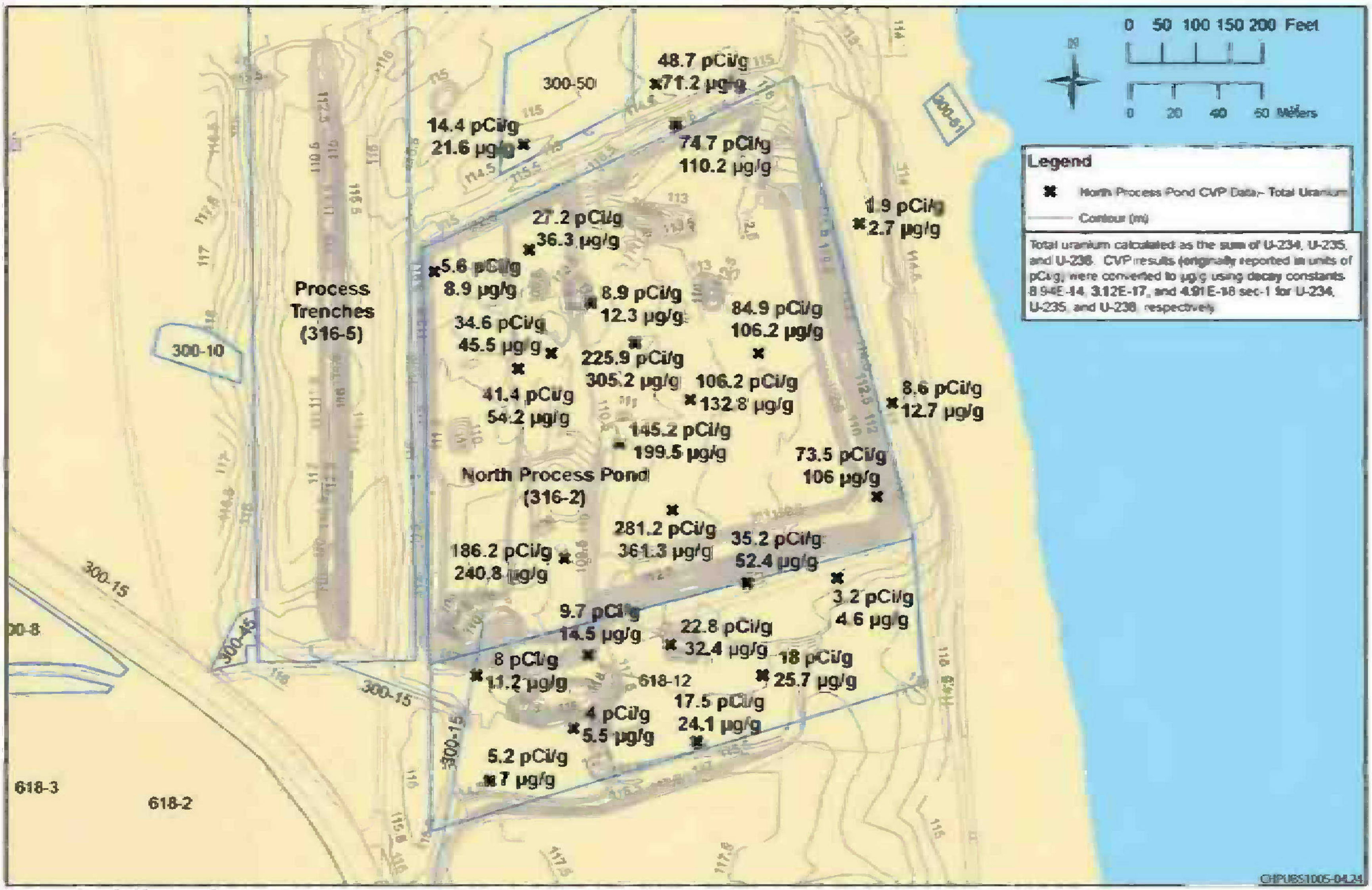


Figure 2-33. Map Showing Locations and Measured Uranium Concentrations for Excavation at the North Process Pond (316-2) and the South End of the 300 Area Process Trenches (316-5)

Two additional sampling campaigns were performed in the North Process Pond and documented in PNNL-14022 and PNNL-15121 following site remediation. PNNL-14022 discusses the results of two sediment samples recovered from the northeast corner of the process pond excavation/remediation depth, and a 1.5 m (5-ft-) deep trench dug below the excavation floor at the southern edge of the pond. The sample collected from the southwest corner yielded an average uranium concentration of 40 mg/kg (13 pCi/g, U-238) and the sample collected from the south edge yielded an average uranium concentration of 540 mg/kg (180 pCi/g, U-238) (PNNL-14022, Table 4.7).

In a study reported in PNNL-15121, two backhoe excavations were dug at the southwest and southeast corners of the North Process Pond from below the excavated (remediated) surface to groundwater. Sediment samples were collected every 0.61 m (2 ft). Sediment samples (less than 2 mm [0.08-in.] fraction) collected from the profile at the southwest corner, near the liquid-waste inlet, yielded uranium concentrations between 15 and 240 mg/kg (5.0 to 8.0 pCi/g U-238). Sediment samples (less than 2 mm [0.08-in.] fraction) collected from the southwest corner yielded uranium concentration between 11 and 20 mg/kg (3.7 to 6.7 pCi/g U-238) (PNNL-15121, Table 2.3). Sediment uranium concentrations tended to be higher in upper 3.66 m (12 ft) than in the lower 3.05 m (10 ft) for the samples collected in the southwest corner near the inlet.

307 Process Trenches (WIDS 316-3). The site received wastes from the 300 Area Laboratory expansion facilities (329 Biophysics Laboratory, 327 Radiometallurgy Building, 324 Radiochemistry Building, 326 Pile Technology Building, and 329 Mechanical Development Building). Expected contaminants in the 307 Process Trenches include silver, cadmium, copper, mercury, lead, zinc, beryllium, chromium, fluoride, nickel, and uranium (BHI-00012, pp. 3 to 68). Exploratory drilling and soil sampling activities conducted in the 307 Process Trenches performed as part of the RI for the 300-FF-1 OU showed elevated uranium concentrations (maximum values of 58.0, 0.40, and 66.0 pCi/g of U-234, U-235, and U-238, respectively) at a depth of 3.14 m (10.3 ft) in a borehole located in the center of the 307 Process Trenches boundary (WHC-SD-EN-TI-279, *Summary of Remedial Investigations at the 307 Retention Basins and 307 Trenches (316-3), 300-FF-2 Operable Unit*). The 307 Process Trenches waste site (WIDS 316-3) has an accepted WIDS status and is scheduled for remediation to begin in 2013.

300 Area Process Trenches (WIDS 316-5). The trenches received 300 Area process effluent from the uranium fuel fabrication facilities. Waste from the 300 Area laboratories that was determined to be below discharge limits based on monitoring performed at the 307 Retention Basins was released to the trenches (BHI-01164, Chapter 1.0, p. 1). In 1991, an expedited response action was performed to reduce the migration of radionuclides and heavy metal contaminants to groundwater. WHC-SP-0193, *300 Area Process Trench Sediment Analysis Report,* provides results of a sampling program for the sediments underlying the Process Trenches conducted before the expedited response action in 1991. The estimated total mean inventory of uranium disposed to the 300 Area Process Trenches was 1,750 kg (3,860 lb) (NUV-06-21106-ES-001-DOC).

The 300 Area Process Trenches were remediated and closed out under EPA/ROD/R10-96/143. Following remedial action verification samples were collected from the Process Trench Spoils Area and analyzed for the COCs U-234, U-235, U-238, Co-60, arsenic, thallium, benzo(a)pyrene, chrysene, and PCBs. Sample results from the verification samples indicated RAGs were achieved for direct exposure, groundwater protection, and protection of the Columbia River for an industrial use scenario (BHI-01164). Figure 2-34 shows the 300 Area Process Trenches with verification sample locations and measured uranium (total) concentrations.

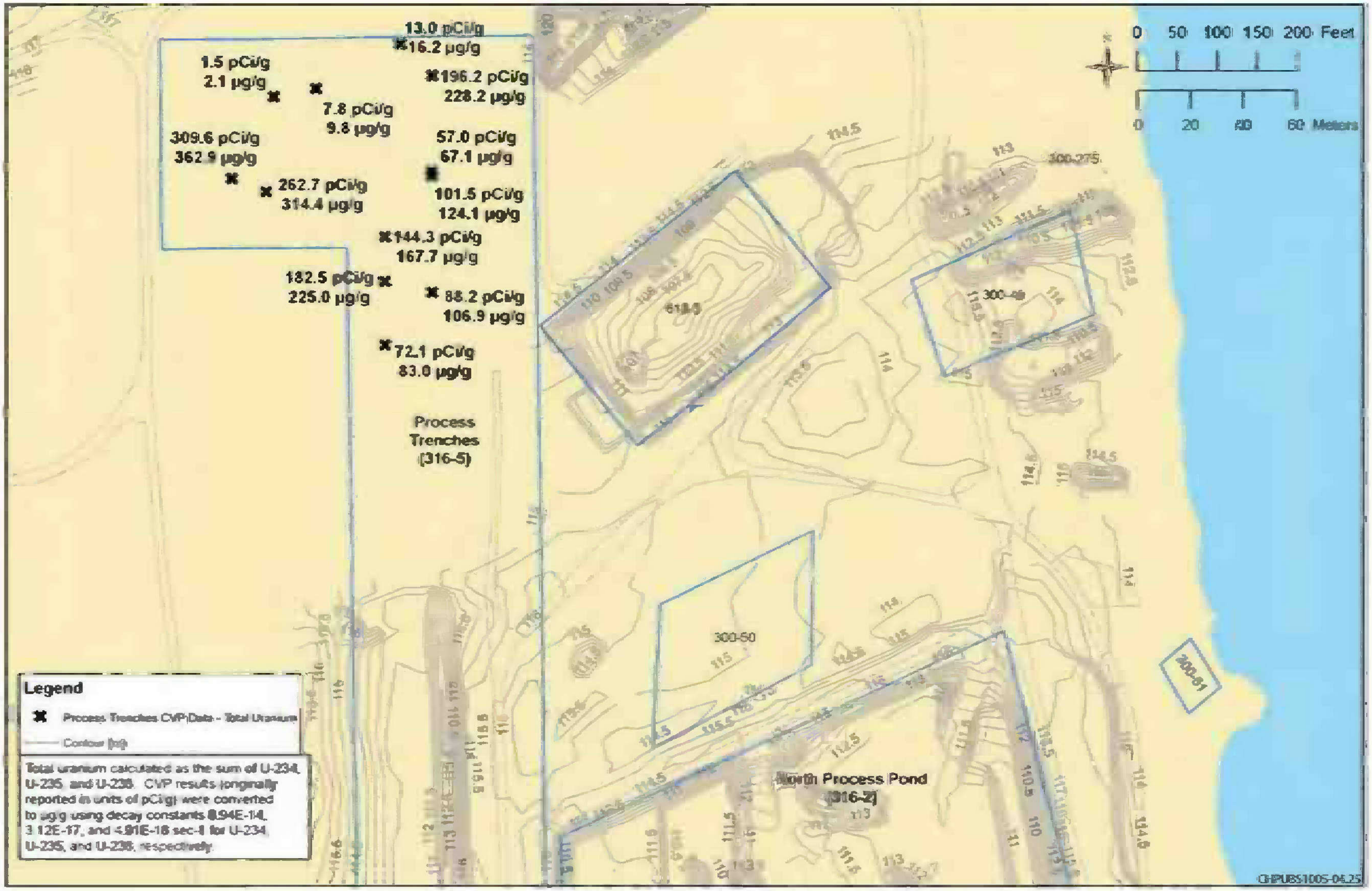
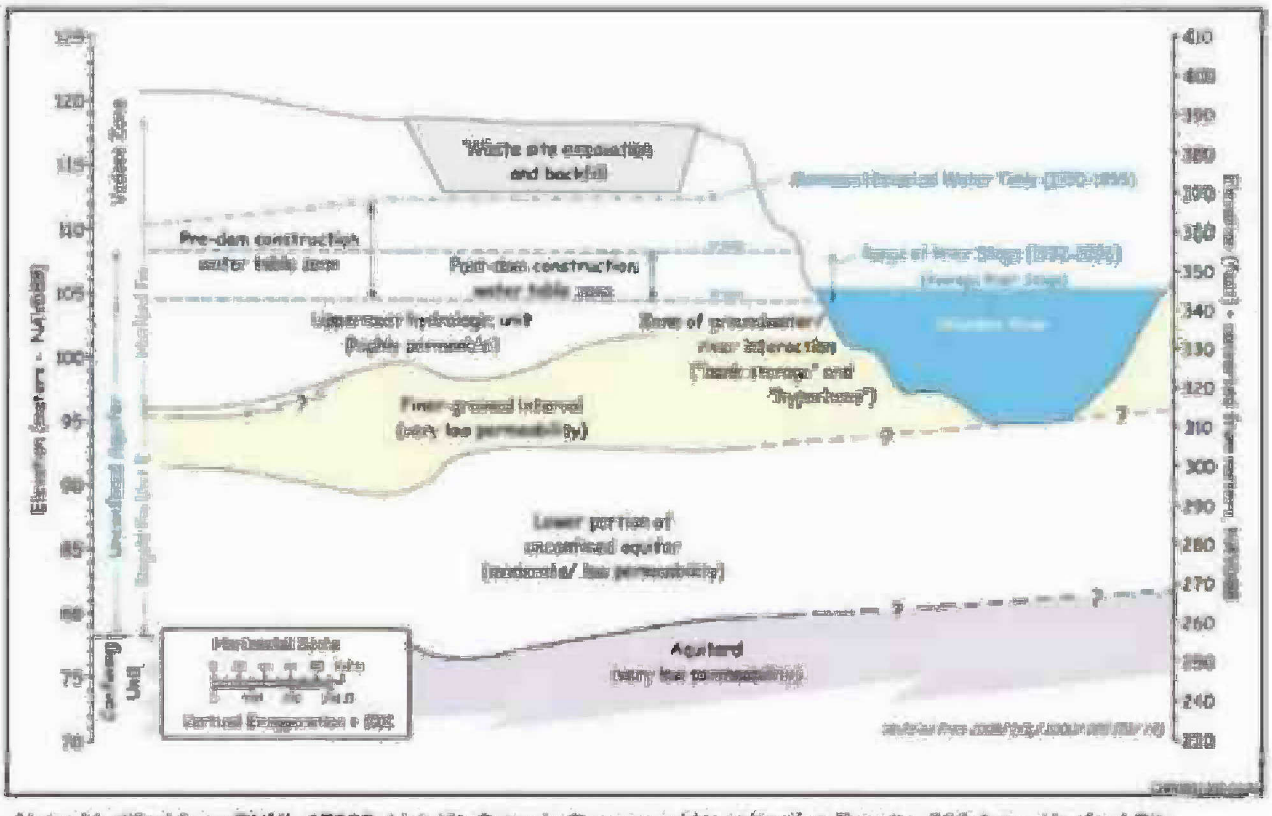


Figure 2-34. Map Showing Locations and Measured Uranium Concentrations for the Excavation for the North End of the 300 Area Process Trenches (316-5)

300 Area Groundwater

Contamination associated with groundwater beneath the 300 Area is present in several subsurface zones, with the unconfined aquifer being the primary zone. Figure 2-35 illustrates the various subsurface zones affected by contamination. Within the unconfined aquifer, the saturated sediment of the Hanford formation contains the preponderance of contamination. Some contamination has been found in limited areas in deeper stratigraphic intervals of the unconfined aquifer, such as the finer grained interval of Ringold sediment, but contamination has not been detected at depths below the unconfined aquifer. Additional subsurface zones of interest for the CSM include the following:

- The lower portion of the vadose zone that is periodically saturated with groundwater as the water table rises in response to high Columbia River stage conditions (“periodically rewetted zone”).
- A zone of groundwater/river interaction (“bank storage and hyporheic zones”) where the groundwater system is influenced by intrusion of river water.
- That portion of the vadose zone where residual groundwater from earlier (pre-1970s) high water-table conditions still may be present.



Note: Modified from PNNL-17666, *Volatile Organic Compound Investigation Results, 300 Area, Hanford Site, Washington*, Figure 2.3.

Figure 2-35. Schematic Illustrating Various Subsurface Zones Associated with Contaminant Pathways

The following descriptions regarding the concentrations and distribution of constituents in groundwater that indicate contamination from past operations, as tracked by the groundwater-monitoring projects, have been extracted from the most recent annual groundwater monitoring report (i.e., DOE/RL-2008-66, pp. 2.12-1 to 2.12-32) unless otherwise cited. A second reference for post-1992 groundwater contaminants in the 300-FF-5 Groundwater OU is PNNL-15127 (pp. 2.1 to 2.50), which contains trend information on constituents of interest for 1992 through 2004.

Uranium

Uranium contamination in groundwater beneath the 300 Area primarily is contained within the saturated portion of Hanford formation gravelly sediment; i.e., the uppermost portion of the unconfined aquifer. The uranium plume is defined by concentrations greater than 10 µg/L (background levels of uranium from natural sources are estimated to range from 3 to 8 µg/L).

Concentrations within the uranium plume vary with the seasonal position of the water table. Maps illustrating the areal extent of contamination typically are drawn for at least two seasonal conditions: a map for December represents the long-term seasonal average pattern and concentrations, while a map for June represents the pattern when the water is elevated at the high point of its typical seasonal range in elevation. Figures 2-36 and 2-37 show the uranium plume as depicted for December 2007 (average water table elevations) and June/July 2008 (seasonal period of high water-table elevations), respectively. The relatively small, separate plume shown just to the east of the 618-7 Burial Ground is a new development and associated with remediation activities at the burial ground, which started in fall 2007 and ended in summer 2008 (DOE/RL-2008-66, pp. 2.12.-5).

The vertical extent of the uranium plume is illustrated to some degree by the geologic cross sections shown in Figures 2-21, 2-22, and 2-23 (i.e., the extent of saturated Hanford formation gravelly sediment). Note that the Columbia River channel completely incises the Hanford formation, so movement of the uranium plume via the unconfined aquifer eastward beyond the river channel is unlikely (i.e., the plume discharges to the river through the riverbed). The vertical extent of uranium in groundwater illustrated in cross sections that show the results of sampling during drilling associated with LFIs for uranium and VOCs (index map to cross sections in Figure 2-38; cross sections in Figures 2-39, 2-40, and 2-41). The results shown are for groundwater samples collected during drilling, with the dates of collection shown beneath the well names. The monitoring program for existing wells along the cross sections provides ranges in results that are shown for an equivalent time interval. These cross sections reinforce the conclusion that uranium contamination is essentially contained within the saturated Hanford formation sediment.

An additional cross section drawn north and south along the 300 Area shoreline reveals concentrations observed in aquifer tubes installed at various depths in the unconfined aquifer (Figure 2-42). The monitoring data from aquifer tubes and near-river wells confirm that uranium contamination appears to be primarily contained within saturated Hanford formation sediment.

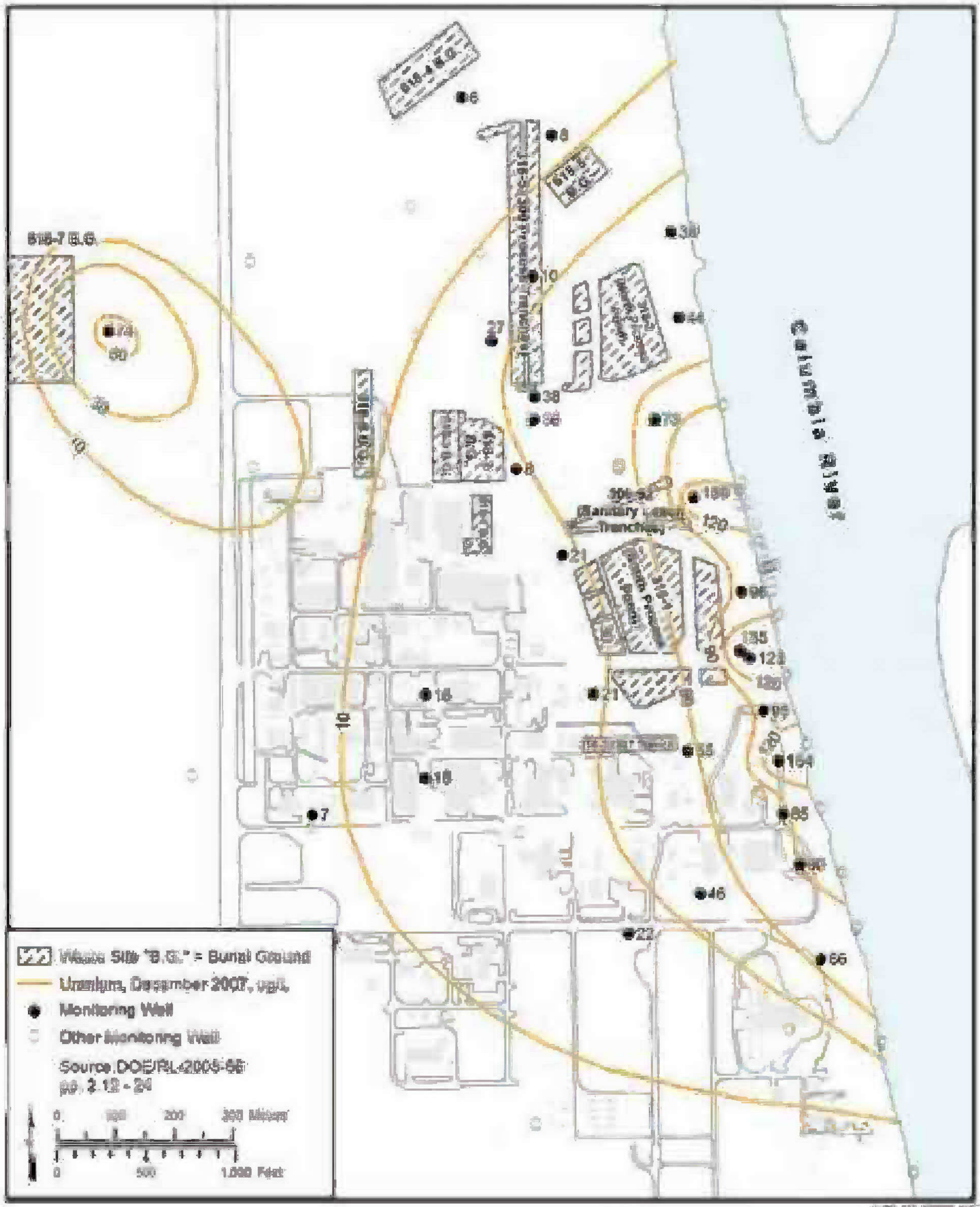


Figure 2-36. Uranium Distribution in 300 Area Groundwater for December 2007

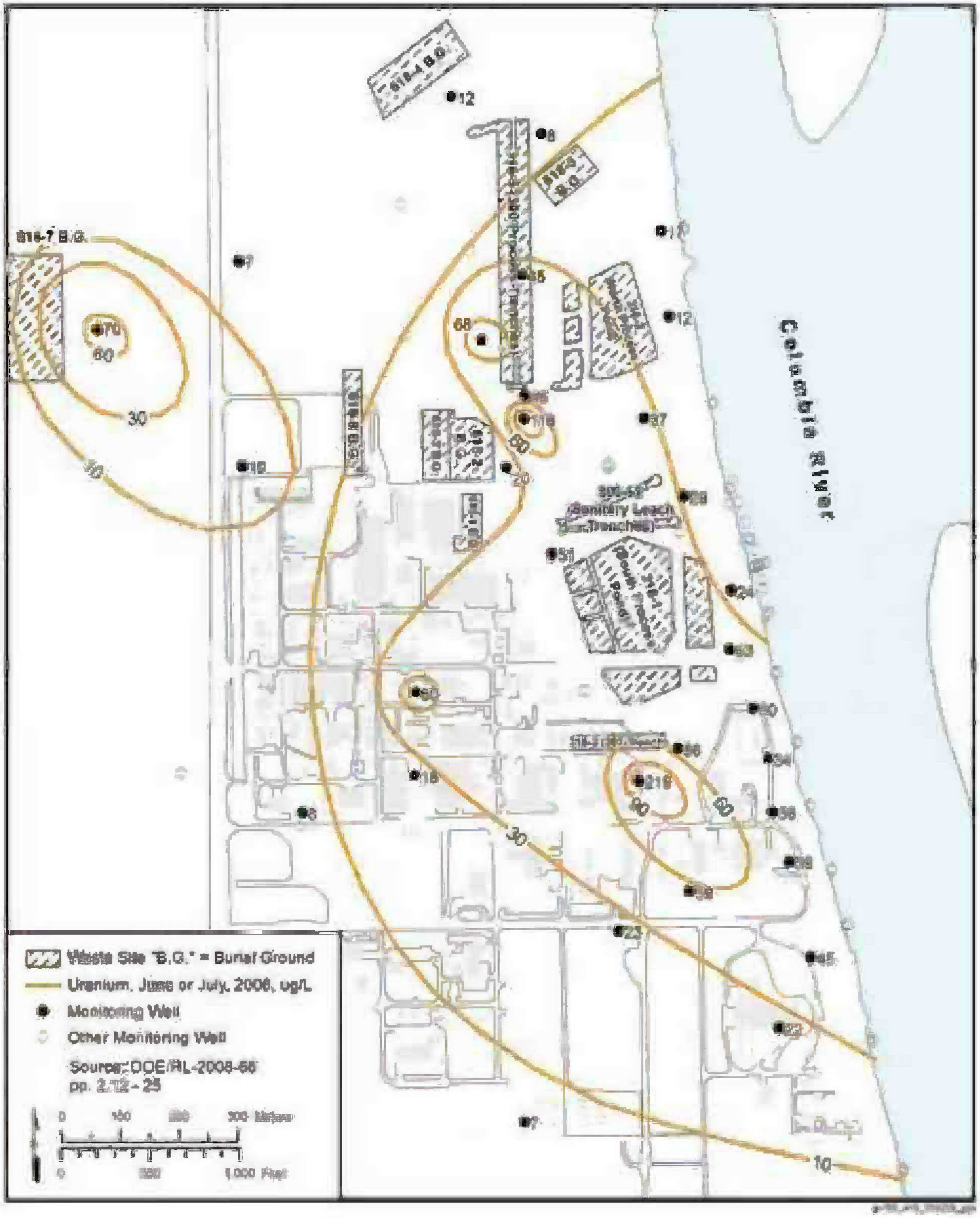


Figure 2-37. Uranium Distribution in 300 Area Groundwater for June/July 2008

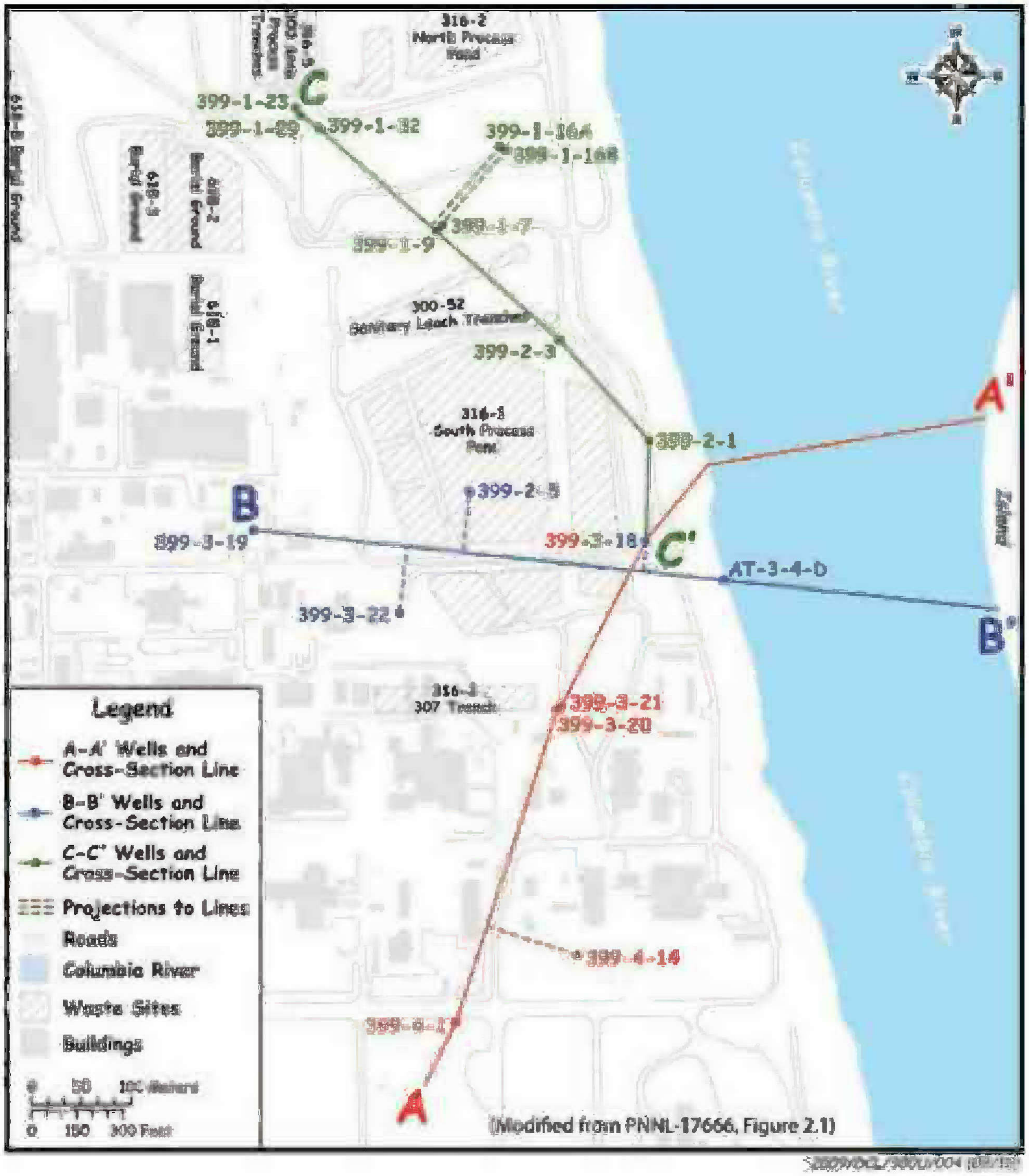


Figure 2-38. Index Map to Cross Sections Showing Vertical Distribution of Uranium

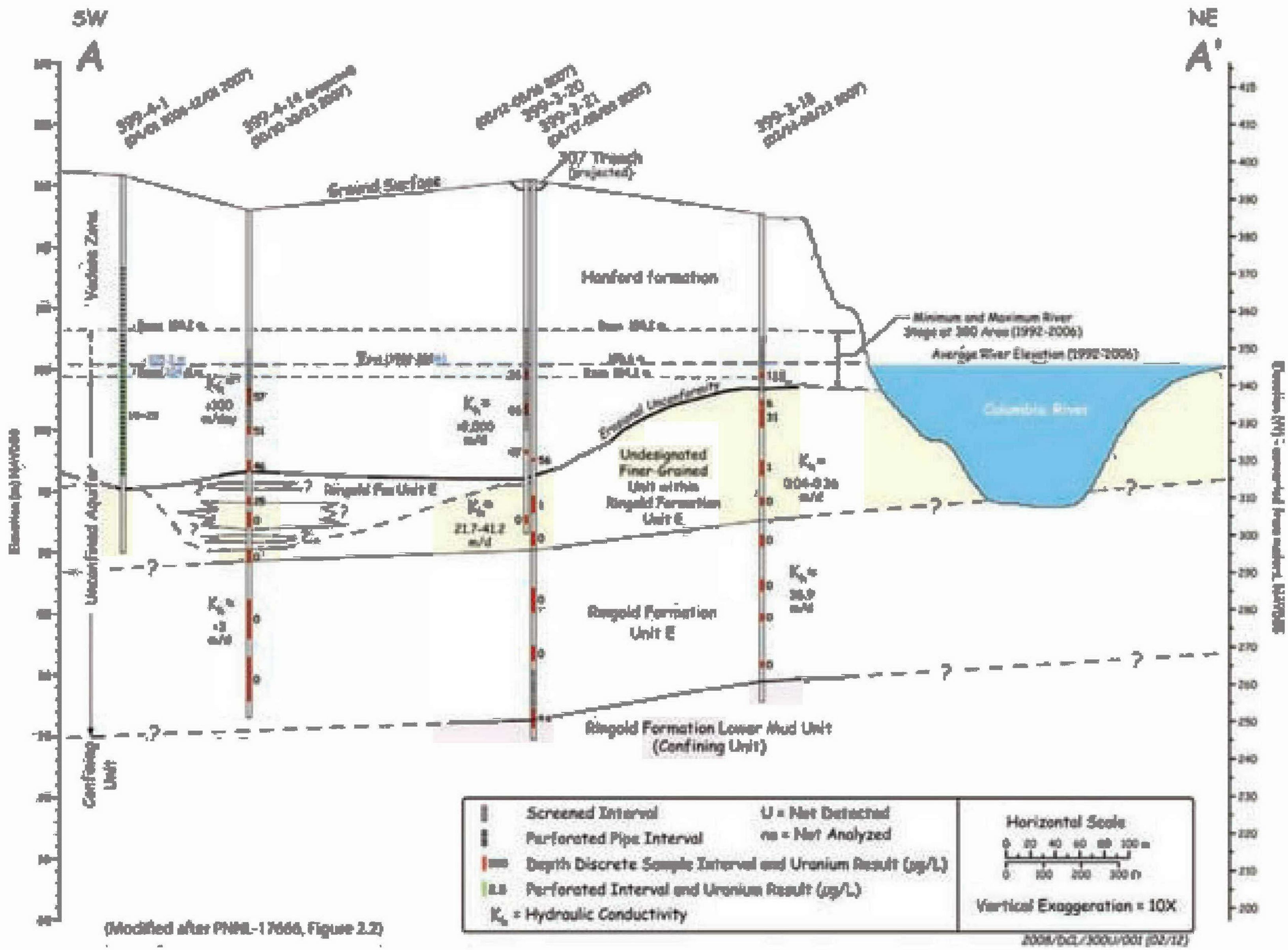


Figure 2-39. Vertical Distribution of Uranium Along Southwest to Northeast Cross Section

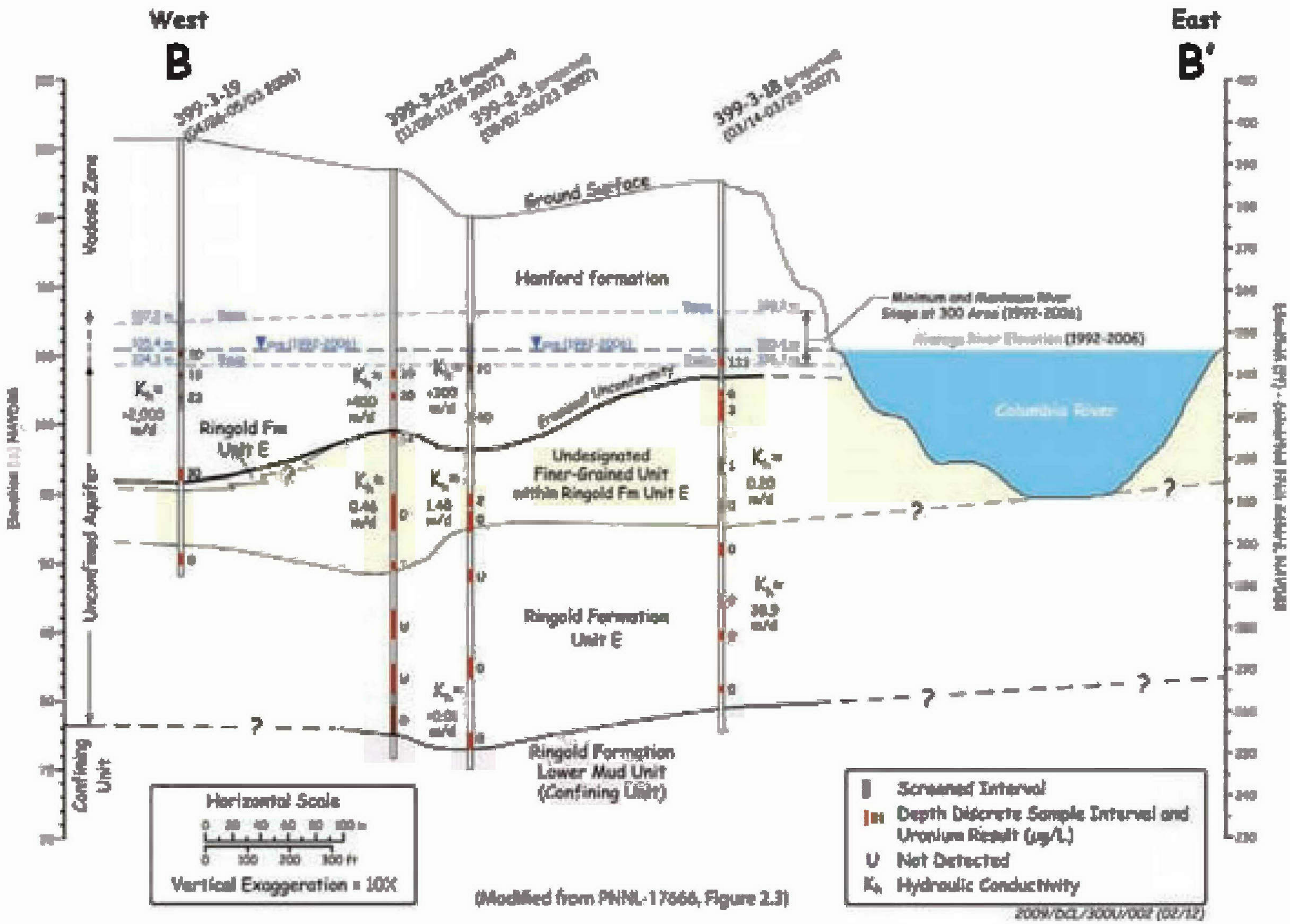


Figure 2-40. Vertical Distribution of Uranium Along West to East Cross Section

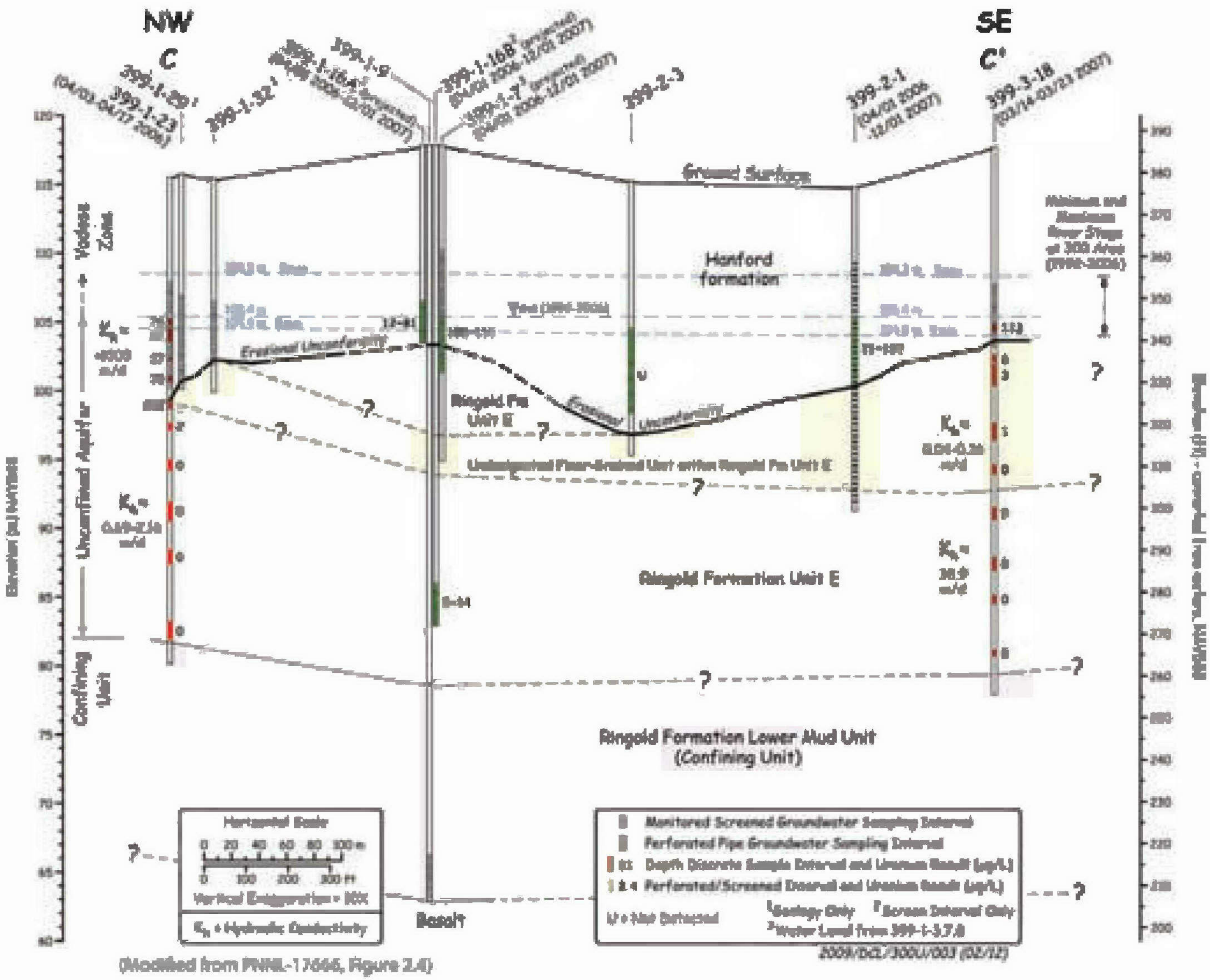


Figure 2-41. Vertical Distribution of Uranium Along Northwest to Southeast Cross Section

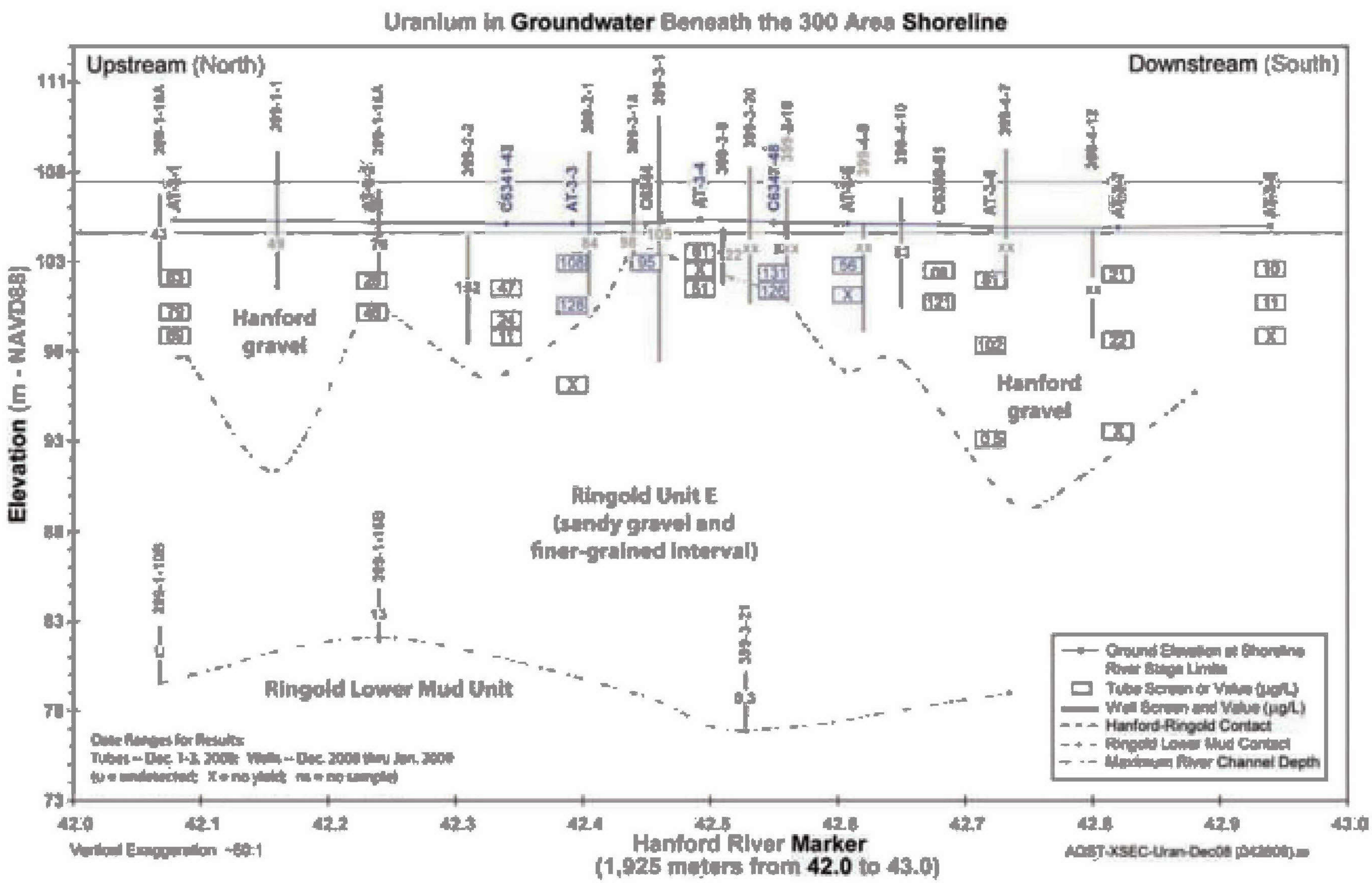


Figure 2-42. Vertical Distribution of Uranium Along Cross Section Parallel to the Columbia River

Figure 2-43 shows the thickness of the saturated Hanford formation sediment for long-term average water table elevations and during the seasonal June high water table condition. The data used to define the space occupied by the uranium plume are in a database using EarthVision[15] software. This database establishes the spatial framework for a variety of computer simulations of groundwater flow and uranium transport beneath the 300 Area (PNNL-17708, pp. 2.3 to 2.13). Based on the areal extent of the plume as mapped using groundwater monitoring results and the distribution of saturated Hanford formation sediment using the spatial framework data, estimates for the area of the plume, the volume of contaminated groundwater, and the mass of uranium in the plume have been developed and are summarized in Table 2-14. The total extent of the plume is indicated by concentrations greater than 10 µg/L and the extent where the EPA drinking water standard is exceeded by concentrations greater than 30 µg/L.

Organic Compounds

Volatile organic compounds are found in groundwater in several different stratigraphic intervals beneath the 300 Area. Low concentrations of trichloroethene are widespread in the saturated portion of the Hanford formation (i.e., upper portion of the unconfined aquifer) (Figure 2-44). In recent years, concentrations have been below the 5 µg/L drinking water standard. However, analytical results for samples from several aquifer tube sites at the river (installed in 2004 or later) show somewhat elevated values (Figure 2-45). The screens for tubes at these sites are relatively close to a finer grained interval of Ringold Formation sediment that contains concentrations that are well above the drinking water standard. Volatile organic compounds typically are not detected at the remainder of the tubes installed in saturated Hanford formation sediment.

Relatively high concentrations of trichloroethene (up to 630 µg/L) were discovered in 2006 in a finer grained interval of Ringold Formation sediment in the unconfined aquifer. The trichloroethene is accompanied by much lower concentrations of tetrachloroethene and the dechlorination degradation product cis-1,2-dichloroethene. Samples collected from above and below this hydrologic unit do not show evidence for similar contamination. The extent of this contamination appears limited to an area east and south of the footprint for the South Process Pond and east of the 307 Process Trenches (PNNL-17666, pp. 3.1 to 3.5). The finer grained interval does extend eastward from the 300 Area and the Columbia River channel incises the unit; however, it is not known whether the contamination extends throughout the unit where it is incised by the river channel.

[15] EarthVision is a registered trademark of Dynamic Graphics, Inc., Alameda, California.

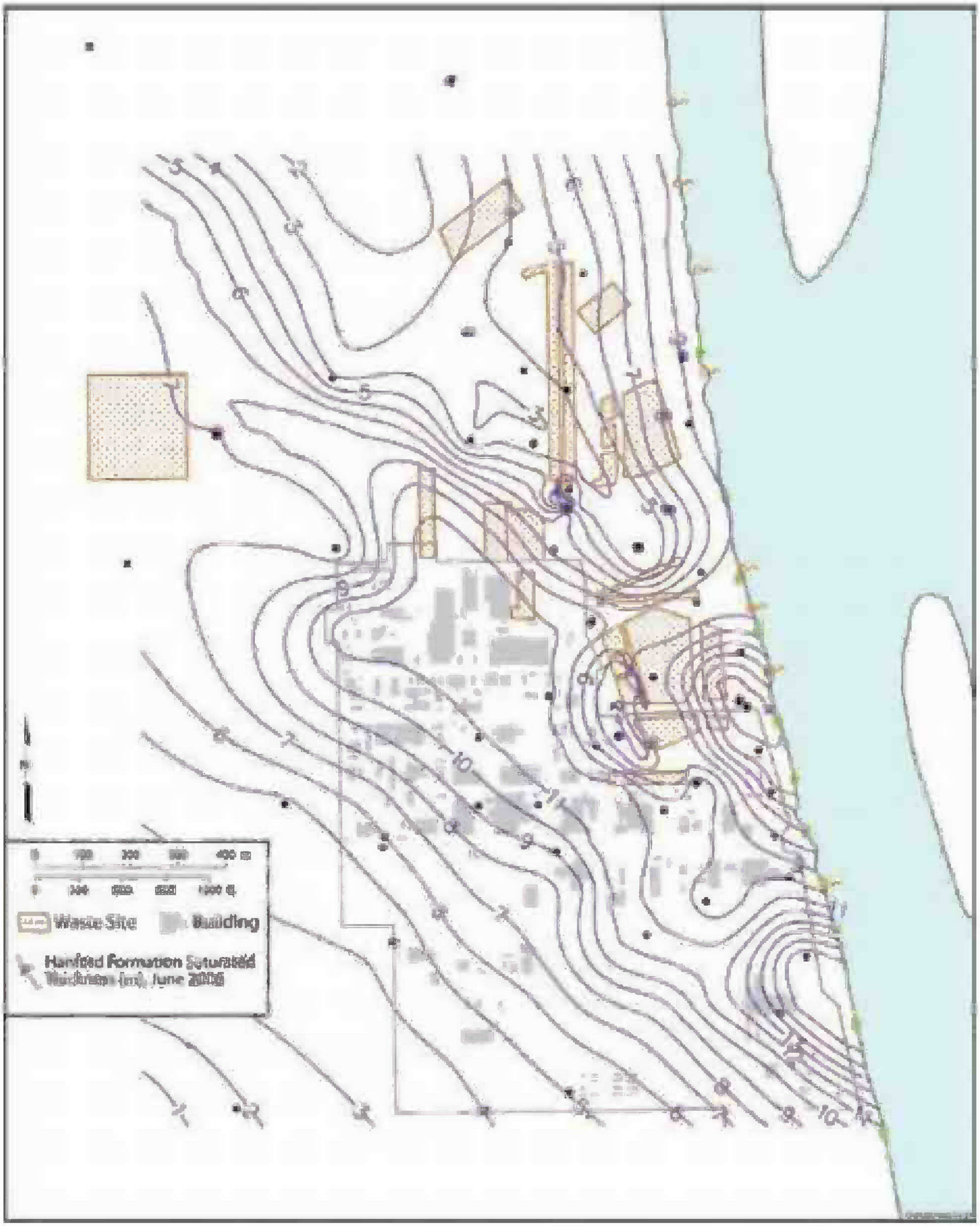


Figure 2-43. Thickness of Saturated Hanford Formation Sediment at the 300 Area

Table 2-14. Attributes of 300 Area Uranium Plume, June 2002 Through June 2008

Time Period Represented	>30 µg/L Portion of Plume			>10 µg/L Portion of Plume		
	Area of Plume (km^2)	Volume of Water (m^3)	Mass of Uranium (kg)	Area of Plume (km^2)	Volume of Water (m^3)	Mass of Uranium (kg)
June 2002	0.42	1,060,626	54.4	1.01	2,580,241	84.8
December 2002	0.43	901,216	78.0	0.86	1,794,192	95.8
June 2003	0.42	1,067,334	54.9	0.87	2,211,604	77.8
December 2003	0.32	673,342	40.7	0.87	1,808,715	63.4
June 2004	0.40	1,008,386	60.8	0.85	2,170,544	84.0
December 2004	0.40	836,520	52.3	0.95	1,979,449	75.2
June 2005	0.42	1,061,158	76.2	1.12	2,852,401	112.0
December 2005	0.41	846,596	63.0	0.96	1,988,448	85.9
June 2006	0.40	1,025,135	76.9	1.12	2,850,525	113.4
December 2006	0.48	1,003,316	78.8	0.74	1,536,019	89.4
June 2007	0.50	1,263,458	82.9	0.83	2,119,758	100.1
December 2007	0.41	853,008	55.1	1.03	2,137,160	80.8
June 2008	0.51	1,298,280	62.5	1.25	3,196,142	100.5

Notes:

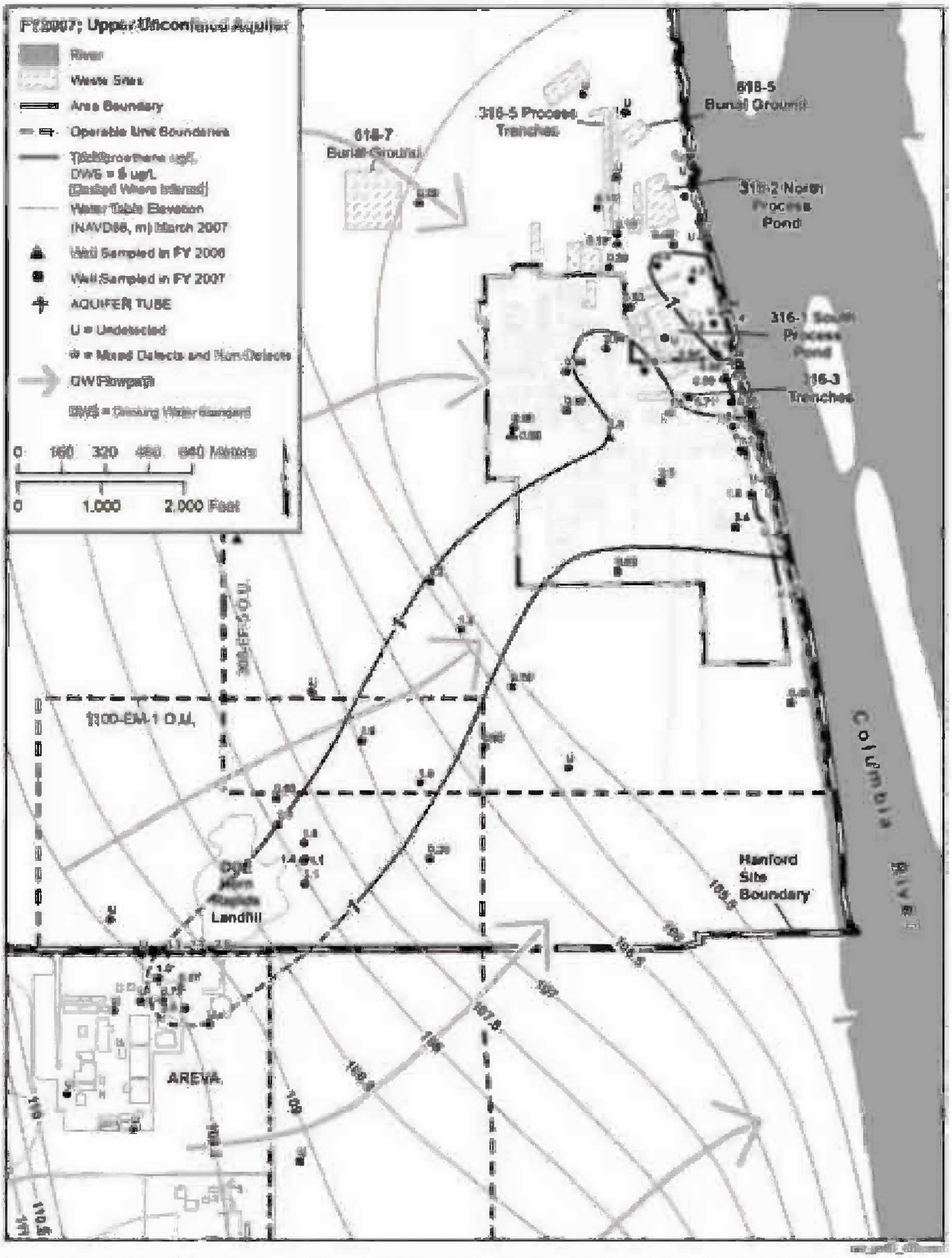
Contaminated thickness: 9.8 m (June) and 8.0 m (December).

Total porosity of 26%.

Mass is estimated using mid-point concentration between map contours.

Number of significant figures does not imply accuracy.

Source: Modified after PNNL-17034, Uranium Contamination in the Subsurface Beneath the 300 Area, Hanford Site, Washington, Table 3.3, with updates for 2008.



Source: PNNL-17666, Volatile Organic Compound Investigation Results, 300 Area, Hanford Site, Washington.

Figure 2-44. Trichloroethene Distribution in Upper Portion of Unconfined Aquifer near the 300 Area

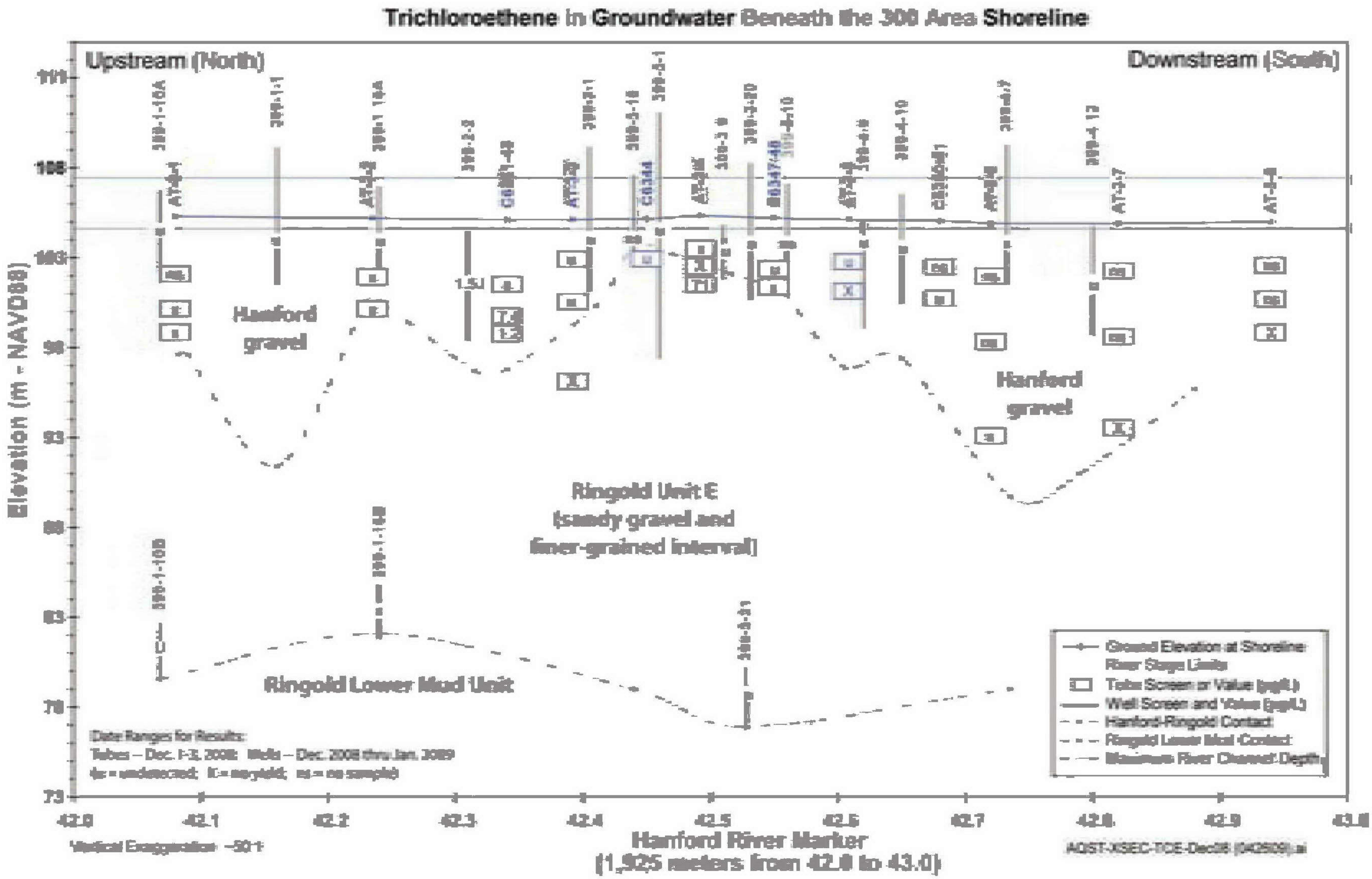


Figure 2-45. Vertical Distribution of Trichloroethene Along Cross Section Parallel to the Columbia River

At one location in the 300 Area, the concentration of cis-1,2-dichloroethene exceeds the 70 µg/L drinking water standard. Concentrations at Well 399-1-16B, which is screened to monitor the lower portion of the unconfined aquifer, have remained remarkably constant since monitoring began at that location in 1991 (Figure 2-46). Adjacent wells screened in the same hydrologic unit do not indicate contamination, thus suggesting a localized occurrence. No information on the potential vertical extent at this location is available. The interval monitored by the screen in Well 399-1-16B may be separated from the upper portion of the unconfined aquifer by the low permeability finer grained interval of Ringold Formation sediment, so the explanation for the presence of this contaminant at this depth interval remains unknown (PNNL-17666, pp. 3.8 and 3.9).

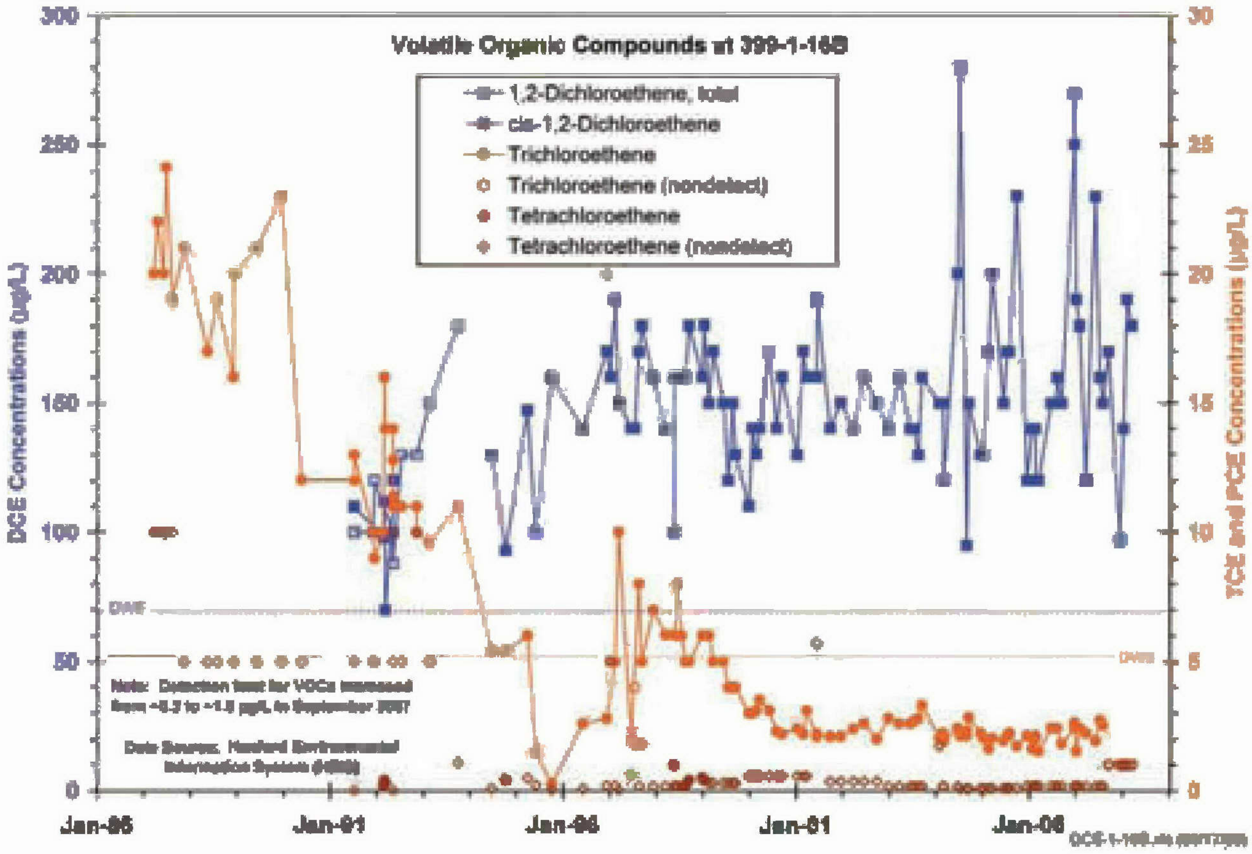


Figure 2-46. Cis-1,2-Dichloroethene Concentration Trend at Well 399-1-16B, Lower Portion of the Unconfined Aquifer

Other volatile and mobile organic compounds used in 300 Area facilities, such as carbon tetrachloride, have not been identified as COPCs in groundwater. When carbon tetrachloride is detected, the concentrations typically are less than 1 µg/L for recent monitoring results. There were carbon tetrachloride detections in several groundwater samples collected during drilling as part of the LFI for uranium (PNNL-16435) and the VOC investigation (PNNL-17666). Low concentrations (i.e., less than 6 µg/L) were detected in Ringold gravelly sediment near the bottom of the unconfined aquifer during drilling at Wells 399-3-22 and 399-2-5. However, the compound was not detected in the completed Well 399-3-22, screened in the lower portion of the unconfined aquifer.

Nitrate

Nitrate concentrations in groundwater beneath the 300 Area are lower than the 45 mg/L drinking water standard, except for the southern portion of the 300 Area (Figure 2-47). The relatively higher concentrations in the southern portion currently reflect the migration of nitrate contaminated groundwater into the 300 Area from sources to the southwest, which possibly include agricultural and industrial activities. For example, the concentration at Well 699-S28-E12, located near the southwestern corner of the 300 Area boundary, was 159 mg/L during 2008. Gradually increasing concentrations are observed in wells and at shoreline sites as this nitrate laden groundwater migrates into the 300 Area. Nitrate also migrates into the 300 Area from the northwest as part of the sitewide plume that originates in the 200 East Area, but at concentrations lower than the drinking water standard.

During the earlier operational period, 300 Area groundwater nitrate contributions came from disposal of fuels fabrication effluent and sanitary sewer systems. Throughout the 1970s and 1980s, nitrate concentrations in groundwater were somewhat higher than today, but still never greatly exceeded the drinking water standard. Remedial investigation monitoring results indicate a relatively constant level of contamination, but with some variability in concentrations between 1992 and 2004 (PNNL-15127, p. 2.19 and Table 2.10).

Other Contamination Indicators

In addition to the contaminants and indicators highlighted in the preceding paragraphs, other groundwater constituents are monitored at various locations in the 300 Area because they exceed the drinking water standard or are helpful in characterizing contamination in the aquifer. These include radiological constituents gross alpha, gross beta, Sr-90, Tc-99, and H-3, and basic water quality parameters such as major anions and metals.

Radiological contamination in groundwater beneath the 300 Area is generally at low levels. Gross alpha and gross beta concentrations are elevated above background at numerous wells, and, at some wells, above their respective drinking water standards as well. Potential sources for both types of activity include daughter isotopes from radiological decay of uranium. Other potential contributors to gross beta include low levels of Tc-99 and Sr-90 at isolated locations, and background levels from natural sources (e.g., K-40 and natural uranium). Where detected at 300 Area wells, Tc-99 and H-3 have migrated into the 300 Area from sources outside the 300 Area. Strontium-90 detected in groundwater in the past has been attributed to well-documented leakage in the 1960s from an underground pipeline associated with the 340 Complex (BNWL-CC-2617).

A recent change in a chemical contamination indicator in groundwater involves the appearance of chromium at Well 399-8-5A, which is adjacent to the 618-7 Burial Ground on its eastern side. Concentrations measured as total chromium in March 2008 were significantly higher than historical background levels of approximately 8 µg/L at this location. The small plume of uranium shown in Figures 2-33 and 2-34 suggests the area impacted by the change in conditions. Other constituents that show an increase include calcium, chloride, gross alpha, gross beta, nitrate, sodium, and uranium.

Remediation activities at this burial ground were underway during 2008 and changes in groundwater conditions may be related to those activities.

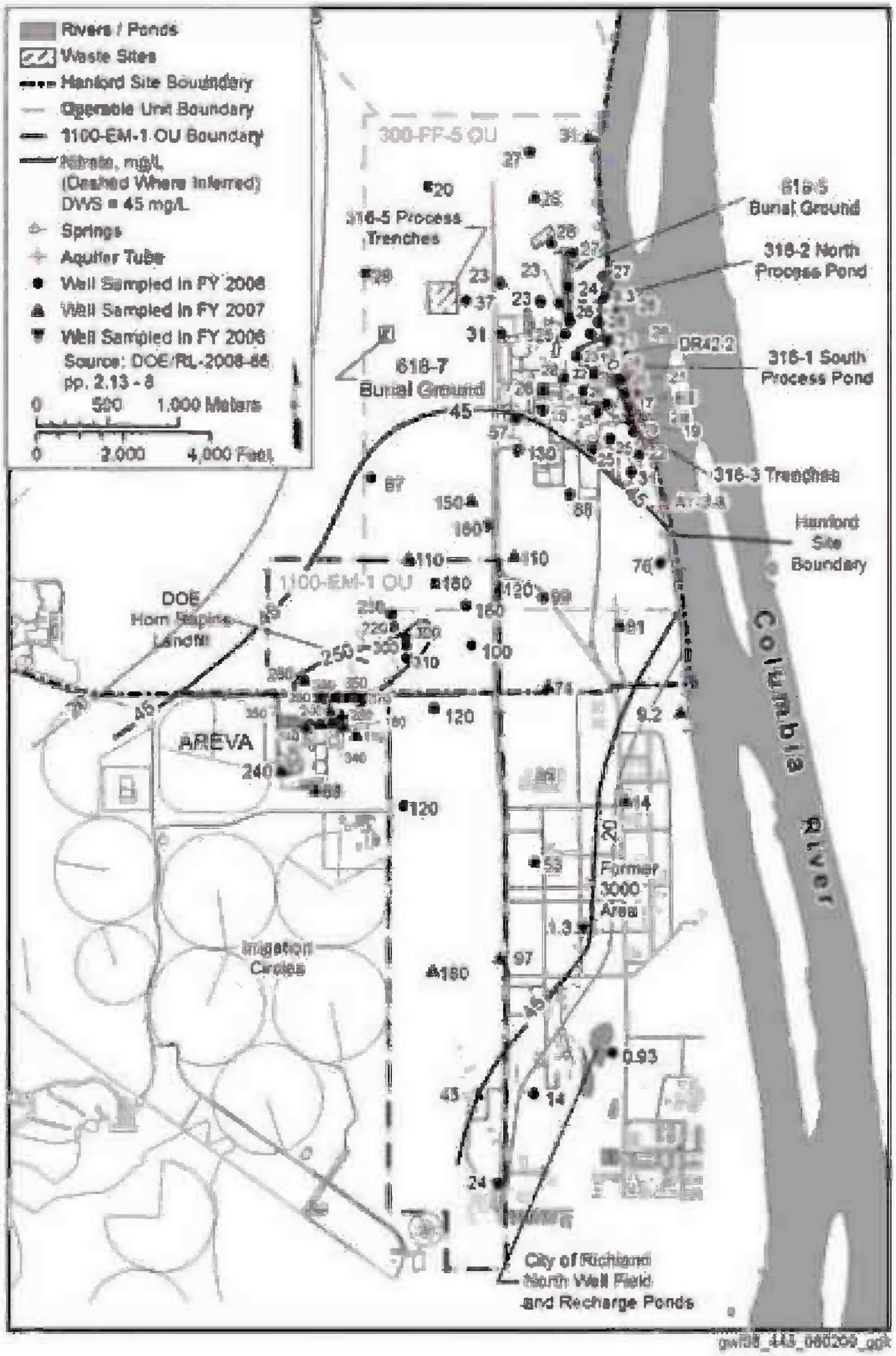


Figure 2-47. Nitrate Distribution in Upper Portion of Unconfined Aquifer near the 300 Area

2.6.5 Contamination in the 400 Area Subregion

The following subsections describe contamination along environmental pathways in the 400 Area subregion.

400 Area Waste Sites, Facilities, and Vadose Zone

The primary waste generating process in the 400 Area was related to the generation of secondary cooling water, or process water, which originated from the following 400 Area facilities: FMEF, MASF, 481-A Pump House, and FFTF cooling towers. This liquid effluent was routed through the 400 Area process sewer, a 300 mm (12-in.-) diameter pipe originating from the center of the 400 Area, to the 4608 Percolation Ponds. Cooling towers for auxiliary cooling systems at the FFTF and FMEF represent the source of the majority of the water that was eventually discharged to the 400 Area process sewer. To control scale formation and bacterial growth, a variety of chemical constituents are added to the cooling water (DOE/RL-96-42, Chapter 1.0).

The extent of contamination in the soil around and beneath the 400 Area accepted waste sites has not been determined. Characterization of these sites will be performed during waste site remediation. Table 2-5 and Section 2.4 provide a list of the 400 Area accepted sites.

400 Area Groundwater

Groundwater monitoring beneath the 400 Area is under the 200-PO-1 Groundwater OU, with a description of conditions presented in the annual groundwater monitoring report (DOE/RL-2008-66, Section 2.11, pp. 2.11-24 to 2.11-25). Contamination indicators present beneath the 400 Area are associated with the sitewide groundwater plume (Figures 2-30 and 2-31), and include H-3, nitrate, and I-129. None of these indicators is attributed to releases from the 400 Area facilities. The locations for groundwater-monitoring wells in the 400 Area are shown in Figure 2-7.

2.6.6 Contamination in the 600 Area Subregion

The following subsections describe contamination along environmental pathways in the 600 Area subregion.

600 Area Waste Sites and Vadose Zone

The waste sites with the highest potential for soil contamination in the 600 Area mainly consist of solid waste burial grounds and one crib location (316-4, 300 North Cribs). The 600 Area waste sites and the known extent of contamination in the soil column beneath the waste sites are described below.

600 Area Solid Waste Burial Grounds

618-3 Burial Ground – Solid Waste Burial Ground No. 3. The 618-3 Burial Ground was remediated in September to October 2004 to meet industrial cleanup standards. Remediation of the 618-3 Burial Ground was authorized by EPA/ROD/R10-01/119. After completing the excavation activities, verification samples were collected and analyzed for the nonradionuclide COCs arsenic, barium, cadmium, chromium, lead, selenium, silver, and uranium; and radionuclide COCs U-233/234, U-235, U-238, and total isotopic uranium. Verification sample results for all radionuclides and nonradionuclides indicated either no detection or detection below statistical background levels, thereby meeting the RAGs for direct exposure, groundwater protection, and river protection under an industrial land use scenario. Three biased samples were collected from suspected hot spots identified during post excavation radiological surveys. The biased samples were analyzed for isotopic uranium with measured results below soil cleanup limits for the industrial land use scenario (CVP-2006-00005, *Cleanup Verification Package for the 618-3 Burial Ground*).

618-4 Burial Ground – Solid Waste Burial Ground No. 4. Remediation of the 618-4 Burial Ground was authorized by EPA/ROD/R10-96/143. Following excavation, verification sampling for the COCs total uranium, arsenic, and lead was conducted. All contaminant concentrations were measured below site background values. In addition to verification samples, nine biased grab samples were collected to verify the absence of potential residual contamination in soil beneath locations where larger quantities of specific waste streams were unearthed. The biased grab samples were analyzed for uranium (total), lead, cadmium, barium, PCBs, trichloroethylene, tetrachloroethene, methyl ethyl ketone, benzene, and total petroleum hydrocarbons; all results were below cleanup levels (CVP-2003-00020, *Cleanup Verification Package for Landfill 1A [WIDS Site 300-49]*).

618-5 Burial Ground – Solid Waste Burial Ground No. 5, Regulated Burning Ground. Remediation of the 618-5 Burial Ground was authorized by EPA/ROD/R10-01/119. After completing the excavation activities, verification samples for the COCs arsenic, cadmium, chromium, lead, total uranium, and isotopic uranium (U-234, U-235, and U-238) were collected and analyzed. Evaluation of verification sample results indicate RAGs were met for direct exposure, protection of groundwater, and protection of the Columbia River for industrial land use (CVP-2003-00021, *Cleanup Verification Package for the 618-5 Burial Ground*).

618-7 Burial Ground – Solid Waste Burial Ground No. 7. The residual contamination below the 618-7 Burial Ground was evaluated during the remediation of the site, completed in FY 2008. The CVP and associated verification data results were completed in December 2008. Results of the sampling, laboratory analyses, and data evaluations for the 618-7 Burial Ground site indicate that all RAOs for direct exposure, protection of groundwater, and protection of the Columbia River have been met for unrestricted land use (CVP-2008-00002, *Cleanup Verification Package for the 618-7 Burial Ground*).

618-8 Burial Ground – Solid Waste Burial Ground No. 8, Early Solid Waste Burial Ground. Remediation of the 618-3 Burial Ground was authorized by EPA/ROD/R10-01/119. Following excavation, verification sampling was conducted for the COCs arsenic, barium, cadmium, chromium, lead, selenium, silver, total uranium, and isotopic uranium (U-233/234, U-235, and U-238). Verification sample results from the 618-8 Burial Ground indicate all RAGs for direct exposure, protection of groundwater, and protection of the Columbia River were met for industrial land use (CVP-2006-00006).

618-9 Burial Ground – 300 West Burial Ground, Dry Waste Burial Site No. 9. All waste was removed in 1991 during an expedited response action. Extensive follow-up soil gas and soil sampling showed only insignificant amounts of kerosene, and hexone was undetected. The expedited response action was complete in October 1992. In 1996, the 300-FF-2 OU LFI determined that no further investigation was required (DOE/RL-96-42).

618-10 Burial Ground. The site consists of 12 trenches and 94 VPUs. The site contains a broad spectrum of low- to high-level dry wastes, primarily fission products and some TRU wastes from the 300 Area. Low-level wastes are buried in trenches, and medium- to high-level beta/gamma wastes are mostly in the VPUs. Some higher activity wastes were placed in concrete-shielded drums, and then disposed in the trenches. The site was surface stabilized with clean backfill material in 1983. The extent of soil contamination beneath the burial ground has not been fully determined. Nonintrusive sampling of the 618-10 Burial Ground began in 2009 and will continue into early 2010. A SAP detailing an intrusive sampling plan for 618-10 Burial Ground will be approved and initiated during 2010. The details of the nonintrusive sampling and further characterization of the 618-10 Burial Ground are outlined in DOE/RL-2008-27.

618-11 Burial Ground. The site consists of three V-shaped trenches, 2 large-diameter caissons, and 50 VPUs. The burial ground received a variety of waste from the 300 Area operations. Low-level activity waste and large items were placed in the burial trenches. Some high-activity liquid waste or plutonium contaminated liquid went into barrels, then sealed with concrete. The burial ground was surface stabilized with additional clean dirt and planted with wheatgrass in 1983. The extent of soil contamination beneath the burial ground has not been fully determined. Nonintrusive sampling activities at the 618-11 Burial Ground are scheduled to begin in 2010, pending approval from DOE. The details of the nonintrusive sampling and further characterization of the 618-11 Burial Ground are outlined in DOE/RL-2008-27.

618-13 Burial Ground – 300 North Solid Waste Burial Ground. The remediation activities for the 618-13 Burial Ground are in progress and are scheduled to be complete in January 2010, based on the current working schedule, which may be subject to change. The residual contamination in the soil beneath the 618-13 Burial Ground will be determined as part of the cleanup verification sampling process.

600 Area Liquid-Waste-Disposal Sites

316-4, 321 Crib (300 North Crib). The site received hexone bearing uranium wastes and limited amounts of other uranium bearing wastes from the 321 Building. The 316-4 Crib was in operation between 1948 and 1962. The site received an estimated 200,000 L (52,834 gal) of hexone bearing uranium liquid wastes, approximately 1,000 kg (2,205 lb) of nitrate, 2,000 kg (4,409 lb) of uranium, and 3,000 kg (6,614 lb) of hexone (DOE/RL-96-42). Additional documentation has been found indicating 12,040 L (3,182 gal) of liquid organic waste was being shipped to the 300 North Crib in 1962. Expected contaminants include Cs-137, Pu-239, Am-241, Sr-90, U-233, U-235, U-236, thorium-228 (Th-228), and U-238. Additional constituents may include 2-butanone, arsenic, chromium, methylene chloride, nitrobenzene, selenium, and tributyl phosphate. Remedial excavation work to remove the crib structures began in 2004. The last load-out of waste occurred in April 2005. The site remains an accepted (unremediated) waste site. Further evaluation of the extent of contamination in the soil resulting from the use of the 316-4 Crib will be determined during the remediation of the 316-4 Crib, scheduled to begin in January 2013.

600 Area Groundwater

Groundwater beneath the 600 Area portion of the 300 Area has been impacted not only by contaminants from sources within the 300 Area, but also by sources in the 200 East Area and sources not associated with Hanford Site operations. Collectively, the latter contamination is referred to as the "sitewide groundwater plume" and for the purposes of CERCLA, is addressed under the 200-PO-1 Groundwater OU. The recent distributions of contaminants tracked as part of the sitewide plume are shown in maps presented earlier in this section (Figures 2-30 and 2-31). Superimposed on the sitewide plume are contaminants released from sources within the 300 Area, as described above. Principal among these impacts is the H-3 plume created by releases from the 618-11 Burial Ground. The nature and extent descriptions that follow for these contaminants have been summarized from descriptions in the most recent annual groundwater monitoring report (DOE/RL-2008-66, Section 2.12, pp. 2.12-9), unless otherwise cited.

H-3 at 618-11 Subregion (Including Co-Contaminants)

High concentrations of H-3 were detected in early 1999 at Well 699-13-3A, which is located at the eastern fence line of the 618-11 Burial Ground. Subsequent investigations (PNNL-13228, *Evaluation of Elevated Tritium Levels in Groundwater Downgradient from the 618-11 Burial Ground Phase I Investigations*) identified a contaminant plume that extends downgradient as a narrow plume with concentrations much higher than the surrounding sitewide plume from the 200 East Area (Figure 2-48). Analysis of helium isotopes in soil gas at sites along the fence line of the burial ground indicated that H-3 gas has been released from buried materials, and by some combination of processes has affected

groundwater (PNNL-13675). Historical records suggest that "hydrogen" was disposed to the burial ground, which may be a reference to irradiated aluminum-lithium fuel used to produce H-3 (HNF-EP-0649, *Characterization of the 618-11 Solid Waste Burial Ground, Disposed Waste, and Description of the Waste-Generating Facilities*; BHI-00012, pp. 6.27 to 6.31; WHC-MR-0416, *Miscellaneous Information Regarding Operation and Inventory of 618-11 Burial Ground*).
A comprehensive description of the possible relationship between the H-3 plume associated with releases from the burial ground and the history of H-3 production at the Hanford Site is presented in PNNL-13228, pp. 4.8 and 4.9.

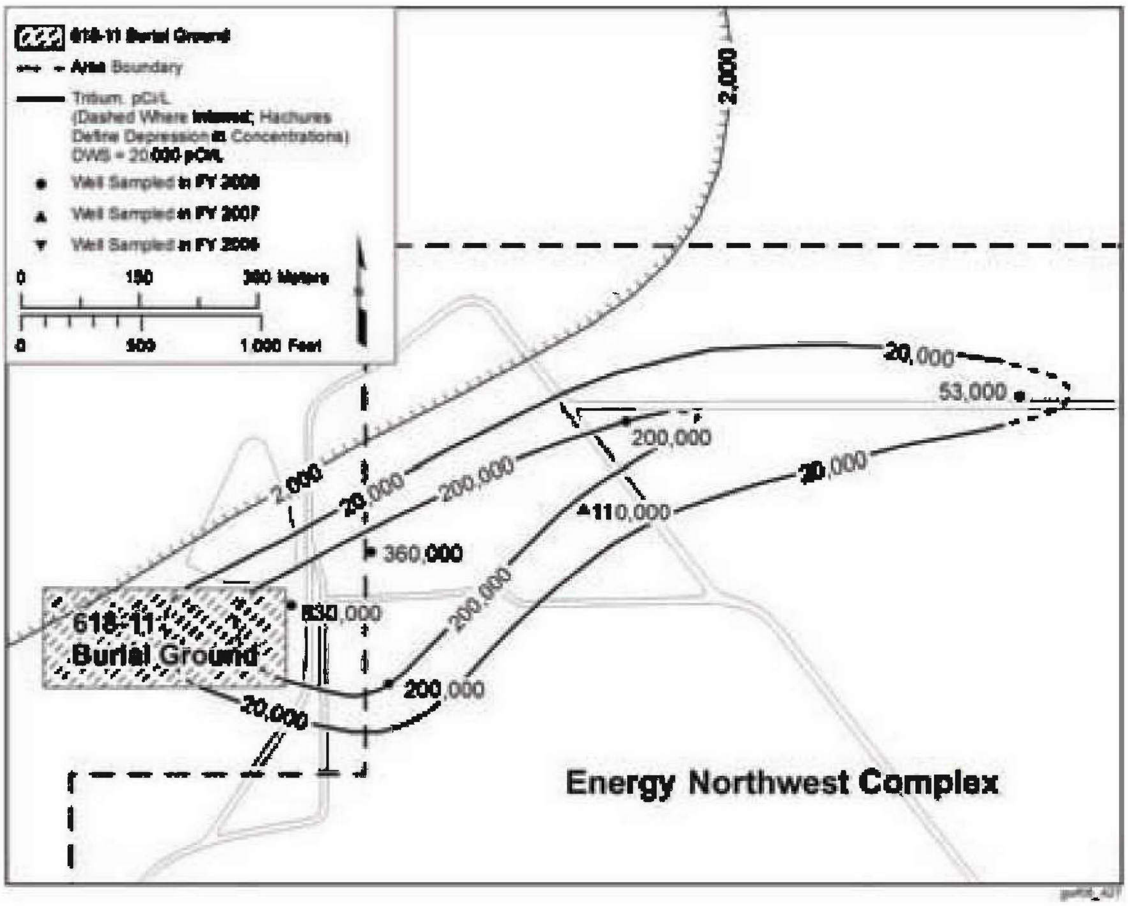


Figure 2-48. H-3 Concentrations in Groundwater Impacted by the 618-11 Burial Ground (Average Values for the Fiscal Year)

The conceptual model was developed describing the plume during 2005 that included computer simulation of the plume (PNNL-15293). A principal conclusion of the simulation effort is that concentrations will attenuate by decay and dispersion to levels lower than the drinking water standard before the plume's arrival at locations of water withdrawal (e.g., Energy Northwest Wells ENW-MW-31 and -32) and at the Columbia River. The Energy Northwest wells are in confined aquifers in Columbia River basalt and do not tap the uppermost portions of the unconfined aquifer impacted by the H-3 plume.

Tritium concentrations near the presumed burial ground source have declined since the 1999 and 2000 values up to approximately 8,000,000 pCi/L, with concentrations during 2008 at Well 699-13-3A ranging between 610,000 and 940,000 pCi/L (Figure 2-49). The trend at Well 699-13-3A suggests that an episodic event of unknown nature caused a release of H-3 from buried materials and/or mobilization of

H-3 in the vadose zone. Concentration trends at wells downgradient and away from the burial ground reflect migration of the plume (i.e., they include constant or gradually increasing concentrations trends).

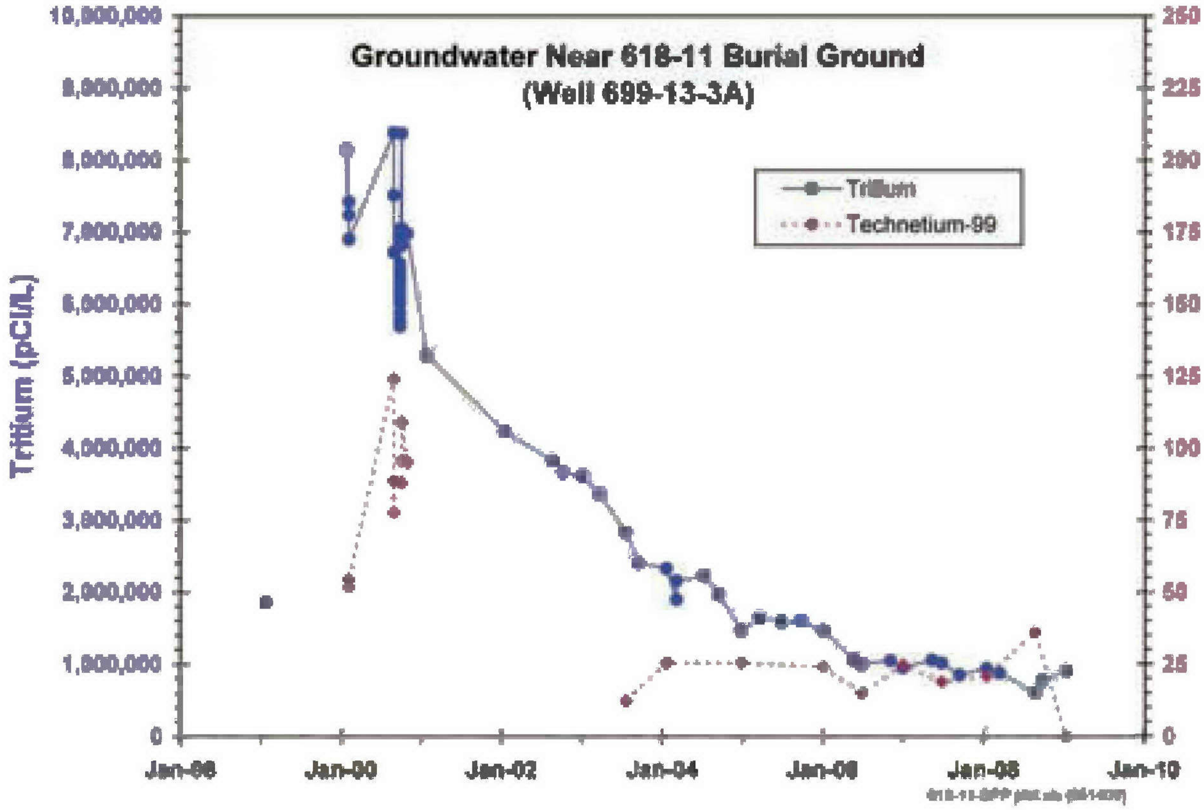


Figure 2-49. H-3 and Tc-99 Concentrations in Groundwater near the 618-11 Burial Ground

While several other contamination indicators are present in groundwater near the 618-11 Burial Ground (e.g., sitewide plume indicators nitrate and Tc-99; possibly uranium), only Tc-99 shows a concentration trend at Well 699-13-3A that is similar to the trend for H-3 (Figure 2-49). Wastes containing irradiated fuel are known to have been disposed in the burial ground (BHI-00012, pp. 6.27 to 6.31; HNF-EP-0649), and Tc-99 is mobile in environmental pathways.

Uranium at 618-10/316-4 Subregion (Including Co-Contaminants)

Uranium concentrations are elevated above the natural background level of 5 to 8 µg/L at several wells near the southeastern portion of the 618-10 Burial Ground and the former 316-4 Crib. The principal source for this contamination is disposal of uranium contaminated organic liquid waste to the 316-4 Crib between 1948 and 1954. Well 699-S6-E4A, which is located within the 2004 excavation footprint for the former cribs, has revealed the highest concentrations in the past, but has shown a steady decline during recent years, with the fall 2007 and summer 2008 results remaining below the 30 µg/L drinking water standard (Figure 2-50). The cause for the earlier variability in uranium concentrations at this well likely are related to excavation and backfilling activities during 2004. Well 699-S6-E4L, which is located adjacent to the southeastern portion of the burial ground, also showed elevated uranium concentrations during excavation activities; however, since January 2006, concentrations have followed a steady downward trend to values approximately one-half the drinking water standard.

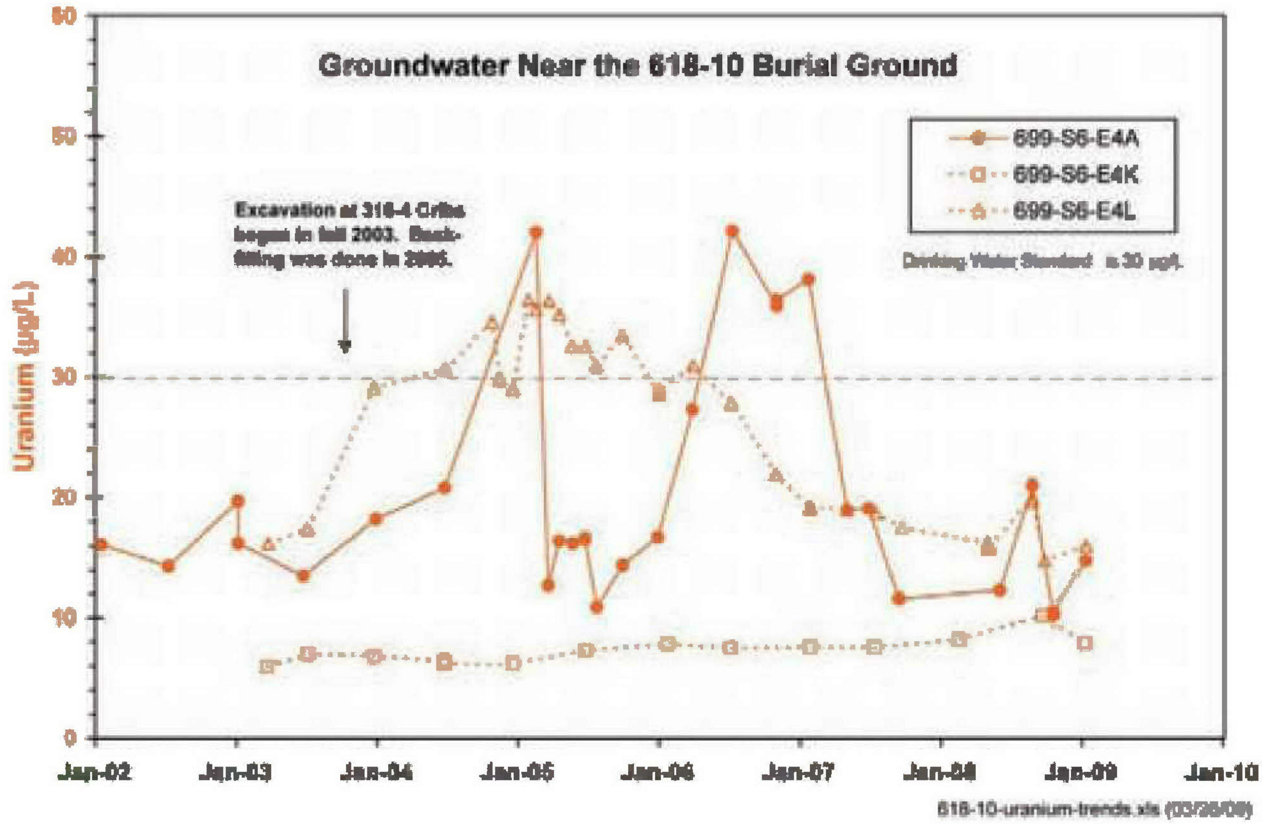


Figure 2-50. Uranium Trends in Groundwater near the 618-10 Burial Ground and Former 316-4 Crib

Although VPUs used to store irradiated wastes are present in the 618-10 Burial Ground (BHI-00012, pp. 6.25 to 6.27; WHC-MR-0415, *Miscellaneous Information Regarding Operation and Inventory of 618-10 Burial Ground*), no evidence to indicate release of H-3 or other radionuclides in sufficient quantity to affect groundwater has been observed. An investigation of helium isotopes in soil gas adjacent to the burial ground was conducted in 2002, but did not find conclusive evidence for release of H-3 gas from buried materials (PNNL-14320, pp. 12 to 14). However, H-3 associated with the sitewide plume is present in groundwater at the 618-10 subregion, along with Tc-99 and nitrate.

At the 618-10 Burial Ground subregion, organic compounds are included in buried materials and disposed to the nearby 316-4 Crib. Oily substances of unknown composition were reported at the ground surface during surface stabilization activities for the burial ground in 1983 (BHI-00012, p. 6-26). The LFI during 1995-1996 for the 300-FF-2 OU found evidence for a variety of VOCs and semi-VOCs, along with petroleum hydrocarbons, in the vadose zone and groundwater (DOE/RL-96-42, pp. 6-5 to 6-12). Subsequent investigations in 2002 related to enhancing the groundwater monitoring capabilities revealed evidence for organic compounds in soil gas near the burial ground; compounds detected included carbon tetrachloride, trichloroethene, and tetrachloroethene (PNNL-14320, pp. 14 to 18).

The former 316-4 Crib received a variety of organic compounds including tributyl phosphate. Removal of these cribs occurred in 2004, and contamination (i.e., uranium and tributyl phosphate) remains in the vadose zone beneath the excavation footprint for the cribs. Recent groundwater samples from a well located within the excavation footprint of the cribs reveal concentrations for uranium at less than the drinking water standard and for tributyl phosphate at relatively low concentrations (i.e., 5.6 µg/L)

(DOE/RL-2008-66, pp. 2.12-8 and 2.12-9). There is no drinking water standard for tributyl phosphate; the compound tends to bind to soil particles and is not particularly soluble in groundwater.

Nitrate in 600 Area

The outlying waste sites in the 300-FF-5 Groundwater OU lie within the large contaminant plume that originates in the 200 East Area. Background levels for nitrate upgradient of the 618-11 Burial Ground are in the range of 20 to 40 mg/L, while near the burial ground concentrations are somewhat higher and exceed the 45 mg/L drinking water standard (Figure 2-31). For example, values during 2008 at Well 699-13-3A ranged from 83 to 98 mg/L and at Well 699-12-2C, ranged from 41 to 52 mg/L. The cause for higher values near the burial ground is not fully understood, but may reflect some hydrogeologic characteristic that has caused retention of more contaminated groundwater from earlier years (PNNL-13228, p. 5.1). Trends for the last several years indicate relatively constant nitrate levels, but with some variability.

At the 618-10 Burial Ground subregion, nitrate concentrations generally are consistent with values expected for the leading edge of the sitewide plume and are currently lower than the drinking water standard. The maximum concentration observed during 2008 was 42 mg/L at Well 699-S6-E4L. There is no identified cause for the somewhat elevated concentration(s).

2.6.7 Contamination Indicators Along Columbia River

The nature and extent of contamination in near-Columbia River environmental pathways is monitored using groundwater from near-river wells and aquifer tubes under the CERCLA program, and a variety of media from locations monitored by the Surface Environmental Surveillance Project, a part of DOE's Public Safety and Resource Protection Program (Figures 2-51 and 2-52). The monitoring schedules for the CERCLA program are in SAPs (DOE/RL-2002-11; DOE/RL-2000-59 for aquifer tubes). The Surface Environmental Surveillance Project monitors riverbank springs (water and sediment), near-shore river water, free-flowing stream river water, and biota in the Hanford Reach of the Columbia River, with schedules published annually (e.g., PNNL-18177 for 2009) and results described in the annual Hanford Site environmental report (e.g., PNNL-17603 for 2007). The following descriptions are from that environmental report, unless otherwise cited.

Riverbank Springs and Sediment

Several riverbank springs are sampled annually along the 300 Area portion of the shoreline. Well established springs are not present along the portion between the 300 Area upstream to the Energy Northwest intake structure, although seepage has been observed in the past. The 300 Area springs are monitored for (1) radiological indicators gross alpha, gross beta, H-3, I-129, Sr-90, uranium (isotopic), and gamma emitters; and (2) chemical indicators involving metals (filtered and unfiltered), anions, and VOCs. At some spring locations, associated sediment is collected and analyzed for contamination indicators that possibly attach to sediment (e.g., gamma emitters, Sr-90, uranium isotopes, and metals).

Recent monitoring results for riverbank springs generally are consistent with observations in near-river wells regarding the nature and extent of contamination. Uranium isotope results, when converted to mass concentrations (assuming natural abundance ratios), provide values consistent with locations and concentrations observed in near-river wells, with maximum values for spring water reaching approximately 120 µg/L during 2007 (PNNL-17603, p. 10.51). Gross alpha and gross beta also are elevated at these locations, as the result of the uranium contamination. No other radiological contamination indicators are elevated in spring water.

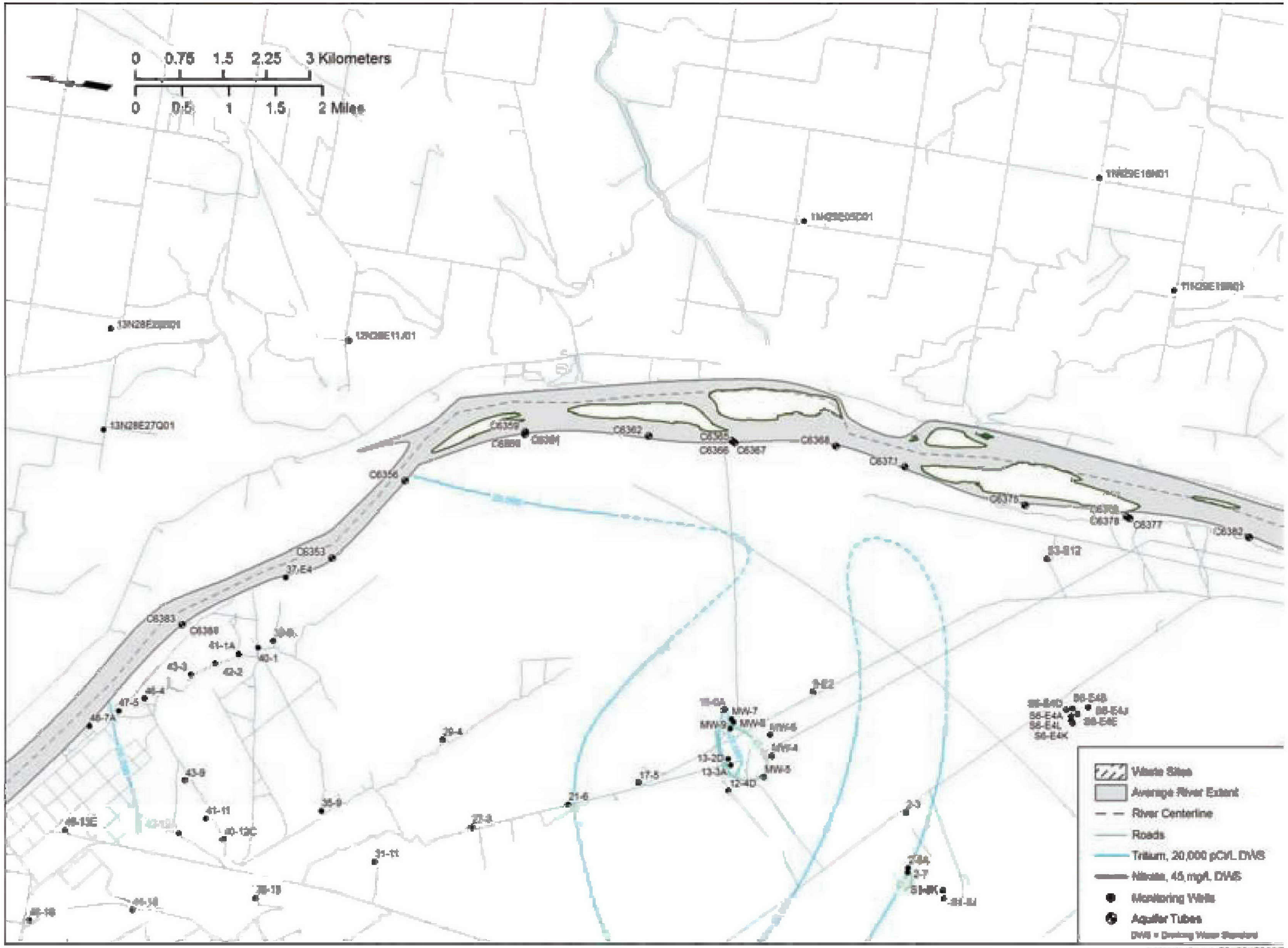


Figure 2-51. Map Showing Locations of Riverbank Springs, Aquifer Tubes, and River Water Sampling Sites Upstream of the 300 Area

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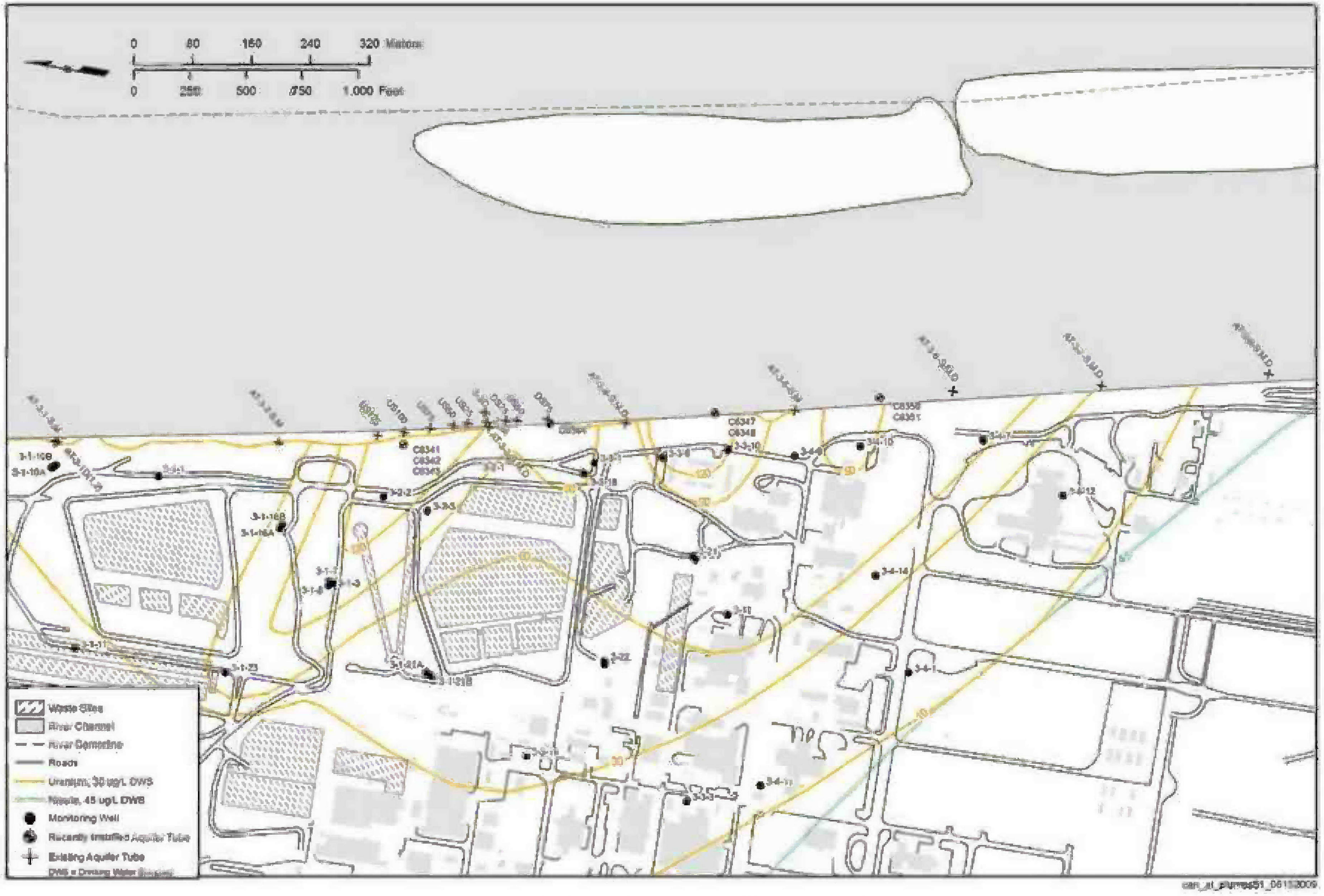

Figure 2-52. Map Showing Locations of Riverbank Springs, Aquifer Tubes, and River Water Sampling Sites at the 300 Area

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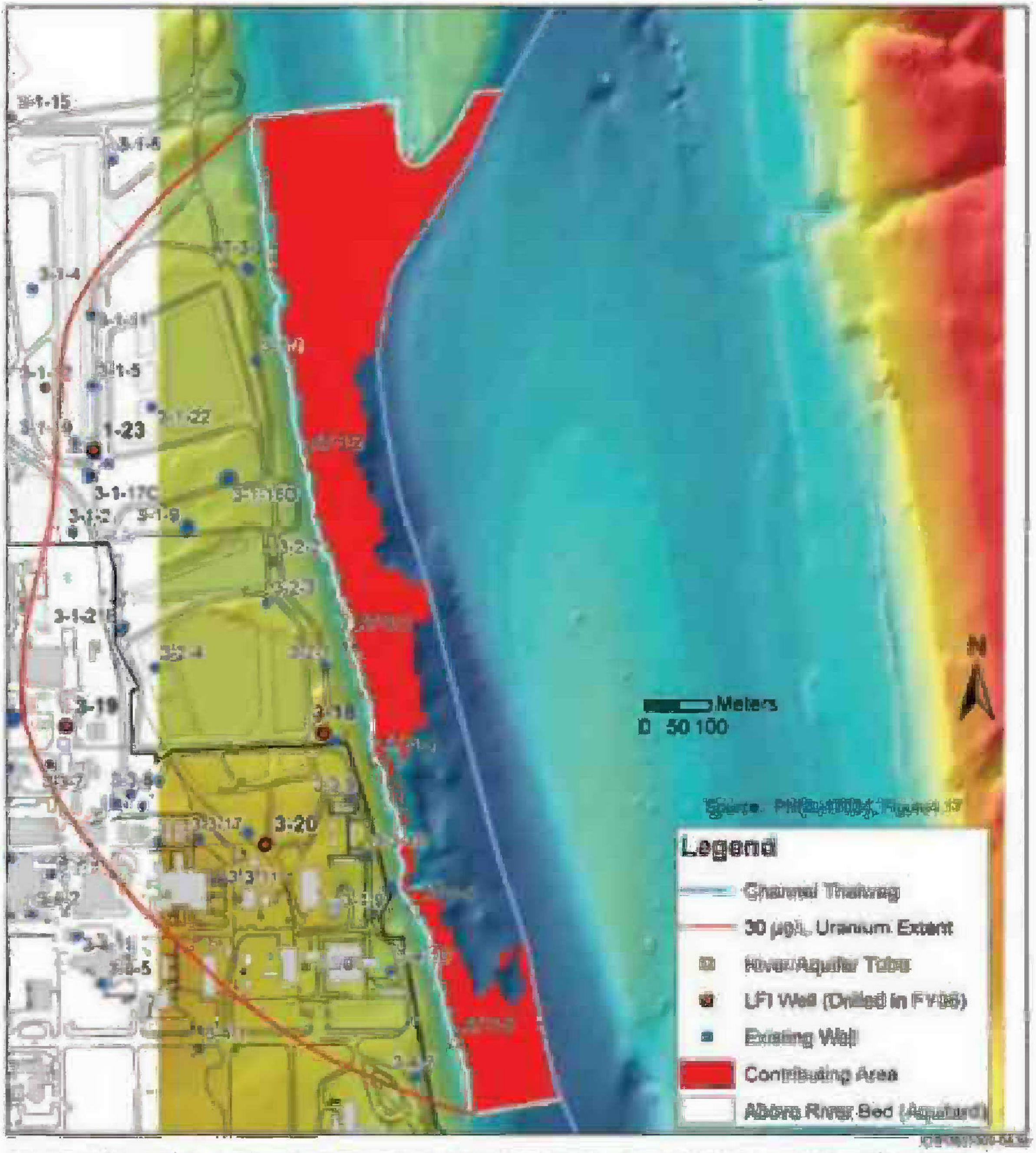
For sediment associated with riverbank springs, radionuclide concentrations are similar to those found in Columbia River sediment. The concentrations reflect multiple sources, including upstream erosion of natural deposits, accumulation of atmospheric fallout in the drainage basin, and agricultural chemical runoff. An exception is uranium in sediment associated with springs at the 300 Area, which is contaminated by groundwater plume discharging through the groundwater/river interface. Concentrations in 300 Area springs sediment are somewhat elevated with respect to sediment from the reservoir behind Priest Rapids Dam, which provides a local background reference value (PNNL-17603, p. 10.54). Metals in 300 Area sediment samples are not elevated beyond the levels observed in Columbia River sediment, in spite of previous disposal of large quantities of metals such as chromium and copper to the 300 Area liquid waste disposal facilities.

Near-shore River Water

In addition to monitoring the free-flowing stream of the Columbia River as it flows across the Hanford Site, the Surface Environmental Surveillance Project collects samples at near-shore sites adjacent to some Hanford Site groundwater plumes, including the 300 Area uranium plume. The results are published annually in the environmental report (e.g., PNNL-17603, Tables C.6 and C.7, pp. C.10 and C.11). During 2007, five locations adjacent to the 300 Area were sampled. Concentrations for radiological indicators were as follows: H-3 (81 to 1,200 pCi/L), Sr-90 (0.041 to 0.054 pCi/L), and uranium, total (0.35 to 1.2 pCi/L). Concentrations for metals also were reported as low, with values less than 1 µg/L during 2007. Concentrations for contamination indicators in recent near-shore river water samples are all well below the Washington State ambient surface water quality criteria for protection of aquatic life (PNNL-17603, pp. 10.34 to 10.39).

Because the Columbia River channel incises the unconfined aquifer that lies beneath the 300 Area, some contaminated groundwater discharges to the river through the riverbed. Figure 2-53 illustrates where the channel incises saturated sediment of the Hanford formation, which contains the preponderance of contaminated groundwater. The rates and distributions of contaminant discharge through the area shown in red are variable for a variety of reasons, including heterogeneity in groundwater flow paths, uneven distribution of contaminants, and the presence of riverbed alluvium. Riverbed sediment and pore water sampling conducted during 2009 under the RCBRA (DOE/RL-2008-11) will help define areas of greatest concern. In addition, research being conducted under the DOE's Environmental Remediation Sciences Program is using geophysical methods to identify areas of preferential groundwater discharge from the 300 Area to the riverbed.



Source: PNNL-17034, Uranium Contamination in the Subsurface Beneath the 300 Area, Hanford Site, Washington, Figure 4.17.

Figure 2-53. Area Where Hanford Formation Sediment is Incised by River Channel

3 CSMs

This chapter describes the CSMs for the 300 Area subregions (i.e., the 300 Area, 400 Area, and 600 Area). The EPA guidance for conducting RIs indicates that a "conceptual site model should include known and suspected sources of contamination, types of contaminants and affected media, known and potential routes of migration, and known or potential human and environmental receptors" (EPA/540/G-89/004, p. 2-7). The stated purpose in the guidance for developing and maintaining a CSM is "…to evaluate potential risks to human health and the environment…" and to "…assist in the identification of potential remedial technologies." The CSM is useful for planning projects, developing computer simulations, interpreting monitoring results, and communicating progress, both within the project and with the general public (EM 1110-1-1200, *Conceptual Site Models for Ordnance and Explosives (OE) and Hazardous, Toxic, and Radioactive (HTRW) Projects*, p. 2-1). Conceptual site models evolve and become focused as the RI/FS for a contaminated site progresses through the CERCLA process.

For the 300 Area, information used for decisions involving interim actions has evolved significantly as the result of source OU remedial actions, years of groundwater monitoring, a renewed FS for uranium, treatability tests, and a variety of research projects. Abundant information on contamination has been gained during waste site and facility removal actions, resulting in effectively removing or blocking contaminated materials from access to environmental pathways, while affording worker safety during these cleanup operations. An improved understanding of processes promoting further dispersion of contaminants from their sources has aided in developing monitoring strategies, conducting risk assessments, and developing strategies for potential remedial actions in the subsurface environment.

As a result of decisions made during various phases of the CERCLA process to date, it has become apparent that uranium contamination in the subsurface at the 300 Area will require the most significant new investigative work in order to provide the technical basis for new decisions for that contamination. Five-year reviews of EPA/ROD/R10-96/143 for interim action involving groundwater in the 300-FF-5 Groundwater OU have reaffirmed that monitoring and institutional controls on the use of groundwater remain appropriate while source removal and facility remedial actions continue. However, the most recent 5-year review concluded that the interim remedy for uranium in groundwater is not considered protective (DOE/RL-2006-20, p. 3.18). In addition, since the most recent 5-year review was conducted, trichloroethene has been discovered in an interval of finer-grained sediment within the unconfined aquifer at concentrations well above the drinking water standard (PNNL-17666). Because the contaminated interval is incised by the Columbia River, new concern has arisen regarding potential ecological impacts in the aquatic environment. For other contamination in the subsurface, long-term monitoring has revealed relatively constant or declining concentration trends. No evidence of renewed or increased threats to human and ecological receptors has emerged for those contaminants since the initial qualitative risk assessment for the 300-FF-5 Groundwater OU, as described in DOE/RL-93-21, *Phase I Remedial Investigation Report for the 300-FF-5 Operable Unit*, Vol. 1, pp. 6.1 to 6.38.

3.1 CSM and Data Need Identification for the 300 Area

The CSM for contamination at the 300 Area is described in terms of (1) engineered facilities and the adjacent soil, (2) the vadose zone beneath engineered facilities, and (3) the groundwater system. Because some contamination is distributed in the vadose zone away from engineered facilities, that description is included as part of the discussion of the groundwater system. Where information regarding aspects of the various conceptual models[16] for features and processes associated with contamination is missing or uncertain ("data gaps"), these gaps are described, along with the steps necessary to fill those gaps ("data needs") that pertain to future remediation decisions.

Remediation of contaminated engineered facilities follows a strategy developed by the Tri-Parties for the source OUs in the 300 Area (i.e., the 300-FF-1 and 300-FF-2 OUs), as presented in proposed plans and RODs. The strategy has evolved by treating first those sites with the greatest potential for further dispersal of contamination in environmental pathways. These sites include the former liquid waste disposal sites. Remediation began with characterizing the facility regarding its former use and likely hazardous wastes, excavation of contaminated soils, verification of final conditions, and backfilling/ surface stabilization. A similar regimen is followed for solid waste burial grounds and sites with unplanned releases, such as leaks and spills. In parallel with remediation of waste disposal facilities, buildings are removed under the D4 process. The foundations and adjacent soils associated with buildings then are surveyed and treated as waste sites if supported by analytical or survey results.

At some locations where remediation has been conducted, residual contamination remains at the bottom of excavations at waste disposal sites, and an unknown amount of contamination may be present beneath the foundations and paved areas where remedial actions have not yet taken place. Of these contaminants, some may be dispersed along environmental pathways, including downward movement through the vadose zone, incorporation into the groundwater flow, and subsequent discharge to the Columbia River. For residual contamination at waste sites, key features relevant to understanding further dispersion in the environment are the sediment characteristics in the vadose zone and aquifer, including textural and mineralogical characteristics, and the capacity for those sediments to have adsorbed contaminants during operations. The key processes that influence contaminant mobility are the availability and geochemical characteristics of a transporting medium, such as moisture in the vadose zone and/or groundwater, and the rates of contaminant exchange between dissolved and solid phases along the various environmental pathways. Among the contamination indicators at the 300 Area, uranium poses the greatest challenge regarding fate and transport issues because of the complex interaction between dissolved and solid forms, and the dynamic hydrologic conditions.

3.1.1 Contaminant Sources (300 Area)

The following sections describe source aspects of conceptual models for contamination in facilities at and in environmental pathways beneath the 300 Area.

3.1.1.1 Contaminant Sources at Engineered Facilities and Adjacent Soils (300 Area)

Sources of contamination in the 300 Area originated with the years of uranium fuel production operations and various R&D activities focused on improving uranium fuel production methods and improving the plutonium extraction operations carried out in the 200 Areas. In accordance with the Tri-Party Agreement, these sources are designated as waste sites and tracked by WIDS. As of January 2010, 385 waste sites have been identified in the 300 Area, 69 in the 400 Area, and 50 in the 600 Area. A breakdown of the waste sites and WIDS classifications is provided in Section 2.2. Currently (as of January 2010), 93 waste sites in the 300 Area, 4 in the 400 Area, and 10 in the 600 Area are classified as accepted and scheduled for remedial action. During 300 Area operations, there were intentional releases of waste materials to the environment, most notably in the form of process liquids discharged to the large unlined infiltration ponds and trenches. Additionally, there were several unplanned releases of solids and liquids to the soil below and around the uranium production laboratories and waste-handling facilities.

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[16] The phrase "conceptual model" is informally used to indicate ideas and concepts, as distinct from the more formal CSM described in EPA guidance for RIs.

Uranium is the contaminant receiving considerable attention at 300 Area sources because it has migrated beyond the engineered facilities and is persistent in vadose zone sediment and groundwater. This persistence is related to heterogeneity of the original waste forms, consequent variable interaction with solids in the vadose zone, and uncertainties regarding apparent resupply to the groundwater plume. The fuels fabrication facilities have been dispositioned through the D4 process and the foundations or pads remain in place (the history of these facilities is covered in Section 2.1). The several waste sites associated with these facilities are scheduled for remediation. A map of the uranium production facilities and associated waste sites is shown in Figure 3-1. Uranium production facilities and associated waste sites are listed in Table 3-1.

With regard to the 300 Area CSM, discussion of contaminant sources has been organized by the potential for their associated constituents to be transported beyond the engineered facility into environmental pathways. The sites with the least potential for contaminant migration are as follows:

- Those solid waste and low-volume, liquid waste disposal sites that have been remediated, with residual contamination being evaluated as protective of groundwater and the Columbia River.
- Sites with little or no contamination, such as contamination fixed to structural materials, dust, metal scraps, debris, and soil with small-volume liquid releases.

The latter source sites are represented by the remaining structures, foundations/pads, and contaminated soils resulting from operations performed in uranium production facilities, R&D laboratories, and waste-handling facilities. Sections 2.2 and 2.3 provide descriptions of these waste sites and facilities.

Sources with a moderate potential for release of contamination to the environment are represented by the liquid waste handling facilities that were used to transport and treat waste streams produced during fuel production and research operations, and the early solid waste burial grounds located in and near the 300 Area complex. Table 3-2 lists the liquid waste handling facilities and associated waste sites. Section 2.1 provides description and the history of the liquid waste handling facilities.

During liquid waste handling facilities operations, there were several unplanned releases of contaminated liquids to the soil. There is some uncertainty with regard to the exact volumes of liquids lost to the soil, but these releases are characterized as relatively low-volume releases compared to waste liquids discharged to the process ponds and trenches, described below. Although a variety of other chemical and radiological constituents were present in the waste effluents released to the soil, uranium persists in environment pathways, while other constituents have dispersed.

Additional sources of contamination in the 300 Area include the burial grounds containing various solid waste and debris from 300 Area operations. Section 2.1 provides the history associated with the solid waste disposal sites. A potential for release of contaminants to environmental pathways exists by way of infiltrating water interacting with buried materials, and possible contaminant mobilization from remedial actions, such as large-scale excavation activities.

The source facilities that offered the greatest potential for contamination to be driven through the vadose zone to groundwater are the high-volume, liquid waste disposal facilities. These include the unlined infiltration process ponds and trenches that received several million gallons per day of contaminated and uncontaminated liquid effluent. The effluent discharged to these sites contained uranium and chemical compounds used in the production of nuclear fuel. Section 2.1 provides the history associated with the high-volume, liquid waste disposal sites. The principal high-volume, liquid waste disposal facilities in the 300 Area facilities were the South Process Pond (316-1), North Process Pond (316-2), 300 Area Process Trenches (316-5), and 307 Process Trenches (316-3).

Note: WIDS waste site classification definitions (e.g., "accepted" and "interim closed out") are provided in Section 2.2.

Figure 3-1. Uranium Production Facilities and Associated Waste Sites in the 300 Area

Table 3-1. Uranium Fuel Production Facilities and Associated Waste Sites at the 300 Area

Facility	Associated Waste Sites	Description	Uncertainties	Remedial Action*
313 Nuclear Fuels Manufacturing Support Building	UPR-300-38, uranium-contaminated soil beneath the existing 313 Building foundation (accepted)	The remaining site constitutes the 313 Building slab and the contaminated soil beneath the slab.	The nature and extent of soil contamination beneath the 313 Building have not been fully defined.	Interim remedial action scheduled to begin in October 2012, based on the current working schedule.
	300-260, lead- and barium-contaminated soil west of the 313 Building (accepted)	It has been documented that soil samples were collected in this area and analyzed for metals in 1988. The soil exceeded regulatory limits for lead and barium.	The nature and extent of soil contamination around the 313 Building have not been fully defined.	Interim remedial action scheduled to begin in February 2014, based on the current working schedule.
	300-270, soil contamination below the 313 Building loading dock (closed out)	Site closed out.	N/A	Remedial action completed.
	UPR-300-44, unplanned release around process sewer line (consolidated with UPR-300-38)	The release consisted of wastewater and possibly uranium bearing acid (nitric and sulfuric acid with uranium in solution) or waste etch acid to the soil.	Uncertainty associated with extent of soil contamination caused by release.	Interim remedial action scheduled to begin in October 2012, based on the current working schedule.
314 Press (Metal Extrusion) Building	300-218, contaminated soils beneath the 314 and 314-A Buildings foundation (accepted)	The remaining site constitutes the 314 Building slab and the contaminated soil beneath the slab.	The nature and extent of soil contamination beneath the 314 Building have not been fully defined.	Interim remedial action scheduled to begin in October 2013, based on the current working schedule.
	300-80, radioactive materials contaminated French drain adjacent to the 314 Building (accepted)	The site is a square concrete structure adjacent to the 314 Building and next to a fenced stairway leading down. Further inspections of facility drawings are required to verify the function and site type.	Uncertainty associated with extent of soil contamination caused by release.	Interim remedial action scheduled to begin in January 2013, based on the current working schedule.

Table 3-1. Uranium Fuel Production Facilities and Associated Waste Sites at the 300 Area

Facility	Associated Waste Sites	Description	Uncertainties	Remedial Action*
	300-24, contaminated soil near the 314 Building (accepted)	Uranium metal dust from the fuel fabrication activities provided a pathway for heavy metal dust to become airborne and accumulate in the soils throughout the northern portion of the 300 Area. In June 2001, during an excavation on the south side of the building, radioactively contaminated soils containing approximately 557 pCi/g of uranium were uncovered.	Uncertainty associated with extent of soil contamination caused by release.	Interim remedial action scheduled to begin in October 2012, based on the current working schedule.
306 Metal Fabrication Development Building	300-33, contaminated soil around and beneath the 306-W Building foundation (accepted)	The site is the contaminated soil around and under the 306-W Building. The area around the 306-W Building is paved and posted as having underground radioactive contamination.	The nature and extent of soil contamination beneath the 306-W Building have not been fully defined.	Interim remedial action scheduled to begin in March 2013, based on the current working schedule.
	300-256, contaminated soil around and beneath the 306-E Building foundation (accepted)	The site is contaminated soil under and around the 306-E Building. The area around the 306-E Building is paved and posted as having underground radioactive contamination.	The nature and extent of soil contamination beneath the 306-E Building have not been fully defined.	Interim remedial action scheduled to begin in February 2013, based on the current working schedule.
	300-41, 306-E Neutralization Tank and Valve Pit (accepted)	The site was used to neutralize nitric acid bearing waste before discharging to the process sewer. The site is located west/northwest of the northeast corner of the 306-E Building.	Uncertainty associated with extent of soil contamination caused by release.	Excavation and load out completed August 2009.
333 Fuels Manufacturing Building	300-32, 333-N Fuels Manufacturing Building (accepted)	The site is the remaining contaminated components of the former 333 Building, including the concrete pad, any subgrade soils, and piping.	The nature and extent of soil contamination beneath the 333 Building have not been fully defined.	Confirmatory sampling scheduled to begin in October 2012, based on current working schedule.

Table 3-1. Uranium Fuel Production Facilities and Associated Waste Sites at the 300 Area

Facility	Associated Waste Sites	Description	Uncertainties	Remedial Action*
	333 WSTF, 333 West Side Tank Farm, Uranium-Bearing Acid Tanks (accepted)	The site is an above grade tank farm containing three cylindrical tanks that stand upright within a concrete containment basin.	Uncertainty associated with extent of soil contamination caused by release.	Interim remedial action scheduled to begin in October 2013, based on the current working schedule.
	UPR-300-17, Metal Shavings Fire (accepted)	The waste consisted of oily rags and other waste material, including what was believed to be uranium shavings located on the asphalt area near the southeast corner of the 333 Building.	Uncertainty associated with extent of soil contamination caused by release.	Interim remedial action scheduled to begin in March 2009, based on the current working schedule.
	333 ESHWSA, 333 Building East Side Hazardous Waste Storage Area (accepted)	This area contained small quantities of miscellaneous waste oils, cutting lubricants, chemicals, and solvents stored in containers.	Uncertainty associated with extent of soil contamination caused by release.	Interim remedial action scheduled to be completed by the end of FY 2011, based on Tri-Party Agreement Milestones.
303 A-J Fresh Metal Storage Buildings	300-28, contaminated asphalt and soil along Ginko Street (accepted)	The site is contaminated asphalt and soil beneath Ginko Street. Patches of new asphalt are visible where utility trenches were excavated.	Uncertainty associated with extent of soil contamination caused by release.	Interim remedial action scheduled to begin in June 2013, based on the current working schedule.
	300-16, Solid Waste near 314 Building, Contamination Found During Utility Pole Replacements (accepted)	On March 6, 1992, May 4, 1994, and September 22, 1995, radioactive contamination (yellow-cake uranium) was discovered on the bottom ends of several utility poles that had been removed.	Uncertainty associated with extent of soil contamination caused by release.	Interim remedial action scheduled to begin in October 2012, based on the current working schedule.
	UPR-300-45, 303-F Building Uranium Bearing Acid Spill (accepted)	Release of liquid to the soil beneath the transfer piping, adjacent to the 303-F Building, containing uranium bearing waste acid, was identified as nitric and sulfuric with uranium in solution.	Uncertainty associated with extent of soil contamination caused by release.	Interim remedial action scheduled to begin in June 2013, based on the current working schedule.
304 Uranium Scrap Concretion Storage Facility (Building 304)	300-43, Unplanned Release Outside the 304 Building (accepted)	The site is uranium-contaminated soil from operation of the Uranium Scrap Concretion Facility and Storage Area.	The nature and extent of soil contamination beneath the 304 Building have not been fully defined.	Interim remedial action scheduled to begin in January 2013, based on the current working schedule.

Table 3-1. Uranium Fuel Production Facilities and Associated Waste Sites at the 300 Area

Facility	Associated Waste Sites	Description	Uncertainties	Remedial Action*
3706 Technical Building	300-46, Soil Contamination Surrounding 3706 Building (accepted)	The site is contaminated soils around and beneath the 3706 Laboratory Building. The above-foundation portion of 3706 and 3706-A was demolished in June 2007. The remaining foundation, subgrade soils, and structures, i.e., French drains, trenches, diesel tank, process sewer, and sanitary sewer piping, were deferred to site 300-46.	The nature and extent of soil contamination beneath the 3706 Building have not been fully defined.	Interim remedial action scheduled to be completed by the end of FY 2011, based on Tri-Party Agreement Milestones.
321 Separations Building	UPR-300-4, Contaminated Soil Beneath the 321 Building (accepted)	The site is the soil beneath and south of the 321 Building, and represents a number of releases that occurred from 1945 to 1988.	The nature and extent of soil contamination beneath the 321 Building and 323 Tanks have not been fully defined.	Interim remedial action scheduled to begin in December 2013, based on the current working schedule.

Notes:

* Scheduled remedial action dates are based on the current working schedule and may be subject to change.

N/A = not applicable

Table 3-2. Liquid-Waste-Handling Facilities and Associated Waste Sites at the 300 Area

Facility	Associated Waste Sites	Description	Uncertainties	Remedial Action*
Process Sewer	300-15, 300 Area Process Sewer (accepted)	The 300 Area Process Sewer System is an extensive system with an estimated 9.7 km (6 mi) of outside lines, and an estimated 40.2 km (25 mi) of interior building waste pipe. Several failures in the Process Sewer System components and subsequent releases of contamination have been documented.	Uncertainty associated with releases to soil along length of the Process Sewer System. The nature and extent of contamination beneath and in the process sewer have not been fully defined.	Interim remedial action scheduled to begin in May 2013, based on the current working schedule.
Sanitary Sewer	300-276, 3607 Sanitary System Miscellaneous Components, 300 Area Sanitary Sewer Disposal System (accepted)	The Sanitary Sewer System potentially contains radioactive and chemical wastes with uranium from sanitary drains being the most likely contaminant.	Uncertainty associated with releases to soil along length of the sewer system. The nature and extent of contamination beneath and in the sanitary sewer have not been fully defined.	Interim remedial action scheduled to begin in November 2014, based on the current working schedule.
340 Complex and Retention Process Sewer	340 Complex, 340 Radioactive Liquid Waste Handling Facility (accepted)	Several spills and leaks over the operational history of the 340 Complex have contributed radionuclides (such as cesium and strontium) and chemical waste to the soil column.	The nature and extent in the soil beneath and around the 340 Complex have not been fully defined.	Interim remedial action scheduled to begin in April 2013, based on the current working schedule.
	UPR-300-2, multiple releases from ongoing decontamination and waste-handling activities starting in January 1954 (accepted)	The site appears to be multiple releases from ongoing decontamination and waste-handling activities starting in January 1954.	The nature and extent of soil contamination have not been fully defined.	Confirmatory sampling scheduled to begin in October 2011, based on the current working schedule.

Table 3-2. Liquid-Waste-Handling Facilities and Associated Waste Sites at the 300 Area

Facility	Associated Waste Sites	Description	Uncertainties	Remedial Action*
	UPR-300-41, a release of hazardous waste liquid from a drum situated on an asphalt pad, resulting in the contamination of the asphalt pad and an area of soil next to the pad (closed out)	The release occurred approximately 4.6 m (15 ft) west of the 340 Building. The spilled material was neutralized, absorbed, and packed into drums. Contaminated soils were excavated and placed in drums for disposal. The asphalt pad was cleaned. Cleanup was judged to be complete when the concentration of chromium in soil samples was less than 5 parts per million.	No uncertainty associated with this site.	Site is closed out under interim remedial action, no further action required.
RLWS	300 RLWS, 300 Area RLWS consists of a network of underground, double-encased stainless steel pipe (encased in reinforced fiberglass or plastic pipe as secondary containment) draining to the 340 Complex (accepted)	The sewer received radioactive liquid waste from various 300 Area R&D laboratories. Wastes consisted of radioactive effluent with small quantities of various chemicals, decontamination solutions, acids, and bases. There appear to be no documented releases from the RLWS.	Uncertainty with presence of contamination in soil beneath the RLWS.	Interim remedial action scheduled to begin in April 2012, based on the current working schedule.

Table 3-2. Liquid-Waste-Handling Facilities and Associated Waste Sites at the 300 Area

Facility	Associated Waste Sites	Description	Uncertainties	Remedial Action*
	300 RRLWS, 300 Area Retired RLWS, 300 Area RRLWS System, Crib Waste System, Contaminated Sewer, Intermediate Level RLWS (accepted)	Gasketed flanges sealing 11 clean-outs may have deteriorated since installation and leaks have occurred between weld joints of pipe sections. A history of leakage of the system began during construction of the west addition of the 327 Building in 1958 and 1959. During 1976, the system was leak tested as part of the new upgrades being performed at the 327 Building. This leak test resulted in replacement of the entire system. Excavation for the building foundation and basin uncovered contaminated soil that was traced to the system. The leak was the result of the use of carbon steel transition pieces in the stainless steel system. This leak was located near the southwest corner of the 327 Building near Pecan Street. The nature and extent of soil contamination have not been fully defined.	The nature and extent of soil contamination have not been fully defined.	Interim remedial action scheduled to begin in April 2012, based on the current working schedule.
307 Retention Basins	307 Retention Basins, the RPS line and the 307 Retention Basin systems were installed to collect "potentially" contaminated liquids from the sinks, drains, and sumps of the laboratory facilities (accepted)	There appear to be no documented releases in the soil beneath the 307 Retention Basins. See UPR-300-1 for a description of a long duration leak discovered in the cast iron transfer line between the 307 Retention Basins and the 340 Vault.	Uncertainty with presence of contamination in soil beneath the 307 Retention Basins.	Interim remedial action scheduled to begin in March 2013, based on the current working schedule.

Table 3-2. Liquid-Waste-Handling Facilities and Associated Waste Sites at the 300 Area

Facility	Associated Waste Sites	Description	Uncertainties	Remedial Action*
	UPR-300-1, a release to the soil in the area between the 307 Retention Basins and the 340 Building (accepted)	The leak was detected in December 1969. Greater than 90% of the contamination is confined within a cylindrical section of earth beneath the release. Groundwater contamination was presumed to be minimal because groundwater samples showed no detectable concentrations of radionuclides (BNWL-CC-2617).	The nature and extent of soil contamination have not been fully defined.	Interim remedial action scheduled to begin in March 2014, based on the current working schedule.
334 Chemical Handling Facility, Tank Farm, and WATS	300-224, WATS and Uranium Bearing Piping Trench, a subsurface, concrete pipe trench with sections that allowed piping connections to be made between process operations in the 313 Building, the 303-F Building, the 311 Tank Farm, and the 333 Building (accepted)	The pipe trench and subsurface soil have become contaminated due to multiple releases into the trench. Releases included acids, bases, and solvents. Some of the released acids contained dissolved uranium. The nature and extent of soil contamination have not been fully defined.	The nature and extent of soil contamination have not been fully defined.	Interim remedial action of 300-224 is in process and scheduled to be completed in August 2013, based on the current working schedule.
	300-219, 300 Area Waste Acid Transfer Line, a subsurface, concrete pipe trench with sections that allowed piping connections to be made between process operations in the 313 Building, the 303-F Building, the 311 Tank Farm, the 333 Building, the 334-A Building, and the 334 Tank Farm (accepted)	Several releases associated with leaks from feed lines, valves, and instrumentation occurred during operation of the pipe trench.	The nature and extent of soil contamination below the waste acid transfer line have not been fully defined.	Interim remedial action scheduled to begin in March 2014, based on the current working schedule.

Table 3-2. Liquid-Waste-Handling Facilities and Associated Waste Sites at the 300 Area

Facility	Associated Waste Sites	Description	Uncertainties	Remedial Action*
311 Tank Farm and 311 Building	300-224, WATS and Uranium Bearing Piping Trench	See above.	See above.	See above.
	UPR-300-40, soil between the 311 Tank Farm and 303 F Building (accepted)	Piping connections were repaired. Apparently, removal of contaminated soil was not pursued. The waste consisted of uranium bearing acid waste containing nitric and sulfuric acid with uranium in solution and chromic acids with copper and zinc in solution.	The nature and extent of soil contamination have not been fully defined.	Interim remedial action scheduled to begin in June 2013, based on the current working schedule.
	UPR-300-45, uranium bearing acid release beneath the transfer piping, adjacent to the 303 F Building (accepted)	The release site was to the soil beneath the transfer piping, adjacent to the 303-F Building. The uranium bearing acid transfer line runs through the pipe trench from the 333 Building to the valve box at the southeast corner of the 313 Building outside the Uranium Recovery Room.	The nature and extent of soil contamination have not been fully defined.	Interim remedial action scheduled to begin in June 2013, based on the current working schedule.

Notes:

BNWL-CC-2617, Failure of 307 Basin Transfer Line and Resultant Ground Contamination.

* Scheduled remedial action dates are based on the current working schedule and may be subject to change.

RRLWS = retired radioactive liquid waste sewer

Because of the large volumes of effluent disposed to these infiltration facilities, contaminants were driven downward through the vadose zone and into groundwater, creating plumes. However, some contaminants reacted with the sediment within and immediately beneath the facilities. Processes included adsorption onto sediment grains, minerals precipitation and/or coatings, and sediment moisture contamination. Constituents in the effluent included large quantities of uranium, aluminum, copper, and organic solvents, and the effluent was frequently very acidic (i.e., had a low pH). More detailed descriptions of the effluents are available in the technical baseline reports for the 300-FF-1 and 300-FF-2 OUs (EMO-1026 and BHI-00012, respectively) and in a past-practices characterization of 300 Area operations (WHC-MR-0388). The acidic nature of the liquid wastes enhanced migration through the vadose zone.

During removal actions at these waste sites, some contamination remained following excavation activities. The nature and amount are documented in the cleanup verification packages for each waste site. Extensive investigative work was completed to determine how much contamination could be left behind and still be protective of human health and the environment. The most recent version of levels considered to be protective can be found in DOE/RL-2001-47. The results of investigative work for uranium, which had clearly migrated away from the infiltration sites and contaminated groundwater, are documented in BHI-01667, *Protection of 300 Area Groundwater from Uranium-Contaminated Soils at Remediated Sites*.

3.1.1.2 Contaminant Sources in the Vadose Zone Beneath Engineered Facilities (300 Area)

Inventories of contamination may exist in the subsurface beneath (1) unremediated uranium fuel production waste sites, (2) low-volume, liquid waste disposal sites (i.e., R&D laboratories and liquid waste handling facilities), and (3) remediated high volume, liquid waste disposal sites. The number of sediment sample analyses available to characterize remaining subsurface contaminant sources is limited, with cleanup verification samples providing most of the information as to what might currently remain at the bottom of excavations. With the exception of uranium, essentially no site-specific laboratory tests of sediment contaminants have been conducted to determine their migration potential. Before remedial actions at the 300-FF-1 OU waste sites, borehole and test pit sediment samples were analyzed for contamination as part of the RI process (WHC-SD-EN-TI-038, *Summary of Drilling and Test Pit Activities for the 300-FF-1 Operable Unit Phase I Soil Sampling Investigation*). The analytical results for borehole and test pit samples associated with the 307 Retention Basins and 307 Process Trenches (316-3) are presented in WHC-SD-EN-TI-279. These data are especially important for planning, because the 307 Process Trenches have not yet undergone final remediation, and the contamination within the trenches has potential for further migration to groundwater. Shallow sediment sample results from suspected source locations are available from an investigation intended to refine estimates of residual uranium contamination considered protective of groundwater (PNNL-14022); use of those results in refining estimates is described in BHI-01667.

Sediment samples in the deeper portions of the vadose zone beneath waste sites were collected using a backhoe (PNNL-15121), before completion of remediation activities at four locations within the footprints of the North and South Process Ponds (two at each facility). Sampling extended from the base of the excavations to the groundwater table to investigate uranium in vadose zone sediments beneath major liquid waste disposal sites. Sediment analyses are available from eight characterization boreholes drilled as part of a limited field investigation for uranium (PNNL-16435) and investigating VOCs (PNNL-17666; PNNL-17793). The borehole locations were chosen as representative of various subsurface conditions near waste sites; for logistical reasons, only one was drilled within the actual footprint of a former liquid waste disposal site. Analytical results from recent research activities and field treatability tests are becoming available; they will add to the inventory of available vadose zone results. The following sections provide detailed discussions of the deeper portions of the vadose zone, including the uranium distribution, fate and transport with respect to groundwater contamination.

The principal uncertainty associated with contaminant sources in the vadose zone beneath engineered facilities is related to the inventory and mobility characteristics of contaminants remaining in sediment at the bottoms of remediated and not-yet remediated waste disposal sites (i.e., the potential for the contaminant to be mobilized along subsequent environmental pathways under present and future conditions).

3.1.1.3 Sources for Contamination in Groundwater (300 Area)

The contamination observed in groundwater beneath the 300 Area has multiple potential sources, including: (1) residual contamination from past liquid waste disposal to 300 Area facilities, (2) contamination possibly remobilized and introduced to groundwater during recent excavation activities, and (3) migration of contaminated groundwater into the 300 Area subregion. Sources for constituents identified as contaminants of concern in 300 Area groundwater (i.e., uranium and VOCs) are discussed in the following sections, along with a brief discussion of sources for other contaminants.

Uranium

Recent subsurface uranium investigations at the 300 Area have focused on identifying the source(s) continuing to supply uranium to groundwater (e.g., PNNL-16435; PNNL-17034; PNNL-17793). While the exact amount of uranium needed to maintain the plume remains uncertain, it is clear an amount is continually added to make up for the loss through groundwater discharge to the Columbia River and withdrawals at a water supply well. The subsurface is subdivided into three zones for discussing potential uranium inventories and processes that resupply the groundwater plume:

1. The vadose zone directly beneath the principal liquid waste disposal sites.
2. A more widespread zone bounded laterally by the extent of the uranium plume and vertically by the range in elevation of the current water table.
3. A similar widespread zone that extends vertically higher than the current high-water-table limit.

The latter zone is included because during the fuels production years, the historical water-table elevation extended much higher than the current range. Figure 3-2 is a schematic guide to these subsurface regions.

Uranium stored in these subsurface regions is a potential source for resupplying the groundwater plume. However, the presence of contaminant inventory is only part of the conceptual model, and the assumption the entire inventory is available for further migration along environmental pathways is not accurate, and possibly overly conservative with respect to evaluating the protectiveness of remediation efforts (work in progress at CH2M HILL Plateau Remediation Company, Jim Hoover; summer 2009). As part of evaluating uranium levels that can remain at remediated waste sites and still be protective of groundwater (BHI-01667, pp. 6-1 and 6-2), a conceptual model was developed describing high ionic strength waste effluent (from operations) migrating rapidly downward through the vadose zone with little retardation by sediment. Upon reaching the water table, the effluent is diluted, reducing the ionic strength of the effluent, and possibly precipitating metals. Because of this, the lower portion of the vadose zone (i.e., periodically rewetted zone) then becomes a long-term source for resupplying the groundwater plume through slow leaching of the precipitates.

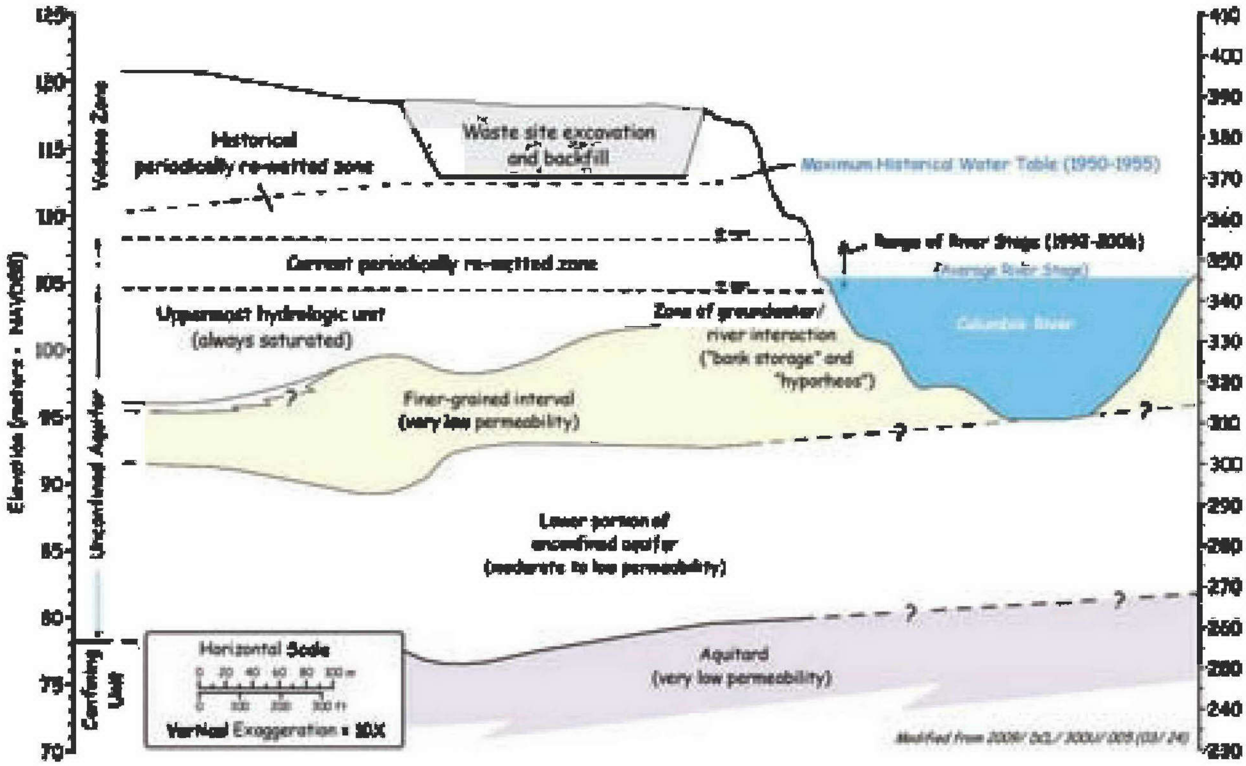


Figure 3-2. Schematic Illustrating Subsurface Regions Associated with the Conceptual Model for Uranium Contamination

Near the Columbia River, in the zone of groundwater/river interaction, changes in the geochemical environment create the potential for part of the uranium dissolved in groundwater to be sorbed onto sediment. This is caused by the intrusion of river water into the aquifer, which lowers the bicarbonate content of contaminated groundwater. The change in geochemistry enhances the tendency for uranium to adsorb to sediment (Yabusaki et al., 2008). Consequently, the potential exists for some uranium in groundwater to be sequestered on sediment in the zone where river water intrudes. When the zone becomes dominated by groundwater following a drop in river stage, conditions become more conducive to release of uranium back into the dissolved form, although this desorption may occur at a slower rate than the adsorption process.

The major uncertainties associated with identifying current sources or source regions capable of resupplying uranium to the plume in groundwater are:

- Locations (horizontal and vertical), amounts, and mobility characteristics of contaminant uranium in the unsaturated or periodically saturated portion of the vadose zone.
- Degree to which uranium may be sequestered in sediment near the Columbia River and capable of resupplying the plume.

VOCs

The VOC contamination observed in various portions of the unconfined aquifer beneath the 300 Area has multiple origins. Documented sources include VOCs used in fuels fabrication and various fuels-related research activities being disposed to the ground. It is likely that VOC contamination at the water table was widespread throughout the 300 Area during the 1950s and 1960s. This resulted in a widespread plume, the remnants of which currently remain, possibly still being fed by slow release from the vadose zone, particularly the historical rewetted zone, and may account for the low but measureable amounts in groundwater throughout the 300 Area. Inadvertent discharge events occurred in 1982 and 1984 at the 300 Area Process Trenches with relatively small quantities of tetrachloroethene; however, they were sufficiently large to reach groundwater and migrate to downgradient wells and riverbank springs (summarized in PNNL-17666, pp. 3.1 to 3.4). An unexplained "spike" in tetrachloroethene was observed in three wells located downgradient of the former 300 Area Process Trenches in 1998. The elevated water table conditions of 1996 and 1997 are implicated as remobilizing contamination in the lower vadose zone (PNNL-16435, pp. 4.17 to 4.19). The origin for trichloroethene observed in an interval of fine-grained sediment in the unconfined aquifer remains a mystery, although the known extent places it proximal to the South Process Pond, a disposal location for fuels fabrication effluent. Finally, the origin for some VOC contamination observed in the southern portion of the 300 Area is related to offsite facilities to the southwest.

Elevated concentrations of cis-1,2-dichloroethene have been observed at Well 399-1-16B since the earliest measurements were made in 1991, with recent concentrations varying between 120 and 180 µg/L, which are well above the 70 µg/L drinking water standard. The contamination is presumed degradation of trichloroethene and/or tetrachloroethene disposed to the North Process Pond and/or 300 Area Process Trenches (PNNL-17666, pp. 3.8 to 3.9), although current information does not allow a definitive explanation of origin. One untested hypothesis is that the inadvertent release of tetrachloroethene to the 300 Area Processes Trenches in 1982 and 1984 is the source (i.e., if the release was pure product, it percolated rapidly through the upper portion of the unconfined aquifer and reached the less permeable lower portion, where conditions were conducive to degradation).

The major uncertainty associated with sources for cis-1,2-dichloroethene contamination in groundwater at Well 399-1-16B is the origin of the original VOCs that have apparently degraded to cis-1,2-dichloroethene are not well defined. There is the possibility that a dense, nonaqueous-phase liquid may have eluded detection to date (considered remote).

Trichloroethene is elevated well above the drinking water standard in groundwater associated with a relatively finer grained interval of Ringold Formation Unit E sediment within the upper portion of the unconfined aquifer (Section 2.6). The origin for this contamination is unknown, particularly since additional co-contaminants that would help identify a waste site or facility source are not present in this sediment (PNNL-17666, pp. 3.1 to 3.4). Trichloroethene and tetrachloroethene were used as part of the fuels fabrication process, so potential sources may be related to an undocumented but substantial spill, or possibly to a "slug" of VOC being delivered to the South Process Pond. The waste stream would have to have been sufficient to drive the contamination through the upper portion of the aquifer and reach the finer grained interval, where it was adsorbed.

The major uncertainty associated with sources responsible for trichloroethene contamination in the finer grained interval of Ringold Formation sediment is the source (facility, waste disposal site, or unplanned release) for the VOCs observed in finer grained Ringold Formation sediment has not been identified. Related to this unknown is the possibility that dense, nonaqueous-phase liquid has gone undetected (considered remote).

Trichloroethene and occasionally tetrachloroethene are detected at concentrations less than the 5 µg/L drinking water standard in groundwater near the water table throughout the 300 Area. This contamination source may include residual contamination from past liquid waste facilities disposal, which continues being slowly released from the lower portion of the vadose zone. Some trichloroethene contamination migrates into the southern portion of the 300 Area from offsite sources ("Other Contamination Indicators" discussion below).

Nitrate

Nitrate likely was introduced to groundwater beneath the 300 Area during fuels fabrication, as the result of nitrate contaminated process wastes disposed to the process ponds and trenches, and the disposal of sewage at the sanitary leach trenches, but has been essentially removed from environmental pathways by natural processes. However, additional nitrate contamination migrates into the 300 Area from sources to the southwest that are outside of the 300 Area. Agricultural activities are the principal contributor. As described in Section 2.6, nitrate concentrations in groundwater beneath the southern portion of the 300 Area exceed the drinking water standard.

Other Contamination Indicators

Additional constituents in groundwater cause degradation of water quality, including exceedances of drinking water standards. These constituents include elevated concentrations of gross alpha and gross beta activity, each of which is associated with uranium contamination. The 300 Area facility sources, waste disposal site sources, and unplanned releases previously described for uranium also produced a variety of other contaminants, most of which have been removed from environmental pathways by natural processes. During 2007 and 2008, some contamination apparently was introduced by remediation activities at the 618-7 Burial Ground, where increases in uranium and chromium, among other constituents, were noted (DOE/RL-2008-66, p. 2.12-10).

Some contaminants migrate into the 300 Area from sources to the southwest of the 300 Area (e.g., former Horn Rapids Landfill; privately owned nuclear fuels fabrication facility; agricultural activity). These contaminants have included trichloroethene and Tc-99, with historical concentrations for trichloroethene exceeding the drinking water standard; Tc-99 remained well below its standard. Contamination from offsite sources was tracked by the Groundwater Surveillance Project during the 1990s and provided useful information on groundwater flow directions (PNL-10698, *Hanford Site Ground-Water Monitoring for 1994*, pp. 5.30 to 5.32; subsequent annual groundwater monitoring reports).

3.1.2 Contaminant Distribution (300 Area)

This section describes the distribution of contaminants for the sources described in the previous section.

3.1.2.1 Contaminant Distribution at Engineered Facilities and in Adjacent Soils (300 Area)

The contaminants distribution in former waste disposal sites is dependent on the original waste effluent characteristics, the particular constituent's geochemical potential to sorb to sediment, and the physical and hydrologic processes available to promote transport along environmental pathways. For adsorbing contaminants, the highest concentrations are expected near the bottom of the waste site. For contaminants to remain at waste sites suggests they are relatively immobile because disposal operations often involved large volumes of acidic waste; the acidity (low pH) typically promotes mobility of certain contaminants, particularly metals. The hydraulic head associated with large volumes of liquids discharged into the waste site promoted contaminant migration downward into the vadose zone. Where relatively small amounts of liquid were discharged to a waste site, soil contamination was likely to remain within or slightly below the waste site. For non-adsorbing contaminants, the highest levels of soil contamination are expected to have been within the waste site, but the tendency for transport into the vadose zone is more pronounced. Soil contaminant levels generally decrease with depth but there are exceptions because of sediment heterogeneities. For example, finer grained sediment intervals promote adsorption of some contaminants and retard further migration. Continued migration of individual constituents in the vadose zone is strongly related to the availability of a transporting medium, such as infiltration of natural precipitation and discharges to the ground because of human activities.

The uranium contamination associated with the fuel production facilities was dispersed in the form of dust, scraps, and unplanned releases of uranium bearing liquids. Uranium dusts and scraps may remain in the shallow vadose zone near the production facilities, having been covered over with windblown soil or transported deeper in the vadose zone by burrowing animals. These uranium sources are not readily mobile in the environment, nor are they sufficiently chemically reactive to be transported downward to the deep vadose zone and groundwater environs. However, they do remain as potential sources that can be physically transported in the atmosphere and soils environment until physically removed through an RTD remedial action.

Uranium contamination released in the form of liquids from production operations, plus unplanned releases from production facilities, R&D laboratories, and at liquid waste-handling facilities, has a greater potential to move through the soil to the deeper vadose zone. These uranium bearing fluids were often acidic, thereby temporarily increasing the waste effluent mobility through the vadose zone, until the effluent is neutralized because of the buffering capacity of the sediment. In the case of the high volume, liquid waste disposal sites, the fluids were transported to the deep vadose zone through a temporarily saturated soil column, with hydraulic head forces contributing to driving the contamination to groundwater. The deep vadose zone remains a potential source for adding uranium and other metals to groundwater (BHI-01667, p. 6.1).

Extensive lateral spreading may have occurred from the process ponds and trenches during times of high river stage. Historical records and modeling of the Columbia River stage indicate groundwater levels may have risen to the bottom of the North and South Process Ponds before the completion of the Priest Rapids Dam in 1961. Historical records indicate flood river stage conditions during 1948 and 1953. If groundwater levels approached the bottom of these high volume, liquid waste disposal sites during full operation, the uranium bearing liquids would have elevated groundwater and dispersed uranium-bearing liquids laterally and inward throughout the 300 Area. After the water receded to normal levels, some of the dispersed uranium would have been left behind adsorbed in the vadose zone.

3.1.2.2 Contaminant Distribution beneath Engineered Facilities (300 Area)

The known extent of contamination for the vadose zone beneath the remediated and unremediated waste sites is discussed in Section 2.6. The extent of contamination beneath and around the uranium production facilities and low volume, liquid waste release sites is not fully defined. The D4 activities have been completed for many of these sites, but the soils remediation beneath and around the remaining foundations has not been performed. The full characterization of these unremediated waste sites will be performed as part of the planned interim remedial actions. Some uncertainty remains with the distribution of uranium contamination beneath the high volume, liquid waste disposal sites remediated as part of EPA/ROD/R10-96/143 (i.e., the North and South Process Ponds, and the 300 Area Process Trenches). Uncertainties associated with the contaminant distribution beneath engineered facilities include the following:

- The nature and extent of uranium contamination associated with sediment in the shallow portion of the vadose zone beneath and around uranium production facilities in the 300 Area are not well defined.

- The nature and extent of leachable uranium contamination in the deep portion of the vadose zone beneath the 300 Area uranium production facilities and low-volume, liquid waste release sites are not well defined.
- The lateral and vertical extent of uranium contamination in the vadose zone beneath high-volume, liquid waste disposal sites is not sufficiently characterized to understand the relationship to elevated uranium concentrations in groundwater.

3.1.2.3 Contaminant Distribution in Groundwater System (300 Area)

Most contamination in the groundwater system beneath the 300 Area is contained within the saturated portion of the Hanford formation, which is characterized by highly permeable sediment (Section 2.6). Groundwater movement within this stratigraphic interval occurs at relatively high rates; up to 15 m/d (49 ft/d) is documented. However, because of the fluctuating stage of the Columbia River, the direction of movement varies widely and quickly, in response to daily, weekly, seasonal, and multiyear cycles in river discharge. A consequence of this variability is that contamination becomes widely distributed and potentially well mixed in groundwater that saturates the Hanford formation sediment.

When the water table rises into the lower vadose zone, groundwater contamination may be introduced to relatively less contaminated sediment, with some contamination remaining when the water table falls to lower elevations. In addition, if contamination is moving downward through the lower vadose zone, saturation by groundwater during high water table conditions will facilitate the transfer to groundwater. Exchange between dissolved forms, and forms associated with solid materials in the zone through which the water table rises and falls, may have a significant role in persistent contaminated groundwater beneath the 300 Area. While the initial RI acknowledged the fluctuating water table could remobilize contamination, it was assumed that resupply of uranium to groundwater from the vadose zone was negligible.

Uranium

Recent field investigations have shown that uranium contamination in groundwater is associated with the saturated sediment of the Hanford formation. An LFI for uranium in 2006 did not find evidence to indicate uranium contamination in other stratigraphic units within the unconfined aquifer (PNNL-16435), nor did analysis of samples collected as part of a VOC investigation discover such evidence (PNNL-17793). The lateral distribution of uranium in the upper portion of the unconfined aquifer beneath the 300 Area (i.e., saturated Hanford formation sediment) is shown in Section 2.6 (Figures 2-36 and 2-37). Attributes of the plume, which can be used to describe the "level" of contamination for evaluating natural attenuation, are listed in Section 2.6, Table 2-14.

The current conceptual model for uranium in the subsurface beneath the 300 Area suggests that the preponderance of contamination initially entered environmental pathways by liquid wastes infiltration through engineered facilities, principally the North and South Process Ponds, and the 307 and 300 Area Process Trenches. The most recent published description of the conceptual model for uranium contamination in the subsurface at the 300 Area is presented in PNNL-17034, from which much of the discussion that follows was extracted. Additional contamination was introduced by unplanned releases (e.g., leakage from the process and radiological sewers; spills). Uranium was retained in the vadose zone beneath these sites by sorption-to-solids processes and as residual, contaminated moisture. A large fraction likely reached groundwater as essentially saturated flow beneath the disposal site, causing a plume in groundwater.

The uranium plume during the peak operations' period was distributed widely in the upper portion of the unconfined aquifer by the rapid rates and diverse movement patterns of groundwater, which were caused by fluctuations in the Columbia River stage and by the large volume of effluent that reached the water table. Although water-table elevation data for the 1950s are sparse, there are data to suggest mounding, and therefore radial flow, beneath the process ponds. While peak fuels fabrication activities were underway during the 1940s, 1950s, and 1960s, the uranium plume would have been distributed inland to distances at least as great as the current north-south highway. Water levels during the early 1950s (and, presumably, during the preceding years since the start of fuels manufacturing in 1944), indicate that the river stage would drop to levels much lower than those following construction of McNary Dam. During those early years, the rate of uranium contaminated groundwater discharge to the Columbia River would have been much greater than discharge under current hydrologic conditions.

To illustrate the major differences between hydrologic conditions during the fuels production years and the present, Figure 3-3 provides trends for conditions at Well 399-3-1 extending back to 1950. Trends shown are uranium concentrations in groundwater and water levels (hydraulic head) in the well at the time of sampling. The figure shows the monthly average elevation of the river and the changes in stage fluctuation patterns that have occurred over time.

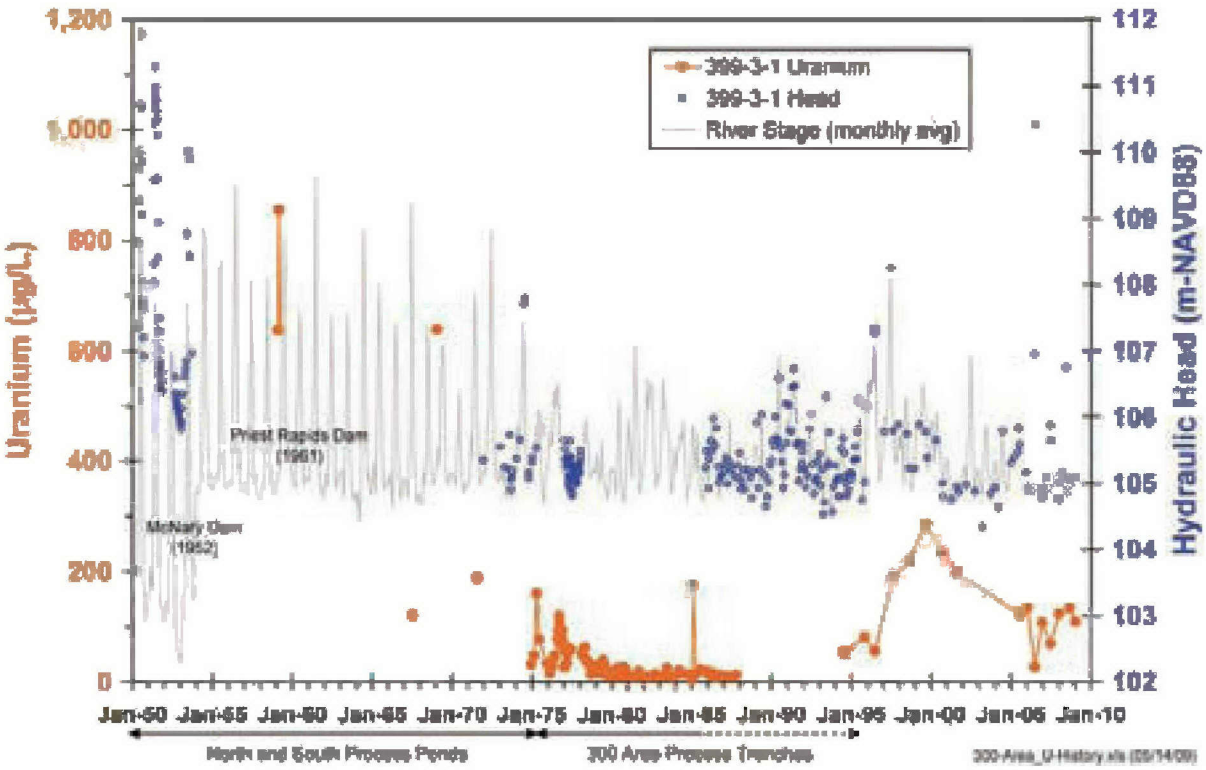


Figure 3-3. Water Level and Uranium Concentration Trends at Well 399-3-1 near the South Process Pond

The widespread groundwater plume during the 1940s through the early 1970s was subjected to large seasonal variations in the water-table elevation. Contaminated groundwater would be moved upward into the uncontaminated vadose zone in areas well away from the liquid waste disposal facilities during the period of seasonal high water-table conditions, which related to seasonal high river discharge.
As the water table subsequently receded, uranium would remain behind sorbed to sediment and in residual moisture. Very few sediment samples have been collected from the portion of the vadose zone

affected by the historical high water-table conditions away from liquid waste disposal sites. An effort was included as part of a limited field investigation of uranium, but cancelled because the geophysical method proposed to identify contaminant uranium in a widely distributed network of boreholes was not sufficiently sensitive for the low amounts of uranium likely to be present (PNNL-16435, p. 5.4).

As part of a recent update to the conceptual model for uranium contamination in the subsurface at the 300 Area, estimates for inventories remaining in various subsurface regions were calculated (PNNL-17034, pp. 6.15 to 6.38). These estimates were prepared using available data for uranium measurements made during past investigations. Figure 3-4 shows the 10 different subsurface regions defined for the box model, along with the values estimated for each region. The figure also suggests the primary pathways for exchange of uranium between various media (e.g., sediment and pore water) and subsurface regions. Key underlying assumptions in the box model are that uranium concentrations from previous studies are representative of the various 300 Area subsurface regions, and that the vadose zone regions beneath former liquid waste disposal facilities are most likely to have the largest inventories. No attempt was made during this initial analysis to differentiate between mobile and relatively immobile forms of uranium associated with sediment.

Principal uncertainties associated with the distribution of contaminant uranium in groundwater beneath the 300 Area are the result of the following:

- Monitoring well coverage of contaminated stratigraphic intervals is uneven, with principal weaknesses at the footprints of former liquid waste disposal sites, and along the perimeter areas of the uranium plume, especially the west and southwest portions.
- The vertical distribution of uranium dissolved in groundwater has not been well characterized by field observations.
- Existing monitoring wells are constructed to a variety of configurations regarding type of casing and open interval (perforated or screened opening; screen slot size), the vertical extent of the open interval, and the position of the open interval relative to various hydrologic units.

VOCs

Trichloroethene and tetrachloroethene are occasionally detected in the uppermost hydrologic unit of the unconfined aquifer beneath the 300 Area (DOE/RL-2008-66, pp. 2.12-7 to 2.12-8). In the past, detections typically were lower than the 5 µg/L drinking water standards, and frequently lower than 1 µg/L (currently, laboratory analyses report <1 µg/L as nondetected). Cis-1,2-dichloroethene, a degradation product of trichloroethene and tetrachloroethene, is occasionally detected in groundwater at locations where those contaminants were disposed. Two exceptions to the low concentrations observed in the hydrologic unit that includes the water table are as follows:

- Elevated concentrations of cis-1,2-dichloroethene that exceed the 70 µg/L drinking water standard at one well, 399-1-16B, whose screen monitors the lower portion of the unconfined aquifer.
- Elevated concentrations of trichloroethene and tetrachloroethene, and their degradation product cis-1,2-dichloroethene, in a finer grained interval of sediment within Ringold Formation Unit E, which lies below the saturated sediment of the Hanford formation.

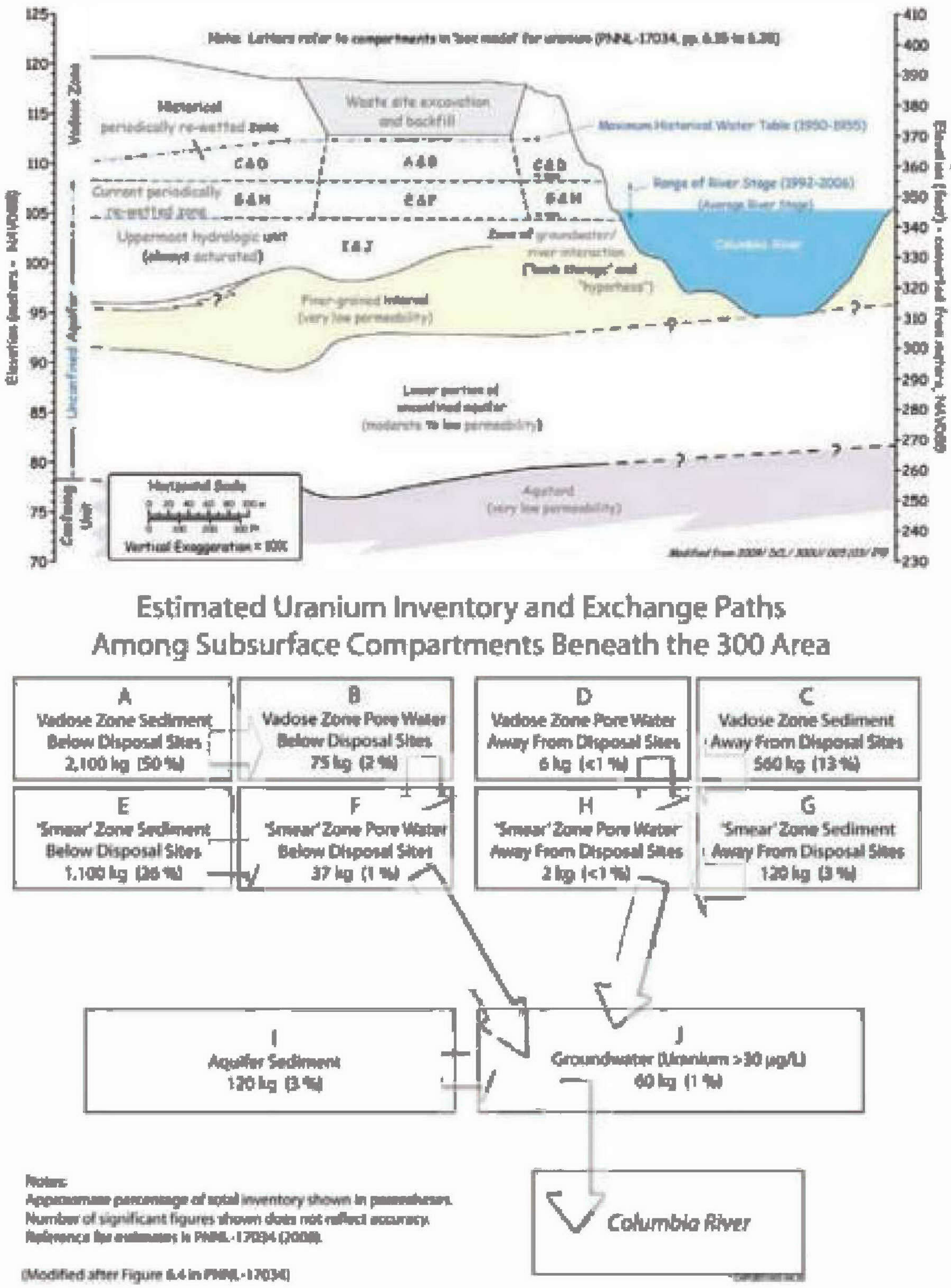


Figure 3-4. Subsurface Regions Where Contaminant Uranium may be Sequestered

The extent of the elevated cis-1,2-dichloroethene contamination appears limited to the lower portion of the unconfined aquifer and to a relatively small area near Well 399-1-16B. The nearest well to 399-1-16B is 399-1-8, located approximately 100 meters to the southwest, where concentrations are typically less than 1 μg/L or below the detection level. The uncertainty regarding the distribution of this contamination is that the extent is not well defined to the northwest and north of Well 399-1-16B (i.e., in the direction of potential sources, such as the former 300 Area Process Trenches and North Process Pond).

The elevated concentrations of trichloroethene in one hydrologic unit within the unconfined aquifer appear contained within a finer grained interval of Ringold Formation Unit E sediment, and with a lateral extent limited to a relatively small area east and southeast of the former South Process Pond (PNNL-17666, p. 4.1). The uncertainty associated with this contamination distribution is the possibility that additional pockets of relatively high concentrations of trichloroethene exist in areas where the finer grained sediment is present in the unconfined aquifer.

Nitrate

The nitrate distribution in 300 Area groundwater is reasonably well described by existing monitoring wells, which provide sufficient coverage to trace the plume back to origins southwest of the 300 Area and outside of the 300 Area (DOE/RL-2008-66, p. 2.13-8). In addition, aquifer tubes provide coverage of the unconfined aquifer near locations of groundwater discharge to the Columbia River.

3.1.3 Fate and Transport (300 Area)

This section describes fate and transport processes associated the conceptual models for contamination in the subsurface beneath the 300 Area.

3.1.3.1 Contaminant Fate and Transport Associated with Engineered Facilities and Adjacent Soils (300 Area)

Uranium is the primary contaminant of interest in the 300 Area. Other contaminants exist within shallow surface soil waste sites or within burial grounds, and have been detected at levels above cleanup criteria outside designated waste sites. Verification sampling for other contaminants has been performed in remediated waste sites, including PCBs and Co-60 in the North and South Process Ponds and 300 Area Process Trenches; arsenic, chromium, and lead in the 618-5 Burial Ground; and Pu-239/240, Pu-241, Sr-90, arsenic, barium, chromium, and lead in the 618-2 Burial Ground, as a few examples. Sections 2.1.2 and 2.6.1 provide a brief description of the history and potential contaminants associated with other 300 Area liquid waste disposal sites, soil contamination sites resulting from facility operations and solid waste disposal sites (burial grounds). To date, verification sampling results show contaminants were removed to meet the RAGs for all remediated waste sites within the 300 Area. Verification sampling results for remediated waste sites are available in Appendix A.

Uranium contamination likely exists within unremediated waste sites associated with uranium production facilities (Table 3-1), liquid waste handling (Table 3-2), and some waste sites associated with R&D laboratories. Uranium contamination is not expected within the excavated portion of remediated waste sites, mainly from the 300-FF-1 OU (Sections 2.6 and 3.1.1.1). The primary mechanisms for uranium transport away from source sites are discussed in Sections 3.1.1.1 and 3.1.2.1. These mechanisms include infiltration and percolation of water through waste sites, and subsequent transport of leachable uranium through the vadose zone; transport of solid uranium scraps and dust through animal activity; and transport of uranium dust through the atmosphere by wind.

3.1.3.2 Contaminant Fate and Transport in the Vadose Zone Beneath Engineered Facilities (300 Area)

The distribution of uranium contamination beneath the engineered facilities, including uranium production facilities and low volume, liquid waste release sites, is discussed in Section 3.1.2.2. There is uncertainty associated with the distribution of uranium contamination beneath engineered facilities, including uranium fuel production facilities, liquid waste handling facilities, and the high volume, liquid waste disposal sites (i.e., North and South Process Ponds, and the 300 Area Process Trenches).
The transport mechanism for uranium contamination may be located in the vadose zone beneath building foundations left after D4 activities and beneath remediated wastes sites, is water percolation and subsequent leachable uranium transport through the vadose zone.

3.1.3.3 Contaminant Fate and Transport in the Groundwater System (300 Area)

Because waste disposal to the ground and leaks/spills associated with fuels fabrication have long since ended, the remaining contamination today represents the following:

- Residual amounts from past operations.
- Contamination that has migrated into the 300 Area aquifer from upgradient sources.
- Recently introduced contamination because of current activities, such as waste sites remediation and D4 associated with buildings and other facilities.

The bulk of mobile contaminants introduced to environmental pathways has long since dispersed, primarily through groundwater flow and discharge to the Columbia River.

However, contamination remains in the unconfined aquifer at concentrations that exceed drinking water standards. To achieve the objective of restoring the aquifer to a condition of "beneficial use whenever possible," cleanup technology may be required, with uranium being the most likely candidate. Evaluation and screening of potential uranium remedial technologies have been done, with in situ methods for immobilizing the contaminant in the vadose zone and/or aquifer ranking highly (PNNL-16761, pp. 35 and 36; Section 4.6.2 of this work plan). Natural processes also help in reducing the level of contamination. An understanding of the processes involved and their rates will be needed to estimate the length of time required to achieve regulatory compliance levels. To provide a technical basis for these remediation decisions requires (1) monitoring field conditions to characterize conditions and establish trends; and (2) simulation of groundwater movement and contaminant behavior, with predictions for future conditions. Fundamental to making informed decisions is developing an understanding of the geochemical processes that control the exchange between dissolved and solid forms, especially important for uranium, and the processes that convey contamination along environmental pathways (e.g., infiltration of moisture and groundwater flow).

For most of the previously identified COPCs in groundwater, a three-dimensional groundwater flow model provides simulations of movement patterns and flow rates under various seasonal hydrologic conditions appears to be sufficient to predict future behavior, particularly for those contaminants that do not interact with sediment (e.g., chromium, nitrate, H-3, and VOCs). Several 300 Area groundwater flow models have been developed for various applications and are described in PNNL-17708. For uranium, simulating transport by environmental pathways is more difficult, because of the complex interactions between dissolved and solid forms. The uranium form sequestered in subsurface compartments varies because of the diverse chemical characteristics of the original waste stream and subsequent changes because of interactions with variable subsurface geochemical environments. A new flow and transport modeling effort is in progress as part of the DOE's Scientific Discovery through Advanced Computing research program, using a highly complex model and super-computer processing.

Uncertainties associated with the existing models are related to the level of detail available for the spatial framework through which flow occurs, and the hydraulic head data available to validate the simulation. The accuracy and completeness of the parameters used to describe the spatial framework through which groundwater flows are influenced by (1) an uneven distribution of locations throughout the area of interest, (2) uneven representations of hydraulic properties of sediment, and (3) a limited number of locations where high-frequency hydraulic head measurements are available (PNNL-17708, pp. 5.6 to 5.8). The drilling activities proposed in this work plan, and water-level data being collected by other investigations in the 300 Area, will aid in reducing the uncertainties associated with groundwater flow simulations.

Uranium

As indicated in the previous discussion of uranium contamination sources and distribution, the fate of part of the uranium originally disposed to the ground at the 300 Area is an enigma. Of the approximately 34,000 kg (75,000 lb) estimated to have been disposed to the North and South Process Ponds based on historical records for disposal (EMO-1026, p. 3.5), approximately 60 to 100 kg (132 to 220 lb) likely remain dissolved in groundwater (Table 2-14). Approximately 4,000 kg (8,818 lb) may be sequestered on solids in the vadose zone and in the unconfined aquifer, although the mobility characteristics for that inventory are variable (PNNL-15121, p. 3.5), so the significance of the vadose zone inventory relative to maintaining the groundwater plume is uncertain. Seasonal concentration patterns do indicate the addition of some uranium on a continuing basis.

Uranium is being continuously removed from the groundwater plume by discharge to the Columbia River and by groundwater extraction at the well that supplies water to the 331 Life Sciences Building. Earlier published estimates for discharge to the Columbia River are summarized in PNNL-17034 (pp. 3.23 to 3.25) and indicated an annual rate of several hundred kilograms/year (kg/yr) through groundwater flow, with another 20 kg/yr (45 pounds per year [lb/yr]) through withdrawal at water supply Well 399-4-12 (PNNL-15127, p. 2.3). A more recent analysis of the net annual water flux to the river, based on additional groundwater flow simulations, suggests a lower rate. However, uncertainty remains in these flux estimates, primarily because of the dynamic nature of the hydrologic and contaminant transport processes beneath the 300 Area, which makes using “average” values less reliable than if more rigorous modeling was conducted.

With the aforementioned uncertainty in mind, the range in estimates for uranium flux to the river has been revised for this work plan using recent groundwater flow modeling results for estimates of the net annual water discharge to the river (PNNL-17708, p. 5.6), with results shown in Table 3-3. The estimates were derived by bracketing the net annual groundwater discharge rate to the river at 100 to 500 $m^3/m_{shore}/yr$, the average uranium concentration in the discharge at 30 to 90 µg/L, and the length of shoreline impacted by the plume at 1,900 m. Figures 2-36 and 2-37 provide plume maps. This analysis suggests the annual uranium flux to the river via groundwater flow ranges from “negligible” to approximately 86 kg/yr (190 lb/yr), with a central tendency indicating approximately 36 kg/yr (80 lb/yr). Withdrawal at the water supply well may involve another 10 kg/yr (22 lb/yr), so the total amount lost from the groundwater plume might likely be 40 to 50 kg/yr (101 lb/yr), which is much lower than previous estimates.

Uranium flux estimates that are based on net annual groundwater discharge to the river do not provide for the influence of significant seasonal variations in contaminant exchange between the aquifer and the river. This adds uncertainty regarding the accuracy of the estimates, because the larger groundwater discharges, which contain uranium contamination, to the river that occur during low river stage conditions are partially offset by the influx of river water, which lacks uranium contamination, to the aquifer during high river stage conditions. Also, the net annual groundwater discharge rates shown in Table 3-3 are for recent conditions; during the peak effluent disposal years (late 1940s through the 1960s), flow to the river channel was likely much greater because of steeper hydraulic gradients directed toward the channel.

Table 3-3. Estimates for the Uranium Flux (kg/yr) to the Columbia River

Groundwater discharge rate: ($m^3/m_{sh}/yr$)	Average uranium concentration (µg/L)				
	30	45	60	75	90
500	29	43	57	71	86
315	18	27	36	45	54
100	6	9	11	14	17

Notes:

315 m3/msh/yr is equivalent to approximately 0.75 ft3/s for the entire length of shoreline impacted by the plume (i.e., 1,900 meters).

Units: Uranium flux in kilograms/year along plume front at 300 Area (1,900 m).

The groundwater discharge rate range is based on PNNL-17708, Three-Dimensional Groundwater Models of the 300 Area at the Hanford Site, Washington State. The groundwater concentration range is based on annual plume maps.

Additional estimates for the current uranium flux to the river are being developed as part of a three-dimensional simulation of groundwater flow and uranium transport for the 300 Area under the DOE's Scientific Discovery through Advanced Computing research program. These simulations are expected to accommodate transient groundwater flow and transport conditions throughout the complete seasonal cycle. Additional simulations could investigate conservative and reactive tracers at the scale of the current uranium plume. These more detailed simulations would account for the seasonal variations and provide refined estimates for the mass flux of uranium from the groundwater plume to the river.

Even though a considerable amount of information has become available in recent years to describe the fate and transport of uranium in groundwater, uncertainties remain regarding the detailed processes and their rates that lead to the persistence of the groundwater plume. The driver for reducing these uncertainties is the need for technical information to be used for refining the strategy for remediation of uranium, selecting an appropriate technology, performing treatability tests, and designing and implementing the remedial action in the field. The major uncertainties are summarized as follows.

- Estimates for the inventory of contaminant uranium in various subsurface regions are becoming available, but information on the proportion that is potentially mobile under current or expected future conditions is still lacking.
- The mass balance for uranium in the groundwater plume remains uncertain, particularly with respect to the amount lost to the river via groundwater discharge through the riverbed.
- The exchange rates between dissolved and sorbed forms of contaminant uranium in two key subsurface regions (i.e., the current water-table zone and the zone where groundwater and river water meet) are only beginning to be understood.
- Simulation of uranium transport through the vadose zone and aquifer pathways remains in the developmental stage, primarily because of the limited data available for input parameters.

VOCs

For the relatively low concentrations of VOCs detected in the uppermost hydrologic unit beneath the 300 Area (i.e., saturated sediment that includes the water table), most of that contamination appears to migrate into the 300 Area from offsite sources. While monitoring data do show evidence of VOCs related to past disposal at certain former liquid effluent disposal facilities, such as the 300 Area Process Trenches, the contribution to groundwater contamination is likely to be small. The fate of VOC contamination in groundwater near the water table appears to be primarily discharge to the Columbia River under current groundwater flow conditions. The low concentrations are quickly reduced to nondetect levels in the river environment because of volatilization and dispersion.

The fate and transport characteristics of cis-1,2-dichloroethene contamination observed at Well 399-1-16B can best be summarized as a limited occurrence, with little potential for worsening conditions at that location and more widespread dispersal along environmental pathways (PNNL-17666, p. 1.5 and p. 3.8). The very low dissolved oxygen in groundwater at this well, along with the relatively constant concentration of cis-1,2-dichloroethene, suggest that reductive dechlorination of waste effluent containing trichloroethene and/or tetrachloroethene has occurred, but that the particular bacteria present are only capable of degradation to the cis-1,2-dichloroethene isomer. The permeability of the sediment monitored by Well 399-1-16B is much lower than that of the overlying sediment (Figure 2-41 in Section 2.6), so future use of this portion of the unconfined aquifer for water supply is unlikely, and a significant flux via groundwater discharge to the nearby riverbed also is unlikely. However, uncertainties in being able to explain this occurrence remain as the geochemical and microbiological characteristics of the stratigraphic interval containing cis-1,2-dichloroethene at Well 399-1-16B have not been characterized in detail, so questions regarding the persistence of the contamination remain.

Fate and transport characteristics for the trichloroethene, tetrachloroethene, and cis-1,2-dichloroethene observed in groundwater samples from the finer grained interval of Ringold Formation sediment in the unconfined aquifer are different from those for cis-1,2-dichloroethene at Well 399-1-16B. Dechlorination of the original organic compound in waste effluent apparently has not occurred to the extent observed at Well 399-1-16B. Geologic logs for this interval suggest alternating oxidized and reduced zones within the interval, so conditions for dechlorination may not be optimal. The permeability of the finer grained interval is low (during drilling, some attempts to collect groundwater from this interval were met with no groundwater yield), so the prospects for future use of this stratigraphic interval for a water supply and widespread dispersal along environmental pathways are limited (PNNL-17666, pp. 3.6 to 3.8). However, it is likely that some contamination slowly “bleeds” from this interval into the overlying or adjacent highly permeable Hanford formation sediment. Periodic detections of VOCs in aquifer tube samples collected from screens positioned near this contact provide evidence for this process. Uncertainties remain regarding an explanation for fate and transport of this contamination include the following:

- The mechanisms by which contaminants were transported from their source(s) to sequestration in the finer grained interval of Ringold Formation sediment are understood only in general terms.
- Lateral contaminant movement within the finer grained sediment interval and release to overlying and underlying sediments is not well characterized.

Nitrate

The fate and transport characteristics of nitrate contamination in groundwater under current conditions include migration into the 300 Area from offsite sources located southwest of the 300 Area, with contamination apparently limited to the upper portion of the unconfined aquifer that includes the water table. This groundwater subsequently discharges into the Columbia River along the southern portion of the 300 Area shoreline.

3.1.4 Identification and Resolution of Data Needs (300 Area)

Principal uncertainties in the conceptual models for various contaminants in the 300 Area are discussed in the context of a CSM in Sections 3.1.1, 3.1.2, and 3.1.3. Uncertainties in understanding features and processes associated with contamination in environmental pathways are referred to as data gaps. Reducing or eliminating some data gaps may be necessary to proceed with the RI/FS process for the 300 Area. For those data gaps requiring more work, the associated data needs are discussed in the following sections. A separate discussion is provided for needs associated with the vadose zone and those associated with the aquifer, for each of the three geographic subregions.

Contamination in 300 Area soil resulting from the operations of uranium fuel production facilities, R&D laboratories, liquid waste handling facilities, and the larger high volume, liquid waste disposal sites requires additional investigation as part of this RI/FS process and other existing programs. A principal driver for additional investigation is to identify and characterize potential contaminant sources in the vadose zone that may be contributing to the persistent uranium groundwater plume beneath the 300 Area. Uranium contamination is expected in unremediated waste sites being addressed as part of the interim remedial action conducted under EPA/ROD/R10-01/119, and may exist in the vadose zone beneath already remediated sites. Of particular interest is the vadose zone beneath and around the high volume, liquid waste disposal sites remediated under EPA/ROD/R10-96/143, and beneath areas of potential leakage from the original 300 Area Process Sewer system.

Uranium and VOC contamination in groundwater beneath the 300 Area warrants additional work as part of the RI process. Uranium needs additional work to provide information for the FS process as it pertains to evaluating potential remedial action technologies. The driver for identifying data needs is the goal of restoring the aquifer beneath the 300 Area to conditions that would support "beneficial use where practical" of the natural resource, which would likely be viewed as a future source for drinking water. For contamination other than uranium and VOCs, monitoring and institutional controls on the use of groundwater under EPA/ROD/R10-96/143 will continue during the period leading to a proposed plan for soil and groundwater. The time period leading to a Remedial Investigation/Feasibility Study Report and Proposed Plan is December 31, 2011 (TPA target milestone M-015-72-T01), and completion of the remedial investigation/feasibility study process through submittal of a Proposed Plan by December 31, 2012 (TPA milestone M-015-00D) for final remedial action.

The following presentation of data needs follows the same sequence as in the preceding description of the CSM, i.e., sources, distribution, and fate & transport, and subdivided into geographical subregions of the 300 Area. For each uncertainty or data gap described in the CSM, the following topics are presented.

- A summary statement describing the uncertainty or data gap. This statement is analogous to the problem statement as used during a data quality objectives analysis, and guides the presentation of data needs with regard to their identification, justification, and resolution.
- Data Need: Specific data or information for which activities are proposed in this work plan.
- Justification: Comments regarding why the data gap is also considered a data need under the CERCLA process that leads to remediation decisions.
- Resolution of Data Need: Activities that will be used to resolve the data need and fill the data gap, thus reducing uncertainty in the CSM. Additional data needs may be subsequently identified in a remedial design/remedial action work plan that will follow a proposed plan for remediation.

Two tables have been developed to help provide a comprehensive view of the work proposed in this work plan. Table 3-4 presents a summary of data needs and their resolution, as described in the following text. Table 3-5 presents borehole characterization activities that will contribute to meeting a variety of data needs. Figure 3-5 is an index map for the proposed locations for characterization boreholes in the 300 Area, each of which will be subsequently completed as a monitoring well.

3.1.4.1 Data Needs: Sources for Contamination (300 Area)

The following descriptions focus on data needs associated with the sources for contamination observed in the vadose zone and aquifer beneath the 300 Area.

Sources in the Vadose Zone (300 Area)

Source data gap – contaminants: Unidentified sources of contamination may exist within and in the soils adjacent to engineered facilities and structures.

- Data Need 1: Identify new waste sites and potential sources of contamination in the 300 Area.
- Justification: The OSE and waste site discovery processes are performed to identify new waste sites and sources that are not currently included in CERCLA decision documents. Remediation decisions associated with this data need include determination of waste site classification after discovery (Section 2.2) (i.e., accepted, rejected, or no action).
- Resolution of data need: Complete OSE process in the 300 Area (industrial complex).

Sources for Groundwater Contamination (300 Area)

Source data gap – uranium: The significance of contaminant uranium remaining in the vadose zone and periodically rewetted zone (current and historical) in areas directly beneath and in the immediate vicinity of remediated waste sites is not fully understood with respect to the persistence of the groundwater plume.

- Data Need 2: Information on (a) the inventory and mobility characteristics of contaminant uranium beneath remediated waste sites, and (b) the current geochemical and hydrologic processes potentially acting to cause that uranium to resupply the groundwater plume.
- Justification: The characteristics of uranium in the vadose zone are known from only a few locations near to or within the footprints of former liquid waste disposal facilities. Additional field and laboratory data are needed during the feasibility study to refine estimates for the amount and characteristics of residual contamination that potentially could reach groundwater, and to evaluate conditions fully relative to protection of groundwater from future contaminant impacts. More complete characterization of these features and processes will contribute to informed decisions regarding long-term monitoring strategies and potential remedial action (i.e., selecting a remedial action alternative) and screening, testing, and implementing a remedial technology.

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
300 Area Sources						
Unidentified sources of contamination may exist within and in the soils adjacent to engineered facilities and structures.	1	Identify new waste sites and potential sources of contamination in the 300 Area.	Complete OSE process in the 300 Area (industrial complex).	No	Complete OSE process in the 300 Area (industrial complex). Data need will be fulfilled as part of the OSE process.	The OSE and waste site discovery processes are performed to identify new waste sites and sources that are not currently included in CERCLA decision documents. Remediation decisions associated with this data need include determination of waste site classification after discovery (Section 2.2) (i.e., accepted, rejected, or no action).
The significance of contaminant uranium remaining in the vadose zone and periodically rewetted zone (current and historical) in areas directly beneath and in the immediate vicinity of remediated waste sites is not fully understood with respect to the persistence of the groundwater plume.	2	The inventory and mobility characteristics of contaminant uranium beneath and immediately adjacent to remediated waste sites, and of the current geochemical and hydrologic processes potentially acting to resupply uranium to the groundwater plume, require additional investigation to fully evaluate conditions relative to protection of groundwater from contaminant input.	Two drilling programs will be used to address this data need: (1) Drill four boreholes within the footprints of former liquid waste disposal facilities (No. 8, No. 9, No. 10, and No. 11 on Figure 3-5). Samples of sediment and pore water will be collected to determine the contaminant content and contaminant mobility characteristics at various depths in the vadose zone. (2) Drill five boreholes at increasing distances from the footprints of the waste sites (Nos. a through e as shown in Figure 3-5) to develop transects along potential uranium migration routes.	Yes	Field sampling: Collect sediment and pore water samples from the water table zone above the groundwater plume. • Four borehole locations (two in North Process Pond; one in South Process Pond; one in 300 Area Process Trenches). • Five borehole locations in the vicinity of the seasonal uranium hot spot just south of the 300 Area Process Trenches and North Process Pond. • Complete the four characterization boreholes as monitoring wells; complete the five additional locations as temporary monitoring wells. See Table 3-5 for drilling sampling details.	The leaching characteristics of uranium in the lower vadose zone are known from only a few locations near to or within the footprints of former liquid waste disposal sites. Additional field and laboratory data are needed during the feasibility study to refine estimates for the amount and characteristics of residual contamination that potentially could affect groundwater. More complete characterization of these features and processes will contribute to informed decisions regarding appropriate monitoring strategies and selection of a remedial action alternative, including screening, testing, and implementing a remedial technology.
The potential exists for contaminant uranium to sequester on sediment near the Columbia River because of river-induced changes in geochemical conditions. The magnitude of this phenomenon and its potential to act as a continuing source for resupplying the groundwater plume has not been determined.	3	Additional sediment and water samples are needed from the subsurface zone impacted by Columbia River water to determine the contaminant uranium inventory of contaminant uranium and to perform laboratory studies on the mobility characteristics of that uranium.	Drill two boreholes near the Columbia River (No. 6 and No. 7 on Figure 3-5). Collect sediment and water samples to determine contaminant content and contaminant mobility characteristics at various depths in the vadose zone and aquifer.	Yes	Field sampling: Collect sediment and pore water samples from the near river zone where groundwater interacts with river water. • Drill two new borehole locations close to river (east of former sanitary leach trenches and east of Well 399-3-9). See Table 3-5 for drilling sampling details.	The change in geochemical conditions near the river, mixing river water and groundwater, may cause dissolved uranium to be preferentially adsorbed onto sediment, so the near-river zone could be implicated in the persistence of the plume. Such information applies to 1) evaluating the risk associated with the level of contaminant discharge to the Columbia River, and 2) to the FS focused on potential ways to reduce the concentration of uranium in groundwater. If remedial action within this zone becomes part of a proposed plan, additional detailed information will be required to design an effective remedy for this dynamic environment.
The source is unknown for the original VOC(s) that have degraded to cis-1,2-dichloroethene near Well 399-1-16B, and there is the possibility that a dense, nonaqueous-phase liquid remains undetected.	4	Identify the original VOC(s) and the pathways leading to the cis-1,2-dichloroethene observed at Well 399-1-16B.	(1) Perform computer simulations of the release of tetrachloroethene similar to historical releases. (2) Collect additional measurements of VOC concentrations in groundwater under conditions of withdrawal at Well 399-1-16B. Hydraulic parameters to be determined as part of withdrawal operations. Include analyses for VOCs for water samples from equivalent aquifer horizons in characterization boreholes (Nos. 6, 8, and 9 on Figure 3-5).	Yes	Field sampling: Perform groundwater withdrawal test in Well 399-1-16B that includes monitoring water quality changes as pumping proceeds and hydraulic pump testing; include analyses for VOCs for samples from wells in the North Process Pond and 300 Area Process Trenches. Collect and analyze water samples from Well 399-1-16B water quality parameters (volatile organic compounds, major anions and cations [including nitrate and nitrite under the major anions category], total organic carbon, and uranium [total, unfiltered sample]; field parameters*, temperature, pH, turbidity, specific conductance, dissolved oxygen, and microbiological activity). See Table 3-5 for drilling sampling details.	Information is not available to fully evaluate whether an undetected source for VOC contamination remains in the lower portion of the vadose zone, and/or at depth in the unconfined aquifer (i.e., at stratigraphic horizon monitored by several "-B" series wells). A more complete understanding of origin will help in developing estimates for how long this contamination is likely to persist.

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
The trichloroethene origin in the finer grained interval of Ringold Formation is not known in sufficient detail to support the technical basis for a proposed plan.	5	Additional information is needed on the potential origin(s) for the VOC contamination observed in an interval of finer grained sediment within the unconfined aquifer.	Searches of historical records for the 300 Area have not revealed hard evidence that would help explain the origin of this contamination. Additional source remedial actions in the 300 Area may reveal information that would point to a source. No specific investigations to identify a source are warranted for the RI.	No	No field work is planned to resolve this data need.	Information is not available as of January 2010 to fully evaluate (1) the potential extent, (2) the possible presence of a dense, nonaqueous-phase liquid, and (3) the processes leading to the persistence of this contamination in the environment. A complete understanding of where, when, and what was introduced to the vadose zone would reduce uncertainties in the current conceptual model. Identification of the source responsible for VOC contamination in this sediment interval would play a role in the FS of an engineered solution to lowering the level of contamination.
Distribution of Contaminants – 300 Area						
The extent of contaminant uranium in the shallow vadose zone beneath and adjacent to 300 Area facilities and waste disposal sites is not defined for waste sites not yet remediated.	6	Conduct sampling to characterize the extent of contamination in the sediment adjacent to and beneath the sites during remedial actions at future waste sites.	The current strategy for interim remedial actions at waste sites will be continued. The strategy has been efficient in obtaining the necessary data during remediation using the observational approach. Data will continue to be obtained that document the extent of residual contamination following completion of the interim remedial action.	No	Complete contaminated soil removal and sampling of the waste sites within the 300 Area subregion. The data need will be fulfilled as part of the ongoing interim action.	The known extent of uranium contamination at remediated waste sites is needed to assess the protectiveness of remedial action regarding human health and the underlying groundwater. Protectiveness levels will be developed as part of the proposed plan for future remedial actions and long-term evaluation of the effectiveness of the remedies selected.
The uranium contamination beneath the high volume, liquid waste disposal sites in the vadose zone between the bottom of the excavations and the periodically rewetted zone is known from a limited number of characterization boreholes. The possibility exists that localized zones of relatively high concentrations of contaminant uranium have gone undetected.	7	Laboratory analytical results for sediment and groundwater samples from boreholes drilled through the footprints of former liquid waste disposal facilities and adjacent areas along contaminant migration routes.	See resolution for Data Need 20. Two drilling programs will be used to obtain field and laboratory data to resolve this Data Need.	Yes	See scope of work for Data Need 2. Collect and analyze sediment. See Table 3-5 for drilling sampling details.	Information on the inventory of uranium potentially available in the vadose zone beneath the high volume, liquid waste disposal sites will be used to evaluate protectiveness relative to groundwater impact. The exchange between dissolved and solid forms of uranium is a complex process and requires additional data on subsurface conditions be obtained to reduce uncertainties to an acceptable level for remediation decisions. For example, additional data will allow an update to the "box model" that provides estimates for uranium in various subsurface regions (Data Need No. 17). Data from characterization drilling beneath these waste sites will provide information essential for the FS.
Data to describe the lateral distribution of uranium in the deeper portion of the vadose zone away from remediated waste sites are very limited. The information available is based primarily on an understanding of historical conditions during the fuels fabrication years, and not on direct observation from characterization boreholes.	8	Analyses of vadose zone sediment samples from borehole locations away from the footprints of principal liquid waste disposal sites will be used to refine estimates for the distribution of contaminant uranium.	Drill five boreholes in the west and southwest portions of plume (Figure 3-5): No. 1, No. 2, No. 3, No. 4, and No. 5. Collect sediment and water samples to determine contaminant content and contaminant mobility characteristics at various depths in the vadose zone and aquifer. Data from boreholes No. 6 and No. 7 will also contribute to resolving this data need, as will information from the five transect wells, a to e, from Data Need No. 2.	Yes	Collect and analyze sediment and pore water samples. See Table 3-5 for drilling sampling details. Collect and analyze vadose zone sediment and pore water from temporary well locations (a) through (e) as shown in Figure 3-5. Collect and analyze sediment samples from future excavations that penetrate to depths of historical high water tables conditions.	The distribution and concentration of the labile (extractable) uranium in sediments of the lower portion of the vadose zone outside the high-volume, liquid waste disposal site footprint are needed to estimate the potential area targeted for remedial action as part of the FS. During periods of flood river stage (e.g., late 1940s through the early 1960s), the water table beneath the 300 Area occasionally raised to an elevation that approached and possibly reached the bottoms of the North Process Pond, South Process Pond, and 307 Process Trenches. The consequences included groundwater interacting with the waste effluent high in the vadose zone, which may have enhanced sorption with sediment, and lateral spreading with subsequent uranium deposition in the vadose zone well above the current periodically rewetted zone. Additional samples from the proposed boreholes will provide data to refine estimates for the distribution of contaminant uranium in the vadose zone, including refinements to the box model (Data Need No. 17).

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Although the distribution of uranium contamination in the aquifer from the existing monitoring well and aquifer tube networks is well described in general terms, details on the vertical distribution are not available.	9	Discrete measurements of uranium concentrations at various depths in the unconfined aquifer under varying water table conditions.	Perform vertical profiling at existing and new wells. The methods proposed to respond to this data need include various tests at a subset of the current monitoring network, and new wells completed as part of this RI. Methods include groundwater sampling at discreet depths in the well bore and use of probes to characterize water movement in the well bore. Recent investigation results from the IFRC site are providing additional insight on the best methods to resolve this data need.	Yes	Field sampling: • Select approximately eight well locations for tests, including subsets that represent (1) locations that show an increase in uranium concentrations when the water table is high, (2) locations that show a decrease in uranium concentrations when the water table is high, and (3) locations where uranium concentrations remain relatively constant (i.e., typically the perimeter areas of the plume). Perform depth-discrete sampling to provide a vertical profile of uranium concentrations at 1 m (3-ft) intervals throughout the open interval of the well. • At wells near the river where river water intrusion is expected during high river stage conditions, measure specific conductance and temperature by lowering a probe into the well before water sample collection. • For wells at locations where uranium concentrations rise significantly when the water table is elevated, capture water samples at the water table during the June sampling event (approximately four inland well locations and four near-river locations). Laboratory analyses: Analyze all collected water samples in accordance with DOE/RL-2002-11.	Additional field measurements are needed to test hypotheses regarding resupply of contaminant uranium to the groundwater plume. If high water table conditions remobilize contamination sorbed in the lower vadose zone, discrete water samples near the top of the unconfined aquifer (i.e., at the water table) should reveal evidence in the form of higher concentrations. A more detailed characterization of the vertical concentration patterns within the plume will contribute to design of an effective long-term monitoring strategy. The improved understanding will lead to refined targeting of the remedy and sample collection protocols for regulatory compliance purposes.

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Monitoring well coverage of the hydrologic unit presumed to contain the bulk of uranium contamination is uneven, with principal weaknesses in coverage at the footprints of former liquid waste disposal sites and near the perimeter of the plume, especially the west and southwest portions.	10	Fill coverage gaps in the groundwater monitoring network for the uranium plume by completing monitoring wells at each of the 11 characterization borehole sites.	Complete each of the 11 characterization boreholes (Figure 3-5) as a groundwater monitoring well. Unless other than expected conditions are encountered during characterization, well screens will be positioned to monitor the uppermost hydrologic unit (i.e., saturated Hanford formation sediment). New wells include two in the North Process Pond; one in South Process Pond; one in 300 Area Process Trenches, five in the west and southwest portions of uranium plume, and two near the Columbia River.	Yes	Field sampling: Install new monitoring wells to cover the uppermost hydrologic unit in the unconfined aquifer. • Install 11 new monitoring locations (same as for vadose zone characterization boreholes) (i.e., 2 in North Process Pond; 1 in South Process Pond; 1 in 300 Area Process Trenches; 5 in west and southwest portions of plume and 2 near the Columbia River). • Conduct quarterly sampling of each new monitoring well for the first year, with a reduction in frequency for subsequent years if warranted. Laboratory analyses: • Use initial analysis of samples to establish baseline conditions at each new monitoring well. Methods are specified in DOE/RL-2002-11, *300-FF-5 Operable Unit Sampling and Analysis Plan*, Rev. 2, or its most recent update). • Radiological contamination uranium (total, unfiltered sample), gross alpha, and gross beta. • Chemical contamination chromium, nitrate, trichloroethene, tetrachloroethene, cis-1,2-dichloroethene, and vinyl chloride. • Basic water chemistry, including major anions and cations. • Additional laboratory analyses based on site specific conditions, as warranted.	The network of wells used to monitor the uranium plume needs to be sufficiently comprehensive to describe the level of contamination with an uncertainty acceptable to decision makers. Data from the expanded monitoring network will permit estimates for the level of contamination, such as, volume of plume; mass of dissolved uranium; concentrations at exposure locations, and how the level changes with time. These estimates are information needed to evaluate natural attenuation and to define the extent of the environment potentially subject to remedial action.
The extent of VOC contamination to the north and northwest of Well 399-1-16B, is not clearly defined by the current monitoring well network.	11	Additional field observations of water quality in groundwater from the lower portion of the unconfined aquifer near Well 399-1-16B, particularly upgradient from the well and within the flow path from potential sources.	Evaluate groundwater quality within horizons immediately above and equivalent to the contaminated horizon observed at Well 399-1-16B during drilling at characterization borehole locations near that well (Figure 3-5).	Yes	Collect groundwater samples during drilling at characterization borehole locations No. 6, No. 9, and No. 10 as drilling proceeds. Analyses to include VOCs, uranium, major anions, including nitrate and nitrite, and cations, and field parameters (temperature, pH, turbidity, specific conductance and dissolved oxygen). Use rapid turnaround VOC analysis to help select screen interval for completing monitoring wells at the three borehole locations. See Table 3-5 for drilling sampling details.	Data from additional monitoring locations will reduce the uncertainty in describing the extent of this contamination and its possible source location. Additional field observations will improve estimates for the level of contamination and changes with time, which is information for the FS analysis of remedial action alternatives.

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
The lateral extent of the contaminated portion of the finer-grained interval of Ringold Formation sediment is based on a limited number of observation locations that do not cover the potential extent beneath the 300 Area and exposure locations in the Columbia River.	12	Additional analytical results for groundwater collected from the finer-grained interval from areas beneath the 300 Area where data do not currently exist, and from the adjacent Columbia River substrate.	New information on the contamination extent will be provided by the characterization drilling, proposed for 11 locations as part of this work plan (Figure 3-5; Table 3-5), and by work in progress under the RCBRA (DOE/RL-2008-11). Information from geophysical research activities that focus on defining areas where groundwater preferentially discharges from the aquifer to the riverbed (DOE-sponsored research using fiber optic cables to reveal temperature anomalies) will contribute to identifying riverbed locations where this contamination may be released.	No	N/A	Current estimates for the extent of this contamination are based on the coverage provided by the LFI and VOC investigation boreholes, used to establish general limits (PNNL-17666). The vertical extent is known in general terms based on several samples collected at each previous characterization borehole. The eastern extent to which contamination extends, i.e., beneath the Columbia River, is not known but data from aquifer tubes provide the most easterly positioned results. Identifying the easterly extent of contamination in this interval is part of the CSM, especially with regard to ecological receptors in the Columbia River. The boundaries for the areal extent are needed to evaluate the feasibility of an engineered solution to reducing the level of contamination.
Fate and Transport of Contaminants – 300 Area						
The physical, geochemical, and hydrogeologic characteristics of the vadose zone sediment beneath the high volume, liquid waste disposal sites between the bottom of the excavations and the periodically rewetted zone are not sufficiently characterized to understand the transport mechanisms for uranium. These sites were remediated as part of EPA/ROD/R10-96/143, but the uncertain relationship between residual amounts of uranium at the bottom of the excavations to dissolved concentrations in the underlying groundwater remains.	13	Additional sediment samples from beneath remediated high volume, liquid waste disposal sites, extending from the bottom of the excavation to groundwater. Additional evaluation of physical properties, geochemical properties, and the hydraulic characteristics, with particular emphasis on the region near the periodically rewetted zone.	See Resolution of Data Need 2. Drill four (two in North Process Pond, one in South Process Pond, and one in 300 Area Process Trenches) boreholes and collect samples for analysis of sediment.	Yes	See Scope of Work for Data Need 2. Collect and analyze sediment and pore water from newly installed wells beneath the North Process Pond, South Process Pond, and 300 Area Process Trenches. See Table 3-5 for drilling sampling details.	The uranium transport mechanisms and the unsaturated flow characteristics beneath the high volume, liquid waste disposal sites remediated as part of EPA/ROD/R10-96/143 (i.e., the North and South Process Ponds, and the 300 Area Process Trenches) need to be known to develop computer simulations of uranium transport through the vadose zone and subsequent potential impacts to groundwater. The simulations outputs will strengthen the conceptual model for explaining the persistence of the groundwater plume, and will provide information that is fundamental to the FS of alternatives for remediation.
The hypothesis that labile or extractable uranium is present in the vadose zone away from the footprints of the remediated high volume, liquid waste disposal sites is not well tested, yet those subsurface areas may play a role in the long-term resupply of the groundwater plume. The physical, geochemical, and hydrogeologic characteristics of the vadose zone sediment that influence transport away from the liquid waste disposal sites are inferred, but direct observational data are limited.	14	Additional sediment analyses collected from the deeper portions of the vadose zone, especially the historic periodically rewetted zone, away from waste sites, including borehole logging using geophysical methods.	Collect samples from characterization boreholes and other subsurface penetrations as the opportunity arises. Perform laboratory analyses of sediment collected from same locations identified for groundwater characterization and monitoring within the 300 Area (complex). Laboratory analyses of sediment samples are intended to reveal the exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected to persist in the subsurface at the 300 Area.	Yes	Collect and analyze vadose zone sediment and pore water from characterization borehole locations inland of the former liquid waste disposal facilities (Locations No. 1 through No. 4 as shown in Figure 3-5). Collect and analyze sediment and pore water from samples collected during drilling at temporary well locations (a) through (e) as shown in Figure 3-5). Collect and analyze sediment samples from future excavations that penetrate to depths of historical high water table conditions. See Table 3-5 for drilling sampling details.	Uranium may have been deposited laterally in the vadose zone sediment outside the high volume, liquid waste disposal site footprint during the historical periods of high river stage (i.e., during the peak fuels production years [1950s and 1960s]). It is essential for the evaluation of remedial action alternatives during the FS to understand if residual amounts of contaminant uranium remain in those portions of the vadose zone and if that contamination is capable of acting as a source for resupplying the groundwater plume.

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Assumptions inherent in the conceptual model used to predict future levels of uranium contamination in the vadose zone and groundwater were based on very limited observational information, resulting in large uncertainty in the predictions based on computer simulation of future conditions.	15	Additional observational information on the inventory, geochemical environment, and potential transporting medium for uranium contamination.	An evaluation of all new analytical results that have become available since 2002 will be done to test the assumptions presented in BHI-01667 that are associated with protectiveness levels for remedial actions at waste sites. The evaluation will include new information on deeper portions of the vadose zone, the current and historical water table zones, and the zone of groundwater/river interaction near the river. New information includes results from laboratory leaching analyses for uranium in sediment samples collected under the LFI (PNNL-16435) and VOC investigations (PNNL-17793). Additional investigations of uranium in the 300 Area sediment has been conducted under DOE's Office of Science programs, leading to a better understanding of the form and geochemical environment of sediment. New insights were gained through the bench-scale tests and field implementation testing using polyphosphate to immobilize hexavalent uranium. Finally, new laboratory analytical results for uranium distribution and transport in sediment from the vadose zone (including the water table zone) will be available from work proposed in this work plan.	No	Review assumptions made and input parameters used during the analysis of protectiveness levels presented in BHI-01667 in light of new information that has become available since ~2002. Provide conclusions and recommendations regarding protectiveness levels for contaminant uranium remaining in environmental pathways.	Analysis of contaminant uranium levels that could remain in place at former waste disposal sites included assumptions regarding the mobility characteristics of uranium in the vadose zone. A sediment concentration of 267 pCi/g has been deemed protective of groundwater (BHI-01667), assuming the ground surface is revegetated and infiltration of moisture from natural sources. The field data, laboratory analyses of sediment, and computer simulation of contaminant migration under expected hydrologic conditions were limited in scope for this evaluation, thus leading to large uncertainties in the assumptions regarding the connection between residual uranium in the vadose zone and groundwater. A stronger technical basis is needed to support a proposed plan for remediation decisions involving uranium.
Lithologic characteristics, stratigraphic contact data, and hydraulic head measurements define the spatial framework through which groundwater flows. The coverage throughout the extent of the 300 Area uranium plume is incomplete.	16	Additional descriptions of sediment characteristics that will fill gaps and expand the current model domain for the 300 Area. Additional hourly hydraulic head measurements at strategic locations for flow model validation.	Collect sediment characteristics and head data to better characterize the flow model.	Yes	Field sampling: Install and operate additional pressure transducers at 10 wells throughout the domain of the model and monitor throughout the investigation period. Computer simulation: Incorporate into the spatial framework new information from drilling associated with recent investigations. Validate the flow model being used with hourly data for water levels at multiple locations and throughout at least one seasonal hydrologic cycle.	A groundwater flow simulation is used to infer conditions between locations of direct observation and to predict future conditions. This capability supports evaluation of remediation alternatives, development of monitoring strategies, and evaluation of the performance of a remedial action. It also can be used to investigate future land use scenarios.

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Current inventory estimates of contaminant uranium in the vadose zone and aquifer are based on limited observational data, including numerous assumptions and inferences. The estimates can be refined by incorporating new information from sampling at remedial action sites, research activities at the IFRC, and characterization associated with treatability testing sites.	17	Update inventory box model and investigate how the inventory might vary under the influence of seasonal groundwater conditions.	Data collected from the RI wells and other ongoing work will produce the data to update inventory in box model and to evaluate how the inventory varies in the groundwater during seasonal influences.	Yes	Field sampling: Collect groundwater samples from the water table during periods of high water table conditions, along with additional samples from discrete depths below the water table. • Laboratory analyses: See laboratory analysis for samples from boreholes identified for source and distribution data needs. • Update the conceptual box model for where contaminant uranium remains in the subsurface (PNNL-17034).	An understanding of the locations and amounts of contaminant uranium in the subsurface available to act as a long-term source for affecting groundwater is an essential element of the conceptual model. This understanding provides the explanation for the persistence of the uranium plume, a technical basis for evaluating remedial action alternatives, and information to evaluate potential risk to human health and the environment. The cause for the persistence of the uranium plume in groundwater beneath the 300 Area remains unexplained at the level of detailed required to support a proposed plan.
The amount of uranium lost from the plume to the river by groundwater discharge through the riverbed, and by withdrawal at Well 399-4-12, have been estimated using limited observational data and several significant assumptions, which create uncertainty.	18	Reduce the uncertainty in estimates for the removal of dissolved uranium from the groundwater plume by discharge to the Columbia River and withdrawal at a water supply well.	Revise the groundwater flow model as new data become available from a variety of investigations underway at the 300 Area, including characterization drilling conducted as part of the RI. Run the model to provide updates on the rate of groundwater discharge to the river. Incorporate withdrawal rate data for Well 399-4-12 and discharge data for the Life Sciences Building aquariums into the estimates. Incorporate results from the RCBRA as they become available (DOE/RL-2008-11). Provide estimates for the rate of uranium loss from the groundwater plume in the RI/FS report, using the most up-to-date input parameters.	Yes	Update the computer simulation model for groundwater flow beneath the 300 Area. Refine estimates for uranium removal from the groundwater plume via withdrawal at Well 399-4-12. Maintain awareness of information developed by other projects in progress at the 300 Area.	An understanding of the exchange of uranium mass among the various subsurface compartments along environmental pathways provides FS focus for evaluating remedial action alternatives. An estimate for the rate of uranium flux to the Columbia River is needed to provide insight on potential impacts to river water quality, and as a guide to the amount that must be resupplied from a vadose zone source. Analysis of the mass balance in the system reveals the amount of uranium to be addressed by remedial action in order to reduce the concentration of dissolved uranium in groundwater.
Existing simulation of uranium transport through the vadose zone and aquifer pathways is based on limited observational information, and can be refined using new information developed under this work plan, the IFRC, and from experience gained during treatability tests (Section 3.1.4.4).	19	Refined simulation input parameters for (1) inventories of labile contaminant uranium in various subsurface regions; (2) exchange rates between dissolved and solid forms; and (3) the form, capacity, and timing of a transporting medium (e.g., infiltration of moisture). Also, consensus on appropriate modeling algorithms, especially with regard to model assumptions.	Three-dimensional groundwater flow and uranium transport modeling involving the vadose zone and uppermost aquifer at the 300 Area is under development as part of the Hanford IFRC project (PNNL-SA-58090). Additional detailed modeling for this purpose is not proposed as part of this work plan.	No	Three-dimensional groundwater flow and contaminant transport modeling being developed as part of the Hanford IFRC project (PNNL-SA-58090).	The capability to simulate the behavior of contaminant uranium in environmental pathways beneath the 300 Area supports the technical basis for remediation decisions presented in a proposed plan. Simulations provide estimates for contaminant levels in areas not readily described with field data, predictions for contaminant transport, and estimates for the time period during which contamination persists. Simulations are an essential part of comparing remedial action alternatives during the FS.

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
The cause for the persistence of cis-1,2-dichloroethene contamination in the lower portion of the unconfined aquifer at Well 399-1-16B is uncertain. A remote possibility is that a continuing subsurface source has not yet been identified by drilling. Circumstantial evidence suggests that the persistence is related to the absence of geochemical and/or microbiological conditions that would allow further degradation of the chlorinated hydrocarbon beyond cis-1,2-dichloroethene.	20	Additional geochemical and microbiological data for groundwater samples, to include oxygen levels, organic carbon and nutrients from the contaminated interval at Well 399-1-16B.	Continue to collect and analyze groundwater samples from the deeper portion of the unconfined aquifer near Well 399-1-16B, per the objectives described in the 300-FF-5 Operations and Maintenance Plan (DOE/RL-95-73) for characterizing VOC contamination and trends.	Yes	Collect groundwater samples from Well 399-1-16B and any newly constructed wells that have open intervals in the hydrologic unit that is continuous with Well 399-1-16B. Laboratory analyses: • Conduct analyses of water chemistry to characterize the geochemical environment in the contaminated hydrologic unit at Well 399-1-16B per the analytical suite described in DOE/RL-2002-11, as periodically amended. During the course of the RI, at least three rounds of sampling will include dissolved oxygen levels, total organic carbon, and nutrients conducive to microbial activity. • Microbiology cultures to identify organisms responsible for the degradation of chlorinated hydrocarbons to cis-1,2-dichloroethene. An estimate for the potential for this compound to degrade further to vinyl chloride will be developed.	The potential for a reduction in the level of contamination in the near future appears limited based on historical monitoring. However, additional data on the geochemical and microbiological characteristics near the well screen will provide additional support for the selection of a remedial action alternative for this occurrence.
The processes by which VOC contaminants have been transported from potential source(s) to sequestration in the finer grained interval of Ringold Formation are not known, although some limits can be placed on the possibilities (PNNL-17666). Contaminant movement within the finer grained interval of sediment and release from the interval to overlying and underlying sediments are not well characterized.	21	Rates of lateral movement of VOC contamination through the finer grained interval of Ringold Formation sediment, and rates of release from the finer grained interval to the overlying saturated Hanford formation sediment.	A comprehensive evaluation of the various possibilities for VOC movement within, and release from, the finer grained interval of Ringold Formation can be acquired by additional analyses of existing and newly acquired information from characterization boreholes (11 locations listed in Table 3-5). Groundwater monitoring will continue to include VOC analyses for wells and aquifer tubes samples whose screens are positioned close to the contaminated portion of the finer-grained interval. Computer simulation(s) of groundwater movement and contaminant migration/degradation can be used to infer future conditions. Results from the RCBRA field activities in the Columbia River will contribute to conclusions regarding the fate of this contamination in the RI report.	No	A more comprehensive evaluation of the various possibilities for VOC movement within and release from the finer grained interval of Ringold Formation sediment may reduce the uncertainty in the conclusions presented in PNNL-17666.	Understanding the processes leading to contamination in this stratigraphic interval, and how it is currently evolving with regard to degradation and migration, is needed to prepare estimates for future trends in the contamination level.

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Initial tests using a polyphosphate solution to immobilize uranium in the aquifer have not revealed an optimal method for delivering the solution. While tests are underway during FY 2010 and FY 2011 for immobilizing uranium in the periodically rewetted zone, it is anticipated that a variety of methods may be needed for delivery in other subsurface compartments.	22	Laboratory and field-scale testing of methods to deliver uranium-immobilizing solutions to the vadose zone and unconfined aquifer.	New information on the distribution and characteristics of contaminant uranium in various subsurface regions as developed under this work plan will be used to anticipate the type of delivery mechanism most likely to result in reducing mobility. If necessary, additional bench and field-scale tests will be performed to augment results from tests already underway or planned. Experience gained at other sites contaminated by uranium will be factored into the analysis of appropriate delivery methods.	Yes	Bench- and field-scale tests associated with implementing remedial action technologies intended to reduce uranium concentrations in the 300 Area groundwater plume.	Method(s) for delivery of a chemical that immobilizes contaminant uranium in subsurface compartments may vary depending on the compartment targeted. For example, infiltration of solutions using widespread irrigation at the surface may be suitable for uranium remaining in shallow vadose zone regions, while injection via boreholes may be more appropriate for contamination in the deep vadose zone and aquifer. Information on the potential delivery methods is needed as part of the feasibility analysis, especially with regard to estimates for the cost of treatment and for the period needed to achieve remedial action objectives.
Testing of in situ methods to immobilize contaminant uranium in the subsurface environment is in progress at other waste sites. Knowledge acquired at sites other than Hanford Site can contribute to the technical basis for selecting a remediation alternative for uranium at the 300 Area.	23	Technical information from research activities and remedial action experience at sites contaminated by uranium.	A search for activities separate from Hanford Site activities will be maintained during the duration of the RI/FS, to identify solutions developed for similar problems. Potential contributors include research involving uranium in the environment at sites in Rifle, Colorado, and Oak Ridge, Tennessee under the DOE's Integrated Field-Scale Research Challenge program (Note: The Hanford Site 300 Area is also part of this program). Cleanup experience gained under the Uranium Mill Tailings Remedial Action program will also be reviewed.	No	Review work conducted at other sites where uranium has contaminated environmental pathways. Incorporate appropriate information obtained in interpretations and conclusions presented in the RI/FS Report.	Conclusions presented in the FS report will be based on all available information at the time of report preparation, including information developed under this work plan, and on information derived from activities at other sites contaminated by uranium.
Technology evaluation, screening, and selection activities associated with contaminant uranium beneath the 300 Area have been conducted to the extent allowed by available information (DOE/RL-2008-36). However, new information generated by the RI activities described in this work plan could be used to validate and potentially update the detailed analysis of remediation technology alternatives completed thus far.	24	Incorporate new information on the distribution and mobility characteristics of contaminant uranium in various subsurface regions beneath the 300 Area into the FS process as related to uranium.	Revisit the technology evaluation, screening, and selection activities performed, to incorporate new information obtained during the RI activities, including treatability testing. Apply computer simulation models to evaluating the effectiveness of alternative technologies as directed toward individual subsurface compartments. Timeframes for reducing levels of uranium contamination to meet applicable or relevant and appropriate requirements under natural environmental processes will be estimated using models. New information developed at other sites contaminated by uranium will be considered as it becomes available.	No	Re-evaluate conclusions presented in earlier uranium cleanup technology screening reports, and strategies developed for reducing uranium concentrations in groundwater, in light of new information developed under this Work Plan. Conduct computer simulation runs for various remedial action alternatives.	Selection of appropriate remedial action(s) depends on the amount and mobility of the contaminant. As new information is developed on uranium in various subsurface compartments, the strategy for addressing uranium contamination can be revisited and the technical basis for conclusions strengthened. (Related Data Needs: No. 2, No. 3, No. 7, and No. 8; see Table 3-5.)

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Existing groundwater flow and uranium transport simulations are not sufficiently developed to (a) simulate the performance of various remedial action alternatives, (b) predict timelines for achieving remedial action objectives, and (c) evaluate post-remediation land-use and environmental scenarios.	25	Computer simulation runs to evaluate remedial action alternatives, especially with regard to the effectiveness at reducing uranium concentrations in groundwater and the period required to do so.	Using the products resulting from fulfilling Data Need No. 16 (groundwater flow simulation) and Data Need No. 19 (uranium transport simulation), existing computer code for simulating groundwater movement and uranium transport will be refined. New spatial information on the hydrogeologic framework; on the distribution of uranium; and on the rates of exchange between dissolved and solid forms of uranium will play a key role in refining existing models.	No	Refine existing computer code for groundwater flow and uranium transport in the subsurface at the 300 Area.	A FS of remediation alternatives and remedial action technologies includes a discussion of the effectiveness, costs, and timeframes associated with each alternative. Anticipating conditions in areas not available for direct observation via monitoring, and future conditions under various environmental and land-use scenarios, can only be accomplished through simulation activities.
Information on the lateral and vertical distribution of contaminant uranium in various subsurface compartments, and the mobility and potential transport processes, is insufficient to complete the engineering design and cost estimating aspects for the FS.	26	Updated information on the mass and mobility characteristics of contaminant uranium in various subsurface compartments.	New information on the lateral and vertical distribution of contaminant uranium is likely to come from characterization drilling at eleven locations during the RI (see Data Needs No. 2, No. 3, and No. 8, and Table 3-5). Particularly significant for the FS analysis will be to fill in details on the mass of uranium and mobility characteristics in each subsurface compartment where contaminant uranium may be found, as these details influence the type of chemical solutions to be used to immobilize uranium and the methods by which the solutions are deployed.	Yes	Incorporate new information on the inventory and mobility characteristics of contaminant uranium in the subsurface at the 300 Area into the FS evaluation of remedial action alternatives.	As discussed in Sections 3.1.1, 3.1.2, and 3.1.3, considerable uncertainty exists in the location, mass, and mobility potential for uranium in subsurface regions beneath the 300 Area. Until those uncertainties are reduced during the course of the RI, it will be difficult to provide sufficient technical data for engineering design and credible estimates for cost.
400 Area Sources						
Unidentified sources of contamination may exist within and in the soils adjacent to engineered facilities and structures.	27	Identify new waste sites and potential sources of contamination in the 400 Area.	Complete OSE process in the 400 Area.	No	Complete OSE process in the 400 Area. The data need will be fulfilled as part of the OSE process.	The OSE and waste site discovery process are performed to identify new waste sites and sources that are not in CERCLA decision documents.
Distribution of Contaminants – 400 Area						
The nature and extent of contamination in the shallow vadose zone beneath and adjacent to 400 Area facilities and waste disposal sites are needed to assess groundwater protection.	28	Characterize below unremediated waste sites to assess nature and extent of contamination in the vadose zone.	Continue interim remedial actions because they have demonstrated to be efficient in obtaining the necessary data during remediation using the observational approach. Obtain data documenting the remaining residual contamination following completion of interim remedial action.	No	Complete contaminated soil removal and sampling of the waste sites within the 400 Area subregion. The data need will be fulfilled as part of the ongoing interim action.	Remediation is needed to protect human health and the environment.
600 Area Sources						
Unidentified sources of contamination may exist within the soils adjacent to engineered facilities within the 600 Area.	29	Identify new waste sites and potential sources of contamination in the 600 Area.	Complete OSE process in the 600 Area.	No	Complete OSE process in the 600 Area. The data need will be fulfilled as part of the OSE process.	The OSE and waste site discovery site process are performed to identify new waste sites and sources that are not in CERCLA decision documents.

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Distribution of Contaminants – 600 Area						
There is uncertainty associated with the contents of the 618-10 and 618-11 Burial Grounds. Operational records and history associated with past waste disposal practices of 300 Area waste streams are incomplete.	30	Characterize contents of the 618-10 and 618-11 Burial Grounds. Complete planned nonintrusive and intrusive sampling of the burial ground disposal sites.	N/A	No	The data need will be fulfilled as part of DOE/RL-2008-27.	Characterization of the burial ground contents will be performed under the current SAP process. The characterization activities prescribed will provide data and information needed for planning future intrusive characterization activities (if required) and/or remediation strategies for the vertical pipe units, caissons, and trenches located in these burial grounds. Planning for intrusive characterization and/or remediation requires additional understanding of the quantity and condition of the material deposited in the 618-10 and 618-11 Burial Grounds.
The nature and extent of contamination in the shallow vadose zone beneath and adjacent to unremediated 600 Area waste disposal sites are not well defined. This includes the 618-10, 618-11, 618-7, and 618-13 Burial Grounds and the 316-4 Crib site.	31	Characterize below unremediated waste sites to assess nature and extent of contamination in the vadose zone.	Continue interim remedial actions because they have demonstrated to be efficient in obtaining the necessary data during remediation using the observational approach.	No	Complete contaminated soil removal and sampling of the waste sites within the 600 Area subregion. The data need will be fulfilled as part of the ongoing interim action.	Remediation is needed to protect human health and environment.
The distribution of contamination in the deep vadose zone beneath the 618-10 and 618-11 Burial Grounds and the 316-4 Crib excavation site is not well understood.	32	Following excavation of the sites during the interim remedial action, drill and collect soil samples from beneath engineered facilities (bottom of excavation) to groundwater. Perform laboratory and field analyses to determine the nature and extent of contamination beneath the remediated waste sites from the bottom of the excavation to groundwater. Elevated tritium in the groundwater near the 618-11 Burial Ground may require further evaluation after characterization and remediation.	Drill characterization boreholes and perform laboratory analysis of sediments collected from boreholes drilled from bottom of excavations, following interim remedial actions, to groundwater. Conduct soil gas sampling at site excavations. Exact locations for boreholes to be drilled within the footprints of the 618-10 and 618-11 Burial Grounds, and the 316-4 Crib will be determined following excavation activities performed as part of remediation of the waste sites.	Yes	Collect sediment and soil gas samples. Conduct sampling in the soil beneath site excavations for tritium and VOCs; radiological screening of sediment samples including gross beta/gamma, low level gamma, high level gamma, and neutron detection; presence of VOC vapors with use of a portable detector. Borehole sampling requirements (e.g., number of samples and collection intervals) are proposed in Table 2-5, but may be modified as approved by EPA following review of characterization and verification data collected during the remedial action. Soil gas sampling may be performed at 618-11 Burial Ground with the purpose of determining the nature, extent, and persistence over time of tritium in the aquifer beyond the boundary of the excavated waste site after the potential sources are removed as part of the remedial activities. Remediation of the 618-10 and 618-11 Burial Grounds, and 316-4 Crib will occur after the period of work outlined in this work plan and further planning will be required to correlate the drilling of boreholes and soil gas sampling with remediation activities. This planning should be performed as part of the 300 Area Remedial Design Report/Remedial Action Work Plan.	Some uncertainty remains with the distribution of contamination below the 618-10 and 618-11 Burial Grounds, and the 316-4 Crib site. Elevated tritium concentrations in the groundwater near the 618-11 Burial Ground and in the soil gas near the 618-10 and 618-11 Burial Grounds constitute the need for further characterization of the vadose zone beneath the excavated sites, from the bottom of the excavation to groundwater. These data will be collected in addition to the verification sampling. In addition, the soils contaminated with uranium bearing tributyl phosphate liquid wastes beneath the 316-4 Crib site constitute the need for further characterization of the vadose zone, from the bottom of the excavation following the interim remedial action to groundwater.

Table 3-4. Summary of Data Needs and Their Resolution

Data Gap	Data Need No.	Data Need	Resolution of Data Need	Additional Data Collection	Scope of Work	Justification
Existing groundwater data sets and the strategies currently in place to monitor groundwater conditions do not meet the RI needs for determining spatial and temporal risk uncertainty for potential human and ecological receptors.	33	Ground water samples from a subset of wells selected to provide representative samples of aquifer conditions throughout the 300 Area; laboratory analysis of the samples to include COPCs as identified in Section 4.5.2 of the work plan; and multiple rounds of sampling to characterize the temporal variability in aquifer conditions.	The groundwater database available for risk assessment activities will be augmented by: • Identifying a subset of monitoring wells in the 300 Area that will provide spatially representative samples of current conditions • Collecting samples from those wells during at least three rounds of sampling that encompass seasonal variability in water table and Columbia River conditions, and • Analyzing those samples for constituents deemed to be of potential concern for human and ecological receptors (Section 4.5.2) The wells selected for this activity are listed in the 300 Area SAP (DOE/RL-2009-45). The periods recommended for sampling are May to mid-June, mid-September to mid-October, and either March through April or July through August.	Yes	Sample a subset of groundwater wells in the 300 Area for three rounds of sampling that correlate with different phases of the seasonal river stage cycle. A proposed list of wells is presented in Table 3-3 and 3-4 of the SAP. Analyze the groundwater samples for constituents identified in Section 4.5.2.	Additional groundwater sampling will help to reduce uncertainties identified in the existing baseline risk assessments for human health exposures. These uncertainties include the possibilities that a) contaminants may have been overlooked by current groundwater monitoring programs, b) sampling frequencies used in the past may have biased interpretations of current conditions, especially near the Columbia River where conditions change rapidly, and c) conditions have changed since the initial qualitative risk assessment. Reducing uncertainties associated with the baseline human health risk assessment will strengthen the basis for analyses of remedial action alternatives during the FS process.

Notes:

* Field parameters are defined as taking groundwater measurements for pH, turbidity, specific conductance, temperature, and dissolved oxygen content.

BHI-01667, *Protection of 300 Area Groundwater from Uranium-Contaminated Soils at Remediated Sites.*

Comprehensive Environmental Response, Compensation, and Liability Act of 1980, 42 USC 9601, et seq.

DOE/RL-2002-11, *300-FF-5 Operable Unit Sampling and Analysis Plan.*

DOE/RL-2008-11, *Remedial Investigation Work Plan for Hanford Site Releases to the Columbia River.*

DOE/RL-2008-27, *Sampling and Analysis Plan for 618-10 and 618-11 Nonintrusive Sampling.*

DOE/RL-2008-36, *Remediation Strategy for Uranium in Groundwater at the Hanford Site 300 Area, 300-FF-5 Operable Unit.*

DOE/RL-2009-45, *Sampling and Analysis Plan for the 300 Area 300-FF-1, 300-FF-2 and 300-FF-5 Operable Units Remedial Investigation/Feasibility Study.*

EPA/ROD/R10-96/143, Declaration *of the Record of Decision for the 300-FF-1 and 300-FF-5 Operable Units, Hanford Site, Benton County, Washington.*

PNNL-16435, *Limited Field Investigation Report for Uranium Contamination in the 300-FF-5 Operable Unit at the 300 Area, Hanford Site, Washington.*

PNNL-17034, *Uranium Contamination in the Subsurface Beneath the 300 Area, Hanford Site, Washington.*

PNNL-17666, *Volatile Organic Compound Investigation Results, 300 Area, Hanford Site, Washington.*

PNNL-17793, *Uranium Contamination in the 300 Area: Emergent Data and Their Impact on the Source Term Conceptual Model.*

PNNL-SA-58090, *Multi-Scale Mass Transfer Processes Controlling Natural Attenuation and Engineered Remediation: An IFC Focused on Hanford's 300 Area Uranium Plume.*

DOE	=	U.S. Department of Energy	OSE	=	orphan site evaluation
FS	=	feasibility study	RCBRA	=	River Corridor Baseline Risk Assessment
FY	=	fiscal year	RI	=	remedial investigation
IFRC	=	Integrated Field-Scale Subsurface Research Challenge	SAP	=	sampling and analysis plan
LFI	=	limited field investigation	VOC	=	volatile organic compound

Table 3-5. Sampling During Drilling

General Location	Fulfills Data Need	Number of Boreholes	Drill Target	Number of Wells	Target Completion Zone	Scope
North Process Pond	2, 4, 6, 7, 11, 13, 15, 33	2	Bottom of unconfined aquifer (i.e., contact between Ringold Unit E and Ringold lower mud unit).	2	Upper unconfined aquifer	Sediment and pore water samples collected by coring, samples in Lexan* liner. Sediment samples collected generally at 3 m (10-ft) intervals from the bottom of the waste sites (or maximum depth of the remedial action), at 1 m (3-ft) intervals after 9 m (30 ft) bgs, continuous sampling within 3 m (10 ft) of the water table, and 1 m (3-ft) intervals from the top of the water table through the saturated Hanford formation. Geologic description of sediments encountered. Laboratory analyses: Leach tests on sediment, with chemical and radiological analysis of pore water samples. Analysis designed to reveal exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected for the 300 Area subsurface during the near future. Analyze all sediment samples collected above water table for soil target analytes listed in WCH-332. Collect and analyze water samples collected during drilling. Collected at the top, middle, and bottom of the unconfined aquifer. Water quality parameters (volatile organic analytes). Geophysical logging: neutron moisture, spectral gamma. Core samples collected from major formations and changes in lithology. Analyzed for physical properties: bulk density, grain size distribution, and soil moisture content. Grab samples collected from major formations and changes in lithology, in the vadose and saturated zone, and starting at 3 m (10 ft) above the water table, sample every meter for three samples. Analyze grab samples for geochemical analyses of sediments: organic carbon, inorganic carbon, calcium carbonate equivalent, trace metals, major cations, and major anions.
South Process Pond	2, 4, 6, 7, 11, 13, 15, 33	1	Bottom of unconfined aquifer (i.e., contact between Ringold Unit E and Ringold lower mud unit).	1	Upper unconfined aquifer	Sediment and pore water samples collected by coring, samples in Lexan liner. Sediment samples collected generally at 3 m (10-ft) intervals from the bottom of the waste sites (or maximum depth of the remedial action), at 1 m (3-ft) intervals after 9 m (30 ft) bgs, continuous sampling within 3 m (10 ft) of the water table, and 1 m (3-ft) intervals from the top of the water table through the saturated Hanford formation. Geologic description of sediments encountered. Laboratory analyses: Leach tests on sediment, with chemical and radiological analysis of pore water samples. Analysis designed to reveal exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected for the 300 Area subsurface during the near future. Analyze all sediment samples collected above water table for soil target analytes listed in WCH-332. Collect and analyze water samples collected during drilling. Collected at the top, middle, and bottom of the unconfined aquifer. Water quality parameters – volatile organic analytes. Geophysical logging: neutron moisture, spectral gamma. Core samples collected from major formations and changes in lithology. Analyzed for physical properties: bulk density, grain size distribution, and soil moisture content. Grab samples collected from major formations and changes in lithology, in the vadose and saturated zone, and starting at 3 m (10 ft) above the water table, sample every meter for three samples. Analyze grab samples for geochemical analyses of sediments: organic carbon, inorganic carbon, calcium carbonate equivalent, trace metals, major cations, and major anions.

Table 3-5. Sampling During Drilling

General Location	Fulfills Data Need	Number of Boreholes	Drill Target	Number of Wells	Target Completion Zone	Scope
300 Area Process Trenches	2, 4, 6, 7, 11, 13, 15, 33	1	Bottom of unconfined aquifer (i.e., contact between Ringold Unit E and Ringold lower mud unit).	1	Upper unconfined aquifer	Sediment and pore water samples collected by coring, samples in Lexan liner. Sediment samples collected generally at 3 m (10-ft) intervals from the bottom of the waste sites (or maximum depth of the remedial action), at 1.0 m (3-ft) intervals after 9 m (30 ft) bgs, continuous sampling within 3 m (10 ft) of the water table, and 1 m (3-ft) intervals from the top of the water table through the saturated Hanford formation. Geologic description of sediments encountered. Laboratory analyses: Leach tests on sediment, with chemical and radiological analysis of pore water samples. Analysis designed to reveal exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected for the 300 Area subsurface during the near future. Collect and analyze water samples collected during drilling. Collected at the top, middle, and bottom of the unconfined aquifer. Water quality parameters (volatile organic analytes). Analyze all sediment samples collected above water table for soil target analytes listed in WCH-332. Collect and analyze water samples collected during drilling. Collected at the top, middle, and bottom of the unconfined aquifer. Water quality parameters (volatile organic analytes). Geophysical logging: neutron moisture, spectral gamma. Core samples collected from major formations and changes in lithology. Analyzed for physical properties: bulk density, grain size distribution, and soil moisture content. Grab samples collected from major formations and changes in lithology, in the vadose and saturated zone, and starting at 3 m (10 ft) above the water table, sample every meter for 3 samples. Analyze grab samples for geochemical analyses of sediments: organic carbon, inorganic carbon, calcium carbonate equivalent, trace metals, major cations, and major anions.
Perimeter	2, 8, 9, 10, 14, 16	5	Bottom of unconfined aquifer (i.e., contact between Ringold Unit E and Ringold lower mud unit).	5	Upper unconfined aquifer	Sediment and pore water samples collected by coring, samples in Lexan liner. Sediment samples starting at the historically high water levels collected at 1.0 m (3-ft) intervals and continuous sampling within 3 m (10 ft) of the water table, and two samples within the saturated Hanford formation. Geologic description of sediments encountered. Laboratory analyses: Leach tests on sediment, with chemical and radiological analysis of pore water samples. Analysis designed to reveal exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected for the 300 Area subsurface during the near future. Collect and analyze water samples collected during drilling. Collected at the top, middle, and bottom of the unconfined aquifer. Water quality parameters. Geophysical logging: neutron moisture, spectral gamma. Core samples collected from major formations and changes in lithology. Analyzed for physical properties: bulk density, grain size distribution, and soil moisture content. Grab samples collected from major formations and changes in lithology, in the vadose and saturated zone, and starting at 3 m (10 ft) above the water table, sample every meter for three samples. Analyze grab samples for geochemical analyses of sediments: organic carbon, inorganic carbon, calcium carbonate equivalent, trace metals, major cations, and major anions.

Table 3-5. Sampling During Drilling

General Location	Fulfills Data Need	Number of Boreholes	Drill Target	Number of Wells	Target Completion Zone	Scope
Near river	3, 4,14	2	Bottom of unconfined aquifer (i.e., contact between Ringold Unit E and Ringold lower mud unit).	2	Upper unconfined aquifer	Sediment and pore water samples collected by coring, samples in Lexan liner. Sediment samples starting at the historically high water levels collected at 1 m (3-ft) intervals and continuous sampling within 3 m (10 ft) of the water table, and two samples within the saturated Hanford formation. Geologic description of sediments encountered. Laboratory analyses: Leach tests on sediment, with chemical and radiological analysis of pore water samples. Analysis designed to reveal exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected for the 300 Area subsurface during the near future. Collect and analyze water samples collected during drilling. Collected at the top, middle, and bottom of the unconfined aquifer. Water quality parameters (volatile organic analytes). Analyze all sediment samples collected above water table for soil target analytes listed in WCH-332. Geophysical logging: neutron moisture, spectral gamma. Core samples collected from major formations and changes in lithology. Analyzed for physical properties: bulk density, grain size distribution, and soil moisture content. Grab samples collected from major formations and changes in lithology, in the vadose and saturated zone, and starting at 3 m (10 ft) above the water table, sample every meter for three samples. Analyze grab samples for geochemical analyses of sediments: organic carbon, inorganic carbon, calcium carbonate equivalent, trace metals, major cations, and major anions.
Vicinity of 300 Area Process Trenches and North/South Process Ponds	2, 8	5	Uppermost portion of the unconfined aquifer.	5 (temporary)	Upper portion of unconfined aquifer	These boreholes are being drilled in relatively proximal to former liquid waste disposal sites, with the intent of defining the extent of uranium contamination in the lower portion of the vadose zone at increasing distance from the source sites. Sediment samples will be collected to characterize the lowermost 3 m (10 ft) of the vadose zone (i.e., 3 m above the water table as estimated during drilling) and the uppermost portion of saturated Hanford gravels. Groundwater samples will be collected when saturated conditions are encountered. Laboratory analysis of sediment samples will include sequential leaching tests to characterize uranium. Additional chemical and physical analyses will be conducted to aid in identifying the mobility potential for contaminant uranium.
618-10 Burial Ground	32	1	Bottom of unconfined aquifer.	0	N/A	Sediment samples collected generally at 3 m (10-ft) intervals from the bottom of the waste sites (or maximum depth of the remedial action), at 1 m (3-ft) intervals after 9 m (30 ft) bgs, continuous sampling within 3 m (10 ft) of the water table, and 1 m (3-ft) intervals from the top of the water table through completion. Laboratory analyses: Analytical test on sediments for appropriate analytes from the 600 Area target analyte list; leach tests on sediment using simulated groundwater, with chemical and radiological analysis of pore water samples. Analyze all sediment samples collected above water table for soil target analytes listed in WCH-332. Field screening: Radiological screening of sediment samples including gross gamma, gross alpha, gross beta; and presence of VOC vapors with use of a portable detector.
316-4 Crib	32	1	Bottom of unconfined aquifer.	0	N/A	Sediment samples collected generally at 3 m (10-ft) intervals from the bottom of the waste sites (or maximum depth of the remedial action), at 1 m (3-ft) intervals after 9 m (30 ft) bgs, continuous sampling within 3 m (10 ft) of the water table, and 1.0 m (3-ft) intervals from the top of the water table through completion. Laboratory analyses: Analytical test on sediments for appropriate analytes from the 600 Area target analyte list; leach tests on sediment using simulated groundwater, with chemical and radiological analysis of pore water samples. Analyze all sediment samples collected above water table for soil target analytes listed in WCH-332. Field screening: Radiological screening of sediment samples including gross gamma, gross alpha, gross beta; and presence of VOC vapors with use of a portable detector.

Table 3-5. Sampling During Drilling

General Location	Fulfills Data Need	Number of Boreholes	Drill Target	Number of Wells	Target Completion Zone	Scope
618-11 Burial Ground	32	1	Bottom of unconfined aquifer	0	N/A	Sediment samples collected generally at 3 m (10-ft) intervals from the bottom of the waste sites (or maximum depth of the remedial action), at 1 m (3-ft) intervals after 9 m (30 ft) bgs, continuous sampling within 3 m (10 ft) of the water table, and 1 m (3-ft) intervals from the top of the water table through completion. Laboratory analyses: Analytical test on sediments for appropriate analytes from the 600 Area target analyte list; leach tests on sediment using simulated groundwater, with chemical and radiological analysis of pore water samples. Analyze all sediment samples collected above water table for soil target analytes listed in WCH-332. Field screening: Radiological screening of sediment samples including gross gamma, gross alpha, gross beta; and presence of VOC vapors with use of a portable detector.

Notes:

WCH-332, *300 Area Remedial Investigation/Feasibility Study Sampling and Analysis Plan for the 300-FF-1, 300-FF-2 and 300-FF-5 Operable Units.*

* Lexan is a registered trademark of SABIC Innovative Plastics, Pittsfield, Massachusetts.

- Resolution of data need: This data need will be addressed by two drilling programs. The first involves characterization boreholes at four locations selected to represent conditions beneath former principal liquid waste disposal sites. The locations are shown on Figure 3-5 as locations No. 8 and No. 9 (North Process Pond), location No. 10 (300 Area Process Trenches), and location No. 11 (South Process Pond). Sediment, vadose zone moisture, and groundwater samples will be collected during drilling and analyzed to characterize contamination that may potentially act as a continuing source to affect groundwater. Geophysical logging also may be used to reveal radiological contamination, although previous experience has been particularly successful for this purpose because of the relatively low levels of contamination (PNNL-16435, p. 3.18 and Appendix C). Laboratory analysis of samples collected during drilling will include chemical and radiological analyses of the bulk sample, and extraction of uranium from sediment samples using leaching methods. Each borehole will be completed as a monitoring well that includes the water table horizon unless unexpected conditions are encountered that would warrant an alternative placement of the screen. The length of the open interval will be comparable to existing wells in the immediate vicinity of the characterization borehole.
  - Field sampling: Collect sediment and pore water samples from the vadose zone.
    - Sediment and pore water samples will be obtained from cores collected during drilling and contained in a Lexan core barrel liner.
    - Sediment samples collected generally at 3 m (10-ft) intervals from the bottom of the waste sites (or maximum depth of the remedial action), at 1 m (3-ft) intervals after 9 m (30 ft) bgs, continuous sampling within 3 m (10 ft) of the water table, and 1 m (3-ft) intervals from the top of the water table through completion.
  - Laboratory analyses: Conduct leach tests on sediment, with chemical and radiological analysis of pore water samples. Analysis is designed to reveal exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected for the 300 Area subsurface during the near future.
  - Logging during drilling: A geologic description of all sediments encountered during drilling will be recorded by the well-site geologist. Geophysical logging of the complete borehole will be done using neutron moisture and spectral gamma downhole probes.
  - Collect core (split-spoon) samples from major formations and changes in lithology. Analyze for physical properties: bulk density and grain size distribution.
  - Collect grab samples from major formations and changes in lithology, in the vadose and saturated zone, and starting at 3 m (10 ft) above the water table; sample every meter for three samples. Analyze grab samples for geochemical analyses of sediments: organic carbon, inorganic carbon, calcium carbonate equivalent, trace metals, major cations, and major anions.
  - Perform saturated hydraulic conductivity tests for major hydrogeologic units in the unconfined aquifer during well construction.

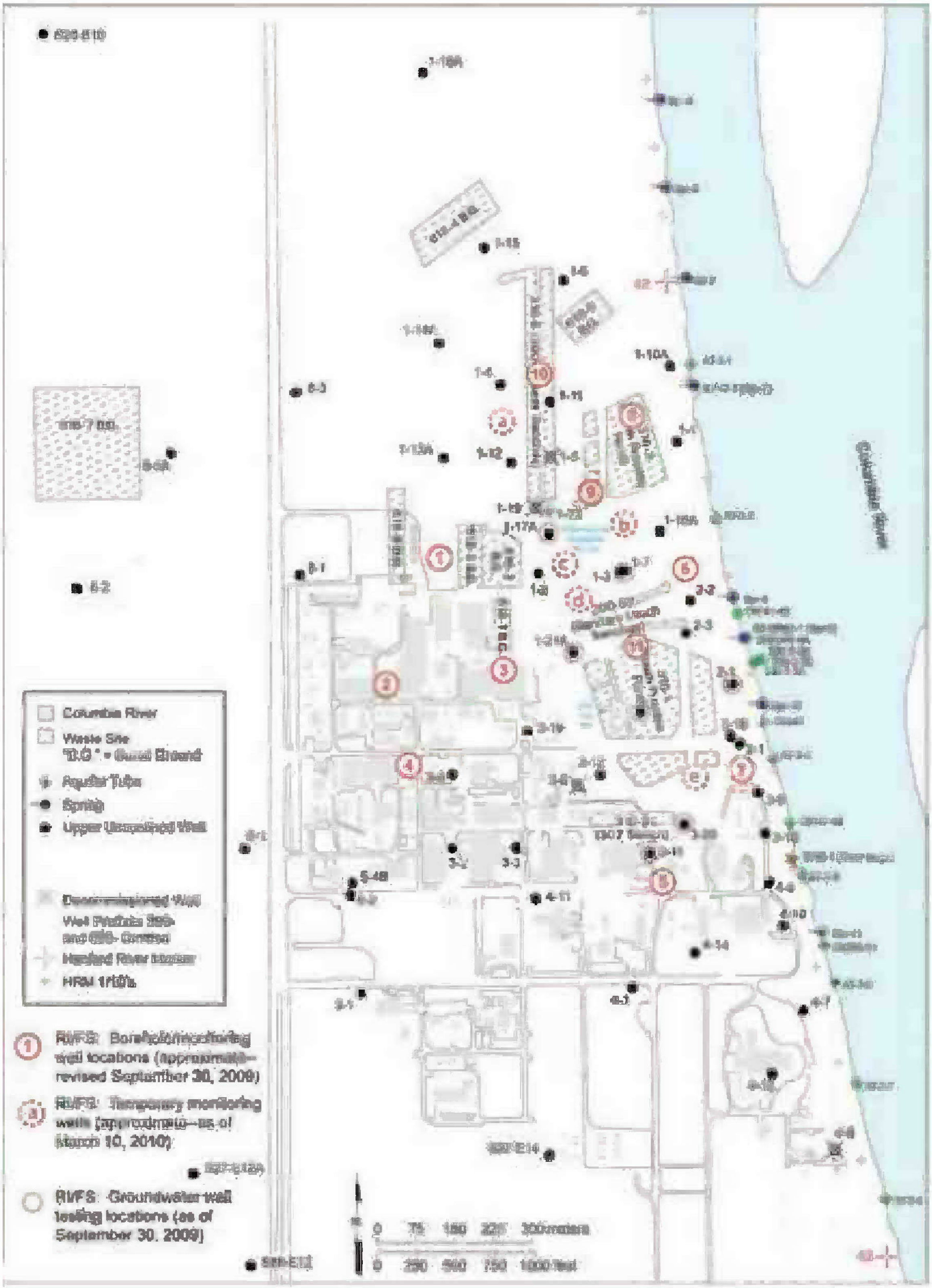


Figure 3-5. Index Map for Proposed Locations for Characterization Boreholes in the 300 Area

The second drilling program involves drilling at five additional locations (a to e shown in Figure 3-5), but with less characterization during the drilling process. The objective will be to collect sediment samples for uranium analysis from the water table zone at locations of increasing distance from the suspected primary source location (i.e., to develop contaminant information along transects away from the footprints of waste sites). The transects are oriented along the predominant long-term plume migration routes, but still within close proximity to the waste sites. The boreholes will be completed as temporary monitoring wells, with relatively short open intervals positioned across the low water table horizon. These temporary wells will complement the existing network of traditional wells, which have much longer open intervals that include the water table horizon. Differences in observed uranium concentrations in groundwater because of different open interval lengths have recently been documented (as of fall 2009), and provide evidence that helps identify areas where uranium may be concentrated in the lower vadose zone near waste sites.

- Field sampling: Collect sediment samples every 2.5 ft from approximately 10 ft above the water table to approximately 10 ft below the water table, ensuring that <u>at least one sample will be collected in the zone always saturated at lowest water level</u>, using best available technology for the drilling method used. Collect one groundwater sample when saturated conditions are encountered.
- Laboratory analysis: Perform sequential leach testing of sediment samples to extract uranium. Conduct additional chemical, radiological, and physical properties tests to characterize the sediment with regard to uranium inventory and mobility characteristics in the water table zone.
- Complete the boreholes as temporary monitoring wells with screened open intervals positioned to cover the lower water table horizon, and an approximate 0.6 m (2-ft) length.

Other contributors to resolving data need:

- Hydraulic conductivity and parameters associated with unsaturated flow in the periodically saturated portions of the vadose zone will be determined as part of the Hanford IFRC project and the 300-FF-5 Groundwater OU polyphosphate infiltration treatability test.

<u>Source data gap – uranium</u>: The potential exists for contaminant uranium to sequester on sediment near the Columbia River because of river-induced changes in geochemical conditions. The magnitude of this phenomenon and its potential to act as a continuing source for resupplying the groundwater plume has not been determined.

- Data Need 3: Sediment and water samples from the subsurface zone impacted by Columbia River water; determination of the contaminant uranium inventory and laboratory tests to reveal the mobility characteristics of that uranium.
- Justification: If the change in geochemical conditions near the river, mixing river water and groundwater, causes dissolved uranium to be preferentially adsorbed onto sediment, the near-river zone could be implicated in the persistence of the plume. Such information is relevant to (a) evaluating the risk associated with contaminant exposure in the Columbia River environment, and (b) the FS focus on potential ways to reduce the concentration of uranium in groundwater. If remedial action within the zone is part of a proposed plan, additional detailed information will be required to design an effective remedy for this dynamic environment.
- Resolution of data need: This data need will be addressed by drilling at two locations relatively near the Columbia River, and within the zone where river water intrudes the aquifer, especially during periods of high river stage (Table 3-5). Proposed locations include areas where relative highs in uranium concentrations appear near the river during most of the year, but that show reduced

concentrations during the seasonal high river stage conditions, when river water intrudes into the aquifer and reduces contaminant concentrations by dilution. The proposed drilling locations are east of the former sanitary leach trenches and east of Well 399-3-9. Sediment, vadose zone moisture, and groundwater samples will be used to identify contamination from past practices that may provide a continuing source for impacts to groundwater.

Geophysical logging also may reveal radiological contamination, although experience has not shown particular success because of the relatively low levels of contamination (PNNL-16435). Laboratory analysis of samples collected during drilling will include chemical and radiological analyses of the bulk sample, and extraction of uranium from sediment samples using leaching methods. Laboratory tests will be performed on sediment samples from the water-table zone and the always-saturated zone immediately below to determine the adsorption/desorption characteristics of the sediment.

- Field sampling: Collect sediment and pore water samples from the near river zone where groundwater interacts with river water. Drill two new borehole locations close to river (east of former sanitary leach trenches and east of Well 399-3-9).
  - Collect sediment and pore water samples by coring, samples in Lexan liner.
  - Collect sediment samples starting at the historically high water levels at 1 m (3-ft) intervals and conduct continuous sampling within 3 m (10 ft) of the water table. Collect two samples within the saturated Hanford formation.
  - Provide geologic description of sediments encountered.
- Laboratory analyses: Conduct leach tests on sediment, with chemical and radiological analysis of pore water samples. Analysis designed to reveal exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected for the 300 Area subsurface during the near future.
  - Collect and analyze water samples collected during drilling. Collect at the top, middle, and bottom of the unconfined aquifer. Water quality parameters – volatile organic analytes.
  - Geophysical logging: neutron moisture, spectral gamma.

Low priority:

- Collect core (split-spoon) samples from major formations and changes in lithology. Analyze for physical properties: bulk density and porosity, grain size distribution, and soil moisture content.
- Collect grab samples from major formations and changes in lithology, in the vadose and saturated zone, and starting at 3 m (10 ft) above the water table; sample every meter for three samples. Analyze grab samples for geochemical analyses of sediments: organic carbon, inorganic carbon, calcium carbonate equivalent, trace metals, major cations, and major anions.

<u>Source data gap – cis-1,2-dichloroethene at Well 399-1-16B</u>: The source is unknown for the original VOC(s) that have degraded to cis-1,2-dichloroethene near Well 399-1-16B, and there is the possibility that a dense, nonaqueous-phase liquid remains undetected.

- Data Need 4: Identity of the original VOC(s) and the pathways leading to the cis-1,2-dichloroethene observed at Well 399-1-16B.
- Justification: Information is not available to fully evaluate whether an undetected source for VOC contamination remains in the lower portion of the vadose zone, and/or at depth in the unconfined aquifer (i.e., at stratigraphic horizon monitored by several "-B" series wells). A more complete

understanding of origin will help in developing estimates for how long this contamination is likely to persist.

- Resolution of data need: This data need will be addressed initially by simulating the release of pure tetrachloroethene, in quantities up to 454 L (120 gal), to the south end of the 300 Area Process Trenches. The simulation will test the hypothesis that the releases in 1982 and 1984 are the origin for the 1,2-dichloroethene contamination in deeper portions of the aquifer. Initial assumptions will be that a dense, nonaqueous-phase liquid moved downward rapidly and became entrained in the less permeable sediment at the "-B" horizon, then degraded to trichloroethene and ultimately 1,2-dichloroethene. A second way to gain insight on the origin of this contamination will involve collecting additional measurements of VOC concentrations in groundwater under conditions of withdrawal at Well 399-1-16B. The test will include monitoring water quality changes as pumping proceeds to see how VOC concentrations vary under stressed conditions. Samples will be collected to identify the particular microbes available to cause degradation. Hydraulic testing of the aquifer will be incorporated into this test to provide estimates for hydraulic parameters associated with the contaminated hydrologic unit. Water levels and VOCs in nearby Well 399-1-8, which monitors the same stratigraphic interval, will be measured during the test.
  - Field sampling: Perform a groundwater withdrawal test at Well 399-1-16B that includes monitoring (a) water levels, and (b) water quality as pumping proceeds, along with other measurements typically associated with hydraulic pump testing. During the withdrawal test, water levels and water quality will also be monitored in adjacent wells, including newly installed wells in the North Process Pond and 300 Area Process Trenches.
  - Laboratory analyses:
    - Water quality parameters – volatile organic analytes, major anions (including bromide and phosphate), major cations, total organic carbon, and uranium (total, unfiltered sample); field parameters temperature, pH, dissolved oxygen, and specific conductance.
    - Collect and analyze water samples to identify microbes present.

<u>Source data gap – trichloroethene in Ringold Formation</u>: The origin of the trichloroethene discovered in the finer grained interval of Ringold Formation is not known.

- Data Need 5: Additional information regarding the potential source(s) for the VOC contamination observed in an interval of finer-grained Ringold Formation sediment within the unconfined aquifer.
- Justification: Information is not available as of January 2010 to evaluate fully (1) the potential extent, (2) the possible presence of a dense, nonaqueous-phase liquid, and (3) the processes leading to the persistence of this contamination in the environment. A complete understanding of where, when, and what was introduced to the vadose zone would reduce uncertainties in the current conceptual model. Identification of the source responsible for VOC contamination in this sediment interval would play a role in the FS of an engineered solution to lowering the level of contamination.
- Resolution of data need: Searches of historical records for the 300 Area have not revealed hard evidence that would help explain the origin of this contamination (PNNL-17666, p. 4.1). Additional source remedial actions in the 300 Area may provide new information to identify a source. However, no specific investigations to identify the origins for this contamination are proposed in this work plan.

Nitrate
No specific data gaps and data needs for the 300 Area are identified regarding sources for this contamination.

Other Contaminants
No specific data gaps and data needs for the 300 Area are identified regarding sources for other contaminants.

3.1.4.2 Data Needs: Distribution of Contaminants (300 Area)

This section describes data needs associated with the distribution of contamination in the vadose zone and aquifer beneath the 300 Area.

Distribution within the Vadose Zone (300 Area)
Distribution data gap – uranium: The extent of contaminant uranium in the shallow vadose zone beneath and adjacent to 300 Area facilities and waste-disposal sites is not defined for waste sites not yet remediated.

- Data Need 6: Conduct sampling to characterize the extent of contamination in the sediment adjacent to and beneath the sites during remedial actions at future waste sites.
- Justification: The known extent of uranium contamination at remediated waste sites is needed to assess the protectiveness of remedial action regarding human health and the underlying groundwater. Protectiveness levels will be developed as part of the proposed plan for future remedial actions and long-term evaluation of the effectiveness of the remedies selected.
- Resolution of data need: The current strategy for interim remedial actions at waste sites will be continued. The strategy has been efficient in obtaining the necessary data during remediation using the observational approach. Data will continue to be obtained that document the extent of residual contamination following completion of the interim remedial action.

Distribution data gap – uranium: The uranium contamination beneath the high volume, liquid waste disposal sites in the vadose zone between the bottom of the excavations and the periodically rewetted zone is known from a limited number of characterization boreholes. The possibility exists that localized zones of relatively high concentrations of contaminant uranium have gone undetected.

- Data Need 7: Laboratory analytical results for sediment and groundwater samples from boreholes drilled through the footprints of former liquid waste disposal facilities.
- Justification: Information on the inventory of uranium potentially available in the vadose zone beneath the high volume, liquid waste disposal sites will be used to evaluate protectiveness relative to groundwater impact. The exchange between dissolved and solid forms of uranium is a complex process and requires additional data on subsurface conditions be obtained to reduce uncertainties to an acceptable level for remediation decisions. For example, additional data will allow an update to the "box model" that provides estimates for uranium in various subsurface regions. Data from characterization drilling beneath these waste sites will provide information essential for the FS.
- Resolution of data need: This data need will be addressed by drilling and collecting sediment samples from the vadose zone and the periodically rewetted zone beneath the high volume, liquid waste disposal sites (e.g., North and South Process Ponds, 300 Area Process Trenches) (Table 3-5). These boreholes are the same described as part of Data Need No. 2. Sediment and vadose zone moisture samples will be used to identify contamination from past practices that may provide a continuing source for impacts to groundwater.

  Geophysical logging also may reveal radiological contamination, although experience has not shown particular success because of the relatively low levels of contamination (PNNL-16435, p. 3.18 and Appendix C). Laboratory analysis of samples collected during drilling will include chemical and radiological analyses of the bulk sample, and extraction of uranium from sediment samples using various leaching solutions, including one that will replicate current environmental conditions.

- Field sampling:
  - Sediment and pore water samples collected by coring, samples in Lexan liner.
  - Sediment samples collected generally at 3 m (10-ft) intervals from the bottom of the waste sites (or maximum depth of the remedial action), at 1 m (3-ft) intervals after 9 m (30 ft) bgs, continuous sampling within 3 m (10 ft) of the water table, and 1 m (3-ft) intervals from the top of the water table through completion.
  - Geologic description of sediments encountered.
- Laboratory analyses: Leach (desorption) and adsorption tests on sediment, with chemical and radiological analysis of pore water samples. Analyses will be designed to reveal exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected for the 300 Area subsurface during the near future.
  - Geophysical logging: neutron moisture, spectral gamma.

Distribution data gap – uranium: Data to describe the lateral distribution of uranium in the deeper portion of the vadose zone away from remediated waste sites are very limited. The information available is based primarily on an understanding of historical conditions during the fuels fabrication years, and not on direct observation from characterization boreholes.

- Data Need 8: Analyses of vadose zone sediment samples from borehole locations beyond the principal liquid waste disposal sites will be used to refine estimates for the distribution of contaminant uranium.
- Justification: The distribution and concentration of the labile (extractable) uranium in sediments of the lower portion of the vadose zone outside the high volume, liquid waste disposal site footprint are needed to estimate the potential area targeted for remedial action as part of the FS. During periods of flood river stage (e.g., late 1940s through the early 1960s), the water table beneath the 300 Area occasionally raised to an elevation that approached and possibly reached the bottoms of the North Process Pond, South Process Pond, and 307 Process Trenches. The consequences included groundwater interacting with the waste effluent high in the vadose zone, which may have enhanced sorption with sediment, and lateral spreading with subsequent uranium deposition in the vadose zone well above the current periodically rewetted zone. Additional samples from the proposed boreholes will provide data to refine estimates for the distribution of contaminant uranium in the vadose zone, including refinements to the box model.
- Resolution of data need: This data need will be addressed by drilling and collecting sediment samples from the vadose zone and the periodically rewetted zone away from the high volume, liquid waste disposal sites in the regions where contamination may have been introduced during periods of high groundwater table conditions. The characterization boreholes shown in Figure 3-5 primarily associated with this data need are locations No. 1 through No. 5, although observations from locations No. 6 and No. 7 may also contribute, as will information from the five transect wells, a to e. Sediment and vadose zone moisture samples will be used to identify contamination from past practices that may provide a continuing source for impacts to groundwater. Collect and analyze vadose zone sediment and pore water from temporary well locations (a) through (e) shown in Figure 3-5. Collect and analyze sediment samples from future excavations that penetrate to depths of historical high water tables conditions.

  Geophysical logging also may reveal radiological contamination, although experience has not shown particular success because of the relatively low levels of contamination (PNNL-16435, p. 3.18 and Appendix C). Laboratory analysis of samples collected during drilling will include chemical and radiological analyses of the bulk sample, and extraction of uranium from sediment samples using leaching methods.

- Field sampling:
  - Sediment and pore water samples collected by coring, samples in Lexan liner.
  - Sediment samples collected generally at 3 m (10-ft) intervals from the bottom of the waste sites (or maximum depth of the remedial action), at 1 m (3-ft) intervals after 9 m (30 ft) bgs, continuous sampling within 3 m (10 ft) of the water table, and 1 m (3-ft) intervals from the top of the water table through completion.
  - Geologic description of sediments encountered.
- Laboratory analyses:
  - Leach (desorption) and adsorption tests on sediment, with chemical and radiological analysis of pore water samples. Analyses will be designed to reveal exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected for the 300 Area subsurface during the near future.
- Geophysical logging: neutron moisture, spectral gamma.

Other contaminants: In addition to uranium, all sediment samples collected above the water table will be analyzed for target analytes listed in WCH-328, *300 Area Decision Unit Target Analyte List Development for Soil*.

Distribution of Contamination in Groundwater System (300 Area)

Distribution data gap – uranium: Although the distribution of uranium contamination in the aquifer from the existing monitoring well and aquifer tube networks is well described in general terms, details on the vertical distribution are not available.

- Data Need 9: Discrete measurements of uranium concentrations at various depths in the unconfined aquifer under varying water table conditions.
- Justification: Additional field measurements are needed to test hypotheses regarding resupply of contaminant uranium to the groundwater plume. If high-water-table conditions remobilize contamination sorbed in the lower vadose zone, discrete water samples near the top of the unconfined aquifer (i.e., at the water table) should reveal evidence in the form of higher concentrations. A more detailed characterization of the vertical concentration patterns within the plume will contribute to (a) refined targeting of potential remedial action technologies, (b) sample collection protocols for regulatory compliance purposes, and (c) an effective long-term monitoring strategy.
- Resolution of data need: The methods proposed to respond to this data need include various tests at a subset of the current monitoring network. Approximately eight well locations will be selected for tests, including subsets that represent the following:
  - Locations that show an increase in uranium concentrations when the water table is high
  - Locations that show a decrease in uranium concentrations when the water table is high
  - Locations where uranium concentrations remain relatively constant; i.e., typically the perimeter areas of the plume
- Depth discrete sampling will be used to provide a vertical profile of uranium concentrations at 1 m (3-ft) intervals throughout the open interval of the well. At wells near the river where river water

intrusion is expected during high river stage conditions, specific conductance and temperature will be recorded by lowering a probe into the well before water sample collection (note: alternative field methods to observe vertical flow within a well bore are being investigated as part of the IFRC). For wells at locations where uranium concentrations rise significantly when the water table is elevated, water samples will be collected at the water table during the June sampling event.

- Field sampling:
  - Select approximately eight well locations for tests, including subsets that represent: (1) locations that show an increase in uranium concentrations when the water table is high, (2) locations that show a decrease in uranium concentrations when the water table is high, and (3) locations where uranium concentrations remain relatively constant (i.e., typically the perimeter areas of the plume). Perform depth-discrete sampling to provide a vertical profile of uranium concentrations at 1 m (3-ft) intervals throughout the open interval of the well.
  - At wells near the river where river water intrusion is expected during high river stage conditions, measure specific conductance and temperature by lowering a probe into the well before water sample collection.
  - For wells at locations where uranium concentrations rise significantly when the water table is elevated, develop and capture water samples at the water table during the June sampling event (approximately four inland well locations and four near river locations).
- Laboratory analyses: Analyze all collected water samples in accordance with the sampling and analysis plan for the 300-FF-5 OU (DOE/RL-2002-11).

<u>Distribution data gap – uranium</u>: Monitoring well coverage of the hydrologic unit presumed to contain the bulk of uranium contamination is uneven, with principal weaknesses in coverage at the footprints of former liquid waste disposal sites and near the perimeter of the plume, especially the west and southwest portions.

- Data Need 10: Fill coverage gaps in the groundwater-monitoring network for the uranium plume by completing monitoring wells at each of the 11 characterization borehole sites (Table 3-5 and Figure 3-5).
- Justification: The network of wells used to monitor the uranium plume needs to be sufficiently comprehensive to describe the level of contamination with an uncertainty acceptable to decision makers. Data from the expanded monitoring network will permit estimates for the level of contamination (e.g., volume of plume; mass of dissolved uranium; concentrations at exposure locations) and how the level changes with time. These estimates are information needed to evaluate natural attenuation and to define the extent of the environment potentially subject to remedial action.
- Resolution of data need: Each of the new characterization boreholes described in Table 3-5 will be completed as a groundwater-monitoring well. The screened interval as proposed in this work plan will cover the uppermost hydrologic unit in the unconfined aquifer. If unexpected conditions are discovered during the characterization phase of drilling, which will extend to the bottom of the unconfined aquifer, screen placement will be reconsidered. The new monitoring wells will be sampled quarterly for the first year to establish baseline conditions. Groundwater analyses will include radiological and chemical contamination, and basic water quality parameters, such as major anions, including nitrate and nitrite, and cations, and will be consistent with the sampling and analysis plan for the 300-FF-5 OU (DOE/RL-2002-11).

- Field sampling: Install new monitoring wells to cover the uppermost hydrologic unit in the unconfined aquifer.
  - Install 11 new monitoring locations (same as for vadose zone characterization boreholes) (i.e., 2 in the North Process Pond; 1 in the South Process Pond; one in the 300 Area Process Trenches; 5 in west and southwest portions of the plume; and 2 near the Columbia River).
  - Conduct quarterly sampling of each new monitoring well for the first year, with a reduction in frequency for subsequent years if warranted.
- Laboratory analyses: Use initial analysis of samples to establish baseline conditions at each new monitoring well. Analytical methods are described in DOE/RL-2002-11, *300-FF-5 Operable Unit Sampling and Analysis Plan,* Rev. 2, or its most recent update, and include the following (as of March 2010):
  - Radiological contaminants uranium (total, unfiltered sample), gross alpha, and gross beta
  - Chemical contaminants chromium, nitrate, trichloroethene, tetrachloroethene, cis-1,2-dichloroethene, and vinyl chloride
  - Basic water chemistry, including major anions and cations, along with field parameters temperature, pH, specific conductance, and dissolved oxygen
  - Additional laboratory analyses based on site-specific conditions, as warranted

<u>Distribution data gap – cis-1,2-dichloroethene at Well 399-1-16B</u>: The extent of VOC contamination to the north and northwest of Well 399-1-16B is not clearly defined by the current monitoring well network.

- Data Need 11: Additional field observations of water quality in groundwater from the lower portion of the unconfined aquifer near Well 399-1-16B, particularly upgradient from the well and within the flow path from potential source locations.
- Justification: Data from additional monitoring locations will reduce the uncertainty in describing the extent of this contamination and its possible source location. Additional field observations will improve estimates for the level of contamination and changes with time, which is information needed for the FS analysis of remedial action alternatives.
- Resolution of data need: Groundwater samples for VOCs, uranium, major anions, including nitrate and nitrite, cations, and field parameters (temperature, pH, turbidity, specific conductance and dissolved oxygen) analyses will be collected during characterization borehole drilling at locations No. 8 and No. 9 (North Process Pond), location No. 10 (300 Area Process Trenches), and location No. 6 (a near-river site east of the former sanitary leach trenches) from depths that reach a comparable hydrologic unit in the unconfined aquifer as at Well 399-1-16B (Figure 3-5). Groundwater samples will be collected for VOC analysis from various depths within the unconfined aquifer as drilling proceeds, and the oxidizing/reducing characteristics of each sample interval will be documented in the drilling logs. If significant levels of contamination are encountered during drilling in the lower portion of the unconfined aquifer, completion of the borehole as a monitoring well may include positioning the screen in the lower portion of the aquifer (i.e., a "-B" horizon well), following concurrence by the regulatory agencies.

Distribution data gap – trichloroethene in Ringold Formation: The lateral extent of the contaminated portion of the finer-grained interval of Ringold Formation sediment is based on a limited number of observation locations that do not cover the potential extent beneath the 300 Area and exposure locations in the Columbia River.

- Data Need 12: Additional analytical results for groundwater collected from the finer-grained interval from areas beneath the 300 Area where data do not currently exist, and from the adjacent Columbia River substrate.
- Justification: Current estimates for the extent of this contamination are based on the coverage provided by the LFI and VOC investigation boreholes, used to establish general limits (PNNL-17666, Figure 3.4, p. 3.5). The vertical extent is known in general terms based on several samples collected at each previous characterization borehole. The eastern extent to which contamination extends (i.e., beneath the Columbia River) is not known but data from aquifer tubes provide the most easterly positioned results. Identifying the easterly extent of contamination in this interval is an element of the CSM regarding ecological receptors in the Columbia River. The boundaries for the areal extent are a factor in evaluating the feasibility of an engineered solution to reducing the level of contamination.
- Resolution of data need: New information on the contamination extent will be provided by the characterization drilling proposed for 11 locations as part of this work plan (Table 3-5), and by work in progress under the RCBRA (DOE/RL-2008-11, Section 4.2.3). Information from geophysical research activities that focus on defining areas where groundwater preferentially discharges from the aquifer to the riverbed (DOE-sponsored research using fiber optic cables to reveal temperature anomalies) will contribute to identifying riverbed locations where this contamination may be released.

Nitrate

No specific data gaps and data needs for the 300 Area are identified regarding the distribution of nitrate contamination.

Other Contamination Indicators

No specific data gaps and data needs for the 300 Area are identified regarding the distribution of other contamination indicators.

3.1.4.3 Data Needs: Fate and Transport of Contaminants (300 Area)

This section describes data needs associated with fate and transport via pathways in the vadose zone and the unconfined aquifer.

Fate and Transport in Vadose Zone (300 Area)

Fate and transport data gap – uranium: The physical, geochemical, and hydrogeologic characteristics of the vadose zone sediment beneath the high volume, liquid waste disposal sites between the bottom of the excavations and the periodically rewetted zone are not sufficiently characterized to understand the transport mechanisms for uranium. These sites were remediated as part of EPA/ROD/R10-96/143, but uncertainties in understanding the relationship between residual amounts of uranium at the bottom of the excavations and dissolved concentrations in the underlying groundwater remain.

- Data Need 13: Additional sediment samples from beneath remediated high volume, liquid waste disposal sites, extending from the bottom of the excavation to groundwater. Additional evaluation of physical properties, geochemical properties, and the hydraulic characteristics, with particular emphasis on the region near the periodically rewetted zone.
- Justification: The uranium transport mechanisms and the unsaturated flow characteristics beneath the high volume, liquid waste disposal sites remediated as part of EPA/ROD/R10-96/143, i.e., the North and South Process Ponds, and the 300 Area Process Trenches, need to be known to develop computer

simulations of uranium transport through the vadose zone and subsequent potential impacts to groundwater. The simulations outputs will strengthen the conceptual model for explaining the persistence of the groundwater plume, and will provide information that is fundamental to the FS of alternatives for remediation.

- Resolution of data need: Part of this data need will be addressed by activities proposed in this work plan that involve drilling and collecting sediment samples from the vadose zone and the periodically rewetted zone beneath the high volume, liquid waste disposal sites, such as the North and South Process Ponds, and 300 Area Process Trenches (Table 3-5). These boreholes are the same described as part of Data Needs 2 and 7. Sediment samples will be analyzed for soil physical properties to aid with the determination of hydrologic flow parameters, and chemical analyses will be performed for characterization of the geochemical environment, which will aid in determining the exchange rates between solid and dissolved forms of uranium. The saturated hydraulic conductivity within the periodically rewetted zone and the unsaturated flow parameters will be determined as part of the Hanford IFRC project and the 300-FF-5 Groundwater OU polyphosphate infiltration treatability test.

  - Field sampling:

    - Sediment samples collected generally at 3 m (10-ft) intervals from the bottom of the waste sites (or maximum depth of the remedial action), at 1 m (3-ft) intervals after 9 m (30 ft) bgs, continuous sampling within 3 m (10 ft) of the water table, and 1 m (3-ft) intervals from the top of the water table through completion.

    - Sediment and pore water samples collected by coring, samples in Lexan liner.

  - Laboratory analyses: Leach tests on sediment, with chemical and radiological analysis of pore water samples. Analysis designed to reveal exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected for the 300 Area subsurface during the near future.

    - Analysis designed to reveal exchange rates between solid and dissolved forms of contaminant uranium under geochemical conditions expected for the 300 Area subsurface during the near future.

    - Geologic description of sediments encountered.

    - Geophysical logging: neutron moisture, spectral gamma.

  Low priority:

  - Collect core (split-spoon) samples from major formations and changes in lithology. Analyzed for physical properties: bulk density, grain size distribution, and soil moisture content.

  - Collect grab samples from major formations and changes in lithology, in the vadose and saturated zone, and starting at 3 m (10 ft) above the water table, sample every meter for three samples. Analyze grab samples for geochemical analyses of sediments: organic carbon, inorganic carbon, calcium carbonate equivalent, trace metals, major cations, and major anions.

  Contributions from other programs to resolve this data need:

  - The DOE's Hanford IFRC project test site in the southwest corner of the former South Process Pond is focused on the mobility characteristics of contaminant uranium in the vadose zone, including the periodically rewetted zone. Detailed analyses of geochemical and hydrologic processes influencing uranium mobility are being investigated at this test site.

– A treatability test involving use of polyphosphate to immobilize contaminant uranium in the vadose zone is underway near the southwest corner of the former North Process Pond. Characterization of vadose zone sediment encountered at the infiltration test site and groundwater at the water table interface are in progress.

Fate and transport data gap – uranium: The hypothesis that labile or extractable uranium is present in the vadose zone away from the footprints of the remediated high volume, liquid waste disposal sites is not well tested, yet those subsurface areas may play a role in the long-term resupply of the groundwater plume. The physical, geochemical, and hydrogeologic characteristics of the vadose zone sediment that influence transport away from the liquid waste disposal sites are inferred, but direct observational data are limited.

- Data Need 14: Additional sediment analyses collected from the deeper portions of the vadose zone, especially the historic periodically rewetted zone, away from waste sites, including borehole logging using geophysical methods.
- Justification: Uranium may have been deposited laterally in the vadose zone sediment outside the high volume, liquid waste disposal site footprint during the historical periods of high river stage (i.e., during the peak fuels production years [1950s and 1960s]). Understanding whether residual amounts of contaminant uranium remain in those portions of the vadose zone, and whether that contamination is capable of acting as a source for resupplying the groundwater plume, are essential information for the evaluation of remedial action alternatives during the FS.
- Resolution of data need: Part of this data need will be addressed by drilling and collecting sediment samples from the vadose zone and the periodically rewetted zone away from the high volume, liquid waste disposal sites in the regions where contamination may have been introduced during periods of high groundwater-table conditions. The boreholes that will contribute the samples are the same as those described under the resolutions for Data Needs 2 and 8. Sediment samples will be analyzed for soil physical properties to aid with the determination of hydrologic flow parameters, and chemical analyses will be performed for characterization of the geochemical environment, which will aid in determining the exchange rates between solid and dissolved forms of uranium.
  - Field sampling:
    - Sediment and pore water samples collected by coring, with cores retained in Lexan core barrel liner.
    - Sediment samples starting at the historically high water levels collected at 1 m (3-ft) intervals and continuous sampling within 3 m (10 ft) of the water table, and two samples within the saturated Hanford formation.
    - Geologic description of sediments encountered.
  - Laboratory analyses: Conduct uranium leaching tests on sediment, with chemical and radiological analysis of pore water samples.
  - Geophysical logging: neutron moisture, spectral gamma.

  Low priority:

  - Collect core (split-spoon) samples from major formations and changes in lithology. Analyzed for physical properties: bulk density, grain size distribution, and soil moisture content.

- Collect grab samples from major formations and changes in lithology, in the vadose and saturated zone, and starting at 3 m (10 ft) above the water table, sample every meter for three samples. Analyze grab samples for geochemical analyses of sediments: organic carbon, inorganic carbon, calcium carbonate equivalent, trace metals, major cations, and major anions.

Contributions from other programs to resolve this data need:

- The DOE's Hanford IFRC project test site in the southwest corner of the former South Process Pond is focused on the mobility characteristics of contaminant uranium in the vadose zone, including the periodically rewetted zone. Detailed analyses of geochemical and hydrologic processes that influence uranium mobility are being investigated at this test site.
- A treatability test involving use of polyphosphate to immobilize contaminant uranium in the vadose zone is underway during 2010 near the southwest corner of the former North Process Pond. Characterization of vadose zone sediment encountered at the infiltration test site and groundwater at the water table interface is underway.

Fate and transport data gap – uranium: Assumptions inherent in the conceptual model used to predict future levels of uranium contamination in the vadose zone and groundwater were based on very limited observational information, resulting in large uncertainty in the predictions based on computer simulation of future conditions.

- Data Need 15: Additional observational information on the inventory, geochemical environment, and potential transporting medium for uranium contamination.
- Justification: Analysis of contaminant uranium levels that could remain in place at former waste-disposal sites included assumptions regarding the mobility characteristics of uranium in the vadose zone. A sediment concentration of 267 pCi/g where the ground surface has been revegetated has been deemed protective of groundwater (BHI-01667, pp. 5-1 to 5-4). The field data, laboratory analyses of sediment, and computer simulation of contaminant migration under expected hydrologic conditions were limited in scope for this evaluation, thus leading to large uncertainties in the assumptions regarding the connection between residual uranium in the vadose zone and groundwater. A stronger technical basis is needed to support a proposed plan for remediation decisions involving uranium.
- Resolution of data need: An evaluation of all new analytical results that have become available since 2002 will be done to test the assumptions presented in BHI-01667 that are associated with protectiveness levels for remedial actions at waste sites. The evaluation will include new information on deeper portions of the vadose zone, the current and historical water table zones, and the zone of groundwater/river interaction near the river. The new analytical results from studies involving uranium associated with the 300 Area sediments that have become available since the evaluation of protectiveness levels presented in BHI-01667 include laboratory leaching analyses for uranium in sediment samples collected under the LFI (PNNL-16435) and VOC investigations (PNNL-17793). Additional investigations of uranium in the 300 Area sediments has been conducted under DOE's Office of Science programs, leading to a better understanding of the form and geochemical environment of sediment, according to the following sources:
  - PNNL-17031
  - McKinley et al., 2007, "Geochemical Controls on Contaminant Uranium in Vadose Hanford Formation Sediments at the 200 Area and 300 Area, Hanford Site, Washington"

  - Arai et al., 2007, "Spectroscopic Evidence for Uranium Bearing Precipitates in Vadose Zone Sediments at the Hanford 300-Area Site"
  - Yabusaki et al., 2008

- New insight also has been gained through the bench-scale tests and field implementation testing of polyphosphate injections to immobilize hexavalent uranium in the aquifer (PNNL-17480; PNNL-18529). Finally, new laboratory analytical results for uranium distribution and transport in sediment from the vadose zone (including the water table zone) will be available from work proposed in this work plan.

Fate and Transport in Groundwater (300 Area)

Principal uncertainties associated with the fate and transport of contaminants in the groundwater beneath the 300 Area are described in Section 3.1.3, with background information on groundwater and surface water hydrology presented in Sections 2.5.6 and 2.5.7. The following description of data needs is subdivided into (1) those that pertain to the groundwater flow system, and (2) movement of contaminants via groundwater flow. The principal uncertainties associated with simulating groundwater flow beneath the 300 Area, along with recommendations for improving the existing computer models, are described in detail in PNNL-17708, pp. 5.6 to 5.8. Problem statements are used to guide the identification, justification, and resolution of data needs associated with groundwater flow, and the fate and transport of contaminants in the aquifer beneath the 300 Area.

Fate and transport data gap – groundwater flow: Lithologic characteristics, stratigraphic contact data, and hydraulic head measurements define the spatial framework through which groundwater flows. The coverage throughout the extent of the 300 Area uranium plume is incomplete.

- Data Need 16: Additional descriptions of sediment characteristics at locations that will fill gaps and expand the current model domain for the 300 Area. Additional hourly hydraulic head measurements at strategic locations for flow model validation.
- Justification: A groundwater flow simulation is used to infer conditions between locations of direct observation and to predict future conditions. This capability supports evaluation of remediation alternatives, development of monitoring strategies, and evaluation of the performance of a remedial action. It also can be used to investigate future land-use scenarios.
- Resolution of data need: New field observations to refine the description of the spatial framework for subsurface environmental pathways will come from drilling at the characterization borehole locations described in Table 3-5. The new information will be managed in a geographic information system to provide digital representations for use in computer simulation of groundwater flow and contaminant transport. Some of the newly completed monitoring wells, along with additional monitoring wells at locations intended to fill coverage gaps, will be equipped with pressure transducers (approximately 10 wells total). Hourly water-level measurements will be made during the RI. This data-gathering activity will be coordinated with similar activities being conducted under the Hanford IFRC project and various treatability tests to avoid duplication of effort.
  - Field sampling: Install and operate additional pressure transducers at 10 wells throughout the domain of the model and monitor throughout the investigation period.
  - Computer simulation: Incorporate into the spatial framework new information from drilling associated with recent investigations. Validate the flow model being used with hourly data for water levels at multiple locations and throughout at least one seasonal hydrologic cycle.

Fate and transport data gap – uranium: Current inventory estimates of contaminant uranium in the vadose zone and aquifer are based on limited observational data, and include numerous assumptions and inferences. The estimates can be refined by incorporating new information from sampling at remedial action sites, research activities at the IFRC, and characterization associated with treatability testing sites.

- Data Need 17: Update the inventory box model and investigate how the inventory might vary under the influence of seasonal groundwater conditions.
- Justification: An understanding of the locations and amounts of contaminant uranium in the subsurface available to act as a long-term source for affecting groundwater is an essential element of the conceptual model. This understanding provides the explanation for the persistence of the uranium plume, a technical basis for evaluating remedial action alternatives, and information to evaluate potential risk to human health and the environment. The cause for the persistence of the uranium plume in groundwater beneath the 300 Area remains unexplained at the level of detail required to support a proposed plan.
- Resolution of data need: The laboratory analysis of samples collected during drilling at the characterization borehole locations (Table 3-5) will provide expanded insight on the potential mobility of contamination uranium sequestered in subsurface regions. Measurement of uranium concentrations in groundwater samples collected at the water table during periods of high water-table conditions will be evaluated as to the potential increase in mass being added to the plume. New field observations soon will become available from the IFRC, which has field work directed at revealing the vertical profiles and seasonal variability of uranium concentrations in the periodically rewetted zone. All new evidence obtained during the characterization-drilling program, selective groundwater sampling, routine groundwater monitoring (DOE/RL-2002-11), and research activities such as the IFRC will be used to refine the box model presented in PNNL-17034, Table 6.4; see Figure 4-5 in this work plan).
  - Field sampling: Collect groundwater samples from the water table during periods of high water-table conditions, along with additional samples from discrete depths below the water table.
  - Laboratory analyses: See laboratory analysis for samples from boreholes identified for source and distribution data needs.
    - Update the conceptual box model for where contaminant uranium remains in the subsurface (PNNL-17034).

<u>Fate and transport data gap – uranium</u>: The amounts of uranium lost from the plume to the river via groundwater discharge through the riverbed and via withdrawal at Well 399-4-12 have been estimated using limited observational data and several significant assumptions, which create uncertainty.

- Data Need 18: Refined estimates for the removal of dissolved uranium from the groundwater plume by discharge to the Columbia River and by withdrawal at a water supply well.
- Justification: An understanding of exchanging uranium mass among the various subsurface compartments along the environmental pathways provides FS focus for potential remedial actions. An estimate for the rate of flux to the Columbia River is needed to provide insight on potential impacts to river water quality, and a guide to the amount that must be resupplied from a vadose zone source. Analysis of the mass balance in the system reveals the amount of uranium to be addressed by remedial action in order to reduce the concentration of dissolved uranium in groundwater.
- Resolution of data need: Estimates for the mass balance for uranium contamination in the upper portion of the unconfined aquifer beneath the 300 Area will be refined by updating the groundwater flow model with new spatial information for the subsurface, new hourly water-level data, and new hydraulic parameter data that are obtained as part of the characterization drilling program. Data Needs 16 and 19 provide more information. Section 3.1.4.5 discusses FS data needs. The drilling program is detailed in Table 3-5. More detailed recording of the volume of groundwater

withdrawn at water supply Well 399-4-12, which serves the 331 Life Sciences Building, also will be incorporated into the flow model (groundwater withdrawal records for the well are available since 2005). The refinements to the flow model will be evaluated in the context of new insight on groundwater discharge to the riverbed provided by other fundamental science investigations that are underway at the 300 Area. Estimates for uranium removal from the groundwater plume via groundwater discharge to the river and withdrawal at the water supply well will be presented in the RI/FS report, and will draw on the most recent input parameter data available at the time of report preparation.

Fate and transport data gap – uranium: Existing simulation of uranium transport through the vadose zone and aquifer pathways is based on limited observational information, and can be refined using new information developed under this work plan, the IFRC, and because of treatability tests (Section 3.1.4.4).

- Data Need 19: Refined simulation input parameters for (1) inventories of labile contaminant uranium in various subsurface regions; (2) exchange rates between dissolved and solid forms; and (3) the form, capacity, and timing of a transporting medium (e.g., infiltration of moisture). Consensus on appropriate modeling algorithms, especially with regard to model assumptions.
- Justification: The capability to simulate the behavior of contaminant uranium in environmental pathways beneath the 300 Area supports the technical basis for remediation decisions presented in a proposed plan. Simulations provide estimates for contaminant levels in areas not readily described with field data, predictions for contaminant transport, and estimates for the time period during which contamination persists. Simulations are an essential part of comparing remedial action alternatives during the FS.
- Resolution of data need: Three-dimensional groundwater flow and uranium transport modeling involving the vadose zone and uppermost aquifer at the 300 Area is under development as part of the Hanford IFRC project (PNNL-SA-58090). Additional detailed modeling for this purpose is not proposed as part of this work plan.

Fate and transport data gap – cis-1,2-dichloroethene at Well 399-1-16B: The cause for the persistence of cis-1,2-dichloroethene contamination in the lower portion of the unconfined aquifer at Well 399-1-16B is uncertain. A remote possibility is that a continuing subsurface source has not yet been identified by drilling. Circumstantial evidence suggests the persistence is related to the absence of geochemical and/or microbiological conditions that would allow further degradation of the chlorinated hydrocarbon beyond cis-1,2-dichloroethene.

- Data Need 20: Additional geochemical and microbiological data for groundwater samples, to include oxygen levels, organic carbon and nutrients from the contaminated interval at Well 399-1-16B.
- Justification: The potential for a reduction in the level of contamination in the near future appears limited based on historical monitoring. However, additional data on the geochemical and microbiological characteristics near the well screen will provide additional help support for the selection of a remedial action alternative for this occurrence.
- Resolution of data need: Continue to collect and analyze groundwater samples from the deeper portion of the unconfined aquifer near Well 399-1-16B, per the objectives described in the 300-FF-5 Operations and Maintenance Plan (DOE/RL-95-73) for characterizing VOC contamination and trends.

Fate and transport data gap – trichloroethene in Ringold Formation: The processes by which VOC contaminants have been transported from potential source(s) to sequestration in the finer-grained interval of Ringold Formation are not known, although some limits can be placed on the possibilities

(PNNL-17666, pp. 3.1 to 3.4). Contaminant movement within the finer-grained interval of sediment and release from the interval to overlying and underlying sediments are not well characterized.

- Data Need 21: Rates of lateral movement of VOC contamination through the finer-grained interval of Ringold Formation sediment, and rates of release from the finer-grained interval to the overlying saturated Hanford formation sediment.
- Justification: Understanding the processes leading to contamination in this stratigraphic interval, and how it is currently evolving with regard to degradation and migration, is needed to prepare estimates for future trends in the contamination level.
- Resolution of data need: A comprehensive evaluation of the various possibilities for VOC movement within, and release from, the finer-grained interval of Ringold Formation can be acquired by additional analyses of existing and newly acquired information from characterization boreholes (11 locations listed in Table 3-5). Groundwater monitoring will continue to include VOC analyses for wells and aquifer tubes samples whose screens are positioned close to the contaminated portion of the finer-grained interval. Computer simulation(s) of groundwater movement and contaminant migration/degradation can be used to infer future conditions. Results from the RCBRA field activities in the Columbia River will contribute to conclusions regarding the fate of this contamination in the RI report.

Nitrate
No specific data gaps and data needs for the 300 Area are identified regarding the fate and transport of nitrate contamination.

Other Contaminants of Interest
No specific data gaps and data needs for the 300 Area are identified regarding the fate and transport of other indicators of contamination.

3.1.4.4 Data Needs: Treatability Tests (300 Area)

Following renewed FS activities for the 300-FF-5 OU in 2004, efforts were started to test an in situ method for reducing uranium concentrations in groundwater using polyphosphate. Injection of polyphosphate solutions into the aquifer ranked high during the screening of several remedial action technologies (PNNL-16761, p. 28). During summer 2007, an initial test using polyphosphate was conducted, followed by monitoring and analyses of subsequent changes in the unconfined aquifer. Impressions from initial monitoring following the aquifer test are that the injections were not as effective as hoped in causing a reduction in uranium concentrations in groundwater. The final report on the test is presented in PNNL-18529. During 2009, testing continued with using polyphosphate solutions in the vadose zone to immobilize uranium.

The results from each of these treatability tests will play a significant role during the RI with respect to the potential implementation of an in situ remedy for reducing uranium concentrations in groundwater. Conducting these tests was identified during the second 5-year review of the record of decision for the interim action (DOE/RL-2006-20, p. 3.17).

<u>Treatability Test Data Gap – Uranium</u>: Initial tests using a polyphosphate solution to immobilize uranium in the aquifer have not revealed an optimal method for delivering the solution. While tests are underway during FY 2010 and FY 2011 for immobilizing uranium in the periodically rewetted zone, it is anticipated that a variety of methods may be needed for delivery in other subsurface compartments.

- Data Need No. 22: Laboratory and field-scale testing of methods to deliver uranium-immobilizing solutions to the vadose zone and unconfined aquifer.

- Justification: Method(s) for delivery of a chemical that immobilizes contaminant uranium in subsurface compartments may vary depending on the compartment targeted. For example, infiltration of solutions using widespread irrigation at the surface may be suitable for uranium remaining in shallow vadose zone regions, while injection through boreholes may be more appropriate for contamination in the deep vadose zone and aquifer. Information on the potential delivery methods is needed as part of the feasibility analysis, especially with regard to estimates for the cost of treatment and for the period needed to achieve remedial action objectives.
- Resolution of data need: New information on the distribution and characteristics of contaminant uranium in various subsurface regions as developed under this work plan will be used to anticipate the type of delivery mechanism most likely to result in reducing mobility. If necessary, additional bench and field-scale tests will be performed to augment results from tests already underway or planned. Experience gained at other sites contaminated by uranium will be factored into the analysis of appropriate delivery methods.

Treatability Test Data Gap – Uranium: Testing of in situ methods to immobilize contaminant uranium in the subsurface environment are in progress at other waste sites. Knowledge acquired at sites other than Hanford can contribute to the technical basis for selecting a remediation alternative for uranium at the 300 Area.

- Data Need No. 23: Technical information from research activities and remedial action experience at sites contaminated by uranium.
- Justification: Conclusions presented in the FS report will be based on all available information at the time of report preparation, including information developed under this work plan, and on information derived from activities at other sites contaminated by uranium.
- Resolution of data need: A search for activities separate from Hanford Site activities will be maintained during the duration of the RI/FS, to identify solutions developed for similar problems. Potential contributors include research involving uranium in the environment at sites in Rifle, Colorado, and Oak Ridge, Tennessee under the DOE's Integrated Field-Scale Research Challenge program (Note: The Hanford Site 300 Area is also part of this program). Cleanup experience gained under the Uranium Mill Tailings Remedial Action program (UMTRA) will also be reviewed.

3.1.4.5 Data Needs: Feasibility Study (300 Area Uranium)

Feasibility Study Data Gap – Uranium: Technology evaluation, screening, and selection activities associated with contaminant uranium beneath the 300 Area have been conducted to the extent allowed by available information (DOE/RL-2008-36). However, new information generated by the RI activities described in this work plan could be used to validate and potentially update the detailed analysis of remediation technology alternatives completed thus far.

- Data Need No. 24: Incorporate new information on the distribution and mobility characteristics of contaminant uranium in various subsurface regions beneath the 300 Area into the FS process as related to uranium.
- Justification: Selection of appropriate remedial action(s) depends on the amount and mobility of the contaminant. As new information is developed on uranium in various subsurface compartments, the strategy for addressing uranium contamination can be revisited and the technical basis for conclusions strengthened. (Related Data Needs: No. 2, No. 3, No. 7, and No. 8; see Table 3-5.)
- Resolution of data need: Revisit the technology evaluation, screening, and selection activities, to incorporate new information obtained during the RI activities, including treatability testing. Apply computer simulation models to evaluating the effectiveness of alternative technologies as directed toward individual subsurface compartments. Timeframes for reducing levels of uranium

contamination to meet ARARs under natural environmental processes will be estimated using models. New information developed at other sites contaminated by uranium will be considered as it becomes available.

Feasibility Study Data Gap – Uranium: Existing groundwater flow and uranium transport simulations are not sufficiently developed to (a) simulate the performance of various remedial action alternatives, (b) predict timelines for achieving RAOs, and (c) evaluate post-remediation land-use and environmental scenarios. The latter may involve irrigation of land areas where waste sites have not been remediated because of continuing use of certain buildings and infrastructure for the foreseeable future.

- Data Need No. 25: Computer simulation runs to evaluate remedial action alternatives, especially with regard to the effectiveness at reducing uranium concentrations in groundwater and the period required to do so.
- Justification: A FS of remediation alternatives and remedial action technologies includes a discussion of the effectiveness, costs, and timeframes associated with each alternative. Anticipating current conditions in areas not available for direct observation via monitoring, and future conditions under various environmental and land-use scenarios, can only be accomplished through simulation activities.
- Resolution of data need: Using the products resulting from fulfilling Data Need No. 16 (groundwater flow simulation) and Data Need No. 19 (uranium transport simulation), existing computer code for simulating groundwater movement and uranium transport will be refined. New spatial information on the hydrogeologic framework; on the distribution of uranium; and on the rates of exchange between dissolved and solid forms of uranium will play a key role in refining existing models.

Feasibility Study Data Gap – Uranium: Information on the lateral and vertical distribution of contaminant uranium in various subsurface compartments, and the mobility and potential transport processes, is insufficient to complete the engineering design and cost estimating aspects for the FS.

- Data Need No. 26: Updated information on the mass and mobility characteristics of contaminant uranium in various subsurface compartments.
- Justification: As discussed in Sections 3.1.1, 3.1.2, and 3.1.3, considerable uncertainty exists in the location, mass, and mobility potential for uranium in subsurface regions beneath the 300 Area. Until those uncertainties are reduced during the course of the RI, it will be difficult to provide sufficient technical data for engineering design and credible estimates for cost.
- Resolution of data need: New information on the lateral and vertical distribution of contaminant uranium is likely to come from characterization drilling at eleven locations during the RI (Data Needs No. 2, No. 3, and No. 8, and Table 3-5). Particularly significant for the FS analysis will be gathering details on the mass of uranium and mobility characteristics in each subsurface compartment where contaminant uranium may be found, as these details influence the type of chemical solutions to be used to immobilize uranium and the methods by which the solutions are deployed.

3.2 CSM and Data Need Identification for the 400 Area

Because of the nature of operations associated with the FFTF, there were no documented incidents of contamination being released to the environment. No groundwater plumes are identified as being the result of 400 Area operations. Additional characterization of groundwater beneath the 400 Area is included in the ongoing RI for the 200-PO-1 Groundwater OU (DOE/RL-2007-31).

3.2.1 Contaminant Sources (400 Area)

The following sections describe the conceptual models for contaminant sources in the 400 Area.

3.2.1.1 Engineered Facilities and Adjacent Soils (400 Area)

Contamination sources in the 400 Area are represented by the identified waste sites. There were nine waste sites initially classified as accepted in the 400 Area. Five of the waste sites have been closed out, and the remaining four have been scheduled for remediation. The nine 400 Area waste sites are as follows:

- 400-31, Sodium Storage Facility, 402 Building
- 400-5, Septic Tank
- 427 HWSA, 427 Building Fuel Cycle Plant Hazardous Waste Storage Area
- 4831 LHWSA, 4831 Laydown Hazardous Waste Storage Area
- 4843 Building, Alkali Metal Storage Facility
- 400 PPSS, 400 Area Process Pond and Sewer System
- 400-37, Fuel Oil Tank
- 400-38, Fuel Oil Tank
- 437 MASF, 400 Area Maintenance and Storage Facility

3.2.1.2 Vadose Zone (400 Area)

None of the 400 Area waste sites appears to provide a significant threat of widespread release to environmental pathways. However, some uncertainty remains with the nature and extent of contamination in the vadose zone beneath unremediated waste sites. Uncertainties associated with contamination in the vadose zone will be addressed during remedial action of the remaining 400 Area waste sites listed above. A principal uncertainty is if contamination exists beneath unremediated waste sites at concentrations above action levels.

3.2.1.3 Sources for Contamination in Groundwater (400 Area)

The sources for contaminants currently observed in groundwater at the 400 Area are located in the 200 East Area. No sources associated with 400 Area operations have been identified, although nondangerous/nonradioactive liquids are/were discharged to the 400 Area Process Ponds via a sewer system under Ecology, 2003, *State Waste Discharge Permit ST-4501*.

3.2.2 Contaminant Distribution (400 Area)

The extent of contamination around and beneath the unremediated waste sites in the 400 Area has not been fully defined. An analysis will be performed during the interim remedial action of the remaining accepted waste sites. The primary uncertainty is the nature and extent of contamination beneath unremediated waste sites at concentrations above action levels.

Contamination in groundwater beneath the 400 Area is illustrated in Figures 2-30 and 2-31 in Section 2.6. Low concentrations of nitrate and H-3 associated with the sitewide groundwater plume (200-PO-1 Groundwater OU) may be present in groundwater at the 400 Area, with concentrations lower than the drinking water standard.

3.2.3 Fate and Transport (400 Area)

The current conceptual model for contamination in environmental pathways at the 400 Area does not indicate the need for additional characterization activities as part of this work plan.

3.2.4 Identification and Resolution of Data Needs (400 Area)

Because of the nature of the FFTF operations, there were few incidents of contamination released to the environment. Additionally, there are no groundwater plumes associated with 400 Area operations.

Contamination sources in the 400 Area are represented by the identified waste sites. None of the 400 Area waste sites appear to be a risk to groundwater and Columbia River protection. There is some uncertainty with regard to the nature and extent of contamination in the vadose zone beneath unremediated waste sites. Uncertainties associated with contamination in the vadose zone will be addressed during interim remedial action of the remaining 400 Area waste sites conducted under EPA/ROD/R10-01/119.

3.2.4.1 Data Needs: Sources for Contamination (400 Area)

The following descriptions focus on data needs associated with the sources for contamination observed in the vadose zone and aquifer beneath the 400 Area.

Sources in the Vadose Zone (400 Area)

Data gap – contaminants: Unidentified sources of contamination may exist within and in the soils adjacent to engineered facilities and structures.

- Data Need 27: Identify new waste sites and potential sources of contamination in the 400 Area.
- Justification: The OSE and waste site discovery process are performed to identify new waste sites and sources that are not in CERCLA decision documents.
- Topical areas for decisions:
  - Determination of waste site classification after discovery (Section 2.2)
  - Accepted, rejected, or no-action waste site
- Resolution of data need: Data need will be fulfilled as part of the OSE process.

Sources for Groundwater Contamination (400 Area)

Local sources have not been identified as potential contributors to contamination in groundwater at the 400 Area (DOE/RL-2008-01, pp. 2.11-23 to 2.11-24).

3.2.4.2 Data Needs: Distribution of Contaminants (400 Area)

This section presents problem statements and describes data needs associated with the distribution of contamination in the vadose zone and aquifer beneath the 400 Area.

Distribution within the Vadose Zone (400 Area)

Data gap – contaminants: The nature and extent of contamination in the shallow vadose zone beneath and adjacent to 400 Area facilities and waste-disposal sites are needed to assess groundwater protection.

- Data Need 28: Characterize below unremediated waste sites to assess nature and extent of contamination in the vadose zone.
- Justification: Remediation is needed to protect human health and the environment.
- Topical areas for decisions:
  - Residual contamination in the vadose zone beneath remediated sites.
- Resolution of data need: Continue interim remedial actions because they have demonstrated to be efficient in obtaining the necessary data during remediation using the observational approach.
  - Obtain data documenting the remaining residual contamination following completion of interim remedial action.

Distribution of Contamination in Groundwater System (400 Area)

Characterizing the distribution of contaminants in groundwater at the 400 Area is included in DOE/RL-2007-31 and no additional investigation is proposed under this work plan.

3.2.4.3 Data Needs: Fate and Transport of Contaminants (400 Area)

No data gaps and data needs have been identified to warrant additional RI/FS activities in this work plan.

3.3 CSM and Data Need Identification for the 600 Area

This section describes potential sources for contamination in the 300 Area that are not included in the previous description of the 300 Area (Section 3.1) and are outside of the 300 Area industrial complex and away from the 400 Area complex. The most significant sites are two former solid waste burial grounds and a former liquid waste disposal facility. Descriptions and a discussion of the history associated with these waste-disposal facilities are provided in Sections 2.1, 2.2, and 2.3. Groundwater impacted or potentially impacted by releases from these waste sites and others associated with the 300-FF-2 OU is also described in this section.

3.3.1 Contaminant Sources (600 Area)

The 618-10 and 618-11 Burial Grounds, and the former 316-4 Crib, are 600 Area sources for releasing contamination to environmental pathways, based on their operational history, and because they have not yet been remediated. In addition, groundwater monitoring has revealed evidence for past releases from these facilities (Section 2.6). Uncertainty associated with the location of contaminant sources in the 600 Area is based on the premise that all contaminant sources have been located, and when applicable, classified as an accepted waste site. The process of finding contaminant sources is conducted through the OSE process, which is described in Section 2.4.

Contamination in the 600 Area remains in the unremediated burial grounds and there is potential for contamination to be transported to the vadose zone beneath the burial grounds. There is uncertainty associated with the contents of the unremediated burial grounds and the nature and extent of contamination in the soil beneath. Inventory estimates for contaminants contained within the unremediated burial grounds have not been fully developed.

Sources for groundwater contamination observed in the 600 Area include releases from sources in the 300-FF-2 OU (Section 2.6) and from sources in the 200 East Area. One discrete plume is being tracked, an H-3 plume beneath portions of the Energy Northwest complex. The source for the H-3 in the plume is within the 618-11 Burial Ground. No data gaps are currently identified with regard to sources for groundwater contaminants in the 600 Area.

3.3.2 Contaminant Distribution (600 Area)

Uncertainties associated with the inventory of sources and distribution of contaminants beneath the 618-10 and 618-11 Burial Grounds will be addressed during the nonintrusive sampling program (DOE/RL-2008-27) and subsequent remedial actions. Additionally, characterization of the soils beneath the other unremediated burial grounds will be performed during remedial action of those sites.

- Although the 316-4 Crib and adjacent soil have been removed, the excavation site has not been closed out. Sediment samples collected at the base of the excavation before backfilling revealed contamination by uranium and tributyl phosphate. The vadose zone at depths below the excavation depth also may be contaminated. Further characterization of this site will be conducted during the remedial action and site close out. Completion of the 316-4 Crib waste site remediation is scheduled directly following the remediation of the adjacent 618-10 Burial Ground.

The following data gaps remain:

- The concentration, distribution, and behavior of contaminants in the vadose zone beneath the unremediated 600 Area Burial Grounds are unknown.

- The concentration, distribution, and behavior of contaminants in the vadose zone beneath the former 316-4 Crib have not been fully characterized.

The distributions of contaminants in groundwater in the 600 Area are described in Section 2.6. With the exception of conditions near the 618-11 Burial Ground (local H-3 plume) and the 618-10 Burial Ground/316-Cribs excavation site, contaminant distribution in groundwater is monitored under the 200-PO-1 Groundwater OU. Results of that monitoring are published annually in the groundwater monitoring report (e.g., DOE/RL-2008-66, Section 2.11). No data gaps are currently identified for contaminant distribution in groundwater in the 600 Area of the 300 Area, although data gaps are identified under the 200-PO-1 Groundwater OU RI that is in progress (DOE/RL-2007-31).

3.3.3 Fate and Transport (600 Area)

Uncertainties remain regarding the fate and transport of contaminants released from material contained within the 618-11 and 618-10 Burial Grounds. Environment monitoring to date has revealed the release of H-3 from the 618-11 Burial Ground, with evidence being found in soil gas adjacent to the facility and in the underlying groundwater. While similar evidence has not been found for similar releases at the 618-10 Burial Ground, the use of that waste disposal site was similar to the 618-11 Burial Ground.

3.3.3.1 Releases from the 618-11 and 618-10 Burial Grounds

Tritium release from materials buried in the 618-11 Burial Ground has been identified based on soil gas analyses at sites adjacent to the facility, and on groundwater monitoring near the burial ground (Section 2.6). The transport of this H-3 in the aquifer was described during a previous investigation, which concluded that the contaminant plume would not likely reach the nearest downgradient receptor locations, i.e., Energy Northwest water supply wells (ENW-MW-31 and ENW-NW-32) and the Columbia River, at concentrations that exceed the drinking water standard (PNNL-15293, pp. 6.1 to 6.2). However, the prediction is based on the assumption that the plume was generated by an episodic event that caused an impact to groundwater, and the processes responsible are not well understood. The principal uncertainties at the 618-11 Burial Ground are:

- The processes by which H-3 released as a gas from irradiated targets transitions downward through the vadose zone to contaminate the underlying groundwater have not been characterized.
- Because of the unknown nature of the processes involved, it is not known with certainty whether the releases represent a single event, or could be repetitive.

The 618-10 Burial Ground contains similar underground structures as at the 618-11 Burial Ground (e.g., VPUs) (the more extensive caissons were not installed at the 618-10 Burial Ground). However, analysis of soil gas at sites adjacent to the facility did not reveal similar evidence for release of H-3, and groundwater monitoring has not revealed evidence for contamination of local origin. Unknowns regarding contaminants in the vadose zone beneath the 618-10 Burial Ground remain, but the lack of current evidence for significant releases that would migrate in environmental pathways suggests that these unknowns do not represent a significant data gap.

3.3.3.2 316-4 Crib

Contamination associated with the use of the 316-4 Crib has migrated into the soils adjacent to and beneath the facility, and to some extent, groundwater (Section 2.6). However, available groundwater monitoring data do not suggest well-defined contaminant plumes emanating from the vicinity of the former crib. The uncertainty that remains with this waste site is that the migration potential for contaminants that remain in the vadose zone sediment beneath the excavation associated with the site remains unknown.

3.3.3.3 Groundwater Contamination (600 Area)

The fate and transport of contaminants other than those attributed to the 618-11 and 618-10 Burial Grounds are part of the RI for the 200-PO-1 Groundwater OU (DOE/RL-2007-31). In general, groundwater moves to the east across the 300 Area and ultimately discharges into the Columbia River at the shoreline and upward through the riverbed. No data gaps were identified for this aspect of the work plan.

3.3.4 Identification and Resolution of Data Needs (600 Area)

Contamination in 600 Area soil resulting from the disposal of solid and liquid-waste streams originating from the 300 Area operations and waste-disposal practices requires additional investigation as part of this RI/FS process and other existing programs. The primary sites of interest are the 618-10 and 618-11 Burial Grounds, and the former 316-4 Crib. Groundwater contamination in the form of an H-3 plume (and possibly a nitrate plume) appears to be originating from the 618-11 Burial Ground. Historical records indicate contents of the 618-10 and 618-11 Burial Grounds include potentially high-level and TRU wastes, and uranium-tributyl phosphate soil contamination was measured in the soil beneath the excavated 316-4 Crib site (Section 2.6). Additionally, soil gas measurements near the 618-11 Burial Ground indicated elevated H-3 concentrations (PNNL-13675). Investigation of the 618-10 and 618-11 Burial Grounds will be performed during a nonintrusive sampling program this FY (FY 2009) (DOE/RL-2008-27), which will lead to an intrusive sampling program, and eventually remediation and close out of the sites. Data gaps associated with the 618-10 and 618-11 Burial Grounds primarily are the nature of the burial ground contents and the distribution of contamination beneath the sites. The data gap associated with the former 316-4 Crib primarily is the distribution of contamination in the soils beneath the excavated site. Contamination is expected to exist in these unremediated waste sites and will be remediated as part of the interim remedial action conducted under EPA/ROD/R10-01/119.

3.3.4.1 Data Needs: Sources for Contamination (600 Area)

The following descriptions focus on data needs associated with the sources for contamination observed in the vadose zone beneath the 600 Area.

Sources in the Vadose Zone (600 Area)

<u>Data gap – contaminants</u>: Unidentified sources of contamination may exist within the soils adjacent to engineered facilities within the 600 Area.

- Data Need 29: Identify new waste sites and potential sources of contamination in the 600 Area.
- Justification: The OSE and waste site discovery site process are performed to identify new waste sites and sources that are not in CERCLA decision documents.
- Resolution of data need: The data need will be fulfilled as part of the OSE process.

3.3.4.2 Data Needs: Distribution of Contaminants (600 Area)

This section presents problem statements and describes data needs associated with the distribution of contamination in the vadose zone beneath the 600 Area.

Distribution within the Vadose Zone (600 Area)

<u>Data gap – contaminants</u>: There is uncertainty associated with the contents of the 618-10 and 618-11 Burial Grounds. Operational records and history associated with past waste-disposal practices of 300 Area waste streams are incomplete.

- Data Need 30: Characterize contents of the 618-10 and 618-11 Burial Grounds. Complete planned nonintrusive and intrusive sampling, and final remediation of the burial ground disposal sites.

- Justification: Characterization of the burial ground contents will be performed under the current SAP process. The characterization activities prescribed will provide data and information needed for planning future intrusive characterization activities (if required) and/or remediation strategies for the VPUs, caissons, and trenches located in these burial grounds. Planning for intrusive characterization and/or remediation requires additional understanding of the quantity and condition of the material deposited in the 618-10 and 618-11 Burial Grounds.
- Resolution of data need: The data need will be fulfilled as part of DOE/RL-2008-27.

Data gap – contaminants: The nature and extent of contamination in the shallow vadose zone beneath and adjacent to unremediated 600 Area waste-disposal sites are not well defined. This includes the 618-10, 618-11, 618-7, and 618-13 Burial Grounds and the former 316-4 Crib.

- Data Need 31: Characterize below partially remediated and unremediated waste sites to assess nature and extent of contamination in the vadose zone.
- Justification: Remediation is needed to protect human health and the environment.
- Resolution of data need: Data needs will be fulfilled as part of the field remediation and verification sampling process, and to some extent by the characterization borehole planned at each of these waste sites following excavation and removal actions (Data Need 32).

Data gap – contaminants: The distributions of contamination in the vadose zone beneath the 618-10 and 618-11 Burial Grounds, and the former 316-4 Crib excavation site, are not well understood.

- Data Need 32: Following excavation of the sites during the interim remedial action, drill and collect soil samples from beneath engineered facilities (bottom of the excavation) to groundwater. Perform laboratory and field analyses to determine the nature and extent of contamination beneath the remediated waste sites from the bottom of the excavation to groundwater. Exact locations for boreholes to be drilled within the footprints of the 618-10 and 618-11 Burial Grounds, and the former 316-4 Crib, will be determined following excavation activities performed as part of remediation of the waste sites. Sampling results collected during intrusive characterization and remediation activities will be used to position boreholes at locations with the best potential to reveal contaminant distribution information below the remediated waste sites.
- Justification: Uncertainty remains regarding the distribution of contamination below the 618-10 and 618-11 Burial Grounds, and the former 316-4 Crib site. The disposal histories of the 618-10 and 618-11 Burial Grounds, along with subsequent releases that have impacted groundwater, provide evidence that supports the need for further characterization of the vadose zone beneath these waste sites. These data will be collected in addition to the cleanup verification sampling. In addition, the soils contaminated by liquid waste containing tributyl phosphate and uranium beneath the former 316-4 Crib support the need for further characterization of the vadose zone, from the bottom of the excavation following the interim remedial action to groundwater.
- Resolution of data need: The data need is intended to reduce the uncertainty associated with the distribution of contamination beneath the 618-10 and 618-11 Burial Grounds, and the former 316-4 Crib (Table 3-5). Characterization boreholes will be drilled into the vadose zone and sediment samples collected following excavation activities and prior to backfilling during interim remedial action. Sampling requirements (e.g. number of samples and collection intervals) are proposed in Table 2-5, but may be modified as approved by EPA following review of verification data collected during the excavation and removal activities. Sediment sampling within the boreholes will be performed to identify potential contamination and to determine the extent. The data will provide verification that sources were removed as part of the remedial activities. Laboratory analyses of the sediments will be performed with the purpose of measuring select analytes (based on the COCs

measured during remediation) including H-3 and VOCs. Radiological field screening and detection of VOCs will aid with the determination of measuring the extent of contamination.

- Sampling and analytical activities include:
  - Field sampling: Collect sediment and pore water.
  - Laboratory analyses: Conduct analytical test on sediments for appropriate analytes from the 600 Area target analyte list.
    - Conduct leach tests on sediment using simulated groundwater, with chemical and radiological analysis of pore water samples.
    - Analyze all sediment samples for soil target analytes listed in WCH-334, *300-Area Decision Unit Target Analyte List Development for the 618-10 and 618-11 Burial Grounds, and 316-4 Crib*.
  - Laboratory analyses: Conduct analytical tests for H-3 and VOCs.
  - Field screening:
    - Conduct radiological screening of sediment samples including gross beta/gamma, low-level gamma, high-level gamma, and neutron detection.
    - Use a portable detector to detect presence of VOC vapors.
- With regard to the H-3 release observed near the 618-11 Burial Ground, soil gas sampling may be performed with the purpose of determining the nature, extent, and persistence over time of H-3 in the aquifer beyond the boundary of the excavated waste site after the potential sources are removed as part of the remedial activities. The technical means including appropriate deployment methods (e.g., boreholes, cone penetrometers, or existing sample ports on the 618-11 perimeter), sampling collection and analytical methods, and scheduling will require planning to be conducted beyond the time frame of this work plan after the 618-11 Burial Ground remedial activities have been planned or completed. Prior to the remediation of the 618-11 Burial Ground, nonintrusive and intrusive sampling campaigns will be conducted in the burial ground trenches. Data gathered from these activities should be reviewed along with data collected during the remediation to aid planning of soil gas sampling activities designed to assess the effects of remedial activities on the H3 release located outside the burial ground boundary.
- Remediation of the 618-10 and 618-11 Burial Grounds, and former 316-4 Crib will occur after the period of work outlined in this work plan and further planning will be required to correlate the drilling of boreholes and soil gas sampling with remediation activities. This planning should be performed as part of the 300 Area Remedial Design Report/Remedial Action Work Plan.

3.3.4.3 Data Needs: Fate and Transport of Contaminants (600 Area)

There are no data gaps associated with the fate and transport of contaminants in the 600 Area vadose zone and unconfined aquifer for which work is proposed in this work plan.

3.4 Human Receptors and Exposure Pathways

Several evaluations of exposure of human receptor pathways to contaminants have been conducted in support of remediation. Activities performed include the LFIs and QRAs to support interim action ROD remedy selection. In addition, the cleanup verification process that follows remedial actions under interim action RODs includes an evaluation of human exposure and assessment of risk for each waste site. Ongoing exposure evaluation and risk assessment activities include the RCBRA, which further evaluates the protection of human health using exposure scenarios that reflect future potential land uses not defined during past risk assessment activities. Additional ongoing human health exposure evaluation and risk assessment activities pertaining to the 300 Area contamination include the RI for Hanford Site releases to the Columbia River.

Spatial and temporal uncertainty data gap: Existing groundwater data sets and the strategies currently in place to monitor groundwater conditions do not meet the RI needs for determining spatial and temporal risk uncertainty for potential human and ecological receptors.

- Data Need 33: Groundwater samples from a subset of wells selected to provide representative samples of aquifer conditions throughout the 300 Area; laboratory analysis of the samples to include COPCs as identified in Section 4.5.2 of the work plan; and multiple rounds of sampling to characterize the temporal variability in aquifer conditions.
- Justification: Additional groundwater sampling will help to reduce uncertainties identified in the existing baseline risk assessments for human health exposures. These uncertainties include the possibilities that a) contaminants may have been overlooked by current groundwater monitoring programs, b) sampling frequencies used in the past may have biased interpretations of current conditions, especially near the Columbia River where conditions change rapidly, and c) conditions have changed since the initial qualitative risk assessment. Reducing uncertainties associated with the baseline human health risk assessment will strengthen the basis for analyses of remedial action alternatives during the FS process.
- Resolution of data need: The groundwater database available for risk assessment activities will be augmented by a) identifying a subset of monitoring wells in the 300 Area that will provide spatially representative samples of current conditions, b) collecting samples from those wells during at least three rounds of sampling that encompass seasonal variability in water table and Columbia River conditions, and c) analyzing those samples for constituents deemed to be of potential concern for human and ecological receptors (Section 4.5.2). The wells selected for this activity are listed in the SAP (DOE/RL-2009-45). The periods recommended for sampling are May to mid-June, mid-September to mid-October, and either March through April or July through August.

3.5 Ecological Receptors and Exposure Pathways

Exposure of ecological receptors to 300 Area contaminants has been characterized in support of remedial action decisions. Initially, to support remediation decisions described in current RODs, a streamlined evaluation of exposure and risk to ecological receptors was conducted in the QRAs. Subsequently, the RCBRA is being performed to characterize ecological exposures and risk.

4 Approach

This chapter summarizes current risk assessment activities evaluated to help develop the characterization scope for the work. In addition, this chapter presents preliminary information related to RAOs, remediation goals, assessment of ARARs, and remedial actions that will be fully developed in the course of completing the RI/FS process.

4.1 Preliminary RAOs

As stated in 40 CFR 300, RAOs must be developed to address COCs, media of concern, potential receptors, and exposure pathways. The RAOs are narrative statements that define the extent to which waste sites require cleanup to protect human health and the environment.

The preliminary RAOs are based on the results of human health risk assessments (HHRAs), ecological risk assessments, and the analysis leading to this RI/FS work plan. Several expedited response and interim remedial actions already have been implemented (including characterization), thereby providing considerable information concerning contamination and risk. Interim action RODs, a final ROD, action memoranda, a removal action work plan, 5-year review reports, and remedial design/remedial action work plans were issued for the 300 Area that addressed buried wastes, and contaminated soil or demolition actions. Expedited response measures for contaminated groundwater also were implemented as remedial actions under interim action RODs to keep principal threat contaminants from reaching the Columbia River. Action memoranda directed efforts to remove various facilities and structures and to place reactors in interim safe storage before final disposition. Sections 2.2, 2.3, and Appendix B are summaries of the implementation of the CERCLA process to date for the 300 Area, including facility demolition and removal.

A preliminary list of RAOs has been prepared for the 300 Area (Table 4-1). Media specific RAOs for groundwater, surface water, soil, and land use were developed and combined into one list. The RAOs were based on existing River Corridor regulatory documents (e.g., interim action RODs) and were expanded to cover gaps when integrating all media and resources into one area. The RAOs are refined through the RI/FS process during the RI, RCBRA (DOE/RL-2007-21), and the detailed analyses of alternatives conducted in the FS. The final RAOs are determined when the selected alternative is documented in the ROD.

Table 4-1. Preliminary RAOs for the 300 Area

RAO No.	Goal
Groundwater	
1	Prevent unacceptable risk to human health from ingestion of and incidental exposure to groundwater containing nonradiological contaminant concentrations above federal and state standards.
2	Prevent unacceptable risk to human health from ingestion of and incidental exposure to groundwater containing radiological contaminant concentrations above federal and state standards.
Surface Water	
3	Prevent unacceptable risk to human health and ecological exposure to surface water containing nonradiological contaminant concentrations above federal and state standards.
4	Prevent unacceptable risk to human health and ecological exposure to surface water containing radiological contaminant concentrations above federal and state standards.

Table 4-1. Preliminary RAOs for the 300 Area

RAO No.	Goal
Soil	
5	Prevent hazardous chemical contaminants from migrating and/or leaching through soil that will cause contamination of groundwater exceeding standards.
6	Prevent migration and/or leaching of radioactive contaminants through soil to groundwater in excess of federal and state standards.
7	Prevent unacceptable risk to human health and ecological receptors from exposure to the upper 4.6 m (15 ft) of soil contaminated with nonradiological constituents at concentrations above the unrestricted land use criteria for human health or soil contaminant levels for ecological receptors.
8	Prevent unacceptable risk to human health and ecological receptors from exposure to upper 4.6 m (15 ft) of soils and to structures and debris contaminated with radiological constituents. • Prevent exposure to radiological constituents at concentrations at or above a dose rate limit that causes an excess cancer lifetime risk threshold of 10^{-6} to 10^{-4} above background for the rural residential exposure scenario. A dose rate limit of 15 mrem/yr above background generally achieves the EPA excess lifetime cancer risk threshold. • Protect ecological receptors based on a dose rate limit of 0.1 rad/d for terrestrial wildlife populations, which is a to-be-considered criterion.
Land Use and Resource	
9	Prevent adverse impacts to cultural resources, threatened or endangered wildlife, and ecological receptors using the Columbia River and prevent destruction of sensitive wildlife habitat.
10	Where it is not practicable to remediate levels that will allow for unrestricted use, ensure that appropriate institutional controls and monitoring requirements are established and maintained to protect future users of the remediated waste sites.

4.2 PRGs

The PRGs provide target cleanup levels for use in evaluating how RAOs are achieved, and they provide preliminary risk reduction targets that a remedial alternative must meet to achieve the criteria set forth in 40 CFR 300.430(e)(9)(iii), "Nine Criteria for Evaluation." The PRGs are refined based on technical feasibility, community acceptance, baseline risk assessment, and other risk management considerations. This refinement process ultimately results in the establishment of final cleanup levels documented in the ROD.

PRGs are developed independently for the protection of human health, ecological receptors, and groundwater. The PRGs are based on regulatory requirements for exposure pathways, baseline risk assessment, and future land use considerations. They are identified for individual hazardous substances identified as COCs or COPCs. If multiple contaminants are present at a waste site, the suitability of using individual PRGs as final cleanup values protective of human health and the environment are evaluated based on site specific information and the potential for contaminant interaction. Preliminary remediation goals should be modified, as necessary, as more information becomes available during the RI/FS.

The PRGs also are compared to each other to determine which offers the most restrictive value that is protective of all pathways, provided it is greater than background concentrations and the practical quantitation limit. If the lowest of the PRGs is lower than background concentrations or the practical quantitation limit, then background concentrations or the practical quantitation limit (whichever is higher) becomes the PRG. The purpose of this process is to identify those constituents that may pose an unacceptable risk or exceed cleanup standards established by ARARs. Meeting PRGs and the potential ARARs and, by extension, achieving RAOs, can be accomplished by reducing concentrations (or activities) of contaminants to PRG levels or by eliminating potential exposure pathways/routes.

Final RAGs developed from the PRGs will be specified in a final ROD that identifies the selected remedial alternative for 300 Area Operable Units waste sites. For the purpose of this analysis, the DOE has determined, in collaboration with the EPA and Ecology that the following principles apply.

- Cleanup levels for contaminated soil and groundwater that were established in interim action RODs and action memoranda will continue to guide ongoing cleanup actions.
- The DOE is committed to establishing final cleanup levels at least as stringent as those levels identified in interim actions.
- The varied exposure scenarios presented in the RCBRA and the calculated risks are appropriate information to insure remedies selected will be protective of reasonably anticipated future land uses.

Therefore, although alternate PRGs may be discussed in this analysis, it is for determining whether the existing cleanup requirements will be protective of human health and the environment.

Residual risks following completion of remediation of the 300 Area must meet the RAOs. Documentation of actual media contaminant concentrations achieving cleanup objectives is presented in a CVP for waste sites. These packages will describe the remediation activities completed, identify any significant contamination remaining, summarize the sampling and data analysis approach, and demonstrate attainment of cleanup levels.

At the time of this writing, PRGs have not been finalized for this final RI/FS work plan. The RCBRA (DOE/RL-2007-21), which presents the results of the ecological risk assessment and HHRA, currently is undergoing revision. Following this regulatory review, the development of the PRGs will be completed during the RI/FS process to address protection of human health and ecological receptors. In the interim, it is anticipated that remedial activities will continue to use previously established cleanup levels. The results provided in the RCBRA will be used to help derive cleanup levels for the final RODs.

The PRGs for protection of ecological receptors, including aquatic receptors, are expected to consider state ecological screening values, EPA soil screening values, and site-specific cleanup levels. Decisions regarding the application for direct contact exposure and derivation of dilution/attenuation factors also must be completed.

As additional information becomes available from site-specific risk information, RI site characterization, and chemical specific ARARs, the PRGs are developed for each area. Some of the standards, procedures, and methodologies used to develop PRGs for the 300 Area are discussed below.

4.3 Potential ARARs

Laws and regulations pertaining to the response actions are identified through the ARAR identification process. The ARARs identification process is based on CERCLA guidance (EPA/540/G-89/004; EPA/540/G-89/006, *CERCLA Compliance with Other Laws Manual: Interim Final*; EPA/540/G-89/009, *CERCLA Compliance with Other Laws Manual – Part II. Clean Air Act and Other Environmental Statutes and State Requirements*). CERCLA, Section 121 requires, in part, that any applicable or relevant and appropriate standard, requirement, criterion, or limitation transmitted under any federal environmental law, or any more stringent state requirement transmitted pursuant to a state environmental statute, be met (or a waiver justified) for any hazardous substance, pollutant, or contaminant that will remain on site after completion of remedial action.

When compiling the requirements presented in this section, the ARARs presented in previous decision documents were reviewed, as well as current requirements that may apply to the investigation and remediation of contaminated waste sites within the 300 Area. In many cases, the ARARs form the basis for the PRGs to which contaminants must be remediated to protect human health and the environment. In other cases, the ARARs define or restrict how specific remedial measures can be implemented. The ARARs identified for the 300 Area Operable Units are preliminary because the results of the RI have not been documented and the FS preferred remedial alternatives have not been identified or evaluated. Contaminant specific requirements may be overly inclusive and action specific requirements may be incomplete. Final ARARs for remediation will be established in the ROD.

Under CERCLA, ARARs consist of two sets of requirements: (1) those requirements that are applicable requirements; and (2) those requirements that are relevant and appropriate requirements of promulgated, environmental laws. CERCLA also provides for the identification of to-be-considered, nonpromulgated advisories, criteria, guidance, or proposed standards, which often are identified with ARARs because they are helpful in selecting or implementing remedies, such as federal and state environmental and public health agencies' advisories, guidance, and proposed standards. However, those to-be-considered are not legally enforceable and are not ARARs. Applicable requirements are those substantive standards that specifically address a hazardous substance, pollutant, contaminant, remedial action, location, or other circumstance at a CERCLA site. All jurisdictional prerequisites of the requirement must be met for the requirement to be applicable.

Relevant and appropriate requirements are determined by a two-step process. First, to assign relevance, it must be determined whether the requirement addresses problems or situations sufficiently similar to the circumstances of the proposed response action. Second, for appropriateness, the determination must be made as to whether the requirement is well suited to the conditions of the site. A requirement that is relevant and appropriate may not meet one or more jurisdictional prerequisites for applicability, but still may make sense at the site, given the circumstances of the site and the release. In evaluating the relevance and appropriateness of a requirement, the following eight comparison factors in 40 CFR 300.400(g), "Identification of Applicable or Relevant and Appropriate Requirements," are considered:

- The purpose of the requirement and the purpose of the CERCLA action
- The medium regulated or affected by the requirement and the medium contaminated or affected at the CERCLA site
- The substances regulated by the requirement and the substances found at the CERCLA site
- The actions or activities regulated by the requirement and the remedial action contemplated at the CERCLA site
- Any variances, waivers, or exemptions of the requirement and their availability for the circumstances at the CERCLA site
- The type of place regulated and the type of place affected by the release or CERCLA action
- The type and size of structure or facility regulated and the type and size of structure or facility affected by the release or contemplated by the CERCLA action

- Any consideration of use or potential use of affected resources in the requirement and the use or potential use of the affected resource at the CERCLA site

The ARARs are evaluated to determine if they apply to chemical-, location-, or action-specific circumstances related to CERCLA response actions. These categories are defined as follows:

- Chemical-specific requirements are usually health- or risk-based numerical values or methodologies that when applied to site-specific conditions result in the establishment of site cleanup levels that are protective of human health and ecological receptors.
- Location-specific requirements are restrictions placed on the concentration of dangerous substances or the conduct of activities solely because they occur in special geographic areas.
- Action-specific requirements are usually technology- or activity-based requirements or limitations triggered by the remedial actions performed at the site.

Only the substantive requirements (e.g., use of control/containment equipment, compliance with numerical standards) associated with ARARs apply to CERCLA onsite activities. According to CERCLA, Section 121(e)(1), ARARs associated with administrative requirements, such as permitting, are not applicable to CERCLA onsite activities. In general, this CERCLA permitting exemption will be extended to all remedial activities conducted in the 300 Area.

To-be-considered materials and information are non-promulgated advisories or guidance issued by federal or state governments that are not legally enforceable but may contain information that would be helpful in implementing selected remedies.

The requirements of DOE orders must be met but are not identified as ARARs. Similarly, requirements pursuant to the Occupational Safety and Health Administration and other federal and state worker safety requirements are not identified as ARARs because they are employee protection laws and not environmental laws. Workers at CERCLA sites must comply with applicable safety requirements both substantively and administratively.

4.3.1 Waivers from ARARs

The EPA may waive ARARs and select a remedial action that does not attain the same level of site cleanup as that identified by the ARARs. The *Superfund Amendments and Reauthorization Act of 1986,* Section 121, identifies circumstances in which the EPA may waive ARARs for onsite remedial actions. The circumstances that are pertinent to the Hanford Site remedial actions are as follows:

- The remedial action selected is only a part of a total remedial action (such as an interim action), and the final remedy will attain the ARAR upon its completion.
- Compliance with the ARAR will result in a greater risk to human health and the environment than alternative options.
- Compliance with the ARAR is technically impracticable from an engineering perspective.
- An alternative remedial action will attain an equivalent standard of performance using another method or approach.
- The ARAR is a state requirement that the state has not applied consistently (or demonstrated the intent to apply consistently) in similar circumstances.

4.3.2 Potential ARARs for the 300 Area Operable Units

The chemical-specific ARARs likely to be relevant to remediation of the 300 Area Operable Units include the federal MCL goals and MCLs for groundwater or surface water that is a current or potential source of drinking water, state cleanup levels for chemical contaminants established in accordance with WAC 173-340, "Model Toxics Control Act – Cleanup," and various other requirements. Potential federal and state ARARs are presented in Appendix D of this work plan. The specific ARARs in Appendix D will be used as the basis for developing the final ARARs for the 300 Area Operable Units.

Groundwater, surface water, and soil cleanup regulations and terrestrial ecological evaluation procedures establish media cleanup standards for nonradioactive and radioactive contaminants. Federal and state air emission standards identify air emission limits and control requirements for any remedial actions that produce toxic air emissions. The RCRA land disposal restrictions will be important standards during the management of dangerous wastes generated during remedial actions. The RCRA corrective action (as implemented by CERCLA through the Tri-Party Agreement), as well as treatment, storage, and disposal closure performance standards, will be consulted (when applicable) for cleanup criteria and compliance monitoring requirements that apply to solid waste management units (including RCRA treatment, storage and disposal units that are regulated units) that are located within the 300 Area.

Potential location specific ARARs that have been identified include those protecting cultural, historic, and Native American sites and artifacts, and those that protect critical habitats of federally endangered and threatened species that may occur within the 300 Area.

Action specific ARARs that could be pertinent to the investigation and remediation include state solid and dangerous waste regulations (for management of characterization and remediation wastes and performance standards for waste left in place), and *Atomic Energy Act of 1954* regulations (e.g., performance standards for high-level radioactive waste sites).

Regarding waste management activities performed during remediation, a variety of waste streams may be generated under an equally wide range of potential remedial actions. It is anticipated that most of the remediation waste will be designated as low-level waste. However, quantities of dangerous or mixed waste, hazardous debris, PCB contaminated waste, and asbestos and asbestos containing material also could be generated. The identification, storage, treatment, and disposal of hazardous waste and the hazardous component of mixed waste are governed by RCRA. The State of Washington implements RCRA requirements under WAC 173-303, "Dangerous Waste Regulations," and has been authorized to implement elements of the RCRA program. Substantive requirements of the state's dangerous waste standards for generation and storage will apply to the management of any dangerous or mixed waste generated during this remedial action. Treatment standards for dangerous or mixed waste subject to RCRA land disposal restrictions are specified in WAC 173-303-140, "Land Disposal Restrictions" (incorporates 40 CFR 268, "Land Disposal Restrictions," by reference), and are applicable. Substantive portions of RCRA corrective action as implemented by WAC 173-303-64620, "Requirements," will apply to remedial actions at any solid waste management unit or spill site that presents a threat to human health and the environment including surface impoundments, landfills, waste piles, and land treatment units.

The *Toxic Substances Control Act of 1976* (TSCA) and regulations at 40 CFR 761, "Polychlorinated Biphenyls (PCBs) Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions," govern the management and disposal of PCB wastes. The TSCA regulations contain specific provisions for PCB waste, including PCB waste that contains a radioactive component. The PCBs also are considered underlying hazardous constituents under RCRA and thus could be subject to WAC 173-303 and 40 CFR 268 requirements.

Removal and disposal of asbestos and asbestos containing material are regulated under the *Clean Air Act of 1990* and amendments and 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," Subpart M, "National Emission Standards for Asbestos." This regulation provides for special precautions to prevent environmental releases or exposure to airborne emissions of asbestos fibers during remedial actions. The regulation found in 40 CFR 61.52, "Emission Standard," identifies packaging requirements. If encountered during the RI/FS, asbestos and asbestos containing material may be removed, packaged as appropriate, and disposed at the ERDF.

Waste designated as low-level and that meets ERDF acceptance criteria is assumed disposed at the ERDF. The ERDF is engineered to meet appropriate performance standards under 10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," and meet minimum technical requirements for landfills under WAC 173-303-665, "Landfills." Waste designated as dangerous or mixed waste would be treated as appropriate to meet land disposal restrictions (and ERDF waste acceptance criteria) and can be disposed of at the ERDF. Applicable packaging and pre-transportation requirements for dangerous or mixed waste generated will be identified and implemented before disposal. Alternate disposal locations also may be considered when the remedial action occurs if a suitable and cost effective location is identified. Potential alternate disposal locations will be evaluated for appropriate performance standards to ensure they are sufficiently protective of human health and the environment.

If encountered, waste designated as PCB remediation waste likely will be disposed at the ERDF, depending on whether it is low-level waste and meets the waste acceptance criteria. The PCB waste not meeting ERDF waste acceptance criteria will be retained at a PCB storage area that meets the substantive requirements for TSCA storage and transported for future treatment and disposal at an appropriate disposal facility. TSCA anti-dilution provisions are only applicable to CERCLA response actions that occur once a remedial action is initiated; thus, remediation is based on the "as-found" PCB concentration at a CERCLA site.

CERCLA Section 104(d)(4) states that where two or more noncontiguous facilities are reasonably related on the basis of geography, or on the basis of the threat or potential threat to the public health or welfare or the environment, the facilities can be treated as one for purposes of CERCLA response actions. Consistent with this, the 300 Area and the ERDF will be considered "onsite" for purposes of CERCLA Section 104, and waste may be transferred between the facilities without requiring a permit.

Remedial actions will be performed in compliance with substantive provisions of federal and state waste management requirements, such as the identification and designation of waste streams. Before disposal, waste will be managed in a protective manner to prevent releases to the environment.

It is anticipated that selected remedial action alternatives will have the potential to generate airborne emissions of both radioactive and criteria/toxic pollutants and will need to comply with applicable provisions of the federal *Clean Air Act of 1990* and amendments and RCW 70.94, "Washington Clean Air Act." Under federal implementing regulations, 40 CFR 61, Subpart H, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities," radionuclide airborne emissions from the facility must be controlled so as not to exceed amounts that would cause an exposure to any member of the public greater than 10 mrem /yr effective dose equivalent. The same regulation addresses point sources (i.e., stacks or vents) emitting radioactive airborne emissions, requiring monitoring of such sources with a major potential for radioactive airborne emissions, and requiring periodic confirmatory measurement sufficient to verify low emissions from such sources with a minor potential for emissions. Under portions of the state implementing regulations, the federal regulations are paralleled by adoption, and in addition more specifically address control of radioactive airborne emissions where economically and technologically feasible (WAC 246-247-040[3] and -040[4], "Radiation

Protection – Air Emissions," "General Standards," and associated definitions). To address the substantive aspect of these requirements, best or reasonably achieved control technology will be addressed by ensuring that applicable emission control technologies (i.e., those successfully operated in similar applications) will be used when economically and technologically feasible based on cost/benefit. If it is determined that there are substantive aspects of the requirement for monitoring of fugitive or nonpoint sources emitting radioactive airborne emissions (WAC 246-247-075[8], "Monitoring, Testing and Quality Assurance"), then these will be addressed by sampling the effluent streams and/or ambient air as appropriate using reasonable and effective methods.

4.4 Assessment of Baseline and Residual Risks in the 300 Area

Several different risk assessments have been conducted in support of remedial decision making, covering specific timeframes, OUs, or geographical areas within the 300 Area. The results from these prior risk assessments will support the development of remedial alternatives and final cleanup levels.

The approach used to assess human and ecological risks as part of the 300 Area RI/FS will need to consider the near shore, riparian, and upland zones (Figures 4-1 and 4-2), along with groundwater. These environmental zones are described as follows:

- Near shore aquatic zone: The near shore zone includes the surface water of the Columbia River from the area that is permanently inundated by river water (i.e., the low water mark commonly referred to as the "green line" where the periphyton remain green year round) up to the riparian zone.
- Riparian zone: The riparian zone is a transition area between the aquatic environment in the near shore zone and the upland zone. The riparian zone extends from the shoreline of the Columbia River to the point on the riverbank where upland vegetation becomes dominant. The riparian zone typically is narrow and varies in width depending on the slope of the riverbank.
- Upland zone: The upland zone consists of land that extends inland from the riparian zone and is situated approximately 3 m (10 ft) above the river high water mark. The upland zone generally is dry and not readily influenced by river flow. Recharge to groundwater in this zone occurs largely from precipitation. The upland zone includes the areas contained within the 300 Area and generally is where waste sites are located.

The river component includes the surface water, pore water, and sediments located in areas of the Columbia River that are permanently inundated by river water. The River Component resources are being addressed through the Columbia River study summarized in Chapter 3 of this document.

The following section summarizes the past and ongoing risk assessment activities within the 300 Area. Previous risk assessment activities performed included the LFIs and QRAs to support interim action ROD remedy selection. Once these activities were completed, the remedial actions under interim action RODs were validated through the cleanup verification process. Ongoing risk assessment activities include the RCBRA, which further evaluates the potential risks posed under a number of human exposure scenarios including consideration of the three environmental zones discussed in the previous section. The RCBRA also comprehensively evaluates protection of ecological receptors, which was not fully developed in the interim action RODs. Additional ongoing risk assessment activities include the RI for Hanford Site releases to the Columbia River. The purpose of this assessment is to characterize the nature and extent of Hanford Site related contaminants that have come to be located within the Columbia River and the associated risks.

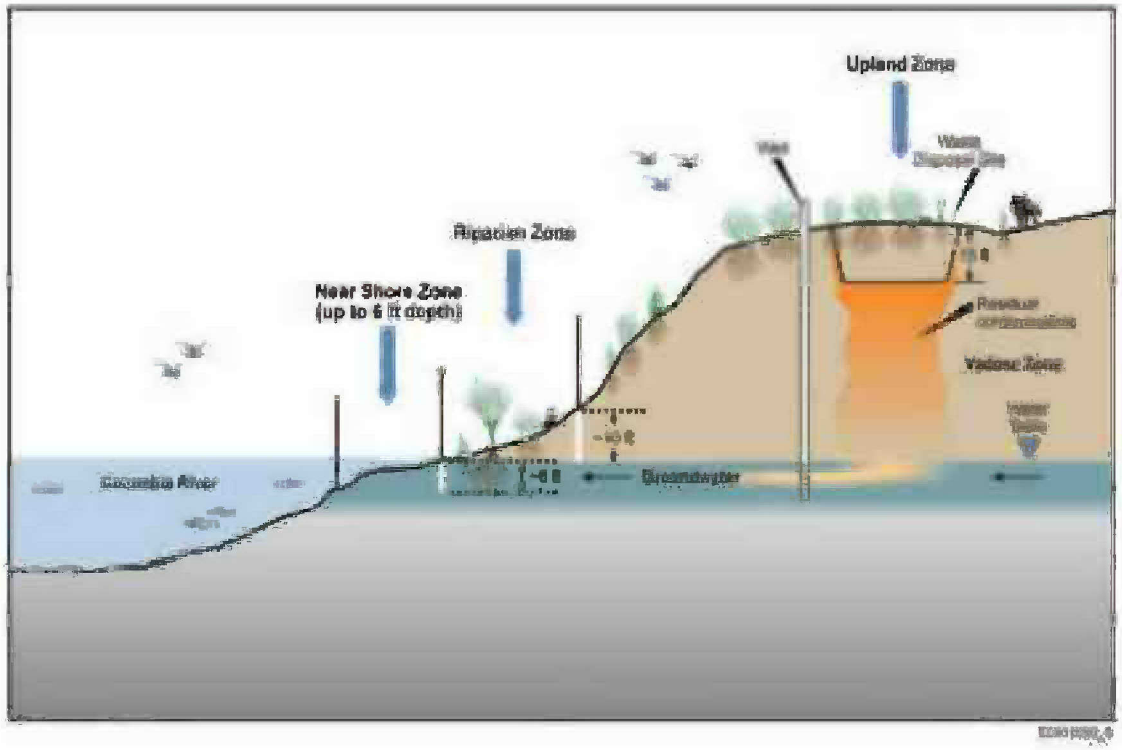


Figure 4-1. Environmental Zones

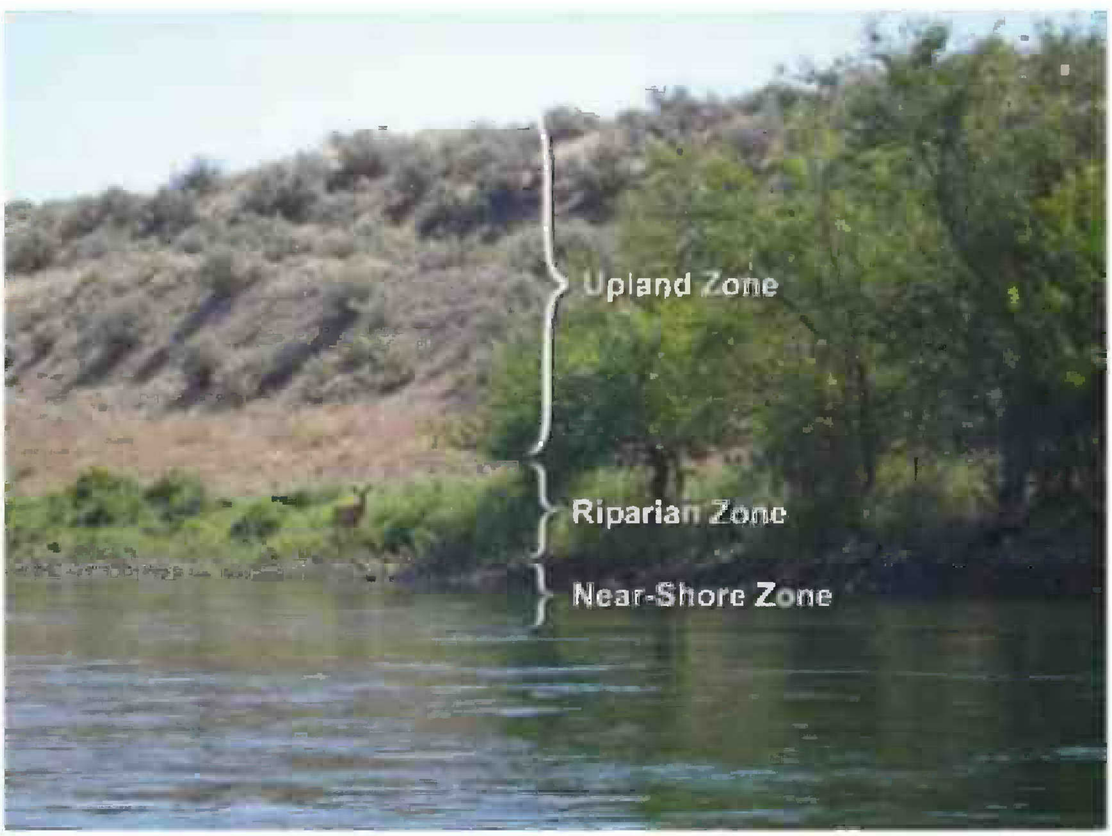


Figure 4-2. Upland and Shoreline Zones

In addition, the following section contains a discussion of uncertainties associated with the risk assessment results and the additional information needed to be developed to reduce uncertainty and support evaluation of remedial alternatives and final remedy decisions.

4.4.1 Risk Assessments in Support of Existing RODs

The cleanup of past-practice waste sites and groundwater at the Hanford Site initially focused on addressing releases to the environment that represent a near-term risk to the public or the environment. This resulted in the cleanup of contaminated waste sites and principal threats to groundwater using interim action RODs. EPA/ROD/R10-96/143 was the first ROD issued for the 300 Area, and included a portion of the 300 Area groundwater and a number of waste sites close to the river. Later, EPA/ESD/R10-00/524 was issued and incorporated the remainder of the groundwater contamination underlying the 300 Area into the 300-FF-5 Groundwater OU. This approach, presented in DOE/RL-91-40, *Hanford Past Practices Strategy*, reflects EPA guidance under CERCLA to make use of interim actions to achieve risk reduction sooner rather than later.

4.4.1.1 ROD for the 300-FF-1 OU and 300-FF-5 Groundwater OU and Associated Baseline Risk Assessments

This approach made use of baseline risk assessments to define the basis for action. The baseline risk assessment for EPA/ROD/R10-96/143 relied on historical site data and data collected during RIs. The assessment also focused on a limited set of human and ecological exposure scenarios to provide sufficient information about the need for action.

Assessment of human health risks for the 300-FF-1 OU and 300-FF-5 Groundwater OU was based on an industrial use scenario and recreational use of the Columbia River, which reflected current guidance for that time. A residential use scenario (including drinking water) was evaluated for the Columbia River. The assessment showed a potential for increased human health risk at a number of 300-FF-1 OU waste sites, attributable primarily to uranium and Co-60. A comprehensive evaluation of groundwater contamination in the 300-FF-5 Groundwater OU was performed, including contributions from 300 Area waste sites. Results of the risk evaluation showed the potential for health risks due to exposure to uranium and trichloroethene.

The baseline ecological risk assessment for the 300-FF-1 OU and 300-FF-5 Groundwater OU concluded that impacts from 300 Area process contaminants are insignificant. The study showed a potential for individuals within the population of the evaluated species (Great Basin pocket mouse) to be impacted. However, the conclusions stated that population level effects will be insignificant, and it was believed that remedial actions to protect humans also will adequately protect ecological receptors. Contaminant migration through the food chain also was believed to be an insignificant factor. The analysis and supporting data can be found in DOE/RL-93-21 and DOE/RL-94-85.

4.4.1.2 LFIs and QRAs

This approach made use of QRAs to define the basis for remedial actions under interim action RODs. The QRAs relied on historical site data, as well as data collected during LFIs (i.e., the collection of limited additional site data to support a decision on conducting a remedial action under an interim action ROD). The QRAs focused on a limited set of human and ecological exposure scenarios to provide sufficient information about the need for a remedial action under an interim action ROD. The LFIs recommended sites for remedial actions and categorized them as high or low priority. The results of these early investigations will continue to provide a basis for action at the waste sites listed in the interim action RODs that have not yet been remediated.

Assessment of human health risks in the QRAs was based on an industrial use scenario that reflected guidance for that time. The industrial use scenario was defined using industrial exposure factors obtained from DOE/RL-94-85. Based on risk assessment results for analogous waste sites, the contaminants in 300-FF-2 OU soil providing the highest contribution to potential increased human health risks included heavy metals (lead and uranium) and various radionuclides (Co-60, U-234, U-235, and U-238).

Conclusions from the ecological risk evaluation for the 300-FF-1 OU waste sites were used to support remedial action decisions for EPA/ROD/R10-01/119. This assessment focused on the Great Basin pocket mouse and predator species (raptors), using waste site dimensions to estimate the home range of the mouse. The conclusions stated that population level effects would be insignificant, and it was believed that remedial actions to protect humans will protect ecological receptor populations.

The LFIs completed for the 300 Area OU consisted of historical data compilation, nonintrusive investigations (e.g., geophysics), intrusive investigations (e.g., boreholes), and the 100 Area aggregate studies (i.e., ecological, river water, and sediment sampling). In addition, the LFIs provide information regarding historical sampling and analysis, which is useful in developing soil (deeper than the 4.6 m [15-ft] point-of-compliance depth) target analyte lists for further investigation.

4.4.1.3 Waste Site Cleanup Verification Process

Following completion of remedial actions at a waste site in accordance with the applicable interim action ROD, cleanup verification or confirmatory sampling and laboratory analysis are performed to confirm attainment of RAGs and, therefore, demonstrate that RAOs for interim site closure have been met. A RAG is a specific numeric goal against which cleanup verification data are evaluated in order to demonstrate attainment of RAOs. The RAGs for the protection of human health were developed using an industrial-use scenario, which represents an industrial worker exposure scenario and an unrestricted use scenario, which represented a rural residential exposure scenario.

During the remediation process, if waste site sampling shows that the RAOs for direct exposure, groundwater protection, or river protection have not been met through the vadose zone, further remedial action is performed, followed by additional verification sampling. If evaluation of the cleanup verification samples shows that the RAOs for a remaining site are met, compliance is documented in the appropriate closeout documentation.

The exposure factors and assumptions defining the industrial worker and rural residential scenarios are defined in DOE/RL-2001-47. Soil RAGs for protection of groundwater also reflected industrial and unrestricted use and were intended to achieve state or federal drinking water standards. In addition, RAGs were developed to protect aquatic organisms in the Columbia River. However, soil RAGs were not developed for the protection of terrestrial ecological receptors due to the absence of regulatory guidance at that time.

4.4.2 RCBRA

As described in the previous sections, the remedial actions completed to date in the River Corridor were implemented primarily under interim action RODs. There is a requirement under CERCLA to perform a baseline risk assessment to characterize current and potential threats to human health and the environment before final RODs can be issued. When completed, the RCBRA will address the regulatory requirement that a baseline risk assessment be performed. These requirements include the following.

- A baseline risk assessment is required by regulation at 40 CFR 300.430, "Remedial Investigation/ Feasibility Study and Selection of Remedy" with the purpose of characterizing current and potential threats to human health and the environment.

- EPA guidance states that interim action can occur without a completed baseline risk assessment and that, in such cases, a complete baseline risk assessment will be needed to support development of a final ROD (EPA, 1991, *Role of the Baseline Risk Assessment in Superfund Remedy Selection Decisions*, OSWER Directive 9355.0-30).

- EPA Region 10 guidance acknowledges that a focused risk assessment or QRA can be performed in lieu of a baseline risk assessment to support interim or early actions. A focused risk assessment or QRA should be followed by a complete baseline risk assessment to justify final action decisions. For partially remediated sites, the baseline risk assessment evaluates the site in its present physical condition (EPA/910/R-97/005, *EPA Region 10 Supplemental Ecological Risk Assessment Guidance for Superfund*).

The source and groundwater component of DOE/RL-2007-21 addresses areas potentially affected by Hanford Site processes within the 100 and 300 Areas. The scope of this risk assessment specifically includes the following elements:

- Upland areas including remediated CERCLA waste sites within 100-BC, 100-D, 100-F, 100-H, 100-K, and 100-N; 100-IU-2; 100-IU-6; the 300 Area; and upland reference sites

- Riparian and near shore aquatic zones on the south and west shoreline of the Columbia River on the Hanford Site and reference sites

- Groundwater underlying the area and areas of groundwater emergence on the south and west shoreline of the Columbia River on the Hanford Site

Residual human health risk is being evaluated for the upland waste sites cleaned up under the current RODs (EPA/ROD/R10-96/143 and EPA/ROD/R10-01/119) that reflect a broad range of exposure scenarios. Baseline ecological risks were evaluated for the riparian and near shore zones. Residual ecological risk was evaluated for selected remediated waste sites in the upland zone. Baseline groundwater risk is being evaluated for the 100 Area and 300 Area.

Given that a primary objective of the Hanford Site cleanup mission is protection of the Columbia River, a work plan has been prepared to assess the impacts of Hanford Site releases to the Columbia River (DOE/RL-2008-11). The purpose of this work plan is to establish the approach for characterizing the nature and extent of Hanford Site related contaminants that have come to be located with the Columbia River and assessing the current risk to ecological and human receptors posed by Hanford Site related contaminants. The risk assessment activities performed as part of this work plan will become a component of the RCBRA.

4.4.2.1 HHRA

Human health risks are being assessed for a number of exposure scenarios that varied from low- to high-intensity exposure conditions to provide risk managers with information on how potential risks may vary under a variety of land use conditions. Exposure scenarios evaluated include the following:

- Future recreational-use scenarios (recreational): avid wild game hunter, avid angler, and casual user.

- Future DOE Tribal-use scenario: non-residential Native American user.

- Future industrial worker scenario (industrial/commercial): long-term industrial worker.

- Future resident National Monument worker scenario (resident National Monument/refuge): seasonal Hanford National Monument worker/resident.

- Future rural residential scenario (rural resident): long-term rural resident.
- Native American exposure scenarios: residential Native American users as developed and provided by the Confederated Tribes of the Umatilla Indian Reservation and the Yakama Nation.

To support risk management decision making, a range of exposure scenarios is included in the HHRA. As previously noted, the RODs prepared for the 100 Area and 300 Area relied on qualitative human health and ecological evaluation using only the Great Basin pocket mouse and ambient water quality standards to demonstrate that risks existed and actions were warranted. The RCBRA supports the final RI/FS and final RODs by providing the following information.

- The HHRA estimates potential human cancer risks, noncancer hazards, and dose associated with exposure to residual contamination at 146 remediated 100 Area waste sites under a range of exposure scenarios.
- The HHRA identifies key risk-driver chemicals or radionuclides for the various waste sites under a range of human-exposure scenarios.
- The HHRA identifies exposure pathways that are key contributors to cumulative risk, hazards, or dose at waste sites for a range of human exposure scenarios.

Risk assessment calculations in the HHRA are being performed independently for the soil source term (includes waste site residual soil and surface soil), the groundwater source term, and fish ingestion. The risk results from exposures to these different media may be summed to estimate the total (additive) risk across each of these media, and can provide some insight into the relative importance of the different sources of risk to a given receptor. It is anticipated that the information to be presented in the HHRA will be sufficient to support risk communication or evaluation of remedial alternatives with regard to all human health scenarios.

4.4.2.2 Ecological Risk Assessment

The primary purpose of the ecological risk assessment portion of the RCBRA (Volume 1 of DOE/RL-2007-21) is to support remedial action decisions that reduce risks to ecological receptors. Through remedial actions, contamination will be reduced to levels that result in the recovery and maintenance of healthy local populations and communities of biota. The ecological risk assessment evaluates contaminants that may pose current risk to receptors associated with residual contamination from waste sites and from associated contaminated soil and groundwater in the River Corridor. The ecological risk assessment addresses residual contaminant concentrations at remediated waste sites in the upland zones and the transport of waste site contaminants to the Columbia River riparian and near shore zones. In addition, ecological management goals for the River Corridor include considering impacts to state or federally listed threatened or endangered species, protecting rare habitats, and minimizing contaminant loading (or bioaccumulation) into biota.

4.4.2.3 Near Shore Zone

Media and biota sample data collected from 85 study areas in the near shore environment of the River Corridor and 10 reference area locations (throughout the Hanford Site) are being evaluated for Hanford Site contaminants of potential ecological concern. These data represent current conditions in study areas where no remedial actions have been conducted; however, the study areas potentially are affected by contaminated groundwater plumes passing through and/or entering the near shore zone. These results are used to present a baseline ecological risk assessment of the River Corridor near shore zone.

The near shore ecological risk assessment evaluates risks to a comprehensive array of assessment endpoints using multiple measures of exposure, effect, and ecosystem/receptor characteristics. The following representative near shore aquatic receptors are being evaluated in the ecological risk assessment:

- Lower trophic level:
  - Plants (algae and vascular plants), aquatic insects, snails, clams, mussels
- Middle trophic level:
  - Herbivores: mallard duck
  - Omnivores: carp
  - Invertivores: Woodhouse's toad, sculpin, bufflehead duck, eastern kingbird, and western kingbird
- Upper trophic level:
  - Carnivores: salmon, mink

There are uncertainties associated with obtaining representative samples of pore water (i.e., a sample that could represent an acute or chronic exposure of concern). Uncertainties were identified with the measurement of exposures for aquatic organisms that inhabit the hyporheic zone. This is relevant because one of the RAOs, under the interim action RODs, for groundwater is protection of aquatic organisms in the Columbia River. The aquatic receptor exposure point is within the river substrate (the salmon redds) at depths of up to 46 cm (18 in.), where embryonic salmon and fry could be present during portions of the year.

Flow paths in the groundwater/river zone of interaction vary with daily and seasonal fluctuations in river stage. River water infiltrates the banks during high-river stages, moves inland, then downward, and mixes with groundwater discharging through the riverbed. This suggests that the discharge to the river is a mixture of groundwater and river water. Monitoring and modeling studies suggest that dilution of groundwater by river water may range from nearly complete to approximately equal during the daily river stage cycle. Better characterization of dilution is important because mixing processes strongly influence the concentrations of contaminants at the location of exposure (i.e., in the riverbed) (PNNL-13674; PNNL-16805; PNNL-16894, *Assessment of the Strontium-90 Contaminant Plume Along the Shoreline of the Columbia River at the 100-N Area of the Hanford Site*). Several uncertainties are associated with evaluating compliance with aquatic water quality standards.

An additional study will be performed before issuing the final ROD and will include the following:

- Determine if there is a sampling technique that can accurately represent exposure conditions in the hyporheic zone.
- Determine if near shore monitoring wells (compliance wells) are adequate for determining protection of aquatic receptors in the absence of sampling within the hyporheic zone.
- Determine if the twofold dilution-attenuation factor is appropriate for the groundwater river interface for purposes of assessing risks from contaminants in groundwater, or for developing cleanup levels in groundwater.

4.4.2.4 Riparian Zone

Media and biota sample data collected from 18 study areas in the riparian environment of the River Corridor and 7 reference area locations (throughout the Hanford Site) were evaluated for Hanford Site contaminants of potential ecological concern. These data represent current conditions in study areas where no remedial actions have been conducted. However, the study areas potentially are affected by contaminated groundwater plumes passing through and/or entering the riparian environment. These results are used to present a baseline ecological risk assessment of the River Corridor riparian zone.

The riparian ecological risk assessment evaluated risks to a comprehensive array of assessment endpoints using multiple measures of exposure, effect, and ecosystem/receptor characteristics. The following are the representative riparian receptors evaluated in the ecological risk assessment:

- Lower trophic level:
  - Plants and soil invertebrates
- Middle trophic level:
  - Herbivores: pocket mouse and California quail
  - Omnivores: deer mouse and meadowlark
  - Invertivores: grasshopper mouse, eastern kingbird, and western kingbird
- Upper trophic level:
  - Insectivores: bank swallow and myotis bat
  - Invertivores: great blue heron
  - Carnivores: mink

Current information is considered sufficient and no additional work plan activities are proposed.

4.4.2.5 Upland Zone

Media and biota sample data collected from study areas associated with 20 remediated waste sites in the upland environment of the River Corridor and 10 reference area locations (throughout the Hanford Site) were evaluated for Hanford Site contaminants of potential ecological concern. Three of these 20 remediated waste sites and one of the reference sites are located within the 300 Area. These data represent residual conditions for a variety of representative waste sites where remedial actions have been completed. These results are used to present an ecological risk assessment of residual conditions on remediated waste sites in the River Corridor upland zone.

The upland ecological risk assessment evaluated risks to a comprehensive array of assessment endpoints using multiple measures of exposure, effect, and ecosystem/receptor characteristics. The following are the representative terrestrial upland receptors evaluated in the ecological risk assessment:

- Lower trophic level:
  - Plants and soil invertebrates
- Middle trophic level:
  - Herbivores: pocket mouse and California quail
  - Omnivores: deer mouse and meadowlark
  - Invertivores: grasshopper mouse and killdeer

- Upper trophic level:
  - Omnivores: badger and red-tailed hawk

Two general types of remediated waste sites were evaluated in the upland environment. Some sites required significant excavation and soil removal, while other sites (referred to as "native soil sites"), generally required less physical disturbance of soil and the associated ecological communities. The absence of RAGs for protection of ecological receptors in DOE/RL-2001-47 created the need to conduct the ecological risk assessment to support final remedy decisions. A primary goal of the ecological risk assessment was to determine if the RAGs developed for protection of human health are adequately protective of terrestrial receptors.

4.4.2.6 Groundwater

Washington State regulations and federal EPA guidance indicate that groundwater always should be evaluated for the "highest beneficial use," i.e., drinking water, unless the aquifer is non-potable because of reasons other than contamination, such as high natural total dissolved solids or the water yield is insufficient for pumping (WAC 173-340). In addition to evaluating the highest beneficial use, groundwater plume movement must be evaluated to assess whether there will be impacts on surface water. If impacts are occurring or might reasonably be expected to occur in the future, then human exposures to surface water and groundwater must be evaluated.

Groundwater beneath portions of the River Corridor currently is contaminated and is not withdrawn for beneficial uses. Under current site use conditions, no complete human exposure pathways to groundwater are assumed to exist. Further, regardless of land use designations for soils, contaminated groundwater beneath waste sites is not anticipated to become a future source of drinking water until cleanup criteria are met. However, to evaluate highest beneficial use, groundwater in the HHRA was evaluated for domestic use and for use in irrigation (i.e., home garden and livestock).

Human health risks associated with each groundwater OU were calculated for the following exposure scenarios:

- Rural resident
- Resident National Monument/refuge worker
- Tribal scenarios based on traditional lifeways

4.4.3 RI for Hanford Site Releases to the Columbia River

A work plan has been implemented to assess potential site release impacts to the Columbia River (DOE/RL-2008-11). To evaluate the impacts from Hanford Site releases, contributions of non-Hanford Site influences to the Columbia River upstream, within, and downstream of the Hanford Site also need to be understood.

The field investigation activities, including sample collection, were initiated in October 2008 and are anticipated to continue throughout much of 2009. Samples will be collected for river water, groundwater upwelling in the river, shoreline and river channel sediment, island soil, groundwater, and fish. Following completion of the field investigation and receipt of the analytical data, risk to ecological receptors and humans will be estimated, and a determination will be made regarding the need for additional investigation and data collection.

When completed, the Columbia River RI/FS will:

- Characterize the nature and extent of Hanford Site-related contaminants that have come to be located within the Columbia River
- Assess the current risk to ecological and human health receptors that is posed by those Hanford Site-related contaminants
- Determine the need to perform remedial action associated with Hanford Site contaminants that have come to be located in the Columbia River

Risk managers will evaluate the conclusions of the river RI and risk assessment along with the results of the integrated source and groundwater RIs and risk assessment to make the appropriate remedial action decisions. If Hanford Site contamination that requires remedial action is identified in the river, and it is associated with a current groundwater or soil contamination source, a cleanup decision that offers protection for the river may be included with the final ROD for the River Corridor. If Hanford Site contamination that requires remedial action is identified in the river beyond the River Corridor boundary and it is associated with a past release, a separate remedial decision for the river may be developed.

Any human, wildlife, or plant risk uncertainties regarding Hanford Site contaminant releases to the Columbia River will be addressed through the investigation of Hanford Site releases to the Columbia River. This work will determine what contaminants are present, how concentrated they are, where they are located, and what (if any) undesirable health effects they may have on people, fish, wildlife, and plants that use or live in the river. This study began in fall 2008 and continued into fall 2009. The risk assessment activities performed as part of this study will become a component of the RCBRA.

4.4.4 Additional Evaluation and Assessment Activities

A number of uncertainties are associated with the RCBRA. The purpose of this section is to summarize a subset of the uncertainties for which additional activities will be conducted in the RI/FS to support development of final remedial action decisions.

4.4.4.1 Uncertainties Associated with the HHRA

To ensure overall protectiveness of human health, rural residential PRGs and industrial PRGs may need to be revised for evaluating remedial alternatives. The rural residential scenario evaluated in the HHRA is considered more protective because it uses a set of exposure assumptions based on current guidance and includes additional exposure pathways when compared with the exposure assumptions and exposure pathways used to develop interim remedial action goals in DOE/RL-2001-47. These differences in exposure pathways and exposure assumptions create a need to develop a final set of rural residential PRGs that are consistent with current regulations and guidance. The following activities identified address uncertainties for the RI/FS associated with developing rural residential exposure.

- Define the appropriate exposure pathways and exposure assumptions for assessing risk from a rural residential use.
- Determine the role of the rural residential exposure scenario in remedy evaluation. DOE is committed to establishing final cleanup levels at least as protective as those levels identified in interim actions. The current HHRA rural residential exposure scenario and other exposure scenarios will be considered during development of cleanup levels for the final RODs in the 300 Area.

- Perform a systematic comparison of the exposure assumptions and exposure pathways used in the HHRA and DOE/RL-2001-47 to determine the significance of the differences between the two scenarios.

Uncertainties associated with the groundwater risk assessment in the HHRA are related to the ability of the existing data set to represent current baseline conditions. Analytical data used for the HHRA are obtained from several groundwater monitoring programs, including the *Atomic Energy Act of 1954* surveillance program, the RCRA compliance program, and the CERCLA program. Sampling and analysis data from these programs comprehensively define the suite of contaminants associated with existing and potential groundwater contamination sources. However, differences in sampling frequencies (monthly, annually, or tri-annually), differences in analytes analyzed at each monitoring well (radiological and chemical), and differences in method detection limits create uncertainties associated with the spatial, chemical, and temporal representative qualities of the data set used for the risk assessment.

Activities that would help reduce uncertainties, verify conclusions of the HHRA, and ensure that no contaminants were inadvertently overlooked based on use of the existing data set include the following:

- Identify existing and/or install new monitoring wells that are spatially representative of the groundwater. This set of monitoring wells will represent locations where a receptor potentially could contact groundwater.
- Conduct multiple rounds of sampling to obtain temporal representation of the unconfined aquifer from influence of river stage. Additional rounds of sampling at spatially representative monitoring wells will represent current groundwater conditions and capture the influence of river fluctuations on COPC concentrations.
- Analyze all spatially representative monitoring wells for a focused list of groundwater COPCs identified for each round of sampling. Analyzing each of the monitoring wells for COPCs will provide a data set that is representative of potential releases to the groundwater.
- Evaluate sample results from characterization activities to support final remedial action decisions for groundwater.

4.4.4.2 Uncertainties Associated with the Ecological Risk Assessment

The following activities identified in the RCBRA will be conducted to address uncertainties for the RI/FS associated with the protection of ecological receptors.

- Determine if surface soil collected from the top 15.2 cm (6 in.) of the waste site perimeter are adequately representative of ecological exposure conditions from residual contamination on the side wall and floor of remediated waste sites. Table 3-4 lists Data Need 6 (300 Area), Data Need 23 (400 Area), and Data Need 25 (600 Area).
- Determine if additional waste site soil samples and bluegrass bioassay data may be useful to address specific uncertainties concerning lead in soil.

If new uncertainties are identified through the approval process of the RCBRA they will be addressed as emerging information as described in Section 5.1. Draft B of the RCBRA is expected to be released to stakeholders in spring 2010, so conclusions will be made available at that time. Implications of the RCBRA conclusions (i.e. data gaps and resulting data needs) will be addressed either as part of the RI data collection process (through SAP revisions) or outside the RI process as project or special tasks. Regardless, the data and information will be covered in the RI/FS report.

4.5 Development of Vadose Zone Soil and Groundwater COPCs for Operable Units

A process has been developed to identify vadose zone soil COPCs for addressing uncertainties associated with the nature and extent of contamination in the vadose zone. Similarly, a process has been developed to identify groundwater COPCs using existing groundwater data obtained from the monitoring programs conducted at the Hanford Site. Table 4-2 shows the similarities between the processes. The processes described in the following sections provide the approach that will be used to select vadose zone soil and groundwater COPCs. The outcomes of these processes are shown in Tables 4-3 through 4-5, and will be documented in the SAP.

Table 4-2. Similarities of Steps for COPCs Identification

Methodology Step	Vadose Zone Soil COPC Identification	Groundwater COPC Identification
1	Prepare Initial Unit Analyte List	Prepare Groundwater Data Set
2	Develop COPC List	Identify Groundwater COPCs
3	Develop Location-Specific COPC List	Compare Groundwater COPCs to Analyte List
4	Agency Review of Locations and Location-Specific COPC List	Agency Review of Monitoring Wells and Groundwater COPCs

Table 4-3. 300 Area Soil/Aquifer Sediment COPCs

Radionuclides	Nonradionuclides	
Americium-241	1,1,1-Trichlorethane	Fluoride
Carbon-14	1,2-Dichloroethene (total)	Hexachlorobutadiene
Cesium-137	Antimony	Hexachloroethane
Cobalt-60	Aroclor-1016 (PCB)	Hexavalent Chromium
Europium-152	Aroclor-1221 (PCB)	Lead
Europium-154	Aroclor-1232 (PCB)	Lithium
Europium-155	Aroclor-1242 (PCB)	Manganese
Iodine-129	Aroclor-1248 (PCB)	Mercury
Nickel-63	Aroclor-1254 (PCB)	Methyl ethyl ketone
Plutonium-238	Aroclor-1260 (PCB)	Methyl isobutyl ketone (hexone)
Plutonium-239/240	Arsenic	Nickel
Plutonium-241	Asbestos	Nitrate
Strontium-90	Barium	Nitrite
Technetium-99	Benzene	Normal paraffin hydrocarbon (kerosene)
Tritium	Benzo(a)pyrene	Phenanthrene
Uranium-233/234	Beryllium	Selenium

Table 4-3. 300 Area Soil/Aquifer Sediment COPCs

Radionuclides	Nonradionuclides	
Uranium-235	Bis(2-ethylhexyl)phthalate	Silver
Uranium-238	Bismuth	Sodium (metal)
	Butylbenzylphthalate	Strontium
	Cadmium	Sulfate
	Carbon tetrachloride	Tetrachloroethene
	Chloride	Thallium
	Chloroform	Tin
	Chromium (total)	Toluene
	Chrysene	Total petroleum hydrocarbons
	cis-1,2-Dichloroethylene	Tributyl phosphate
	Cobalt	Trichloroethene
	Copper	Uranium (total)
	Cyanide	Vanadium
	Ethyl acetate	Vinyl chloride
	Ethylene glycol	Xylene
		Zinc

Table 4-4. 300 Area Groundwater COPCs

Radionuclides	Nonradionuclides	
Strontium-90	1,2-Dichloroethene (total)	Mercury
Tritium	Antimony	Nickel
	Arsenic	Nitrate (as N)
	Cadmium	Nitrite (as N)
	Carbon tetrachloride	Selenium
	Chloroform	Silver
	Chromium	Sulfate
	cis-1,2-Dichloroethene	Tetrachloroethene
	Cobalt	Thallium
	Copper	Trichloroethene
	Cyanide	Uranium
	Fluoride	Vinyl Chloride
	Lead	Zinc
	Manganese	

Table 4-5. 600 Area Groundwater COPCs

Radionuclides	Nonradionuclides	
Iodine-129	Antimony	Nitrate (as N)
Strontium-90	Arsenic	Nitrite (as N)
Tritium	Cadmium	Sulfate
	Carbon tetrachloride	Tetrachloroethene
	Chromium	Tributyl phosphate
	Copper	Trichloroethene
	Fluoride	Uranium
	Lead	Vinyl Chloride
	Manganese	Zinc
	Nickel	

4.5.1 Methodology for Development of the Vadose Zone Soil Target Analyte List

The approach for development of vadose zone soil COPCs is a multi-step process. The first steps develop an analyte list for each operable unit. The third step is to develop location specific (e.g., waste site) lists where additional characterization is proposed.

4.5.1.1 Step 1 – Prepare Initial COPC List

Characterization data for vadose zone soils are not available for addressing uncertainties associated with the nature and extent of contamination in the vadose zone. Therefore, remediation and characterization information (historic and current) are identified and reviewed to develop an initial list of analytes to represent potential contamination in the vadose zone. The following types of reference documents and information sources are evaluated:

- Focused FSs, LFI reports
- Interim action RODs
- Cleanup verification documents (CVPs, remaining sites verification processes)
- Technical baseline reports
- Dangerous waste permit applications
- Databases containing analytical data resulting from these activities (i.e., characterization, remediation, waste management information)
- Other pertinent documents

4.5.1.2 Step 2 – Prepare Unit Analyte List

After the initial analyte list is compiled, the information undergoes additional review steps to remove analytes using generally accepted exclusion criteria, conduct a comparison of the soil COPC list to the groundwater COPC list, and identify the appropriate analytical methods and detection limits for the list.

At the conclusion of this step, the COPC list is established. It is comprehensive, and includes analytes with the potential to be present in the vadose zone and are important for waste site remediation. The following steps are taken to prepare this COPC list:

- Apply the following generally accepted exclusion criteria to the initial set of COPCs:
  - Radionuclides with half-lives less than 3 years (and no significant "daughters")
  - Naturally occurring radionuclides associated with background radiation (e.g., K-40, Th-230, Th-232, and radium-226 [Ra-226])
  - Essential nutrients (minerals)
  - Analytes that have no toxicity values (based on the hierarchy of toxicity values recommended by Cook, 2003, "Human Health Toxicity Values in Superfund Risk Assessments"
- Compare the COPCS for vadose zone soil with the groundwater COPC list. Groundwater COPCs not found on the analyte list are further evaluated to determine if there is a valid basis for their inclusion.
- Identify appropriate analytical methods for each analyte on the list. Determine if the detection limits for each analyte can achieve the RAGs for direct exposure, groundwater protection, and Columbia River protection.

4.5.1.3 Step 3 – Develop Location-Specific COPCs

The COPC list represents all potential analytes that could be present in the vadose zone for an operable unit. Location-specific analytes will be identified from the list using the following approach:

- Identify the COCs for the specific waste sites where characterization is proposed from the applicable interim action ROD (which reflects information from LFIs and technical baseline reports) and from the available interim closure cleanup verification documentation (CVPs or remaining site verification packages [RSVPs]). If the characterization location is not at a waste site, evaluate information from waste sites in the vicinity (where available). Include these analytes on the location-specific COPC list.
- Identify the COPCs for the specific waste site locations from the verification documentation (CVPs or remaining sites verification processes). If the characterization location is not at a waste site, evaluate information from waste sites in the vicinity (where available). Include these analytes on the location-specific list.
- Evaluate local groundwater monitoring well data (wells located within waste site "zones of influence"). Determine if groundwater COPCs have been analyzed for in these local wells:
  - If the groundwater COPCs have been analyzed for and have been detected, then these analytes will be included on the location-specific COPC list.
  - If the groundwater COPCs have not been analyzed for, then an additional evaluation will be performed to determine if there is a data need. If there is a data need, these COPCs will be included on the waste site-specific list.

4.5.1.4 Step 4 – Agency Review of Locations and Location-Specific COPC Lists

Following development of the location-specific analyte list pursuant to steps 1 through 3 above, the agencies will review the locations and specific COPC lists to determine whether adjustments/ modifications are required to address information needs for the area. This review is intended to provide an opportunity to address any information requirements not identified in steps 1 through 3. When additional information needs are identified, the agencies will modify the locations for additional characterization or the location-specific COPC lists to reflect the additions/modifications determined to be needed on an area basis.

4.5.2 Methodology for Identifying Groundwater COPCs

The following process will be used to select COPCs. This process will identify groundwater COPCs that will be carried forward and evaluated for nature and extent characterization and future risk assessment activities. The steps used in the COPC selection process are as described below. A COPC is a constituent chemical(s) that is potentially site-related and its data are of sufficient quality for use in a quantitative risk assessment. The steps used in the groundwater COPC selection process are described below.

4.5.2.1 Step 1 – Prepare Groundwater Data Set

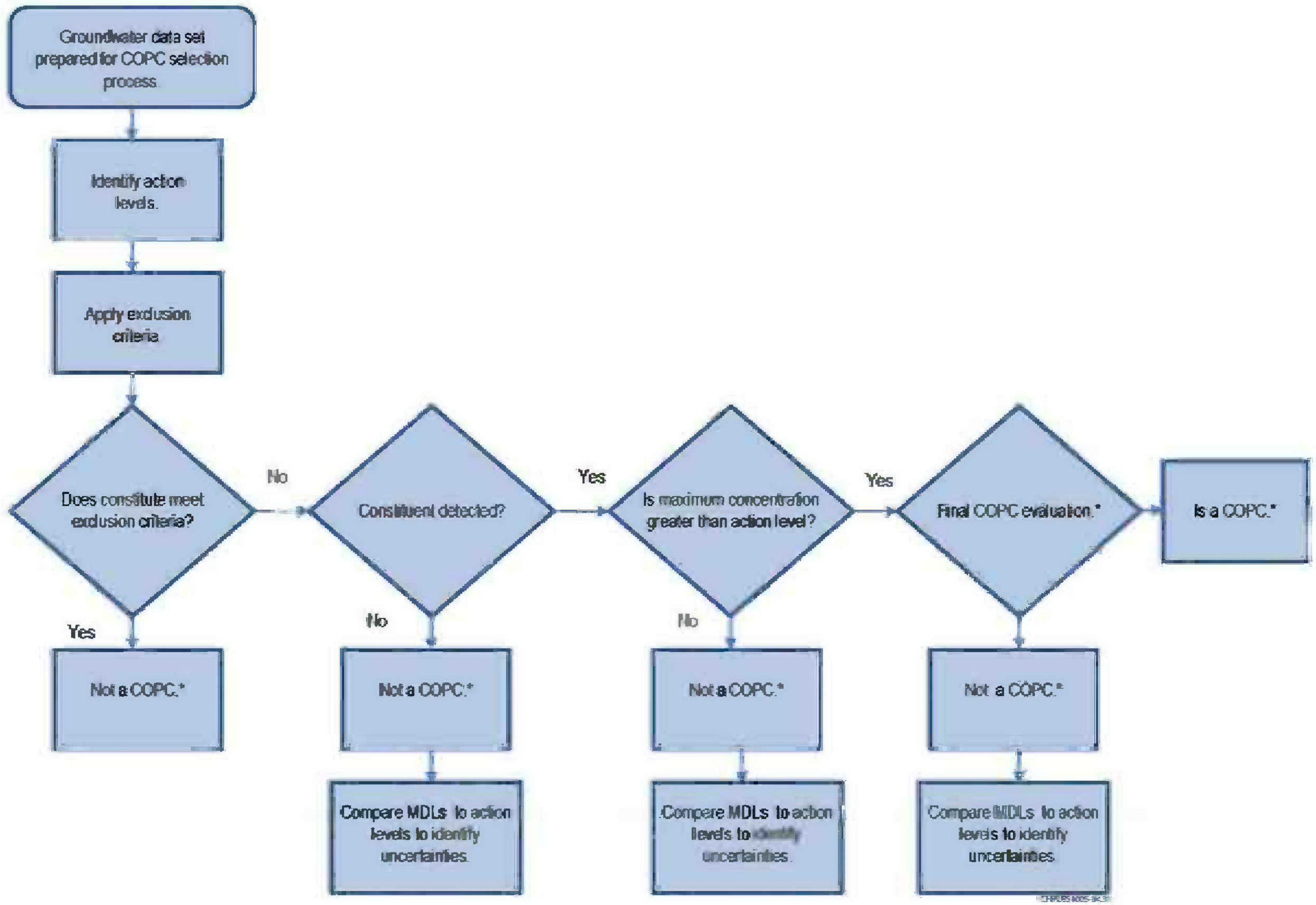
A groundwater data set will be prepared for the purpose of identifying groundwater COPCs. Analytical data will be obtained from the Hanford Environmental Information System database for all monitoring and compliance wells identified within the area. The analytical data set will represent groundwater samples collected from these wells between 1992 and the present (approximately 18 years). This timeframe was selected because it captures analytical data collected during the LFIs, which were used to prepare the QRA for each groundwater OU. The analytical data from each will be processed using the steps described below before COPC selection to identify one set of results per sampling location and time of collection:

- Select only unfiltered analytical results as these data represent total concentrations of the analyte. Use of filtered sampling results may underestimate chemical and radiological concentrations in water from an unfiltered tap and are not used for the COPC selection process.
- Eliminate analytical results that are rejected and flagged with an "R" qualifier.
- Identify the method that provides the most reliable results when an analyte is reported by more than one analytical method.
- Resolve parent, field duplicate, and field split samples into one set of results per location and collection time.

4.5.2.2 Step 2 – Identify Groundwater COPCs

After the groundwater data set has been prepared, the following steps are taken to identify groundwater COPCs. Figure 4-3 shows a flowchart presenting the COPC selection process.

Identify Action Levels. Action levels are derived from readily available sources of chemical-specific ARARs or risk-based PRGs using EPA health criteria and default exposure assumptions. The most protective of chemical-specific ARARs for groundwater are identified as the "action level" for each groundwater COPC.



* Review vadose zone soil target analytes to determine if groundwater COPC should be added.

Figure 4-3. COPC Selection – A Multi-Step Process

A summary of the sources of available chemical-specific ARARs and PRGs is provided below:

- ARAR-based remediation goals are presented and discussed in Section 4.3 of this document.
- Risk-based PRGs: The risk-based concentration table for residential tap water is used as the source of PRGs. These values are obtained from the "Regional Screening Levels for Chemicals Contaminants at Superfund Sites" (EPA, 2010). The PRGs for chemicals with carcinogenic effects correspond to a 10^{-6} incremental risk of an individual developing cancer over a lifetime because of exposure to the potential carcinogen from all significant exposure pathways for a given medium. The PRGs for chemicals with non-cancer effects correspond to a hazard index of 1, which is the level of exposure to a chemical from all significant exposure pathways in a given medium below which it is unlikely for even sensitive populations to experience adverse health effects. The direct contact exposure pathway for groundwater considers exposure from ingestion, inhalation of vapors, and dermal contact.

Apply Exclusion Criteria. Analytes that meet the exclusion criteria will be eliminated as a COPC. Analytes that do not meet the exclusion criteria will be carried to the next step. The exclusion criteria are as follows:

- Naturally occurring radionuclides associated with background radiation (including K-40, Ra-226, Ra-228, Th-228, and Th-232) will be eliminated as COPCs.
- Radionuclides with a half-life of 3 years will be eliminated as COPCs. A half-life can be selected to eliminate those radionuclides that have decayed to insignificance since the reactors have ceased operation. A half-life of 3 years has been selected as the cut-off value because only a small fraction of activity remains after 3 years of decay. Radionuclides with short half-lives can include Sb-125, Be-7, Cs-134, Cm-242, Ra-224, Ru-106, and Th-228.
- Essential nutrients are those chemicals considered essential for human nutrition. Recommended daily allowances are developed for essential nutrients to estimate safe and adequate daily dietary intakes (NAS, 1989, *Recommended Dietary Allowances*). The following metals are considered essential nutrients: calcium, magnesium, potassium, iron, zinc, manganese, and sodium.
- Water quality parameters that do not have available toxicological information will be eliminated as COPCs. Groundwater samples are frequently analyzed for water quality parameters and used for purposes other than risk assessment.
- Analytes without toxicity information will be eliminated as a COPC.

The potential impacts to understating overall cumulative effects by eliminating analytes without an action level will be evaluated as an uncertainty. Activities will be conducted to understand potential uncertainties, including determining if the analyte has been associated with a release associated with a historical operation process or if a structurally similar analyte can be identified to evaluate its relative toxicity.

Identify Nondetected Analytes. Analytes that are not detected in any of the samples will be eliminated as groundwater COPCs. All constituents that are detected at least once will be carried to the next step. The reporting limits and detection limits for all analytical constituents (whether detected or not) in groundwater will be compared to the action levels. The potential impacts to the risk estimates of eliminating nondetected constituents as COPCs that have detection limits that exceed action levels will be discussed in an uncertainty assessment of this groundwater COPC selection process. Activities that will be conducted to understand the uncertainties include determining if the analyte has been associated with any historical operation processes, associated with a potential release, or associated as a potential degradation produce and if method detection limits can be achieved at concentrations less than or equal to the action level.

Identify Analytes with Maximum Detected Concentrations Less than Action Levels. Maximum concentrations of analytes that are less than their action level are not identified as COPCs. An uncertainty analysis will be conducted for analytes with maximum concentrations slightly less than their action level (i.e., less than 10 times the action level or one order of magnitude). The purpose of this evaluation is to determine if there is the potential for underestimating cumulative effects when concentrations of analytes are near but do not exceed the action level. Additionally, method detection limits for these analytes are used to determine if they are adequate for confirming their presence or absence at the action level.

Identify Analytes with Maximum Detected Concentrations Greater than Action Levels. Maximum concentrations of analytes detected in groundwater are compared to action levels to identify analytes that are likely to contribute to overall risk. Steps are taken to identify when an analyte is infrequently detected to determine if the results are reproducible or associated with localized contamination. Additionally, method detection limits will be evaluated to determine if they are adequate for determining their presence or absence at the action level. If the results of this comparison show that the presence of an analyte is reproducible, then the analyte is identified as a groundwater COPC.

4.5.2.3 Step 3 – Compare Groundwater COPCs to Master Target Analyte List

This step of the process is used to confirm that the target analytes identified for vadose zone soils are appropriately considered for groundwater. The target analytes identified for vadose zone soil are developed based on the review of available remediation and characterization reference documents. Based on the transport mechanism associated with the target analyte, it is a reasonable assumption that not all target analytes identified for vadose zone soil will be COPCs for groundwater. If a COPC is identified in groundwater that has not been identified as a target analyte for vadose zone soil, then it will be considered in accordance with the methodology described in step 2 of Section 4.5.1.

4.5.2.4 Step 4 – Agency Review of Monitoring Well Locations and Groundwater COPCs

Following development of the groundwater COPC list pursuant to steps 1 through 3 above, the agencies, DOE and EPA, will review the monitoring wells and the groundwater COPC list to determine whether adjustments/modifications are required to address information needs for the area. This review is intended to provide an opportunity to address any information requirements not identified in steps 1 through 3. When additional information needs are identified, the agencies will modify the locations for additional characterization or the groundwater COPC list to reflect the additions/modifications determined to be needed on an area basis.

4.6 Preliminary Remedial Actions

Technologies have been developed, evaluated, and implemented for final and interim remedial actions in the 300 Area over the past 15 years for vadose zone soils and groundwater contamination. Understanding what the possible solutions might be for the remediation within the area will assist in gathering the necessary data to assist in the final remediation decision. Supplemental data will be needed to determine the vertical and lateral extent of contamination in the soil and the groundwater so that a range of remedial alternatives, including ex situ treatment, in situ treatment, or other alternatives, can be evaluated as appropriate. In accordance with applicable CERCLA guidance (EPA/540/G-89/004), a comparative analysis of the alternatives will be conducted in the FS. The comparative analysis will facilitate the relative performance of each alternative in terms of the CERCLA evaluation criteria.

4.6.1 Remedial Action Process for Vadose Zone Source Sites

The selected remedy is the RTD cleanup approach for waste sites contained in the 300-FF-1 and 300-FF-2 OUs. Remediation of designated waste sites involves excavation of clean and contaminated soils, debris, and anomalous waste present within the sites' boundaries. For some sites, remediation involves an intermediate step in which the need for removal of contaminated soil is established through confirmatory sampling. Excavated materials are characterized as they are removed from the waste site footprint and are designated for transport to the ERDF, a clean material storage area, or a soil treatment storage area.

Once a need to take action is established, remediation does not stop at a pre-determined depth but proceeds until it can be demonstrated through a combination of field screening, in-process sampling, and verification sampling that cleanup objectives for direct exposure, groundwater protection, and river protection have been achieved.

The objectives for direct exposure, groundwater protection, and river protection apply to the upper part of the soil column (the top 4.6 m [15 ft] of soil below the surrounding grade). The objectives for protection of groundwater and the Columbia River must be met through the entire soil column from the surface to groundwater. Because the cleanup objectives are not the same for direct exposure and groundwater/river protection, the final depth of remediation often will be close, but not limited, to 4.6 m (15 ft) below the surrounding grade. The exposure factors and assumptions defining the exposure scenarios for the waste sites in the 300 Area are defined in DOE/RL-96-70 and DOE/RL-2001-47.

During remediation, soil and debris characterization and analysis are based on the observational approach. This approach relies on recorded information from historical process operations, including effluent discharges and waste-disposal records and information from LFI documents on the nature and extent of existing contamination. This information is combined with waste site specific information gathered pursuant to the "characterize and remediate in one step" methodology stipulated in the interim action RODs.

During excavation, in-process samples are often collected, and soils are monitored for both radiological and chemical constituents. For the waste sites known to have received large amounts of radioactive liquid process effluent, gamma emitting radiological constituents are used during remediation activities as the primary "indicator" contaminants to guide the extent and direction (laterally and/or vertically) of excavation for the following reasons:

- Data indicate, in general, that when gamma emitting radionuclide concentrations are less than cleanup criteria, concentrations of nonradiological constituents also are less than cleanup criteria. This is always verified and additional remediation is done as necessary.
- Gamma emitting radionuclide contaminants are readily detected with field instruments at levels specified for cleanup, whereas alpha- and beta-emitting radionuclides and chemical constituents are not readily detected.

At other sites, monitoring methods depend on the anticipated contaminants. If field screening methodologies are not available for the primary or indicator contaminants, in-process samples may be collected for quick-turnaround laboratory analysis to guide excavation until it is demonstrated that cleanup goals have been met.

After initial completion of excavation at each waste site, cleanup verification sampling and analysis are performed to confirm attainment of cleanup criteria for all contaminants.

The primary statistical calculation to support cleanup verification is the 95 percent upper confidence limit on the arithmetic mean of the data. The 95 percent upper confidence limit values for each COC and detected COPC are computed for each area (e.g., for the shallow and deep zones and overburden, as appropriate). Comparisons of quantified COC and COPC results with the RAGs for the waste site are summarized in the CVP/remaining sites verification process documents.

According to direct exposure soil criteria under WAC 173-340, the RAG must be met for soil that is less than 4.6 m (15 ft) bgs. For direct exposure to radionuclide COCs, the site must meet a 15 mrem/yr above background total dose rate (this RAG must be met for 1,000 years). For nonradionuclide COCs, the residual contamination at a site cannot result in a hazard quotient of more than 1.0 for noncarcinogenic contaminants, and excess cancer risk of more than 1×10^{-6} for individual carcinogenic contaminants or a cumulative excess cancer risk of less than 1×10^{-6}. Analytical results for nonradionuclides also must pass the WAC 173-340 three-part test.

Although groundwater is not considered a potential exposure pathway in the QRA that supports the basis for remedial action, groundwater is considered a potential future drinking water source that must be restored to drinking water standards in a reasonable timeframe, as established in EPA/ROD/R10-96/143. The ROD requires that any residual contamination in the vadose zone not cause contamination of groundwater above drinking water standards or cleanup levels in WAC 173-340-720(4), "Method B Cleanup Levels for Potable Ground Water." This requires meeting individual contaminant RAGs in some cases, and meeting 40 CFR 141.66, "Maximum Contaminant Levels for Radionuclides," dose rate standards of 4 mrem/yr total body or organ dose rate for a period of 1,000 years. Drinking water standards must be met for predicted concentrations of non-uranium alpha emitting radionuclides. Finally, if individual verification sample results do not pass the WAC 173-340 three-part test, site-specific RESRAD modeling is used to demonstrate that residual concentrations do not pose an unacceptable threat to groundwater or surface water for 1,000 years. If these evaluations indicate that RAGs have not been achieved, then excavation will resume with appropriate analyses as guidance.

With respect to uranium contamination, the soil cleanup level designated for the protection of groundwater was determined to be 267 pCi/g, based on the determination of desorption or leach distribution coefficient values (PNNL-14022), and RESRAD modeling used to predict the residual uranium soil contamination that will not cause exceedance of the groundwater protection standard of 30 µg/L (BHI-01667). The RESRAD model assumes a generic site with a surface area of 10,000 m^2 (107,639 ft^2), a length of 100 m (328 ft) parallel to groundwater flow, a contaminated soil zone thickness of 4 m (13 ft), and an uncontaminated soil zone thickness of 5.6 m (18.4 ft). The RESRAD model evaluation of groundwater protection is intended to be a simplified, conservative prediction of whether a given waste site with specific residual soil concentrations will be protective of groundwater. During the remedial action process, the 267 pCi/g uranium soil cleanup level is used for screening purposes to guide cleanup decision making, while site specific data are used when verifying compliance with the RAOs specified in the interim action ROD. Additionally, this soil concentration is used to identify material that is "below cleanup levels" and can be used as backfill or left in place within the site boundary.

Implementation of remedial actions results in significant reductions to contaminant inventories and impact to the environment as RAGs and objectives are achieved. Through remedial actions, contaminants that pose a threat to humans or the environment are removed from the waste site and only residual contamination at protective levels remains. The process of removing contaminated material from waste sites changes the nature and extent of waste site contamination.

4.6.2 Preliminary Remedial Actions for Vadose and Groundwater

Based on the final and interim remedial alternatives implemented, and the 2008 work on a remedial strategy for uranium (DOE/RL-2008-36), the remedial technologies and process options used for development of preliminary remedial alternatives are summarized in the following sections and tables.

The 300 Area Groundwater Operable Units contains several contaminants that are likely candidates for active, engineered remedies: uranium and chlorinated VOCs, notably trichloroethene and cis-1,2-dichloroethene. Several other contaminants that exceed drinking water standards in one or more portions of the area are unlikely candidates for active remediation under the current CSMs.

4.6.2.1 Uranium

Uranium is a persistent contaminant beneath the 300 Area and the primary focus of additional RI/FS activities at this time. Uranium-contaminated sediment and resulting plumes in groundwater extend throughout a large portion of the 300 Area. In groundwater, uranium contamination is primarily contained within the upper portion of the unconfined aquifer in saturated Hanford formation sediment (Section 2.6). A comprehensive review of potential remedies for uranium contaminating the groundwater is presented in the DOE report on remediation strategy for uranium (DOE/RL-2008-36). Treatment of uranium contamination in groundwater was extensively discussed in terms of strategies to decrease the rate of release of uranium into groundwater as well as direct removal of various potential repositories of mobile uranium in subsurface regions. At the time of the report, information for selecting a remedy was considered inadequate. This remediation strategy study outlines the need for more information concerning the location and extent of uranium sources and the need for further engineering development of promising but new treatment technology using phosphate induced stabilization. The scope of this work plan will build on earlier evaluations of uranium treatment technologies (PNNL-16761) and the remediation strategy (DOE/RL-2008-36).

The listing of preliminary remedial action technologies for treating uranium (Table 4-3) is inclusive of the two potential targets for remedial action: groundwater within the saturated zone, and sediment in the vadose zone and aquifer. The preliminary screening process of the FS has evaluated the preliminary remedial action technologies according to three evaluation criteria. Refinements can be made as a result of a more fully developed CSM that will result from the characterization activities described in this work plan.

Effective deployment of the remedial actions requires further delineation of the locations of uranium residuals in the subsurface, including the vadose zone. Previous soil removal actions in principal disposal areas, such the South Process Pond, the North Process Pond, and the 300 Area Processes Trenches, have removed large quantities of uranium contamination that could have acted as a continuing source for contaminating groundwater. However, a significant volume of sediment at depths greater than the waste site excavation depths may also pose a threat with regard to continuing to supply uranium to the groundwater plume. As of 2009, limited characterization of the deep vadose zone beneath waste sites has occurred, and even less characterization in areas away from the footprints of waste sites, but where higher historical water table conditions may have caused contamination (Section 3.1). Identifying and evaluating various remedial action alternatives for uranium during the feasibility study process will include contamination in the vadose zone and aquifer, and will consider contaminants associated with sediment and dissolved in water.

Table 4-3. Preliminary Remedial Action Alternatives for Uranium

Alternative	Technology	Media	Maturity	History	Applicability	2008 Ranking
No Action	No Action	All	Presumptive	1995	FS Reference	4
Institutional Controls	Monitored Natural Attenuation	Water	Contingent	2008	Area Wide	3
Ex Situ Treatment	Pump and Treat (hydraulic containment or mass removal)	Water	Presumptive	1995	Focused or Extensive	Rejected
In Situ Treatment	Cut-off Wall (slurry or sheet pile)	Water	Mature	1995	Selective or Parallel to River	Rejected
	In Situ Leach with Recovery	Sediment	Mature	1995	Focused	Rejected
	In Situ Redox Manipulation	Sediment	Developmental	2008	Focused	Rejected
	Stabilization with Phosphate (polyphosphate)	Water	Developmental	2008	Focused or Extensive	2
	Stabilization with Phosphate (citrate-phosphate)	Water	Developmental	2008	Focused	Rejected
	Stabilization with Phosphate (polyphosphate)	Sediment	Developmental	2008	Focused or Extensive	1
Removal	Excavation and Disposal	Sediment	Mature	1995	Focused	4
	Excavation and Disposal	Sediment	Mature	1995	Extensive	Rejected

4.6.2.2 VOCs

Volatile organic compounds have persisted in the upper aquifer of the 300 Area since the end of disposal operations from historic site operations. In addition, sources to the southwest of the 300 Area have contributed to the observed presence of VOCs via migration with regional groundwater flows. Volatile organic compounds in groundwater beneath the 300 Area are frequently detected but at concentrations generally below drinking water standards. The sources of the dissolved VOC concentrations have not been clearly identified. A 2007 investigation did discover elevated concentrations of VOCs in an interval of finer grained Ringold Formation sediment (PNNL-17666).

The observed VOCs include cis-1,2-dichloroethene, trichloroethene, and tetrachloroethene. Trichloroethene is the most widespread of the observed VOCs. The drinking water standard for trichloroethene is 5 µg/L. Under anaerobic conditions, in the presence of specific bacteria consortia, with available substrate or electron donor, tetrachloroethene and trichloroethene may be reductively degraded to form dichloroethene isomers vinyl chloride and finally ethane. Tetrachloroethene is observed at a few scattered wells and near former waste disposal areas such as the 300 Area Process Trenches.

Cis-1,2-dichloroethene is elevated above the 70 µg/L drinking water standard at one well near the North Process Pond, and the source is presumed to be degradation of trichloroethene and/or tetrachloroethene disposed to the Pond, or possibly to the 300 Area Process Trenches.

The undissolved phases of VOCs are immiscible in water and denser than water. Consequently, large quantities of VOC chemicals sink to a confining layer when released to the subsurface and form a dense, nonaqueous phase liquid that provides a persistent, secondary source of long-term groundwater contamination. To date, observed concentrations of dissolved VOCs are not high enough to suspect the presence of dense, nonaqueous phase liquids in the aquifer beneath the 300 Area.

Remedial actions for VOCs are configured according to the hydrogeologic conditions of the aquifer, the extent of dissolved contamination, the location and nature of contaminant sources, the depth of contamination, and the redox conditions. Table 4-4 lists preliminary actions that could be applied to remediate VOCs in the 300 Area.

Table 4-4. Preliminary Remedial Action Alternatives for VOCs

Alternative	Technology	Mode	Maturity	Targeted Depth	Applicability
No Action	No Action	Passive	Presumptive	N/A	FS reference
Institutional Controls	Monitored Natural Attenuation	Passive	Contingent	Entire extent	Operable unit wide
Ex Situ Treatment	Pump and Treat (hydraulic containment or mass removal)	Physical	Presumptive	Extract in or closest to zone to fine grain source sediments	Focused or extensive
In Situ Treatment	Bioremediation	Biological	Innovative	Within source zone	Focused
	Flushing Technologies (cosolvent/alcohol/surfactant)	Chemical with physical removal	Innovative	Within source zone	Focused, dense nonaqueous phase liquid
	In Situ Chemical Oxidation	Chemical	Developmental	Within source zone	Focused
	In Situ Reduction	Chemical	Innovative	Within source zone	Focused
	Permeable Reactive Barrier	Chemical	Innovative	Perimeter of source areas	Focused
	Phytoremediation	Biological	Developmental	Spring areas along river	Focused
	Thermal Processes (electrical resistance heating)	Physical	Innovative	Source areas	Focused
	Volatilization	Physical	Mature	Source areas	Focused

4.6.2.3 H-3

Tritium is the contaminant of greatest significance in the 600 Area subregion of the 300 Area. The H-3 originates from two sources: (1) A widespread H-3 plume originates from sources in the 200 East Area and is investigated under DOE/RL-2007-31, and (2) a second source is associated with the 300-FF-2 OU and is responsible for a more concentrated H-3 plume near the Energy Northwest complex (Section 2.6).

Tritium is not dissolved in groundwater like other typical contaminants. Rather, H-3 substitutes for regular hydrogen as an atom of the water molecule. Consequently, most physical, chemical, and biological processes are ineffectual in treating "tritiated" water. One physical process, membrane separation using reverse osmosis technology, can remove tritiated water from groundwater in an ex situ process. The half-life of H-3 is 12.32 years. Consequently, natural attenuation in conjunction with source removal can provide significant reduction of H-3 contamination. Another potential approach is freezing the contaminated groundwater in place for a sufficient period to allow significant H-3 decay. Table 4-5 lists preliminary actions that could be applied to remediate H-3 in the 300 Area.

Table 4-5. Preliminary Remedial Action Alternatives for H-3

Alternative	Technology	Mode	Maturity	Targeted Depth	Applicability
No Action	No action	Passive	Presumptive	N/A	FS reference
Institutional Controls	Monitored natural attenuation	Passive	Contingent	Entire extent	Area wide
Removal	Excavation and disposal	Physical	Mature	Burial grounds	Focused
Ex Situ Treatment	Pump and treat with reverse osmosis (hydraulic containment or mass removal)	Physical	Presumptive	Extract in or closest to source areas	Focused or extensive
In Situ Treatment	Frozen subsurface barrier	Physical	Innovative	Barrier near or around source areas	Focused

4.6.2.4 Nitrate

Nitrate concentrations in groundwater ranging from 18 mg/L to more than 200 mg/L have been observed in groundwater at wells associated with the 300 Area Operable Units (the drinking water standard is 45 mg/L). The highest concentrations appear to be emanating from sources southwest of the 300 Area and may be associated with fertilizer application in cultivated fields or possible releases from industrial facilities. Focused sources of nitrate appear to be associated with the 618-11 and 618-10 Burial Grounds in the northwest region of the 300 Area where localized nitrate plumes appear to exceed the regional nitrate plume that originates in the 200 East Area. The observed nitrate levels have been generally constant over the past 15 years.

Remediation of nitrate in groundwater traditionally is affected by source removal. At the 300 Area, such active measures may be difficult to apply because of the apparently diffuse, offsite location of the sources of nitrate contamination. Focused removal actions in the 618-11 and 618-10 Burial Grounds may be locally appropriate. However, the offsite sources contributing to the elevated nitrate plume in the southern area may require regional land use controls beyond the scope of this CERCLA work plan. Technologies and practices applicable for nitrate contamination of groundwater are listed in Table 4-6.

Table 4-6. Preliminary Remedial Action Alternatives for Nitrate

Alternative	Technology	Mode	Maturity	Targeted Region	Applicability
No Action	No action	Passive	Presumptive	N/A	FS reference
Institutional Controls	Monitored natural attenuation	Passive	Contingent	Entire extent	Operable unit wide
	Institutional controls (land use restrictions)	Fertilizer Management	Mature	Offsite farming	Extensive
Removal	Excavation and disposal	Physical	Mature	Burial Grounds	Focused
Ex Situ Treatment	Pump and treat with ion exchange (hydraulic containment or mass removal)	Physical	Presumptive	Extract in or closest to source areas	Focused or extensive
	Pump and treat with reverse osmosis	Physical	Mature	Extract in or closest to source areas	Focused or extensive
	Pump and treat with biological treatment (hydraulic containment or mass removal)	Biological	Mature	Extract in or closest to source areas	Focused or extensive
In Situ Treatment	Permeable reactive barrier (mulch or straw)	Biological	Innovative	Near source areas	Focused
	Permeable reactive barrier (anaerobic substrates)	Biological	Innovative	Near source areas	Focused
	In Situ anaerobic bioremediation	Biological	Innovative	Near source areas	Focused

4.7 NEPA Values

Under DOE O 451.1B, *National Environmental Policy Act Compliance Program*, Section 5.a.(13), DOE will "…incorporate NEPA values, such as analysis of cumulative, off-site, ecological, and socioeconomic impacts, to the extent practicable, in DOE documents prepared under the Comprehensive Environmental Response, Compensation, and Liability Act." These NEPA values include, but are not limited to, cumulative, ecological, cultural, historical, and socioeconomic impacts, and irreversible and irretrievable commitments of resources.

For the 300 Area, the NEPA value analyses will be documented in conjunction with the CERCLA criteria in (1) each FS, and (2) in the resulting CERCLA ROD. The aforementioned NEPA values will be based on consideration of detailed information presented in the FS for the 300 Area CERCLA Evaluation Criteria, specific site characteristics, COPCs, and the evaluation of the remedial action alternatives. A "sliding scale" of analysis of the NEPA values for the 300 Area Operable Units (using DOE, 2004, *Recommendations for the Preparation of Environmental Assessments and Environmental Impact Statements*) will be applied, in conjunction with consideration of the CERCLA ARARs (to be detailed in the 300 Area FS). The principal impacts and resource areas of concern associated with the NEPA values are expected to include, but not be limited to, solid and liquid radioactive and hazardous waste management, air emissions, potential adverse effects to historic and cultural resources, ecological resources, socioeconomics (including environmental justice concerns), and transportation. The following is a general discussion of NEPA values anticipated to be addressed for the 300 Area, with the analysis to be provided in the FS.

In general, when soils at a site are found to be contaminated with hazardous substances in concentrations presenting a material threat to human health and the environment, it would be expected that the threat would be mitigated by meeting the applicable ARAR standards as well as following current DOE policy and guidance. The net anticipated effect could be a positive contribution to cumulative environmental effects at the Hanford Site through RTD of such hazardous substances and COCs into a facility that has been designed and legally authorized to safely contain such contaminants. DOE expects that the primary facility to receive contaminated soils will be the ERDF.[17]

Any airborne releases of radiological contaminants that could occur during these removal actions would be controlled in accordance with DOE radiation control and DOH air pollution control standards to minimize emissions of air pollutants at the Hanford Site, and protect all communities residing outside the Site boundaries. As part of the development of the CERCLA RI/FS, investigations and site-specific surveys are performed to assess the presence of historical, cultural, and ecological resources on the sites planned for remediation. Impacts on ecological resources near the removal actions would be mitigated in accordance with DOE/RL-96-32, *Hanford Site Biological Resources Management Plan* and DOE/RL-96-88, *Hanford Site Biological Resources Mitigation Strategy* and with the applicable standards of all relevant biological species protection regulations. Although these sites previously have been disturbed, only isolated cultural resources artifacts would be potentially encountered during project activities. Impacts to other cultural values including the viewshed from nearby traditional cultural properties could be minimized through implementation of DOE/RL-98-10, *Hanford Cultural Resources Management Plan*, DOE/RL-2005-27, *Revised Mitigation Action Plan for Environmental Restoration Disposal Facility*, and consultation with area Tribal Nations throughout the design and project implementation. This could help ensure appropriate mitigation to avoid or minimize any adverse effects to natural and cultural resources and address any other relevant concerns.

In accordance with Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, DOE seeks to ensure that no group of people bears a disproportionate share of negative environmental consequences resulting from proposed federal actions. Because access to the Hanford Site is restricted to the public, the majority of potential environmental

[17] The NEPA values in the planning for the ERDF operation were explained in detail in the original ERDF NEPA roadmap (DOE-RL-94-41, *NEPA Roadmap for the Environmental Restoration Disposal Facility Regulatory Package*) for the ERDF RI/FS (DOE/RL-93-99, *Remedial Investigation and Feasibility Study Report for the Environmental Restoration Disposal Facility*) as described in EPA, 2007, *USDOE Environmental Restoration Disposal Facility Record of Decision Amendment*.

impacts from the proposed action would be associated with onsite activities and would not affect populations residing offsite; thus, the potential for environmental justice concerns is small.

In addition, DOE is including the combined effects anticipated from ongoing CERCLA/Tri-Party Agreement response actions as part of the cumulative impact analysis in the forthcoming draft Tank Closure and Waste Management environmental impact statement. Cumulative groundwater impacts from the proposed actions evaluated in the environmental impact statement as well as from other ongoing Hanford Site activities, including Tri-Party Agreement cleanup actions, are included in this site-wide cumulative impact analysis. This will present the public with an additional, separate opportunity for comment as part of the Tank Closure and Waste Management environmental impact statement NEPA process. The cumulative impact analysis will be used to inform the public concerning the effects of ongoing cleanup actions on the Hanford Site in combination with other planned site activities.

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5 RI/FS Tasks

This chapter describes the tasks and processes that will be used during the RI/FS. These descriptions incorporate RI site characterization tasks, data evaluation methods, analysis of remedial alternatives, reporting, and the preliminary determination of tasks to be conducted after site characterization. Figure 5-1 illustrates the relationships among these CERCLA RI/FS tasks. As part of the RI process, continued implementation of interim cleanup actions during the RI/FS process has been ongoing at the Hanford Site for the past 15 years.

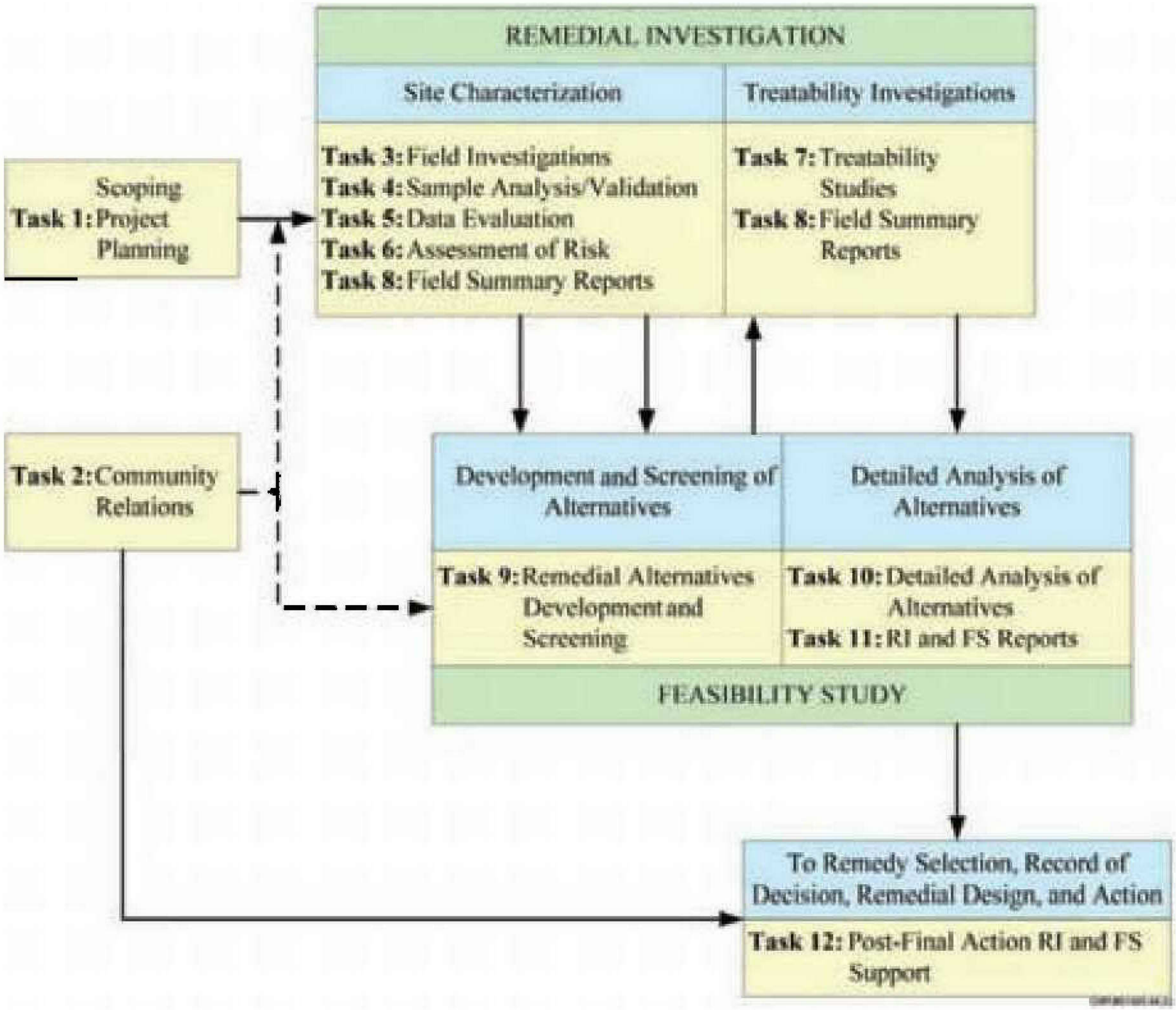

Figure 5-1. CERCLA RI/FS Process

An integrated cleanup program is implemented in the River Corridor with a primary objective of protecting the Columbia River and restoring the site to the maximum beneficial use. Elements of the integrated cleanup program include D4 of contaminated and excess facilities, placing shutdown reactors in interim safe storage, removal of contaminated soil and debris from waste sites, and cleanup or immobilization of contaminants in groundwater. Implementation of these cleanup actions in the River Corridor has reduced risk and produced large quantities of information and data that are valuable to guide development of the RI/FS work plan. Continued implementation of these cleanup actions throughout the RI/FS process will produce additional information to address many of the current data gaps and provide opportunities for refinement of site knowledge. These activities continue to be efficient and cost-effective approaches for addressing the additional information needed to complete the RI/FS process.

Elements of the integrated cleanup program that will continue to be implemented through the RI/FS process and their associated relevance toward the objective of protecting the Columbia River and restoring the site to the maximum beneficial use are summarized below:

- **Facilities** – Eliminate potential for future environmental releases and provide access to remediate underlying structures and soil. Contaminated and excess facilities will be removed and disposed at the ERDF or other offsite facility (as appropriate) through the D4 process. Implementation of these actions removes contamination and waste inventories that might otherwise present a potential for future releases to the environment if left in place. Completing the D4 process provides access to underlying waste sites that are present in many of the facilities in the River Corridor. It also provides opportunities for discovery of new waste sites that may be plugged-in to the existing remedies for cleanup as appropriate.

- **Waste sites** – Remove contaminated soil and debris to reduce potential exposure and prevent future degradation of groundwater. Remediation of waste sites in the River Corridor will continue to be implemented with a bias for action approach. Cleanup primarily will consist of RTD remedy implementation, which will generate additional characterization data to address many of the current data gaps and help refine overall site knowledge. Contaminated soil and debris will be removed and disposed at the ERDF or other offsite facility (as appropriate) until the cleanup levels are met. Risk associated with remaining sites will be addressed as data gaps in each addenda.

  As part of the remedy, borehole drilling and/or additional test pitting in conjunction with sampling and analysis may be performed to better define the nature and extent of the contamination and identify sources within the vadose zone. Activities are guided during excavation using data obtained through field measurements or in-process sampling using quick-turnaround laboratory analyses working concurrently with excavation and used to continually update the site characteristics databases. The observational approach based cleanup also provides opportunities for discovery of new waste sites that will be plugged into the existing remedies for cleanup. Sequencing of waste site cleanup is based on the Tri-Party Agreement milestone framework.

- **Groundwater** – Restore groundwater to its highest beneficial use to protect human health, the environment, and the Columbia River. Groundwater remedial actions are expected to restore groundwater to drinking water standards, and in those cases where groundwater discharges are affecting the Columbia River water, ensure that the water quality criteria for aquatic life are achieved. It is intended that these objectives be achieved, unless technically impracticable, within a reasonable period. One approach is to pump and treat contaminated groundwater, which is supplemented with other technologies (e.g., chemical treatment) to remediate specific contaminants or to address select areas of high concentration within contaminant plumes.

Community involvement during the RI/FS activities will be consistent with Ecology et al., 2002, *Hanford Site Tri-Party Agreement Public Involvement Community Relations Plan* (Community Relations Plan).

5.1 Task 1 – Project Planning

Project planning includes the previously approved RI/FS work plans for the individual OUs, the systematic planning workshops (including the CSM plates), development of the CSM, and development of data needs and SAP.

Existing LFI work plans describe the approach and rationale for the initial characterization activities. The approach and rationale to support the final ROD is supplemental to previously approved RI/FS work plans, and incorporates the additional data needs to support the final decisions.

5.1.1 RI/FS Change Control

Extensive field work is planned for each operable unit. Normal reporting processes will continue to provide progress reporting and preliminary findings during and after the implementation of the final RI/FS work plan. Emerging information during investigations can be classified into the following three categories, each requiring a different response:

- The first category of new information is not relevant to the final RI/FS report. Information that might be classified as not relevant might include new information on the details associated with historical operation, general weather conditions, etc.
- The second category of new information is relevant to the final RI/FS report, but generally within expected ranges or bounds for the type of data. This information will be considered in the development of the RI report, but would not likely lead to changes in the final RI/FS work plan.
- The third category is information or results from field activities that might call the CSM into question (e.g., waste sites extending and/or below the ordinary high water mark, waterfront structures, and pipelines extending into the Columbia River) or identifies data gaps that need to be filled to support the final ROD. Unexpected results of sample analysis or field observations could fit into this category. This category could lead to changes in the final RI/FS work plan activities.

Significant changes to the work plan, including changes in the schedule by 2 months or more to complete sampling and analysis or decreasing the number of sampling locations and/or contaminants of concern, would occur formally and with regulatory approval. At a minimum, the disposition of emerging information will be reported at regular 300 Area Tri-Party Agreement project managers' meetings.

Minor changes, including changes in sample locations by a few meters (e.g., less than 3 m [less than 10 ft]) because of physical obstructions, changes in location to better meet the DQOs in the SAP, or additions of sample depth(s), can be made and documented in the field log in accordance with Section 12.4 of the Tri-Party Agreement Action Plan.

More significant changes in sample locations that do not affect the DQOs in the SAP will require notification and approval of the waste site remediation task lead as detailed in the SAP. Changes to sample locations that could result in impacts to meeting the DQOs in the SAP will require RL and regulatory approval. Significant differences in geophysical or hydrological conditions encountered require regulatory notification. If such differences are determined to result in an impact to meeting the objectives of the DQOs in the SAP, RL and regulatory approval is then required.

Revisions to the SAP will be evaluated and processed in accordance with Section 9.3 of the Tri-Party Agreement Action Plan.

5.2 Task 2 – Community Relations

The Community Relations Plan and 40 CFR 300, the "National Oil and Hazardous Substances Pollution Contingency Plan" (NCP), outlines stakeholder and public involvement opportunities. Community involvement during the RI activities will be consistent with the Community Relations Plan and comply with the NCP. The project will use existing public and stakeholder mechanisms to ensure input to the work plan. The Hanford Site is located on lands ceded in the *Treaty with the Walla Walla, Cayuse and Umatilla 1855*, thereby involving the Confederated Tribes of the Umatilla Reservations, the Yakama Indian Nation, and the Nez Perce Tribe. Although not a signatory to the Treaty, the Wanapum Tribe's territory traditionally included the Hanford Site.

Involvement efforts fall into three categories: tribal, stakeholder, and public. All interactions with the Hanford Advisory Board and public are done through and coordinated with the RL Public Involvement manager.

5.2.1 Tribal Nations Involvement

All interactions with Tribal Nations are done through the RL tribal liaison. RL has biweekly conference calls with the tribes to brief them on upcoming issues of interest. Because Tribal Nations are not stakeholders, their involvement is on a government-to-government basis. Where possible, briefings to Tribal Nations will be done through existing forums, such as the monthly Tribal Nations, State of Oregon, and DOE groundwater and vadose meetings. RL will work with Tribal Nations to ensure ongoing communication and involvement in the River Corridor decision making process.

Relationship with the Tribal Nations is based on treaties, statutes, executive orders, and DOE policy statements. The treaties secured to the Tribes certain rights and privileges to continue traditional activities outside the reservations, and established a trust relationship between the federal government and the Tribes. To meet this responsibility, and to facilitate consultations, Executive Order 13175, *Consultation and Coordination with Indian Tribal Governments*, states that each federal agency "shall have an accountable process to ensure meaningful and timely input by tribal officials in the development of regulatory policies that have tribal implications." More specifically, under DOE Order 1230.2, *American Indian Tribal Government Policy*, DOE "will implement a proactive outreach effort of notice and consultation regarding current and proposed actions affecting tribes. This effort will include timely notice to all potentially impacted Indian nations in the early planning stages of the decision making process." Further, under this order, "consultation will include the prompt exchange of information regarding identification, evaluation, and protection of cultural resources. To the extent allowed by law, consultation will defer to tribal policies on confidentiality and management of cultural resources."

5.2.2 Stakeholder Involvement

The Community Relations Plan and the NCP identifies processes governing public information and involvement processes. Stakeholders are individuals who see themselves affected by and/or have an interest in Hanford Site issues. They commit time and energy to participate in decisions. Hanford Site stakeholders include local governments, local and regional businesses; Hanford Site workforce; local, regional, and national environmental interest groups; and local and regional public health organizations. Another group of stakeholders with whom the Tri-Parties work are the Hanford Natural Resources Trustees and the State of Oregon. The trustees will, by Executive Order 12580, *Superfund Implementation*, (Section 2 (d), and 2(e)(2)) be informed of possible impacts, or other aspects regarding releases or potential releases from facilities in the 300 Area. In accordance with CERCLA 104(b)(2), Coordination of Investigations, the Trustees shall be promptly notified as follows: "appropriate federal and state natural resource trustees of potential damages to natural resources resulting from releases under investigation pursuant to this section and shall seek to coordinate the assessments, investigations, and planning under this section with such Federal and State trustees."

The Hanford Advisory Board is a Federal Advisory Committee Act Board consisting of 31 individuals representing a balanced mix of the diverse interests affected by Hanford Site cleanup issues. The Hanford Advisory Board advises the Tri-Parties on cleanup issues. The body of Hanford Advisory Board advice was reviewed for this work plan to ensure responsiveness to Hanford Advisory Board values, principles, and issues. The Hanford Advisory Board's River and Plateau Committee is addresses River Corridor and Central Plateau issues. The cleanup program will work with DOE to identify opportunities to inform and involve this committee on significant work plan issues and progress. The River and Plateau Committee meets approximately 10 times per year. Based on the timing of the development of significant work plan components (e.g., the CSM and data needs), periodic updates will be provided to the River and Plateau Committee.

The River and Plateau Committee provides an ongoing opportunity for informal stakeholder feedback on work plan components and evolving project activities. Issues are discussed at the committee level. The committee decides if an issue should be brought to the Hanford Advisory Board.

5.2.3 Public Involvement

Public involvement also is governed by Tri-Party Agreement activities. The general public consists of those individuals who are aware of but may choose not to be involved in decisions. At this time, public meetings or comment periods are not conducted on the initial draft work plan. As subsequent addenda to the work plan are developed, consultation with the Tri-Parties, River and Plateau, and Public Involvement and Communication Committees would determine the need for public involvement.

5.3 Task 3 – Field Investigations

Field investigations will be conducted in the 300 Area to supplement information received from the LFIs and in response to results from ongoing remedial actions (e.g., CERCLA 5-year reviews). The field investigation and data collection activities will address additional data needs developed through the systematic planning process (Section 1.7). The specific data needs are defined in Chapter 3.

The scope of the field investigation will be described in a SAP, a primary document tied to this work plan. The primary objective of the SAP is to provide sampling strategies to obtain the supplemental data required to satisfy operable unit specific data needs identified during systematic planning workshops. An RI specific SAP has been prepared for the 300 Area, 300-FF1, 300-FF-2, and 300-FF-5 operable units and is found in DOE/RL-2009-45.

It is anticipated that the RI field investigations will use similar approaches to those in the LFIs and remedial actions under interim action RODs for characterizing site conditions; delineating waste disposal; defining the nature and extent of contamination; and characterizing human health, ecological, and environmental impacts. Future field investigation approaches include the following:

- Field screening (e.g., radionuclides and VOCs)
- Soil gas surveys
- Wipe sampling
- Boreholes and test pits
- Surface and subsurface soil sampling
- Surface and borehole geophysics
- Sludge sampling

- Sediment sampling
- Groundwater sampling
- Pore water sampling
- Aquifer testing
- River gauging
- Ecological surveys and sampling

The following two items support information needs for the entire River Corridor and will be addressed separately from other field investigation activities described in the SAP:

- Determine whether 1:1 dilution factor is appropriate.
- Values for antimony and selenium will be collected through the metals analytical suite, and the data can be used to augment developing 300 Area background values.

Selection of sites or locations where additional vadose zone soil characterization is planned as part of the RI/FS field investigation is based on the consideration of the following criteria:

- Existing plans/commitments for remedial action in accordance with interim RODs
- Historical demolition activities and associated end-state
- Proximity to high-concentration groundwater plumes
- Volume and concentration of liquid disposal activities
- Historical impacts to groundwater quality
- Extent of excavation relative to the bottom of the engineered structure(s)
- Contaminants sampled to support site reclassification relative to contaminants identified in historical investigations (e.g., LFIs)
- Concentration of residual soil contamination relative to screening levels for groundwater protection
- Concentration of residual soil contamination relative to RCW 70.105D, "Hazardous Waste Cleanup -- Model Toxics Control Act," 2007 values
- Characterization information beneath extent of excavation
- Evidence of deep soil contamination
- Contaminant mobility properties in soil (i.e., distribution coefficient)
- Potential data needs identified in the systematic planning workshops
- Anticipated applicability of RI/FS characterization results to other sites

Consideration and relative weighting of the criteria at specific sites or locations may vary based on process history and present conditions at the site or locations being evaluated. Final selection of sites or locations where additional vadose zone soil characterization is planned as part of the RI/FS field investigation will be based on discussion with and concurrence by the Tri-Parties.

The Tri-Party Agreement Action Plan, Section 7.3.2, *Remedial Investigation/Feasibility Study Work Plan*, allows for the initiation of site survey and screening activities before submittal of the RI/FS work plan. These nonintrusive activities may include the following:

- Surveillance for location of sites
- Cultural review
- Surface radiation surveys
- Surface geophysical surveys
- Air sampling
- Soil gas surveys
- Biotic surveillance

These surveys allow for a quicker start of characterization activities upon approval of the RI/FS work plan and results may be factored into the work plan, as appropriate. To further expedite the process, near-surface vadose zone sampling may commence 2 weeks after receipt of lead regulatory agency comments (Tri-Party Agreement Action Plan, Section 7.3.2, Ecology et al., 1989b) on the initial draft of the RI/FS work plan, if the comments regarding vadose zone sampling have been resolved.

Because additional field investigations are taking place in the 300 Area, collaboration among various field activities will occur. For example, the Integrated Field-Scale Research Challenge testing site in the former South Process Pond, and the polyphosphate treatability test site near the former 300 Area Process Trenches, will be conducting tests that may affect groundwater conditions. Timing of groundwater sample collections as part of the RI will consider the potential influence of these field tests, so that the representativeness of the samples is known. Likewise, intrusive field activities in the 300 Area will be done in collaboration with ongoing geophysical research using equipment installed in the ground and adjacent river channel, to avoid disrupting investigations in progress.

5.4 Task 4 – Sample Analysis/Validation

This work plan will identify operable unit specific target analytes, analytical methods, and quantification levels for analysis of media samples collected. The data obtained will be reviewed, verified, and validated. Data verification will be performed to ensure and document that the reported results reflect work that was actually done.

The data verification checks include review for completeness, use of the correct analytical methods/procedures, transcription errors, correct application of dilution factors, appropriate reporting of dry weight versus wet weight, and the correct application of conversion factors. Laboratory personnel may perform data verification.

Data validation will be performed to ensure that the data quality goals established during the RI/FS planning phase have been achieved. Validation activities will be based on EPA functional guidelines. Data validation may be performed by the analytical laboratory, the Sample Management and Reporting organization, and/or by a party independent of both the data collector and the data user.

5.5 Task 5 – Data Evaluation

Following verification and validation, the data will need to be evaluated to assess whether the original questions were answered (e.g., the project DQOs). The data quality assessment process compares completed field sampling activities to those proposed in corresponding sampling documents, and provides an evaluation of the resulting data. The data quality assessment process (EPA/240/B-06/003, *Data*

Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S) is discussed in further detail in the SAP.

The RI data will be managed through a data management system to provide accurate, appropriate, consistent, traceable, and defensible data to all users throughout the project. The data management process will provide project teams with electronic data access and control revisions and additions to the dataset. The types of data expected to be managed during the RI may include the following:

- Analytical laboratory data
- Physical data
- Hydraulic data
- Field observation data
- Borehole logs
- Well construction reports
- Geographical information systems data
- Modeling data input parameter values for computer simulations
- Drawings
- Historical narrative/reports
- Process engineering data
- Environmental surveillance data
- Geophysical and geochemical data

To meet modeling input and output data needs, DOE will conduct a verification and validation of RESRAD (Version 6.5 as of October 30, 2009) for chemicals. Further details of the data management process are provided in the SAP.

5.6 Task 6 – Assessment of Risk

Section 4.4 discusses the process and activities for evaluating baseline and residual risks for the 300 Area. The sample collection tasks under the RI/FS do not include additional risk assessment. RI/FS information and data will be compared to the assumptions and conclusions of the RCBRA (and other pertinent assessments) to determine if there is any impact on risk conclusions that would affect final decision making. Results of this evaluation will be in the RI/FS report.

5.7 Task 7 – Treatability Studies

Treatability studies may be conducted to provide additional operable unit specific data to reduce cost and performance uncertainties, to allow a treatment alternative to be fully developed and evaluated during the RI/FS detailed analysis, and to support the remedial design of a selected alternative. The process for incorporating treatability studies into the RI/FS includes the following steps:

- Determine data needs.
- Review the existing site data and available information on technologies to determine if existing data are sufficient to evaluate alternatives.

- Perform treatability studies, as appropriate, to determine performance, operating parameters, and relative costs of potential remedial technologies.
- Evaluate the data to ensure that data quality objectives are met.

The DOE, 2008, *Technology Readiness Assessment (TRA)/Technology Maturation Plan (TMP) Process Guide*, may be used at the Hanford Site to assess whether the maturity of critical technology elements is sufficient for incorporation into final designs. The Technology Readiness Assessment Process consists of three parts.

- Identify the critical technology elements.
- Assess the technology readiness level of each critical technology element using the technical readiness scale used by the U.S. Department of Defense and National Aeronautics and Space Administration, and adapted by the assessment team for use by DOE.
- Evaluate technology testing or engineering work necessary to bring immature technologies to appropriate maturity levels.

A saturated zone treatability test was previously conducted in the 300 Area to evaluate the efficiency of using polyphosphate injections to treat uranium contaminated groundwater in situ (PNNL-18529). The treatability test was designed for the formation of two minerals: (1) autunite (an uranium-phosphate mineral) formation for sequestration of existing uranium in the treatment zone, and (2) apatite formation for long-term treatment of uranium that migrates into the saturated treatment zone. During this treatability study, two separate overarching issues were identified that affect the efficiency of apatite remediation for uranium sequestration within the 300 Area (PNNL-17480). These issues include: (1) the efficiency of apatite for sequestering uranium under the present aquifer geochemical and hydrodynamic conditions, and (2) the formation and emplacement of apatite by polyphosphate technology.

In addition, it was determined that the long-term stability of uranium sequestered by apatite depends on specific conditions (e.g., the chemical speciation of uranium, surface speciation of apatite, and the mechanism of retention), some of which are highly susceptible to dynamic geochemical conditions in the aquifer (Wellman et al., 2008, "Sequestration and Retention of Uranium(VI) in the Presence of Hydroxylapatite Under Dynamic Geotechnical Conditions"). For this long-term stability to work, the uranium sequestered via apatite would convert to autunite-group minerals; however, the carbonate concentrations in 300 Area groundwater inhibit the conversion to autunite. Since the conversion to autunite is inhibited and sequestration of uranium by apatite is reversible, the focus of remedial technology development was shifted to direct treatment of uranium contamination in the vadose and zone of water table fluctuation. During 2009 and continuing into 2010, a polyphosphate infiltration test is underway to evaluate the efficiency of infiltration of phosphate solutions from ground surface (or some depth of excavation) and the type of equipment needed to monitor the infiltration front.

5.8 Task 8 – Field Summary Reports

As the field investigations and treatability studies are completed, field summary reports are prepared to document the data collection and provide updates to the CSM. The field summary reports are used during the preparation of the RI/FS report and discuss the investigative approach used, the results, and conclusions.

5.9 Task 9 – Remedial Alternatives Development and Screening

The development and screening of remedial alternatives begins once sufficient data are available. This task may occur concurrently with the preparation of field summary reports. The primary objective of this task is to develop an appropriate range of remedial options that will be analyzed more fully in Task 10. Appropriate remedial options may include the complete elimination of hazardous substances, the reduction of concentrations of hazardous substances to acceptable health based levels, and the prevention of exposure to hazardous substances via engineering or institutional controls.

Remedial alternatives are developed by assembling combinations of technologies for affected media into alternatives that address the contamination for the 300 Area. This process consists of six general steps (EPA/540/G-89/004):

- Develop RAOs specifying the contaminants and media of interest, exposure pathways, and PRGs that permit a range of treatment and containment alternatives to be developed. The PRGs are developed based on chemical specific ARARs, when available, other available information (e.g., reference doses), and operable unit specific risk related factors.
- Develop general response actions for each medium of interest defining containment, treatment, excavation, pumping, or other actions, singly or in combination, which may be taken to satisfy the RAOs.
- Identify volumes or areas of media to which general response actions might be applied, taking into account the requirements for protectiveness as identified in the RAOs and the chemical and physical characterization of the area.
- Identify and screen the technologies applicable to each general response action to eliminate those that cannot be implemented technically. The general response actions are further defined to specify remedial technology types (e.g., the general response action of treatment can be further defined to include chemical or biological technology types).
- Identify and evaluate technology process options to select a representative process for each technology type retained for consideration. Although specific processes are selected for alternative development and evaluation, these processes are intended to represent the broader range of process options within a general technology type.
- Assemble the selected representative technologies into alternatives representing a range of treatment and containment combinations, as appropriate.

The screening should be used to identify and distinguish any differences among the various alternatives and to evaluate each alternative for effectiveness, implementability, and cost. The result of this task is a refined list of remedial alternatives judged as the best or most promising based on these evaluation factors and should be retained for a more detailed analysis.

DOE/RL-2008-36 describes technologies and alternatives for treatment of uranium in the vadose zone and groundwater. This analysis will be used as a starting point for the current work.

The remedial action alternatives developed through this process are screened and FS-level designs and costs are developed for the preferred alternative.

5.10 Task 10 – Detailed Analysis of Alternatives

During the detailed analysis, the alternatives that passed screening are further refined and analyzed. A number of alternatives should be developed that provide a range of options and sufficient information to adequately compare alternatives against one another. For source control options, the following types of alternatives should be developed to the extent practicable (EPA/540/G-89/004):

- A number of treatment alternatives ranging from one that would eliminate or minimize to the extent feasible the need for long-term management (including monitoring) at a site to one that would use treatment as a primary component of an alternative to address the principal threats at the site. Alternatives within this range typically will differ in the type and extent of treatment used and the management requirements of treatment residuals or untreated wastes.
- One or more alternatives that involve containment of waste with little or no treatment but protect human health and the environment by preventing potential exposure and/or reducing the mobility of contaminants.
- A no-action alternative.

For groundwater response actions, the range of alternatives may use different technologies to achieve cleanup levels within varying timeframes.

The selection of the preferred alternative is determined through the application of nine evaluation criteria identified in the detailed analysis of alternatives. These criteria are grouped by their importance. Each alternative must meet the following threshold criteria:

- Overall protection of human health and the environment
- Compliance with ARARs

The analysis of alternatives is based on the following primary balancing criteria:

- Long-term effectiveness and permanence
- Reductions in toxicity, mobility, and volume through treatment
- Short-term effectiveness
- Implementability
- Cost

Modifying criteria evaluated following comment on the proposed plan and addressed in the ROD are as follows:

- State acceptance
- Community acceptance

5.11 Task 11 – Final RI/FS Report(s)

The previous tasks lead to preparation of the final RI/FS report. As an outcome of the systematic planning process, the results of the source and groundwater investigations, results of ongoing activities, and DOE/RL-2007-21 will be presented together in the final RI/FS report.

The final RI report presents the collection of data and evaluations to characterize site conditions, determine the nature and extent of contamination, and assess risk to human health and the environment. The field summary reports prepared under Task 8 address these RI elements for individual field investigation activities and are discussed overall within the final RI report. The FS report presents the RAOs; development, screening, and detailed evaluation of remedial alternatives; and selection of the preferred remedy. The results of treatability studies also are presented, if available.

The final RI and FS reports will consider all information available at the time of their preparation, including information from activities conducted outside of this work plan. Key among those activities are the products of research being conducted under the Integrated Field-Scale Research Challenge program, which focuses on uranium at Hanford and other DOE sites, and DOE-funded research to do the following:

- Develop complex hydrologic and contaminant transport simulations using massively parallel computers
- Use geophysical methods to track groundwater movement and discharge to the Columbia River channel

Information developed under the RCBRA also will be factored into the RI report.

5.12 Task 12 – Post-Final RI/FS Support

The 300 Area final RI/FS and proposed plan will be written by DOE and are subject to EPA review and approval. Following public comment on these documents and the administrative record, EPA writes the final ROD for all media in the 300 Area. These documents will incorporate all existing completed remedial actions under interim action RODs, validate their completion, and identify any remaining actions to support the final action, including presumptive remedies, plug-in approaches, and contingent remedies, as appropriate.

5.12.1 Proposed Plan

The proposed plan is the mechanism by which the lead agency presents the preferred and other alternatives to the public. The plan briefly describes the remedial alternatives analyzed, proposes a preferred alternative, and summarizes the information on which the preferred alternative was selected. The purpose of the proposed plan is to summarize the RI/FS information and provide the public with a reasonable opportunity to comment on the preferred alternative, as well as alternatives under consideration, and to participate in the selection of remedial alternatives. Following public review and comment on the plan, a responsiveness summary will be prepared that summarizes significant comments, criticisms, and new relevant information received during the comment process. The responsiveness summary will be incorporated into the final ROD.

5.12.2 ROD

Following receipt of public comments and any final comments from supporting agencies, a remedy is selected and documented in a final ROD. The ROD documents the remedial action plan for a site or OU and serves three basic functions (EPA/540/R-98/031, *A Guide to Preparing Superfund Proposed Plans, Records of Decision, and Other Remedy Selection Decision Documents*, OSWER 9200.1-23P). The ROD serves as:

- A legal document in that it certifies that the remedy selection process was carried out in accordance with CERCLA and, to the extent practicable, in accordance with the NCP
- A substantive summary of the technical rationale and background information contained in the administrative record file (e.g., RI/FS including the baseline risk assessment)

- A technical document that provides information necessary for determining the conceptual engineering components, and which outlines the remedial action objectives and cleanup levels for the selected remedy
- A key communication tool for the public that explains the contamination problems the remedy seeks to address and the rationale for its selection

5.12.3 Post-ROD Activities

The selected remedial alternative is implemented when the final ROD is approved. This stage may involve remedial design and design verification studies, construction, remediation process optimization, and operation and maintenance of the implemented processes. Protectiveness is evaluated during 5-year reviews. Actions identified in the first two 5-year reviews have been completed or are in progress. The next 5-year review is scheduled to occur in 2011.

If new information is generated that could affect the implementation of the selected remedy, the information can be addressed through one of the following means:

- A memorandum to the post-ROD file for an insignificant or minor change
- An ESD for a significant change
- A ROD amendment for a fundamental change

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6 Project Schedule

The schedule was developed to meet the Tri-Party Agreement milestones and goals for the 300 Area (Table 6-1). Figure 6-1 shows the project schedule for activities discussed in this work plan. This schedule will serve as the baseline for the work planning process. It will be used to measure the progress of the implementation of this process. Any updates to the project schedule will be done in accordance with the Tri-Party Agreement, Section 11.4.

Table 6-1. 300 Area Summary of Proposed Milestones and Target Dates

Milestone	Milestone Summary	Status	Milestone Due Date
M-015-71	Submit CERCLA RI/FS Work Plan for the 300-FF-2 and 300-FF-5 Operable Units for Groundwater and Soil.	Enforceable	Oct 31, 2009
M-15-72 T01	Submit CERCLA RI/FS Report and Proposed Plan for 300-FF-2 and 300-FF-5 Operable Units for Groundwater and Soil.	Target	Dec 31, 2011

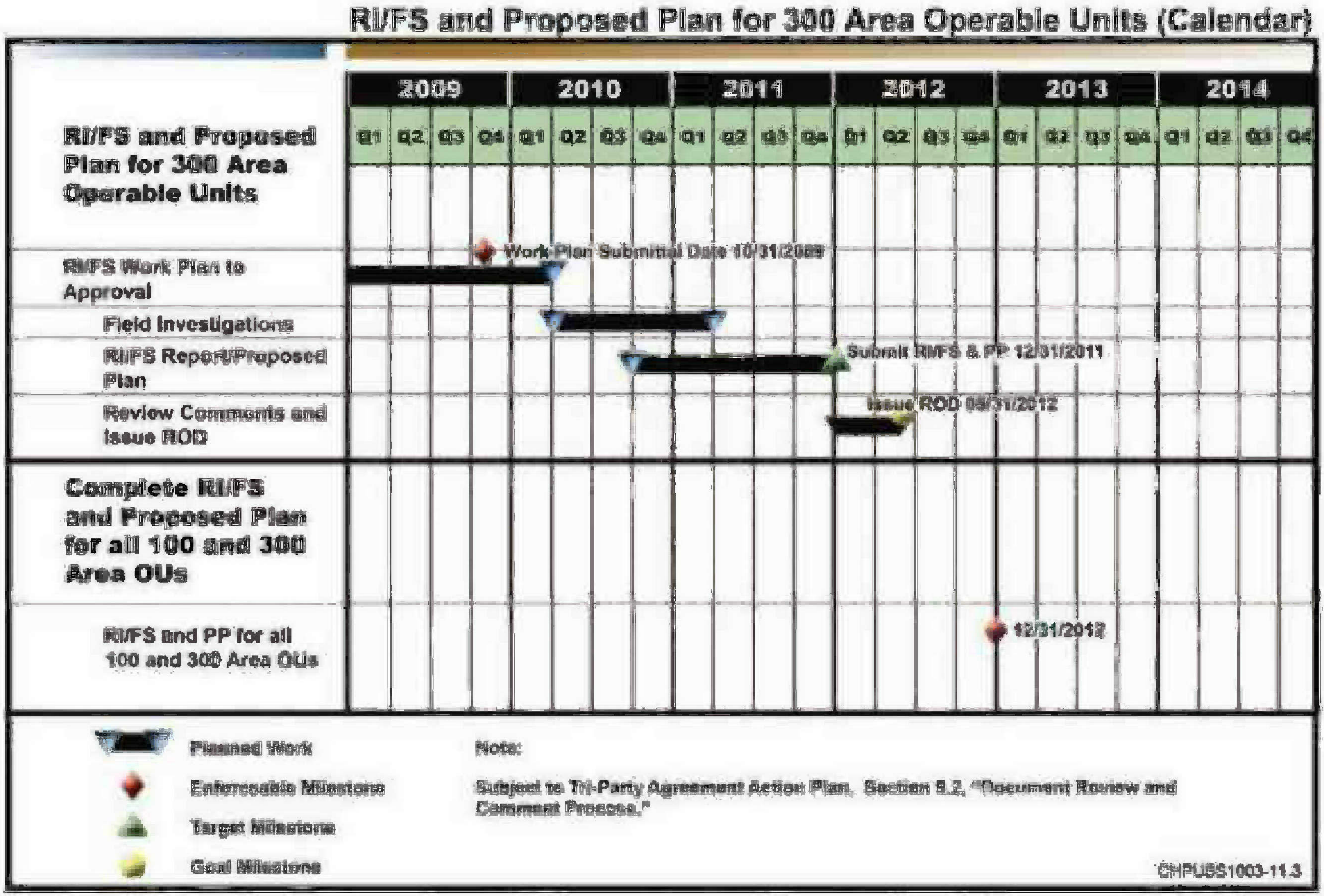

Figure 6-1. 300 Area Project Schedule

7 Project Management Considerations

This chapter discusses project organization, project coordination, change control, and dispute resolution processes. Change control processes increase in definition as needed to document and achieve approval for changes that arise during the RI/FS. Problems are resolved at the lowest possible level, with higher levels of project oversight engaged to resolve the issues.

7.1 Project Organization

The U.S. Department of Energy, Richland Operations Office is responsible for Hanford Site cleanup of the River Corridor. The RL contractors implement the cleanup for RL and are responsible for planning, coordinating, and executing the RI/FS activities. The lead regulatory agency authorizes the work scope in accordance with the Tri-Party Agreement and oversees the work for regulatory compliance. Figure 7-1 illustrates the project organization structure for cleanup of the 300 Area Operable Units.

7.1.1 RL Project Organization

Cleanup actions for source and groundwater OUs in the River Corridor are programmatically separated between RL projects and associated Hanford Site contractors. RL has established an interface control agreement (08-AMRC-0116, 2008, "Contract No. DE-AC06-05RL14655 – Interface Agreement for Coordinating Groundwater and Vadose Zone Remediation Activities in the River Corridor") between programs to ensure integration and coordination between source and groundwater actions and to identify responsibilities for RL associated contractors. As cleanup progresses and the Tri-Parties work toward establishing final RODs for the River Corridor, effective integration between RL programs and responsible contractors will continue to be a focus and an expectation of the Tri-Parties and Hanford Site stakeholders.

The RL River Corridor Closure Project is responsible for cleanup of source OUs in the River Corridor. The federal project director for the River Corridor Closure Project reports to the assistant manager for the River Corridor. RL's responsibility for groundwater cleanup lies with the Groundwater Project. The Groundwater Project federal project director reports to the assistant manager for the Central Plateau. The assistant manager for the River Corridor and the assistant manager for the Central Plateau report to the RL manager.

The RL federal project directors are responsible for authorizing the respective contractors to perform the RI/FS activities for the 300 Area Operable Units. The federal project director also is responsible for obtaining lead regulator approval of the work plan and SAP, which authorize the RI/FS activities under the Tri-Party Agreement. The RL technical leads are responsible for day-to-day oversight of contractors performing the RI/FS activities, for working with the contractors and the regulatory agencies to identify and work through issues, and for providing technical input to the RL federal project directors.

7.1.2 Regulatory Agency Oversight Organization

The EPA has assigned a project manager who is responsible for overseeing various RI/FS field activities. The project manager is responsible for working with RL to resolve issues and approve the documents in accordance with the Tri-Party Agreement, Article XVI. The project manager is responsible for approving the final remedy, approving completion of construction, and proposing sites for deletion from the National Priorities List.

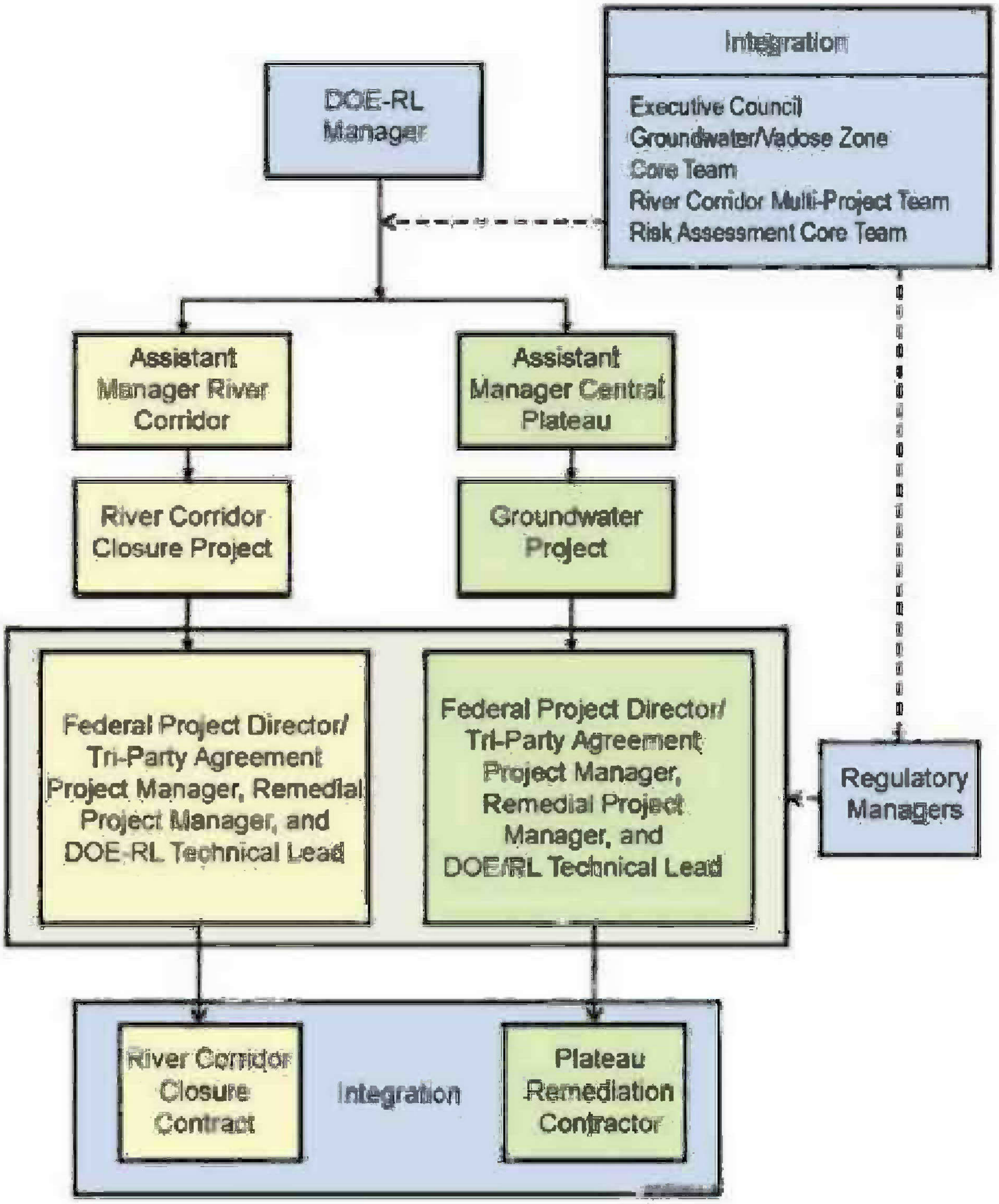

Figure 7-1. Project Organization

7.1.3 Contractor Organization

Cleanup of the source OUs and development of the RCBRA is conducted by Washington Closure Hanford, LLC, under DE-AC06-05RL14655, *Washington Closure Hanford, LLC (WCH), River Corridor Closure Contract*. The RL oversight of the work performed by Washington Closure Hanford, LLC, is provided through the River Corridor Closure Project federal project director and the assistant manager for the River Corridor. The CH2M HILL Plateau Remediation Company, under DE-AC06-08RL14788, *CH2M HILL Plateau Remediation Company Plateau Remediation Contract*, conducts groundwater cleanup activities and lead integration responsibilities. The RL oversight of the work performed by the CH2M HILL Plateau Remediation Company is provided through the Groundwater Project's federal project director and the assistant manager for the Central Plateau. Together, CH2M HILL Plateau Remediation Company and Washington Closure Hanford, LLC, are the contractors responsible for integrating and executing the full scope of RI/FS activities in the River Corridor. The SAP provides general descriptions of the key positions responsible for conducting the RI/FS sampling and characterization activities.

7.1.4 Integration Teams

RL has established multiple teams to facilitate integration of work among RL programs, contractors, and the regulatory agencies. The teams report to the Groundwater/Vadose Zone Executive Council, which oversees the integration of groundwater and vadose zone work scope and provides policy direction. The Executive Council prepares, updates, and assesses the progress of priorities to guide integration activities. The teams that are relevant to the scope of RS/FS activities in the River Corridor are as follows:

- <u>Groundwater/Vadose Zone Multi-Project Team</u>: The purpose of the Groundwater/Vadose Zone Multi-Project Team is to ensure successful implementation of the memorandum of agreement, DOE-RL, 2008, *Interface Agreement for Coordination of Groundwater and Vadose Zone Cleanup Programs*). This multi-project team oversees all aspects of groundwater and vadose zone work at the Hanford Site, including integration of field work, decision processes, treatability testing, and remedy implementation. This includes Central Plateau and River Corridor work scope, as well as vadose zone investigations.

- <u>River Corridor Multi-Project Team</u>: The River Corridor Multi-Project Team develops and maintains an integrated approach to assessment and decision making for River Corridor Project remediation decisions. This team ensures that all River Corridor source, vadose zone, and groundwater OU cleanup decisions are coordinated between the River Corridor Project and the other Hanford Site CERCLA projects.

- <u>Risk Integration Core Team</u>: The Risk Integration Core Team provides a forum for coordinating Hanford Site risk assessments to ensure their applicability to remediation, corrective action, closure, and disposal decisions. This team identifies risk assessment activities that are underway and planned for Hanford Site projects and determines whether those activities require DOE management decisions to improve their coordination, consistency, and effectiveness. The team identifies issues affecting multiple projects that may require resolution by the Groundwater/Vadose Zone Executive Council.

Each of these teams meets on a regular basis to discuss integration items, opportunities, and emerging issues. Team representatives consist of RL and contractor representatives. In addition, individuals representing the regulatory agencies typically are invited to participate in the team meetings.

7.2 Project Coordination, Decision Making, and Documentation

Field decisions will be documented with meeting notes stating consensus decisions. A decision log will be kept to track each decision, and the decision log will refer to attachments as applicable. Larger-scale changes may require formal decision memoranda. In either case, the project manager for the Groundwater Project and the regulatory agency project managers will be involved in the decision and formal documentation.

7.3 Change Control and Dispute Resolution

The SAP represents the Tri-Parties' assessment of the data needs at the end of the systematic planning process. As new information becomes available, changes to work scope may be required. These changes will be made to the SAP and/or the work plan, depending on the nature of the change. Changes that affect the Tri-Party Agreement are documented using change control forms. The class or level of the change (i.e., signatory, executive management, or project management) is noted and the description/justification and impact of the change is documented.

Dispute resolution is handled in accordance with the Tri-Party Agreement, Article XVI. The Tri-Parties are to make reasonable attempts to resolve all disputes informally at the project manager level. Disputes that cannot be resolved informally are submitted in writing to, and resolved by, the Interagency Management Integration Team at the executive manager level. If resolution is not achieved at this level, the dispute is forwarded to higher levels of management. As a last resort, the dispute resolution process outlined in the Tri-Party Agreement, Article XXVI, is used. To promote dispute avoidance, potential problems will be identified during field preparation planning, and associated contingency/variance plans will be developed.

8 References

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Appendix A

Description and Brief History of 300 Area Waste Sites and Facilities

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Terms

ACL	above cleanup level
BBP	butylbenzylphthalate
BCL	below cleanup level
BHI	Bechtel Hanford, Inc.
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CHWSA	Complex Hazardous Waste Storage Area
Cr(III)	trivalent chromium
Cr(VI)	hexavalent chromium
COC	contaminant of concern
CVP	closeout verification package
CWS	contaminated waste storage
D&D	decontamination and decommissioning
DHX	Dump Heat Exchanger
DOE	U.S. Department of Energy
dpm	disintegrations per minute
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
ESHTSSA	East Side Heat Treat Salt Storage Area
FBP	Filter Backwash Pond
FFTF	Fast Flux Test Facility
FH	Fluor Hanford
FMEF	Fuels and Materials Examination Facility
FRTE	Fast Reactor Thermal Engineering
GEL	Geotechnical Engineering Laboratory
GPR	ground penetrating radar
HAMMER	Volpentest Hazardous Materials Management and Emergency Response Training and Education Center

HCBD	hexachlorobutadiene
HCE	hexachloroethane
HEPA	high efficiency particulate air
HEW	Hanford Engineering Works
hp	horsepower
HTLTR	High Temperature Lattice Test Reactor
HTS	heat transport system
HTSF	High Temperature Sodium Facility
HVAC	heating, ventilation, and air conditioning
HW	hazardous waste
HWSA	Hazardous Waste Staging Area
HWSF	Hazardous Waste Storage Facility
kV	kilovolt(s)
kVA	kilovolt-ampere(s)
LHWSA	Laydown Hazardous Waste Storage Area
LMFBR	Liquid Metal Fast Breeder
LSLDF	Life Sciences Laboratory Drain Field
LSLT1	Life Sciences Laboratory Trench #1
MASF	Maintenance and Storage Facility
MCO	multi-canister
Met Semi-Works	Metallurgical Semi-Works
NDE	non-destructive examination
NPDES	National Pollutant Discharge Elimination System
OU	Operable Unit
PCB	polychlorinated biphenyl
PIU	personal identification unit
PNL	Pacific Northwest Laboratory
PNNL	Pacific Northwest National Laboratory
PRTR	Plutonium Recycle Test Reactor
PSHWSA	Paint Shop Hazardous Waste Satellite Area

PUREX	Plutonium Uranium Reduction Extraction Facility
PVC	polyvinyl chloride
R&D	research and development
RCC	Radiation Coordinating Council
RCF	Radiological Counting Facility
RCRA	*Resources and Conservation Recovery Act of 1976*
RECUPLEX	Recovery of Uranium and Plutonium by Extraction
REDOX	reduction oxidation
RFBP	Retired Filter Backwash Pond
RL	U.S. Department of Energy, Richland Operations Office
RLWS	Radioactive Liquid Waste Sewer
RMW	radioactive mixed waste
RPS	retention process sewer
RRLWS	Retired Radioactive Liquid Waste Sewer
RSDF	Retired Sanitary Drain Field
SPP	South Process Pond
SSF	Sodium Storage Facility
SSHWSA	Sign Shop Hazardous Waste Satellite Area
SSS	sanitary sewer system
SWFL	Special Waste from Lysimeter
T&G	tongue and groove
TC	temporary construction
TCA	tetrachloroethane
TCE	trichloroethylene
TCLP	toxicity characteristic leaching procedure
TEDF	Treated Effluent Disposal Facility
TFWAST	Tank Farm Waste Acid Storage Tank
TPH	total petroleum hydrocarbons
TRF	Test Reactor Facility
TRIGA	training, research, isotopes, general atomics

TRU	transuranic
TSD	treatment, storage, and disposal
TT	treatment tank
TTL	Thermal Transient Loop
UCL	undetermined contamination level / upper confidence limit
UPR	unplanned release
UPS	uninterruptible power supply
URMA	underground radioactive material area
URO	Uranium Recovery Operations
UST	underground storage tank
V	volt(s)
VTS	Vitrification Test Site
WAC	Washington Administrative Code
WATS	Waste Acid Treatment System
WCH	Washington Closure Hanford
WDNR	Washington Department of Natural Resources
WIDS	Waste Information Data System

A1 Introduction

The following tables provide a complete list and brief description of waste sites located in the 300 Area. During remedial action planning, larger waste sites were occasionally segmented into smaller, manageable sub-units called subsites to facilitate safe and cost effective field operations. Waste sites described in the tables include subsites.

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Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]/ ACL	Max Concentration (pCi/g, mg/kg) Deep[b]/ BCL	Max Concentration (pCi/g, mg/kg) UCL Area	95% UCL (pCi/g, mg/kg) Shallow[a]/ ACL	95% UCL (pCi/g, mg/kg) Deep[b]/ BCL	95% UCL (pCi/g, mg/kg) UCL Area
300 FBP	Surface Impoundment	300-FF-1	97.54 × 64.92 × 7.62	1987-1992	The unit consists of two subsites; one is a single, rubber-lined basin measuring 97.5 × 65 × 7.6 m (320 × 213 × 25 ft). This site is not addressed within EPA/ROD/R10-96/143. From 1987 to 1992, the second subsite is a basin that operated as an unlined percolation pond. In 1992, the basin was lined with a synthetic liner on a concrete foundation. Before the pond was lined, it received discharge of filter backwash, which was allowed to percolate to groundwater. After 1995, the backwash was held in the lined pond to clarify. The clarified water was sent to the 300 Area TEDF. The unit receives 76 million L/year (20 million gal/year) of water and alum backwashed from filters. This component of the 300 FBP is included as a "no action" site within EPA/ROD/R10-96/143. Analysis of the backwash has shown it to be nonhazardous.	No Action	EPA/ROD/R10-96/143	N/A										
300 RFBP	Pond	300-FF-1	147.83 × 47.24	1975-1987	The 300 RFBP and the 316-1 SPP, collectively referred to as the 316-1 SPP Site, are the site of former high-volume liquid waste disposal activities located north of the 300 Area complex, near the Columbia River. The 316-1 SPP Site was built in 1943 and was the first 300 Area process liquid disposal unit. It was originally a single, large infiltration pond to which dikes were later added, forming three settling ponds and a large main infiltration pond. The east lobe of the site was used by the 300 Area water treatment plant as a FBP (WIDS Site 300 RFBP).	Closed Out	CVP-2003-00002	Site was cleaned up in conjunction with Site 316-1. Refer to decision document CVP-2003-00002.										
316-1	Pond	300-FF-1	32,000 m^2	1943-1975	The original unlined percolation pond had a surface area of 45,522 m^2 (490,000 ft^2), was 1.5 m (5 ft) deep, and was separated into five separate sections. The site originally received cooling water and low-level liquid wastes from the fuel fabrication facilities and early laboratories (313, 314, 3706, and 321 Buildings). Contaminants from these facilities included uranium, copper, cobalt, and small amounts of plutonium. Combined process wastes discharged from the fuel fabrication facilities to the South and North Process Ponds ranged from 1,514,000 to 11,360,000 L/day (400,000 to 3,000,000 gal/day). In August 1945, the pond overflowed on the east side (toward the Columbia River). A crushed rock and earth dike was built in September 1945. This overflow gave the first indication that the infiltration rate was affected by the accumulation of aluminum/uranium hydroxide precipitate. In October 1948, the SPP dike broke on the northwest side, releasing the bulk of the pond's contents, including 5.4 to 27.7 kg (12 to 61 lb) or uranium, into the Columbia River. The breach was attributed to the accumulation of aluminum/uranium hydroxide precipitate on the pond bottom. The North Process Pond was built as a substitute for the SPP while repairs were made and the bottom was cleared of precipitate. Following the incident, the ponds were regularly dredged to prevent future dike failures. The sediments from dredging were deposited on the surrounding dikes and on the scrapings disposal area. The site was Closed Out under EPA/ROD/R10-96/143. Approximately 234,000 metric tons (257,000 tons) of material were removed from the site. The excavation depth was about 5.7 m (19 ft).	Closed Out	CVP-2003-00002	1997	2000	234,000	5.7	Co-60	0.12	7.2	0.0133 U	0.047	2.03	0.00605
												U-234	30.1	242	40.8	13.7	21.2	18.3
												U-235	2.15	11.9	1.87	0.991	2.11	0.801
												U-238	28.9	216	40.6	13.8	19.6	18.5
												Aroclor-1248	0.034 U	0.072 U	3	0.034	0.038	3
												Aroclor-1254	0.062	0.188	0.035 U	0.062	0.091	0.035

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
316-2	Pond	300-FF-1	Not Documented	1948-1974	This site consisted of seven separate sections separated by 3.7 m (12-ft-) wide dikes, with the entire 40,000 m^2 (10-ac) area surrounded by a dike 4.6 m (15 ft) wide and approximately 3.0 m (10 ft) high. It was built and began receiving waste in 1948 after a dike failure at the SPP. The site originally received cooling water and low-level liquid process wastes from the fuel fabrication facilities and the early laboratories (313, 314, 3706, and 321 Buildings). In 1955, the North Process Pond was taken out of service for 14 months to deal with the uranium-bearing sludge on the bottom of the pond. Dredging recovered 4,672 kg (10,300 lb) of uranium from deposits up to 22.9 cm (9-in.) thick in two locations in the southwest region of the pond. It is estimated that before 1954, 21,955 L (5,800 gal) per month of sodium aluminate containing 22.7 kg (50 lb) of uranium, was released into the South and North Process Ponds, resulting in a total accumulation of 2,722 kg (6,000 lb) of uranium. Additionally, an estimated 8,684 kg (19,145 lb) of mostly depleted U-235 was discharged to the Ponds from the 321 Building. By 1956, sodium aluminate was included in the 313 Building waste stream instead of going to the Ponds. The South and North Process Ponds were phased out in 1974 and 1975. The North Process Pond was Closed Out under EPA/ROD/R10-96/143. Remediation began in May 1998 and was completed in June 1999. Almost 140,000 metric tons (154,324 tons) of contaminated soil was taken from the North Process Pond to ERDF.	Closed Out	BHI-01298	May 1998	January 1999	139,204	2.1	PCBs (total)	0.28 U	2.12 J	0.29 U	N/A	1.87	N/A
												U (total)	/	/	/	96.22	221.6	49.7
												U-234	95	147	36.5	/	/	/
												U-235	12.2	15.2	1.39	/	/	/
												U-238	79	119	36.8	/	/	/
												Co-60	0.1	0.75	0.02 U	0.09	0.46	N/A
316-5	Trench	300-FF-1	467.87 × 3.05 × 3.66	1975-1994	This unit served as the discharge site for the 300 Area Process Sewer System. The 468 m (1,535-ft) long, 3 m (10-ft) wide, 3.7 m (12-ft) deep ponds, spaced 15 m (50-ft) apart were constructed to receive the low-level waste that had previously gone to the South and North Process Ponds (316-1 and 316-2). The two trenches operated alternately with one being filled to a predetermined level before switching to the other one, usually every 2 to 6 months. The site received approximately 9.8 million (2.6 million gal) of water per day. This water was chlorinated by the water filter plant for the 300 Area and contained minerals added to the water during use. Water discharged to the process sewer was used primarily for cooling purposes and was not modified. Other sources of discharge include steam condensates, janitorial solutions from washing and waxing floors, water treatment (primarily salt), laboratories, process water from fuel fabrication and other aqueous solutions not designated as dangerous wastes by WAC 173-303. In 1991, an Expedited Response Action resulted in the removal of contaminated soil and sludge from the sides and bottom of the trenches. The excavated sediments were used to fill the north end of the trenches and were immobilized in the Process Trench Spoils Area. The excavation resulted in the removal of 0.3 m (1 ft) and 1.3 m (4 ft) of contaminated soil from the sides and bottom of each trench, respectively. The 300 Area Process Trenches Waste Site was closed out under EPA/ROD/R10-96/143. Approximately 34,000 metric tons (37,479 tons) of material and six 208 L (55-gal) drums of sediment were transported to ERDF.	Closed Out	BHI-01164	July 1997	February 1998	34,386 + 6 (55-gal) drums	4.3	As	14.7	/	15.1	12.8	/	12.1
												Thallium	3.6 U	/	3.5 U	N/A	/	N/A
												Benzo (a)pyrene	0.37 U	/	0.36 U	N/A	/	N/A
												chrysene	0.37 U	/	0.38	N/A	/	N/A
												PCBs	0.26 U	/	0.25 U	N/A	/	N/A
												Co-60	0.04	/	0.12	0.04	/	0.08
												U (total)	310	/	196	229.7	/	171.8

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300 Ash Pits	Coal Ash Pit	300-FF-1	127.0 × 62.0 × 4.57	1944-1994	The 300 Area coal-fired powerhouse generated coal ash starting in about 1944. The ash was suspended in water slurry and sluiced to the SPP until 1951. When the coal fly ash was dry, it was hauled to several locations, including the disposal pit located west of the 300 Area. These pits received about 56,000,000 L (15,000,000 gal) per year of fly ash slurry during operations.	Closed Out	BHI-01132	8/13/1997	8/14/1997	No Excavation	4.6 (depth of test pits)	Co-60	0.04	/	/	0.03	/	/
												U (total)	1.61	/	/	1.61	/	/
												As	8.20	/	/	8.81	/	/
												benzo(a)pyrene	0.035 U	/	/	N/A	/	/
												chrysene	0.35 U	/	/	N/A	/	/
												PCBs (total)	0.26	/	/	0.25	/	/
												Thallium	5.20	/	/	5.25	/	/
300 SE	Evaporator	300-FF-2	15.2 × 9.8	1975-1985	The site was a treatment unit for radioactively contaminated spent solvents generated in the fuel fabrication process at the 300 Area. The 300 SE was installed in spring 1976 and was a treatment tank (evaporator) that received barrels of accumulated solvent waste from degreasing operations associated with the N Reactor fuel manufacturing facility.	Closed Out	Not Documented	N/A										
300 VTS	Process Unit/Plant	300-FF-2	103.63 × 85.34	1983-1986	The site was used in the 1980s and 1990s as a field demonstration site for the vitrification (glassification) of soils containing waste simulates. Tests using PCBs and limited tests with very low levels of radioactivity were also conducted at the site.	Interim Closed Out	CVP-2005-00009	December 2004	8/22/2005	10	Not Docu-mented	Am-241	0.22 U	/	/	0.11 U	/	/
												Cs-137	0.031	/	/	0.024	/	/
												Co-60	0.039 U	/	/	0.017 U	/	/
												Pu-238	0 U	/	/	0 U	/	/
												Pu-239/240	0 U	/	/	0.067 U	/	/
												Ru-106	0.29 U	/	/	0.13 U	/	/
												Sr-90	-0.046 U	/	/	-0.017 U	/	/
												PCB	0.0013 U	/	/	ND	/	/
300-1	Dumping Area	300-FF-2	Not Documented	Not Docu-mented	The area was used by North Richland residents to conduct automotive repairs and recreational activities. No evidence exists that radiological contamination may be at the site. Debris removed from the area in late 1993 included empty bottles, lumber, empty cans of automotive oil, 19 L (5-gal) cans and buckets, an 46 cm (18-in.) wooden wire spool, an automotive front grill, old automotive oil filters, etc. Because of the culturally sensitive issues in this area, the decision makers associated with DOE/RL-96-42 concluded that no further action would be necessary at this site.	No Action	DOE, 1999	N/A										
300-18	Dumping Area	300-FF-2	12.70 × 12.40 × 0.91 Overburden Depth: 0.61	Not Docu-mented	The site was identified in 1993 as an approximately 4.6 m × 6.1 m (15 × 20 ft) area containing radiologically contaminated soil, metal shavings, nuts and bolts, and concrete. Soil and metal shavings were identified with contamination levels of 3,000 to 4,000 dpm.	Interim Closed Out	CVP-2005-00004	December 2004	5/25/2005	392	1.0	U (total)	1.38	/	/	0.878	/	/
												As	2.2	/	/	2.20	/	/
												Ba	67.7	/	/	62.1	/	/
												Be	0.65	/	/	0.62	/	/
												Cd	0.4	/	/	0.04	/	/
												Cr	7.40	/	/	6.40	/	/
												Pb	3.60	/	/	3.40	/	/

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-223	Storage Tank	300-FF-2	10.1 × 2.7 (diameter) 60,566.6 L (capacity)	1964-1998	The tanks were carbon steel, USTs. Fuel oil was pumped into the day tanks from the larger fuel oil bunkers. The oil was used to fuel the 384 Powerhouse boilers to create steam. The tanks and associated appurtenances and piping were dedicated for the storage of heating oil for consumptive use on the premises and, thus, qualify for exemption under WAC 173-360.	Closed Out	Not Documented	Not Documented				N/A						
300-23	Storage Tank	300-FF-2	4.27 (length) × 3.66 (depth) 1.22 (overburden) 2.44 (diameter)	1959-1969	This site no longer exists as a waste site. The tank has been removed and the trench backfilled. Previously, this site was a tank that held diesel fuel used to power the PRTR emergency generator located inside the 309 Building. The tank was installed in 1959 and taken out of service (abandoned) in 1969.	Closed Out	McGuire, 1996	8/24/1996	8/26/1996	Not Documented	Not Documented	N/A						
300-231	Electrical Substation	300-FF-2	11.00 × 7.60	1983-1999	The site was a transformer station connected to a 13.8 kVA overhead power line. The transformers have been removed. The transformers were used to provide electricity for in situ vitrification tests at the 300 VTS, a separate WIDS site. As of 5/13/1999, the transformers had been disconnected and removed from the site. The enclosure associated with the transformers is empty, and the concrete pad is clean.	Closed Out	Not Documented	Not Documented				N/A						
300-253	Sump	300-FF-2	4.51 × 2.65	1977-1998	The site was a two-chambered concrete structure. The larger chamber was the salt dissolving pit, also identified as the "Salt Storage Pit." This section held the salt that was dissolved to make the brine. The smaller chamber was the brine pump pit, also identified as "brine." This chamber held the filtered brine for use in powerhouse operations. The steam system used "soft" water. Brine was used to regenerate the ion exchange demineralizers in the water softeners.	No Action	Not Documented	Not Documented				N/A						
300-262	UPR	300-FF-2	Not Documented	1943-1975	The waste is radioactively contaminated soil. The contamination is suspected to be scrapings from the 316-1, SPP. The survey report indicates readings up to 15,000 dpm beta/gamma. Potential COCs may be the same as those for 316-1, including U-238 and Co-60. Other contaminants may be copper, chromium, ammonia, and PCBs.	Closed Out	CVP-2003-00002	Site was cleaned up in conjunction with Site 316-1. Refer to Decision Document CVP-2003-00002.										
300-272	Storage Tank	300-FF-2	11,356.24 L (capacity)	Not Documented	The site was an UST in a gravel field. The 11,356 L (3,000-gal) tank served as a gasoline fueling station until the 1960s. The dispensing pump was removed before 1968 and the tank was removed in 2002. No evidence of leaking or failure of the connecting pipe or the tank was observed.	Closed Out	N/A	12/17/2001	1/25/2002	Not Documented	Not Documented	N/A						

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-29	UPR	300-FF-2	18.29 × 6.10 × 3.05	Not Documented	The waste is radioactively contaminated soil (reported 5/29/1980). The site is a U-shaped soil berm that surrounds the east wing of the 305-B Chemical Waste Storage Building. On 5/29/1980, the JA Jones subcontractor workers had excavated 76.5 m^3 (100 yd^3) of soil from the 305-B berm before the contaminated rubble was detected and work was stopped. The contaminated material had been taken to the JA Jones Pit No. 1, which was designated as a nonradioactive landfill. Work was stopped immediately after the contamination was identified and the appropriate personnel were notified. Low-level beta/gamma contamination (600 to 4,000 counts/min) was discovered in a small amount of blacktop rubble on the south side of the berm.	No Action	EPA, 2001	N/A										
300-35	Storage Tank	300-FF-2	Capacity: 1,135.62	Not Documented	The site is an abandoned underground fuel storage tank. The underground diesel fuel storage tank was used to support emergency generator operations for HVAC.	Closed Out	Not Documented	N/A										
300-37	UPR	300-FF-2	2.44 × 2.44 × 0.30	Not Documented	The site was a PCB leak that contaminated the soil. The leak originated from a rectifier located on a concrete pad outside of the 335-A Building. The rectifier was installed in the early 1970s, but was never activated.	Closed Out	Not Documented	7/19/1994	Not Documented	Not Documented	0.6	N/A						
300-44	UPR	300-FF-1	159.0 m^2	Not Documented	This contaminated area was identified during the 300-FF-1 OU Phase 1 RIs conducted in 1989 and 1990 (DOE/RL-92-43). An attempt was made to remove the contamination, but it was concluded that the area appeared to be shallow buried material. The soil contamination appears to be the result of shallow buried materials.	Closed Out	BHI-01135	Not Documented	11/18/1997	Not Documented	1.2	As	16.9	9.1	/	/	/	/
												Thallium	3.2 U	3.4 U	/	/	/	/
												Benzo(a) pyrene	0.33 U	0.35 U	/	/	/	/
												Chrysene	0.33 U	0.35 U	/	/	/	/
												PCBs (total)	0.23 U	0.23 U	/	/	/	/
												U (total)	0.61	0.69	/	/	/	/
												Co-60	0.051 U	0.19 U	/	/	/	/
300-45	UPR	300-FF-2	1874.23 m^2	Not Documented	It has been determined the area consisted of contaminated soil caused by the spread of radioactive rabbit feces.	Closed Out	BHI-01136	Not Documented	10/3/1997	Not Documented	0.3	As	6.1 U	/	/	/	/	/
												Thallium	3.5 U	/	/	/	/	/
												Benzo(a) pyrene	0.36 U	/	/	/	/	/
												Chrysene	0.36 U	/	/	/	/	/
												PCBs (total)	0.23 U	/	/	/	/	/
												U (total)	2.47	/	/	/	/	/
												Co-60	0.051 U	/	/	/	/	/

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-49	Dumping Area	300-FF-1	104.85 × 74.98	Not Documented	The site was a large rectangular area with visible debris on the surface and areas of subsidence. Material visible on the surface included empty acid and mercury bottles, ceramics, and other glassware that appeared to be of laboratory origin, metal, and a partially buried 208 L (55-gal) drum. Materials that are radiologically contaminated include soil, tumbleweeds, pipes, ceramics, glass, and a small amount of yellow material that resembles "yellow cake" (a complex uranium compound, the product of chemically refining natural uranium). The site was identified as an undocumented landfill in 1990 during the 300-FF-1 OU RI (DOE/RL-92-43). The original purpose of the landfill and its period of operation are unknown. The site is believed to have been used for random disposal of miscellaneous waste from laboratory operations in the 300 Area.	Closed Out	CVP-2000-00020	January 2000	6/28/2000	17,761	3	Co-60	0.027 U	0.026 U	/	0.011	0.011	/
												U-233/234	1.7	1.1	/	1.24	0.99	/
												U-235	0.24 J	0.057 J	/	0.14	0.083	/
												U-238	1.3	1.1	/	1.0	1.0	/
												Aroclor-1254	0.035 U	3.0	/	0.035	1.3	/
												Pb	8.90	41	/	6.3	21.0	/
300-50	Dumping Area	300-FF-1	Not Documented	Not Documented	The site was an area of surface disturbance. Many discrete objects were detected by GPR. The Landfill 1 B site was identified as an undocumented landfill in 1990 during the 300-FF-1 OU RI (DOE/RL-92-43). The original purpose of the landfill and its period of operation are unknown.	Closed Out	CVP-2000-00021	December 1999	8/12/2000	35,652	3.1	Co-60	0.062 U	0.059 U	/	0.025	0.027	/
												U-233/234	15.5	8.0	/	7.4	5.7	/
												U-235	0.89 J	0.54 J	/	0.61	0.43	/
												U-238	16.6	7.7	/	7.9	5.7	/
												Aroclor-1254	0.180	0.026 J	/	0.12	0.035	/
												Aroclor-1260	0.04 U	0.230	/	0.04	0.15	/
300-51	Dumping Area	300-FF-1	23.00 × 15.00	Not Documented	The site contained radiologically contaminated surface debris. This area of surface contamination and debris was identified in 1990 during the 300-FF-1 OU (UPR-300-FF-1) RI (DOE/RL-92-43). Geophysical surveys of the area did not detect any significant anomalies.	No Action	EPA/ROD/R10-96/143	N/A										
300-52	Trench	300-FF-1	182.88 × 19.81	1948-1996	The 300 Area Sanitary Trenches Site includes two septic tanks and unlined trenches that were connected to the 300 Area SSS. The trenches received sanitary waste from 300 Area facilities.	No Action	EPA/ROD/R10-96/143	N/A										
300-53	UPR	300-FF-2	0.91 × 0.30	1996	The site was contaminated soil that was discovered on the surface of some slightly eroded soil located within a posted URMA. The actual erosion was at the end of a concrete splashguard underneath the water discharge pipe. Disruption of the ground surface by the fire suppression system testing exposed sub-surface contamination that had been previously covered with clean soil.	Closed Out	Not Documented	N/A										
300-57	Storage Pad (<90 day)	300-FF-2	Not Documented	1994-1998	The 90-Day Waste Storage Accumulation Area was used to store sodium-contaminated piping and components after dismantling, before shipment for disposal.	Closed Out	Not Documented	N/A										
300-8	Dumping Area	300-FF-2	351.00 × 97.00 × 0.30	1962-1971	The site consisted of six irregularly shaped soil contamination areas. The area was used to stage aluminum scrap from fuel fabrication operations to be sold to salvage contractors.	Interim Closed Out	CVP-2005-00007	December 2004	May 2005	39,750	0.6	Be	0.65	/	/	0.57	/	/
												U (total)	3.175	/	/	1.622	/	/

Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]/ ACL	Max Concentration (pCi/g, mg/kg) Deep[b]/ BCL	Max Concentration (pCi/g, mg/kg) UCL Area	95% UCL (pCi/g, mg/kg) Shallow[a]/ ACL	95% UCL (pCi/g, mg/kg) Deep[b]/ BCL	95% UCL (pCi/g, mg/kg) UCL Area
303-K CWS	Storage	300-FF-2	24.08 × 28.6 × 4.11	1943-2002	The main building was constructed to store radioactive and mixed waste generated in the 300 Area. Since 1943, the building had been used to store various amounts of low-level radioactive wastes and mixed waste. Solids were stored outside, while liquids were contained inside the building. There were no records of waste spills or leaks at the site.	Closed Out	Bond, 2002	Not Documented	7/22/2002	Not Documented	Not Documented	N/A						
304 CF	Process Unit/Plant	300-FF-2	14.69 × 8.02	1952-1995	This unit operated from 1971 until 1994 as a RCRA treatment, storage, and/or disposal unit for reactive dangerous waste from the uranium fuel fabrication process and from PNNL activities involving depleted uranium alloys. In addition, in 1988, the unit was used to repackage spent organic solvents from the uranium fuel fabrication process. Radiological contamination (derived from building concretion and plating activities) on surfaces and in building piping may still be present. Hazardous wastes were addressed in the facilities RCRA closure plan.	Closed Out	N/A	N/A										
304 SA	Storage	300-FF-2	6.92 × 5.94	1972-1986	The 304 Storage Area is a concrete pad surrounded by asphalt on two sides. The storage area was used to store potentially contaminated wastes generated in the fuel fabrication process. The area was previously used to store containers of potentially contaminated waste generated in the fuel fabrication process. The 304 Concretion Facility and 304 Storage Area were clean closed for hazardous constituents only. The residual radioactive contamination within the building is documented as WIDS Site 300-249, 304 Building. The uranium contamination on the pad and in the soil surrounding the facility is documented as WIDS Site 300-43, UPR Outside the 304 Building. The site was RCRA clean closed in 1995. Radiological contamination may be present on pad surfaces and in the surrounding soil. The TSD activities of this unit were clean-closed in accordance with WAC. Ecology accepted the closure certification for this site on 11/30/1995.	Closed Out	WHC-SD-EN-TI-301	8/3/1994	2/2/1995	Not Documented	Not Documented	Be	0.91	/	/	/	/	/
												Cd	1.3	/	/	/	/	/
												Cr	19.8	/	/	/	/	/
												Pb	863	/	/	/	/	/
												Ni	89.5	/	/	/	/	/
												Ur	256	/	/	/	/	/
												TCE	0.0067 U	/	/	/	/	/
												PCE	0.0067 U	/	/	/	/	/
												1,1,1 TCA	0.0067 U	/	/	/	/	/
												1,1 DCE	0.0067 U	/	/	/	/	/
												cis- 1,2 DCE	0.0067 U	/	/	/	/	/
												trans-1,2 DCE	0.0067 U	/	/	/	/	/
												MEK	0.014 U	/	/	/	/	/
311 MT1	Storage Tank	300-FF-2	7.32 (length) 1.63 (diameter) 15,142 L (capacity)	1955-1971	The site consisted of a horizontal, flat-ended cylindrical tank. While in service, the unit stored pure methanol used as a final rinse to remove water from aluminum end caps and cans in the "triple dip" and "lead dip" fuel fabrication processes. The tank was in use until 1971, when the tank was pumped out and filled with water. The tank was emptied in 1987 and removed on 11/30/1989.	Closed Out	Not Documented	8/30/1989	8/30/1989	N/A	N/A	N/A						

Table A-1. Summary of 300 Area Waste Sites

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
311 MT2	Storage Tank	300-FF-2	7.41 (length) 1.83 (diameter) 22712 L (capacity)	1955-1971	The site consisted of a horizontal, flat-ended cylindrical tank. While in service, the unit stored used methanol solution generated in the 313 fuel fabrication/final rinse processes, until the solution was de-watered in the still. The dewatered methanol was then added to the 311 Methanol Tank (WIDS Site 311 MT1). The tank was in use until 1971, when the tank was pumped out and filled with water. The tank was emptied in 1987 and removed on 8/30/1989.	Closed Out	Not Documented	8/30/1989	8/30/1989	N/A	N/A	N/A						
311-TK-40	Storage Tank	300-FF-2	7.25 (length) 1.83 (diameter) 15142 L (capacity)	1953	The 311-TK-40 tank is an isolated, stainless steel cylinder in the horizontal position that has been drained, isolated, and clean closed. From 1953 to 1973, the tank held nitric acid. Since 1973, the system has been part of the 300 Area WATS. It held liquid mixed waste before disposal. The sample of the drained TK-40 liquid was found to be non-corrosive (pH 9.12), but was determined by ICP to contain greater than the regulatory limit for both chromium (8.53 µg/ml) and silver (6.41 µg/ml) compared to a designation threshold of 5 µg/ml for each according to WAC 173-303-090. The tank is empty and isolated.	Closed Out	Davis, 2001	Not Documented	Not Documented	N/A	N/A	N/A						
311-TK-50	Storage Tank	300-FF-2	18,927 L (capacity)	1985	This site is an 18,927 L (5,000-gal) vertical stainless tank that has been drained, characterized, isolated, and clean closed. Starting in 1985, the tank was used to decant liquid waste starting before it moved on to the 340 Complex. The unit received waste solutions consisting of neutralized liquid from the non-recoverable uranium stream and filtrate from processing of the uranium-bearing waste stream. The liquids, which contained 8% solids, had a pH of 10.4. Lab results for both liquids and solids samples reported less the regulatory limit (WAC 173-303-090) for all RCRA metals. A dried sample of process residue from inside tank TK-50 was analyzed and shown to be non-corrosive, contained no beryllium, and included less than the regulatory limit for RCRA metals.	Closed Out	Davis, 2001	Not Documented	Not Documented	N/A	N/A	N/A						
313 CENTRIFUGE	Process Unit/Plant	300-FF-2	4.27 × 1.52	1985-1997	The centrifuge treated neutralized non-recoverable uranium-bearing waste slurry by separating the solid and liquid phases. The centrifuge was removed in 1997 and disposed of as low-level solid waste.	Closed Out	Davis, 2001	1997	1997	N/A	N/A	N/A						
313 FP	Process Unit/Plant	300-FF-2	Not Documented	1944-1997	The unit treated recoverable and non-recoverable uranium-bearing waste acid by separating solid and liquid phases. Residual radiological and chemical contamination may be present. The uranium-bearing nitric acid solutions were transferred to two 1,700 L (449-gal) storage tanks (TK-3 and TK-4) in the Uranium Recovery Room in the south end of the 313 Building.	Closed Out	Davis, 2001	1997	1997	N/A	N/A	N/A						
313 MT	Storage Tank	300-FF-2	Not Documented	1955-1971	The site consisted of a steel cylindrical tank lying horizontally. The tank was below the floor of the 313 Building. From 1971 to 1987, the tank contained an aqueous methanol solution. In case of a fire in the 313 Building, the methanol from the dehydration tanks could be released to the underground tank. The tank was never used for an emergency dump. The tank was filled with water in 1971, and emptied in 1987. 2,271 L (600 gal) of water and 0.7% methanol was removed from the tank. The excavation was backfilled and the floor was patched with concrete.	Closed Out	Not Documented	8/30/1989	8/30/1989	N/A	N/A	N/A						

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
313-TK-2	Neutralization Tank	300-FF-2	2.74 m (depth) 1.74 m (diameter) 5,678 L (capacity)	1975-1997	The tank was part of the 300 Area WATS. The vertical, stainless steel, cylindrical tank was located within a bermed area with other uranium recovery and acid treatment equipment. The unit treated uranium-bearing acid waste by neutralization. Before removal of the tank, a precipitate cake was present in the bottom of the tank.	Closed Out	Davis, 2001	August 1997	September 1997	Not Documented	Not Documented	N/A						
313 URO	Process Unit/Plant	300-FF-2	Not Documented	1954-1997	The 313 URO processed uranium-bearing acid wastes from the fuel fabrication processes to recover uranium for recycle. The equipment contained uranium-bearing acid wastes from fuel fabrication processes that were used to treat and recover uranium. All contaminated equipment was removed from the facility. In 1997, the 313 URO process equipment and piping were removed and the concrete surfaces scabbled and decontaminated.	Closed Out	Not Documented	1997	1997	N/A	N/A	N/A						
332 SF	Storage	300-FF-1	10.67 × 6.10	1984-1997	The storage facility was used for the temporary storage (<90 day) of flammable and explosive materials. The building is a prefabricated, insulated metal structure erected on concrete footings. The facility's storage design capacity was less than 6,800 L (1,800 gal) of material.	Closed Out	Davis, 1997a	N/A										
333-TK-7	Storage Tank	300-FF-2	0.91 × 0.61 × 0.91 511 L (capacity)	1961-1998	Tank 333-TK-7 was a square, uncovered metal tank and was last used in 1987. The unit was connected to the 300 Area WATS by a PVC drain line. The tank was used to store spent etch acids (nitric and sulfuric acid with uranium in solution). The unit was later used to reduce Cr(VI) to Cr(III) in metal-bearing waste acids.	Closed Out	Davis, 2001	2001	2001	N/A	N/A	N/A						
333-TK-11	Storage Tank	300-FF-2	0.91 × 0.61 × 0.91 511 L (capacity)	1961-1998	It was a square uncovered metal tank. The unit was connected to the 300 Area Waste Treatment System by a PVC drain line. The tank was used to store spent etch acids (nitric and sulfuric acid with uranium in solution). The unit was also used to treat metal-bearing waste acids by reducing Cr(VI) to Cr(III).	Closed Out	Davis, 2001	1998	1998	N/A	N/A	N/A						
334 TFWAST	Storage Tank	300-FF-2	22,712 L (capacity)	1971-1988	The 334 Chemical Handling Building and Tank Farm were built in 1960 at the same time as the 333 Building. The 334 Building housed the controls for the facility acid system. The 334 Tank Farm consisted of four 27,000 L (6,000-gal) Koroseal-lined mild steel above ground tanks. It was a vertical cylindrical tank installed on the upper level of the 334 Tank Farm structure, about 8 ft (2.4 m) above ground level. The unit was intermittently used to store waste acids containing non-recoverable uranium from the fuel fabrication process. Numerous leaks occurred throughout the operational history of the tanks and their associated valves and piping. The 334 TFWAST was used in the WATS.	Closed Out	Davis, 2001	1988	1988	N/A	N/A	N/A						
334-A-TK-B	Storage Tank	300-FF-2	3.54 × 1.77 7,571 L (capacity)	1975-1998	The horizontal 7,570 L (2,000-gal) tank was a high-density polyethylene tank resting on a steel saddle. The tank was one of three tanks in a 3 m (10-ft-) deep concrete pit below the 334-A Building. It received waste acids from the fuel fabrication process. The waste contained non-recoverable uranium, hydrofluoric, nitric, sulfuric, and chromic acids, and various metals. This site has been clean closed. The tank was removed in 1998.	Closed Out	Davis, 2001	1998	1998	N/A	N/A	N/A						

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
334-A-TK-C	Storage Tank	300-FF-2	3.54 × 1.77	1975-1998	The horizontal 7,570 L (2,000-gal) tank was a high-density polyethylene tank resting on a steel saddle. The tank was one of three tanks in a 3 m (10-ft-) deep concrete pit below the 334-A Building. A cover has been installed over the pit and the cover sealed. It received waste acids from the fuel fabrication process. The waste contained non-recoverable uranium, hydrofluoric, nitric, sulfuric, and chromic acids in solution-bearing metals in solution.	Closed Out	Davis, 2001	2001	2001	N/A	N/A	N/A						
3718-F BS	Process Pit	300-FF-2	3.66 × 3.05	1968-1998	The site was a small structure designed to burn waste alkali metals. The structure has been removed and all that remains is the concrete pad that it shared with other sites related to the 3718-F Alkali Metal Treatment and Storage Facility. Wastes treated at the unit included: sodium, lithium, and sodium-potassium alloys. After burning, the remaining wastes would have consisted of alkali metal oxides and carbonates. Small quantities of reactive laboratory waste may also have been treated. All wastes have been removed.	Closed Out	Wallace, 1998	September 1996	May 1998	Not Documented	Not Documented	N/A						
3718-F TT1	Storage Tank	300-FF-2	7.39 × 0.27	1968-1998	The 3718-F TT1 was a tank used to clean equipment contaminated with alkali metals by reacting the metals with alcohol. The tank has been removed and all that remains is the concrete pad that it shared with other sites related to the 3718-F Alkali Metal Treatment and Storage Facility. Wastes treated at the tank included sodium, lithium, and sodium-potassium alloys. Cleaning agents used within the treatment tank included methanol, isopropanol, and 2-butoxy ethanol. The reaction products were alkoxides (strong organic bases).	Closed Out	Wallace, 1998	September 1996	May 1998	N/A	N/A	N/A						
3718-F TT2	Storage Tank	300-FF-2	3.05 × 0.76 × 0.7	1968-1998	The 3718-F TT2 was a tank used to clean equipment contaminated with alkali metals by reacting the metals with water. Wastes treated at the tank included sodium, lithium, and sodium-potassium alloys. Water was used as the cleaning agent and the reaction products were alkali metal hydroxides. The tank has been removed and all that remains is the concrete pad that it shared with other sites related to the 3718-F Alkali Metal Treatment and Storage Facility.	Closed Out	Wallace, 1998	September 1996	May 1998	N/A	N/A	N/A						
3718-F SF	Storage	300-FF-2	14.6 × 6.10	1968-1989	The 3718-F Storage Facility was used to store high-purity alkali metals and alkali metal alloys to be used in laboratories. The wastes stored at the facility while in use consisted of sodium, lithium, and sodium alloys. Cleaning agents used within the treatment tanks and discharged to the concrete pad included water, methanol, isopropanol, and 2-butoxy ethanol. Reaction products contained within the solutions included alkali oxides, alkali carbonates, and alkoxides (strong organic bases). Hazardous wastes are no longer stored in this facility.	Closed Out	Wallace, 1998	September 1996	May 1998	N/A	N/A	N/A						
400-31	Storage	300-FF-2	28 × 27 × 9	N/A	The 402 SSF was designed to receive sodium drained from the FFTF reactor coolant system.	Closed Out	03-RCA-0262	N/A										
400-36	Storage	300-FF-2	Not Documented	1998-2002	The 4843 Building was used as a transfer station to check Hanford Site garbage (sanitary waste) for radiological or hazardous contaminants before transporting the garbage to the Richland landfill for final disposal.	No Action	N/A	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
400-5	Septic Tank	300-FF-2	0.6 depth	1970s	The vault may have been a septic tank or cistern used in the 1970s during the construction phase of the 400 Area.	Closed Out	N/A	September 1998	Not Documented	Not Documented	Not Documented	N/A						
427 HWSA	Satellite Accumulation Area	300-FF-2	9 × 5	1985	The site is a concrete pad described as the reusable oil and empty drum storage area used to stage containers of oils and lubricants, as well as empty drums. Another report states that the 427 HWSA was used as a staging area for ethylene glycol and ammonium hydroxide.	Closed Out	N/A	N/A										
4831 LHWSA	Storage Pad	300-FF-2	15 × 6	1984-1993	The site was used as a staging area for oils and HW produced and collected in the 400 Area. Wastes staged at this site were primarily oils, solvents, ethylene glycol, and empty drums for cooling water treatment chemicals such as Endcor 4690, which is acutely hazardous. These wastes were stored in containers on the pad.	Closed Out	N/A	N/A										
4843	Storage	300-FF-2	12 × 12	1986-1997	The unit was a storage area for dangerous and mixed alkali metal wastes generated by FFTF and various other operations at the Hanford Site, which included mixed sodium waste, materials used to clean up radioactive sodium, non-radioactive sodium waste, waste radioactive sodium metal, and non-waste, non-radioactive sodium metal. Waste containers used at this facility may have included steel drums or sealed piping and components that have been welded.	Closed Out	Davis, 1997b	N/A										
600-22	Dumping Area	300-FF-2	0.25 mi^2	1942	This site appears on aerial photographs as a large, asterisk-shaped area. It is believed to be an old bombing target site that was used by the U.S. military for practice with live bombs. According to Site personnel, the asterisk-shaped area was used for bombing practice around 1942, before construction began on the Hanford Site reactors. Bomb fragments are scattered throughout the site but are concentrated at the site's southeastern corner. No unexploded bombs have been found in the area.	No Action	Not Documented	Not Documented				N/A						
600-278	Surface Impoundment	300-FF-2	45.72 × 45.72	1999	The soil on the bioremediation pad was originally contaminated with petroleum (fuel oil No. 6 and diesel oil No. 2) from the excavation of the 384 Day Tanks (Site Code 300-223). The soil was removed from around the 384 Fuel Oil Day Tanks and spread onto the ground inside Pit 9 in 1999 to facilitate bioremediation of petroleum contained in the soil.	Closed Out	Not Documented	N/A										
600-46	Dumping Area	300-FF-2	12.00 × 0.91 × 1.00	1995	The site contained used diesel oil filters, an empty can of starting fluid, pieces of lumber, and an empty 208 L (55 gal) drum. It was the consensus of RL, EPA, and Ecology that the only potential contaminants involved with past use of the site were TPH, PCBs, and possibly lead, cadmium, and chromium.	Closed Out	McLeod, 1995	6/15/1995	7/10/1995	10	1	Because of discussions with local representatives of EPA and Ecology, it was determined that this site could be addressed by a voluntary action by RL. This determination was supported by physical evidence that indicated that the actions required generally consisted of removal of trash and soil contaminated with diesel oil. The determination was further substantiated by process knowledge indicating that the site had not been used for radioactive or HW disposal, nor had it involved any past management of hazardous or radioactive materials. Furthermore, the location of this waste site was far removed from any past RL operations involving the management of radioactive or hazardous materials or wastes. It was recommended that the RL voluntary action should meet WAC 173-340-704 cleanup standards. After completing the excavation, samples were taken from the sides and bottom of the excavation indicated that both PCB and TPH levels were less than the WAC 173-340-704 cleanup standards of 1 ppm and 200 ppm, respectively. On 7/21/1995, the regulatory agencies were notified that cleanup activities had been completed. On 7/25/1995, the site was returned to conditions similar to the natural surrounding area.						

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600-47	Dumping Area	300-FF-2	Consists of seven subsites	Not Documented	The site consisted of several areas of surface debris and contamination near the banks of the Columbia River. Debris found at the site includes concrete, brick, cinder block, glass, stainless steel, steel millings/filings, plastic, tar roofing paper, wire, pipe, bottles, sheet metal, screen, clay pipe, irrigation pipe, etc. Concreted soils were found during test diggings, burned wood was found on top of the rise.	Interim Closed Out	CVP-2005-00005	December 2004	5/25/2005	2,159	N/A	U	2.96	/	/	2.79	/	/
												As	2.3	/	/	2.2	/	/
												Ba	81	/	/	67	/	/
												Be	0.50	/	/	0.50	/	/
												Cd	0.090	/	/	0.091	/	/
												Cr	7.4	/	/	5.3	/	/
												Pb	3.5	/	/	3.4	/	/
628-4	Burn Pit	300-FF-1	36.58 × 27.43	1962-1974	The unit was used mainly for burning paper, wood, paint cans, and other operations debris; however, some incidental radioactive materials may have also been burned.	Closed Out	CVP-2003-00001	1999	July 2000	5,635	5.7	Co-60	0.029 U	0.055	/	0.014	0.0224	/
												U-234	1.03	1.74	/	0.84	1.07	/
												U-235	0 U	0.123 J	/	0.057	0.106	/
												U-238	0.81	1.81	/	0.758	0.995	/
												Pb	9.7	120	/	6.9	64	/
												As	3.7	4.80	/	/	/	/
												Aroclor-1242	0.036 U	0.0424	/	0.036	0.17	/
												Aroclor-1248	0.036 U	1.12	/	0.036	1.1	/
												Aroclor-1254	0.036 U	0.405	/	0.036	0.18	/
												Thallium	1.8	0.452	/	/	/	/
												Benzo(a) pyrene	0.35 U	3.50E-01 U	/	/	/	/
												Chrysene	0.35 U	3.50E-01 U	/	/	/	/
UPR-300-7	UPR	300-FF-2	Not Documented	1972	The release site was to the ground and concrete valve pits around the underground day tanks located behind the 384 Building (300 Area Powerhouse). Most of the spilled oil was contained in the underground, concrete pits that surround the day tanks. The release consisted of approximately 3,220 L (850 gal) of No. 6 fuel oil. An estimated 3,028 L (800 gal) were recovered in cleanup operations. Approximately, 114 L (30 gal) were conveyed to the powerhouse, of which 76 L (20 gal) went to the ash pits and 38 L (10 gal) were observed at the process pond (WIDS Site 316-2). That would leave approximately 38 L (10 gal) that may have remained in the soil between the day tanks, the powerhouse facility, piping, the ash pits or process ponds. All values are approximate.	Closed Out	BHI-01298	Site was cleaned up in conjunction with Site 316-2. Refer to Decision Document BHI-01298.											

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
UPR-300-8	UPR	300-FF-1	Not Documented	9/20/1980 - 9/22/1980	UPR-300-8 was associated with the caustic storage tank in the 311 Tank Farm and the 316-5 Process Trenches. The release was confined to the 300 Area Process Trench. A defective valve in the storage tank steam sparge line allowed steam condensate to overflow the caustic storage tank contents into the process sewer system. The release consisted of 50% sodium hydroxide solution. The pH in the process sewer was 11.95.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-9	UPR	300-FF-1	Not Documented	7/3/1976 - 7/5/1976	Nitric acid drained from a storage tank in Room 120 of Building 306-W and drained to the process sewer leading to the north (316-5) process trench. Groundwater analysis showed that the lost uranium and acid never reached the trench. The release consisted of nitric acid solution containing 121.5 kg (267.9 lb.) of depleted uranium. The draining system was dye tested. Fluorescein dye was added to the floor drain and showed that the system was free of leaks.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-15	UPR	300-FF-1	Not Documented	8/19/1980	The site was a release that flowed into the 313 Process Sewer leading to the 316-5 Trench. UPR-300-15 was associated with uranium- bearing acid storage Tanks 3 and 4, the overflow catch barrel in Building 313, and the 316-5 Process Trenches. The spill was completely contained by the process sewer system, posing no risk to workers, the public, or the environment at the 313 Building. The system engineer rinsed the residual acid out of the sewer with rinse water and caustic (sodium hydroxide) to help neutralize the acid. The defective valves were replaced. The waste contained uranium-bearing acid.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to decision document BHI-01164.										
UPR-300-19	UPR	300-FF-1	Not Documented	9/30/1980	The release originated at the 313 Building floor trenches and was confined to the 300 Area Process Trench. Two 53 L (14-gal) drums of incoming deoxidization chemicals (nitric sulfuric chromic acid mixture) were found to be leaking. After the leaks were discovered, the floor was washed off, resulting in discharge to the process sewer. The process sewer showed high nitrate, fluoride, and pH values because of this incident. The event is documented in SO-80-12. The waste contained nitric, sulfuric, and chromic acid, followed by an ammonium bifluoride and sodium hydroxide discharge with incoming acid used in copper component deoxidizing. The leaking drums were repacked to prevent further release.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to decision document BHI-01164.										
UPR-300-20	UPR	300-FF-1	Not Documented	8/19/1980	The release originated at the 313 Building Uranium Recovery Area and confined to the 300 Area Process Trenches. On 8/19/1980, an overflow of a storage tank in the 313 Building resulted in an overflow of the catch barrel into the process sewer system. The release was documented on Occurrence Report 80-26. The release consisted of nitric and sulfuric acids with uranium in solution, quantity unknown.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										

Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)			95% UCL (pCi/g, mg/kg)		
													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
UPR-300-21	UPR	300-FF-1	Not Documented	8/5/1980	The release originated in the 333 Building and was confined to the 300 Area Process Trench. UPR-300-21 was associated with Tanks 13, 15, and 16 in Building 333 and the 300 Area Process Trench. The tanks were removed and the fill lines were capped off. Nitric acid fill lines to Tanks 13, 15, and 16 in the 333 Building were removed. Some residual nitric acid from these lines was discharged into the process sewer. The waste contained a small quantity of nitric acid.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-22	UPR	300-FF-1	Not Documented	1980	UPR-300-22 originated in the 333 Building Chemical Bay Area, but was confined to the 300 Area Process Trench. UPR-300-22 was associated with Tanks 13 and 15 in Building 333 and the 300 Area Process Trench. Acid Etch Tanks No. 13 and 15 were leaking, discharging acid into the process sewer. The waste consisted of a small quantity of etch acids (nitric and hydrofluoric acids). The tanks were removed from service.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-23	UPR	300-FF-1	Not Documented	8/1980	UPR-300-23 originated in the 333 Building nitric and sulfuric acid fill lines and was confined to the 300 Area Process Trench. Leak inspection revealed two leaks in the nitric and sulfuric acid fill lines. The waste consisted of a small quantity of incoming etch acids (nitric and sulfuric acid). The leaks were repaired.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-24	UPR	300-FF-1	Not Documented	8/1980	UPR-300-24 originated at the 333 Building Waste Acid System and was confined to the 300 Area Process Trench. Leak inspection revealed two small drip leaks around a newly installed etch tank. The waste consisted of a small quantity of waste etch acids (nitric and hydrofluoric acid). The leak was repaired.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-25	UPR	300-FF-1	Not Documented	2/15/1980	UPR-300-25 originated in the steam coils in the Uranium Mill Tank Number 32 in the 333 Building and was confined to the 300 Area Process Trench. Leaks in steam coils in the uranium mill tank caused acid to be siphoned into the cooling coils at the nightly shutoff. During startup in the morning, steam discharged the acid in the coils into the process sewer system. The waste consisted of a small quantity of uranium etch acids (nitric and sulfuric acid) in uranium solution. The leaking coils were repaired.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-26	UPR	300-FF-1	Not Documented	1/12/1980	UPR-300-26 originated in the Caustic Storage Tank in the 311 Tank Farm and was routed to the 300 Area Process Trench for disposal. Condensate from a steam heating line in the caustic storage tank caused overflow to the process sewer. The waste consisted of a very small quantity of 50% sodium hydroxide consisting of less than 0.05 kg (0.1 lb) of sodium hydroxide. The steam line was shut off to stop the discharge.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
UPR-300-27	UPR	300-FF-1	Not Documented	10/30/1979	UPR-300-27 originated in the Uranium Bearing Acid Storage Tank piping in the 333 Building and was routed to the 300 Area Process Trench. Failure of a check valve in the piping system resulted in discharge of a stream of uranium-bearing acid into the 300 Area process sewer system. An operator noticed the leakage and immediately shut down the transfer pump, stopping the release. The spilled solution was washed into the 300 Area process sewer system. The waste contained an unknown quantity of uranium-bearing acid waste consisting of nitric and sulfuric acids.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-28	UPR	300-FF-1	Not Documented	6/1978	UPR-300-28 originated with an overflow into the 334A Containment Pit from the 334A Storage Tank. The UPR was routed to the 300 Area Process Trench. An open water fill line in the 333 Building caused the process tank to overflow into the 334A Storage Tanks, which overflowed into the containment pit. The pit then overflowed into the process sewer system. Overflow to the process sewer apparently began at 7:30 a.m. on 6/3/1978, and was discovered on the morning of 6/5/1978. The release consisted of solution containing hydrofluoric, nitric, and sulfuric acids with copper, uranium, and zirconium in solution. The sewer pH monitor indicated the pH dropped from 7.4 to 6.8 after the solution from the pit entered the sewer, indicating very little acid was dumped into the sewer. In FY 1998, the R 12 refrigerant in all eight chillers was replaced with R 134A, which is nonhazardous and non-ozone depleting.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-29	UPR	300-FF-1	Not Documented	6/1975	UPR-300-29 originated as leaks in the PVC piping in the chemical waste system in the 333 Building. The release was routed to the 300 Area Process Trench for disposal. Leak testing of the system revealed three leaks in the PVC piping system. In addition, one leak was found in the incoming nitric acid supply line. The waste consisted of an unknown quantity of waste etch acids containing hydrofluoric, nitric, sulfuric, and chromic acids with copper, uranium, and zirconium in solution.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-30	UPR	300-FF-1	Not Documented	1/30/1975	UPR-300-30 was associated with the waste receiving tank and chemical processing tanks in the 333 Building and the 300 Area Process Trench. A chemical reaction occurred when a carbonate-bearing solution was added to the waste acid solution. This caused foaming and eventually an overflow of the process tanks that discharged to the process sewer. The waste consisted of a small quantity of waste etch acids and spent film chemicals containing hydrofluoric, nitric, sulfuric, and chromic acids.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-32	UPR	300-FF-1	Not Documented	1974	UPR-300-32 occurred within the uranium- bearing system in Building 333 and was routed to the 300 Area Process Pond. Leak testing of the system revealed one leak in the piping, three leaking transfer pumps, and five leaks in the uranium mill tank. The waste consisted of an unknown quantity of uranium etch acids containing nitric and sulfuric acid with uranium in solution.	Closed Out	CVP-2003-00002	Site was cleaned up in conjunction with Site 316-1. Refer to Decision Document CVP-2003-00002.										

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UPR-300-33	UPR	300-FF-1	Not Documented	1974	UPR-300-33 occurred in the acid drain system and incoming acid fill line in the 333 Building and was routed to the 300 Area Process Pond. A leak test in the chemical waste drain system revealed 16 leaks from the 333 Building to the 334-A Building. Additionally, five leaks were found in the incoming acid fill lines (presumably nitric or sulfuric acid system). The waste consisted of an unknown quantity of waste etch acids containing hydrofluoric, nitric, and chromic acids with copper, uranium, and zirconium in solution.	Closed Out	CVP-2003-00002	Site was cleaned up in conjunction with Site 316-1. Refer to Decision Document CVP-2003-00002.										
UPR-300-34	UPR	300-FF-1	Not Documented	1973-1975	On 8/1/1973, failure of the limestone neutralization tank resulted in a discharge of acidic waste solutions to the ground beneath the tank (WIDS 300-21 report) and the routing of the acid waste to the process pond. Potential COCs are those generated by the 333 N Fuels WATS processes. These can include nitrate and sulfate salts of Cr(VI), uranium, copper, aluminum, beryllium, nickel, manganese, hexafluorozirconates, and iron. The potential acids involved include nitric acid, sulfuric acid, and hydrofluoric acid. An unknown quantity of waste etch acids were discharged to the soil. The waste etch acids contained hydrofluoric, nitric, and chromic acids with copper, uranium, and zirconium in solution. The site of the limestone neutralization tank was partially excavated during removal of the failed tank. It is assumed that some of the acid-contaminated soil beneath the tank was removed and the subsoil area was neutralized with water and sodium bicarbonate.	Closed Out	CVP-2003-00002	Site was cleaned up in conjunction with Site 316-1. Refer to Decision Document CVP-2003-00002.										
UPR-300-35	UPR	300-FF-1	Not Documented	1973	UPR-300-35 occurred in the acid overflow alarm system behind Tank 32 in the 333 Building Uranium Bearing Acid Facility and in a uranium-bearing acid transfer pump. The UPR was routed to the 300 Area Process Pond (316-1). A leak was discovered in the overflow alarm system in the uranium mill tank. The uranium acid transfer pump was also discovered to be leaking. The waste consisted of an unknown quantity of uranium- bearing etch acids containing nitric and sulfuric acids with uranium in solution.	Closed Out	CVP-2003-00002	Site was cleaned up in conjunction with Site 316-1. Refer to Decision Document CVP-2003-00002.										
UPR-300-36	UPR	300-FF-1	Not Documented	1973	UPR-300-36 occurred in the acid drain system and incoming nitric acid lines of the 333 Building. The waste was routed to the 316-1, 300 Area Process Pond. Leak testing of the acid drain system showed nine leaks. Four leaks were also found in the incoming nitric acid lines. The waste consisted of an unknown quantity of waste etch acids containing hydrofluoric, nitric, and chromic acids with copper, uranium, and zirconium in solution. The leaks were repaired and the release was routed to the 316-1, 300 Area Process Pond for disposal.	Closed Out	CVP-2003-00002	Site was cleaned up in conjunction with Site 316-1. Refer to Decision Document CVP-2003-00002.										
UPR-300-37	UPR	300-FF-1	Not Documented	1972	UPR-300-37 occurred in the 333 Building Waste Acid System and was routed to the 316-1 300 Area Process Pond. Leak testing of the waste line revealed several large and numerous small leaks that discharged directly to the process sewer. The waste consisted of an unknown quantity of waste etch acids containing hydrofluoric, nitric, and chromic acids with copper, uranium, and zirconium in solution. The release was routed to the 300 Area Process Pond for disposal.	Closed Out	CVP-2003-00002	Site was cleaned up in conjunction with Site 316-1. Refer to Decision Document CVP-2003-00002.										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
UPR-300-41	UPR	300-FF-2	Not Documented	6/3/1986	113.60 L (30 gal) of the liquid, which is categorized as extremely HW, leaked from the drum situated on an asphalt pad; it contaminated part of the asphalt pad and an area of soil next to the pad. The released liquid consisted of phosphoric acid with the following constituents: 14,000 ppm chromium, 1,900 ppm manganese, 1,700 ppm iron, and 400 ppm nickel. The liquid released was from a leak in a 208 L (55-gal) drum situated in an asphalt pad.	Closed Out	Not Documented	Not Documented				N/A						
UPR-300-47	UPR	300-FF-1	Not Documented	4/30/1993	UPR-300-47 originated at the number 3 water chiller, drained to the sump, and discharged to the process sewer in the 309 Building and process trenches (316-5). The release was the result of the failure of the expansion joint in the number 3 water chiller. The sump had collected the ethylene glycol and discharged approximately 3,030 L (800 gal) of 38% ethylene glycol solution to the process sewer before being turned off. Liquid samples taken at the process trench weir box on 4/30/1993, at approximately 6:30 a.m. indicated ethylene glycol concentrations of approximately 3,000 ppm. Samples taken at 7:00 p.m. indicated non-detectable amounts of ethylene glycol. Preliminary results from four downgradient wells indicate of ethylene glycol concentrations of 5 ppm. It is possible that the sediment near this area has some contamination, but it is assumed that most of the ethylene glycol went to the groundwater, where it was diluted in the underlying aquifer. The release site cleaned up and waste generated during the cleanup was disposed of properly on 5/7/1993.	Closed Out	BHI-01164	Site was cleaned up in conjunction with Site 316-5. Refer to Decision Document BHI-01164.										
UPR-300-FF-1	UPR	300-FF-1	Not Documented	Not Documented	The site consisted of multiple contaminated areas identified in 1990 during the 300-FF-1 OU RI. The release sites were associated with WIDS Sites 300-44, 300-49, 300-50, 300-51, the SPP, and 316-2 North Process Pond. The UPR file listed 77 individual areas of surface or near surface contamination (identified as R-1 through R-77) ranging from 15 cm to 15 m (6 in. to 50 ft) in diameter and larger areas measuring up to 24 × 61 m (80 × 200 ft). Three areas of subsurface disturbance were identified and named Landfills 1A, 1B, and 1C. Landfills 1A (300-49) and Landfill 1B (300-50) have been surface stabilized. The debris at Landfill 1C (300-51) has been removed. An area adjacent to the west end of 618 4 (300-44) appears to be shallow buried material and was surface stabilized. These areas are entered into the WIDS database as separate waste sites. Primarily, contamination was associated with the soil; however, some contaminated metal and other materials were also found. GM/P-11 instrument readings range from 100 to 50,000 counts/min. Analysis of samples showed that the radiation levels were caused primarily by the presence of uranium. Some soil samples also contained relatively high concentrations of copper.	Closed Out	CVP-2003-00002	Site was cleaned up in conjunction with Site 316-1. Refer to Decision Document CVP-2003-00002.										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
UPR-600-15	UPR	300-FF-1	18.29 × 2.13	1979	The area is posted as "Underground Radioactive Materials." The release site was an area of soil outside the entrance to the 618-4 Burial Ground. The new fence was built in 1974; however, it was installed in a new location that left the release site outside of the burial ground boundaries. The previous fenced area included the release site. UPR-600-15 occurred in an area of soil running north and south of the west boundary fence of the 618-4 Burial Ground in the 600 Area.	No Action	Not Documented	N/A										
300-3	Burial Ground	300-FF-1	657 m^2 × 3.05 (depth)	Not Documented	The 300-3 Aluminum Hydroxide Site was identified during installation of a sump pit for the 300 Area TEDF. The site consists of several horizontal 0.3 to 0.45 m (1 to 1.5-ft-) diameter cedar logs forming a vertical wall approximately 3 m (10-ft-) high running in a north south direction.	No Action	EPA/ROD/R10-96/143	N/A										
300-10	Burial Ground	300-FF-2	656.73 m2	1950	The site was expected to consist primarily of soil mixed with clean and contaminated metal shavings. The northwest corner terminates very near a dirt road that intersects the midpoint of the west 316-5 Process Trenches. On 11/11/1994, a field walk down resulted in a report that the site appeared as a soil-covered field with natural vegetation.	Closed Out	BHI-01134	Not Documented	10/3/1997	Not Documented	1.2	As	13.5	/	/	/	/	/
												Thallium	4.1 U	/	/	/	/	/
												Benzo(a)-pyrene	0.36 U	/	/	/	/	/
												Chrysene	0.36 U	/	/	/	/	/
												PCBs (total)	0.25 U	/	/	/	/	/
												U (total)	2.69	/	/	/	/	/
												Co-60	0.02 U	/	/	/	/	/
618-2	Burial Ground	300-FF-2	49 × 9 × 4.6 (north trench)	1951-1954	The waste site consisted of three east-west- oriented trenches. A GPR investigation, performed in 1995, identified three distinct trenches. Historical documents stated that there were either three or four trenches. The discrepancy of whether there are three or four trenches could be because the geometry of the middle trench is broken into two pieces at the east end. The unit was used for disposal of uranium-contaminated equipment and materials, plutonium, and fission products. The uranium waste was typically solid metallic uranium oxides in the form of metal cuttings from Reactor Fuel Fabrication facilities in the 300 Area. The plutonium and fission products came from 300 Area laboratory facilities that began to operate in 1953. The burial ground may also contain tin from the triple dip canning process and lead from the lead dip process. In December 2004, during remedial excavation of this burial ground, a combination lock safe was unearthed. When opened, bottles of liquid waste were found.	Interim Closed Out	CVP-2006-00010	11/1/2004	8/1/2006	71,049	6	As	1.90	1.80	/	1.9	1.4	/
												Ba	79.8	185	/	73.6	76.9	/
												Cd	9 U	0.14	/	0.09 U	0.09 U	/
			54 × 15 × 4.6 (middle trench)									Cr	7.10	6.70	/	6.6	5.7	/
												Pb	5.60	6.60	/	4.9	5.5	/
												Sn	2.40	8.70	/	2.3	2.9	/
			55 × 15 × 4.6 (south trench)									Se	0.75	0.78	/	0.76	0.78	/
												U (total)	12.50	501	/	4.17	338	/
												Am-241	0.81	17.8	/	0.54	6.52	/
												Cs-137	2.24	1.04	/	1.5	0.914	/
												Co-60	0.048 U	0.049 U	/	0.021 U	0.023 U	/
												Eu-152	0.13 U	0.16 U	/	0.055 U	0.068 U	/
												Eu-154	0.17 U	0.18 U	/	0.070 U	0.080 U	/
												Eu-155	0.18 U	0.35 U	/	0.069 U	0.13 U	/
												Ni-63	5.95 U	4.44 U	/	0.498 U	0.261U	/
												Tritium	0.477 U	0.0713	/	0.0938 U	0.788 U	/

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
												Pu-238	0.068 U	1.50	/	0.056 U	1.08	/
												Pu-239/240	7.67	92.3	/	5.2	72.9	/
												Pu-241	9.65	42	/	14.5 U	34.3	/
												Sr-90	0.063	11.6	/	0.037 U	7.4	/
												U-233/234	5.02	161	/	0.93	108	/
												U-235	0.214	0.776	/	0.062	2.24	/
												U-238	4.98	165	/	1.07	111	/
618-3	Burial Ground	300-FF-2	121.92 × 51.21 × 4.57	1954-1955	The site consists of uranium-contaminated waste, primarily building materials from the remodeling of the 313 Building. It may also contain waste from the 303-J and K upgrades. In 1986, the volume of contaminated soil was estimated to be 12,549 m^3 (443,160 ft^3), with 12,643 m^3 (446,480 ft^3) of overburden.	Interim Closed Out	CVP-2006-00005	9/9/2004	1/31/2006	30,878	Not Documented	U-233/234	1.09	/	/	0.626	/	/
												U-235	0.038	/	/	0.170 U	/	/
												U-238	1.07	/	/	0.696	/	/
												As	3.1	/	/	2.7	/	/
												Ba	76.5	/	/	73.7	/	/
												Cd	0.14 U	/	/	0.082 U	/	/
												Cr	9.7	/	/	9.4	/	/
												Pb	3.9	/	/	3.8	/	/
												Se	0.66	/	/	0.61	/	/
												Ag	0.21 U	/	/	0.15 U	/	/
												U (total)	1.64	/	/	1.56	/	/
618-4	Burial Ground	300-FF-1	178.67 × 68.13	1955-1961	During remedial activities, drums of depleted uranium packed in oil were uncovered. The presence of these drums was not previously known, therefore, the documented uranium inventory for this burial ground did not include these (estimated to be up to 1,500) barrels of depleted uranium. The inventory contained in the drums has been estimated to be 110,600 kg (243,800 lb).	Closed Out	CVP-2003-00020	February 1998	August 2003	46,585	11	As	3.2	2.2	/	3.1	2.1	/
												Pb	18.4	49	/	34	16	/
												U-234	3.22	20.20	/	/	/	/
												U-235	0.0481	1.09	/	/	/	/
												U-238	3.07	21.50	/	/	/	/
												U (total)	6.38	42.79	/	5.25	16.7	/
618-5	Burial Ground	300-FF-2	96 × 56 × 6	1945-1962	The site was one large (single) pit and received 300 Area waste from 1945 through 1962. It was also used as a burn pit. HW-39076 states the area was a burning trench as well as a storage area for aluminum silicate containing 17% uranium and bronze crucibles with radiation levels up to 200 mr/hr. The site was used for the disposal of uranium-bearing trash. Characterization test pits dug in 1992 encountered radiologically contaminated lead bricks, steel pipes, wood fragments, and other garbage. Asbestos was found in Test Pit 2.	Interim Closed Out	CVP-2003-00021	10/1/2002	9/1/2003	46,300	7.5	Asbestos	4.3	5.2	/	4.3	5	/
												Cd	0.51 U	0.51 U	/	0.24	0.47	/
												Cr	11.3	14.7	/	11	14	/
												Pb	6.1 J	82.3 J	/	5.7	34	/
												U-234	1.59	8.6	/	/	/	/
												U-235	0.137 U	0.462	/	/	/	/
												U-238	1.96	8.87	/	/	/	/
												U (total)	3.69	17.93	/	1.96	16.2	/

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618-8	Burial Ground	300-FF-2	30.48 × 182.88	1954	The site is assumed to have been used for the disposal of uranium-contaminated solid waste from fuel fabrication facilities.	Interim Closed Out	CVP-2006-00006	11/1/2004	1/31/2006	6,462	Not Docu-mented	U-233/234	1.19	/	/	1.04	/	/
												U-235	0.078	/	/	0.228 U	/	/
												U-238	1.1	/	/	0.643	/	/
												As	4.1	/	/	3.7	/	/
												Ba	97.6	/	/	93.30	/	/
												Cd	0.53 U	/	/	0.07 U	/	/
												Cr	12.4	/	/	11.8	/	/
												Pb	5.1	/	/	4.8	/	/
												Se	0.85	/	/	0.83	/	/
												Ag	1.1 U	/	/	0.15 U	/	/
												U (total)	3.28	/	/	1.7	/	/
618-9	Burial Ground	300-FF-2	56.39 × 12.19 × 4.57	1950-1956	The site was a burial ground composed of a single trench. In 1991, this burial ground was excavated. Approximately 2,600 L (700 gal) of hexone, and 3,400 L (900 gal) of kerosene solvent were recovered from 120 drums in the trench's western end. Severely corroded drums were also found at the eastern end of the trench. Approximately 39.6 m^3 (1,400 ft^3) of debris was also found, including more than 80 empty drums, a wheelbarrow, scrap process equipment, construction debris, two breached bags of ammonium nitrate, unidentified white powders, and several lead bricks. Debris and soil were removed to the 200 Area Low-level Radioactive Burial Ground. Liquid wastes were sent to licensed offsite waste handling facilities.	Closed Out	DOE/RL 91-38	2/28/1991	Not Docu-mented	Not Docu-mented	Not Docu-mented	Acetone	0.680		/	0.126		/
												Chloroform	0.009 J		/	0.00388		/
												1,1,2,2,-TCA	0.110		/	0.0294		/
												TCA	0.920		/	0.156		/
												HCE	17.000		/	5.81		/
												HCBD	0.760		/	0.295		/
												Phen-anthrene	0.24 J		/	0.217		/
												TCE	0.005		/	0.00253		/
												Toluene	0.009		/	0.00257		/
												BBP	2.700		/	1.26		/
												Bis (2-ethylhexyl) phthalate	5.200		/	/		/
												Methylene Chloride	2.300		/	0.322		/
												Di-n-butyl phthalate	6.2 J		/	2.94		/
												Al	8,570.0		/	3,081.98		/
												Sb	4.0 U		/	/		/
												As	11.6		/	/		/
												Ba	90.2		/	56.9		/
												Be	0.45 B		/	0.25		/
												Ca	5710.0		/	3,648.13		/

Table A-1. Summary of 300 Area Waste Sites

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
												Cd	0.84 U		/	/		/
												Co	12.3		/	6.61		/
												Cr	9.7		/	0.29		/
												Cu	16.7		/	9.22		/
												Cyanide	514.6 U		/	/		/
												Fe	20,400.0		/	11,970.71		/
												Hg	0.51		/	0.12		/
												Mg	4,450.0		/	2,457.38		/
												Mn	359.0		/	212.1		/
												Ni	10.6		/	6.15		/
												K	1,800.0		/	783.23		/
												Ag	1.4 B		/	1.31		/
												Na	201 BU		/	121.66		/
												Pb	7.7		/	/		/
												Se	1.0 U		/	/		/
												Thallium	2.1 U		/	/		/
												V	59.3		/	14.82		/
												Zn	66.9		/	29.67		/
												Chloride	678.0		/	/		/
												Fluoride	2.8 U		/	/		/
												Nitrate	1670.0		/	265.71		/
												Nitrite	1.4 U		/	/		/
												Phosphate	43.4 J		/	/		/
												Sulfate	983.0		/	/		/
												K-40	16.6		/	/		/
												Ra-226	2.36		/	/		/
												Th-228	0.809		/	/		/
												U (total)	3.18		/	/		/
												U-234	0.48		/	/		/
												U-235	0.71		/	/		/
												U-238	0.48		/	/		/

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618-12	Burial Ground	300-FF-1	121.92 × 60.96 × 2.44	1949-1964	The Sodium Removal Pilot Plant consisted of a reaction vessel, a nitrogen gas supply, a steam supply, and equipment for decontamination studies. The reaction vessel was decommissioned and removed in 1991. The unit has been inactive since 1987. From 1983 to 1987, the unit was used to clean and decontaminate test equipment, reactor components, and other sodium-contaminated parts. Before 1983, the system was used to treat small amounts of alkali metals for R&D and to perform equipment decontamination. Decontamination and R&D activities generated liquid effluents that contained radionuclides and sodium hydroxide. The sodium hydroxide was neutralized before discharging the solution to a crib.	Closed Out	BHI-01298	Site was cleaned up in conjunction with Site 316-2. Refer to decision document BHI-01298.				PCBs (total)	0.28 U	2.12 J	0.29 U	/	1.87	/
												U (total)	/	/	/	96.22	221.6	49.7
												U-234	95	147	11.5	/	/	/
												U-235	12.2	15.2	1.39	/	/	/
												U-238	79	119	36.8	/	/	/
												Co-60	0.1	0.75	0.02 U	0.090	0.46	/
300-19	Process Unit/Plant	300-FF-2	Not Documented	1979-1987	The Sodium Removal Pilot Plant consisted of a reaction vessel, a nitrogen gas supply, a steam supply, and equipment for decontamination studies. The reaction vessel was decommissioned and removed in 1991. The unit has been inactive since 1987. From 1983 to 1987, the unit was used to clean and decontaminate test equipment, reactor components, and other sodium-contaminated parts. Before 1983, the system was used to treat small amounts of alkali metals for R&D and to perform equipment decontamination. Decontamination and R&D activities generated liquid effluents that contained radionuclides and sodium hydroxide. The sodium hydroxide was neutralized before discharging the solution to a crib.	Closed Out	97-EAP-040	1991	1991	N/A	N/A	N/A						
600-259	Laboratory	300-FF-2	40 × 40 (fenced area)	1984-1994	The site is any contaminated soil associated with this facility. The site included the SWFL and the Grout Waste Test Facility (exhumed). The SWFL contained masonry cement, Portland cement, and vinyl ester styrene waste forms spiked with Mn-54, Co-60, Cs-134, and Cs-137. The waste forms were placed into the lysimeters at various depths. The leachate was collected and disposed of. The lysimeters were capped in 1995 to prevent any further water intrusion. The leachate was drained for the last time by PNNL in 1996. The Grout Waste Lysimeter caissons (A-1 and B-1) contained layers of waste, containing small amounts of both radioactive and non-radioactive tracer agents embedded into grout material. The waste layers were separated by layers of soil. The lysimeter caissons were buried below ground. The radioactive tracers used in this test were primarily Co-60 (up to 330 Ci/L) and lesser amounts of Co-58, Fe-59, Cr-51 and Mn-54 and trace amounts of other radionuclides. In 1991, there was also a release of 300 L of drainage containing trace amounts of Tc-99 from the bottom of one caisson containing cladding removal waste.	Interim Closed Out	CVP-2005-00008	September 2004	7/21/2005	Not Documented	Not Documented	Cs-134	0.056 U	0.054 U		0.026 U	0.025 U	
												Cs-137	0.038	0.034	/	0.051 U	0.025	/
												Co-60	0.045 U	0.042 U	/	0.021 U	0.020 U	/
												Mn-54	0.037 U	0.04 U	/	0.017 U	0.019 U	/
												Tc-99	0.275 U	0.556 U	/	-0.0045 U	0.18 U	/
												Tritium	-1.37 U	0.389 U	/	-1.92 U	-0.656 U	/
Biological Treatment Test Facilities	Laboratory	300-FF-2	Not Documented	1988-1996	The unit consisted of various laboratories in the 324, 325, and 331 Buildings. The processing equipment covered under this unit included lab, bench, pilot, and full-scale treatment equipment. Wastes treated by the unit included listed waste, waste from non-specific sources, characteristic wastes, and state-only wastes. The RCRA Part A Permit Application for this unit was closed on 12/12/1996.	Closed Out	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
Physical and Chemical Treatment Test Facilities	Laboratory	300-FF-2	Not Documented	1979-1995	The unit consisted of the use of the 324 Building Biological Treatment Test Facilities, the 324 Building Radiochemical Hot-Cell Complex, and the 325 Building Shielded Analytical Laboratory to test treatment technologies for RMW and HW. The processing equipment covered under this unit included lab and bench-scale treatment equipment. Waste treated by various processes included listed wastes, wastes from non-specific sources, characteristic wastes, and state-only wastes. Petroleum refining wastes were also included. The processes used in this unit included pH adjustment, ion exchange processes, waste concentration, precipitation/filtering, solids washing, catalytic destruction, and grouting.	Closed Out	Ecology, 1996	Not Documented				N/A						
Thermal Treatment Test Facilities	Laboratory	300-FF-2	Not Documented	1978-1996	The unit consists of various laboratories in the 324 and 325 Buildings and the in situ vitrification unit, which is a transportable treatment unit. The processing equipment covered under this unit included bench, engineering, pilot, and full-scale treatment equipment. These units treated mixed and HW with in situ vitrification or waste vitrification treatment processes. Wastes treated by these processes included listed wastes, wastes from non-specific sources, characteristic wastes, and state-only wastes.	Closed Out	Ecology, 1996	Not Documented				N/A						
300 RLWS	Radioactive Process Sewer	300-FF-2	853.44	1979-1998	The 300 Area RLWS consists of a network of underground, double-encased stainless-steel pipe (encased in reinforced-fiberglass or plastic pipe as secondary containment) draining to the 340 Complex. The sewer system is designed to transfer radioactive liquid wastes from the generating facilities to the 340 Complex. Contaminants would include uranium, acids, bases, metals, solvents, and fission products. Contaminated soil and piping is estimated to be 7928.7 m^3 (280,000 ft^3).	Accepted	EPA, 2001	N/A										
300 RRLWS	Radioactive Process Sewer	300-FF-2	0.05, 0.08, 0.1, and 0.15 (diameter)	1954-1975	The 300 Area RRLWS is a network of single-walled stainless steel piping and carbon steel fittings buried between 3 and 6 m (10 and 20 ft) below grade. The unit received radioactive wastes from various 300 Area facilities including the fuel fabrication and R&D laboratories. Wastes discharged to the sewer included water and small quantities of chemicals, decontamination solutions, aqueous fuel fabrication solutions, acids, and bases. Contaminants of potential concern would include uranium, mercury, acids, bases, fission products, metals, and solvents.	Accepted	EPA, 2001	N/A										
300-109	Injection/ Reverse Well	300-FF-2	Not Documented	Not Documented	DOE/RL-95-82c states the injection well is below grade and drains a network of four catch basins.	Accepted	EPA, 2001	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-15	Process Sewer	300-FF-2	The 300 Area process sewer system is an extensive system with an estimated 9.7 km (6 miles) of outside lines, and an estimated 40 km (25 miles) of interior building waste pipe. Interior building feeder pipes can be 2.5-5 cm (1 to 2 in.) in diameter, while the large header pipes are 46 cm (18 in.) in diameter.	1943	The site is an underground process sewer built in 1943 that extends throughout the 300 Area for the disposal of process wastes such as potable water, cooling water, precipitation runoff, waste brine solution (sodium chloride with magnesium salts), chromium, copper, uranium nitrate, sulfate, and fluoride ions with the contaminants lead, silver, acetone, and cyanide. The original system was primarily 20 cm (8-in.-) diameter vitrified clay pipes with acid-proof joints running eastward to the SPP and the North Process Pond until 1975, then to the 300 Area Trenches from 1975 to 1994. Starting in 1994, the discharges were sent through a new pipeline to the 300 Area TEDF for treatment and release into the Columbia River. Initially, the system received low-level liquid wastes from the 313 and 314 Buildings and later from the 3706 and 321 Laboratories. The 321 Building connected to the main 20 cm (8-in.) lines through a combination of 8 cm (3-in) stainless steel, 20 cm (8-in.) wrought iron, and 15 cm (6-in.) earthenware pipes, all of acid-proof construction. By 1994, more than 50 facilities were connected to the process sewer with an estimated 9.6 km (6 mi) of outside, underground utility piping and an estimated 40.2 km (25 mi) of interior building piping. As the system was updated and expanded, pipe materials included the original vitrified clay as well as cast iron, steel, concrete, PVC, and stainless steel.	Accepted	EPA, 2001	N/A										
300-2	Trench	300-FF-2	Not Documented	1965-1966	About 189,250 L (50,000 gal) of secondary cooling water and other contaminated water containing 33 mCi of I-133 and 12 mCi of I-131were disposed of to ground. About 10 µCi of alpha emitters (calculated as Pu-239) and about 40 mCi of non-volatile beta emitters plus rutheniums were transferred to the trench during the first 36 hours of the incident. A small number of short pumpings were made after that, however, the total volume and radioisotopic inventory are insignificant in comparison to those during the first 36 hours.	Accepted	EPA, 2001	N/A										
300-214	Radioactive Process Sewer	300-FF-2	274.32 (length)	1953	The site is an underground carbon steel and PVC pipeline connecting the 300 Area laboratory facilities (308, 324, 325, 326, 327, and 329 Buildings) to the 307 Retention Basins. The waste discharged to the RPS is nonhazardous, potentially radioactive waste (not to exceed 5,000 pCi/L) from the 300 Area Laboratory facilities. In FY 1998, approximately 12 million L (3 million gal) flowed through the RPS to the 307 Retention Basins.	Accepted	EPA, 2001	N/A										

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300-219	Process Sewer	300-FF-2	Not Documented	Not Documented	This site includes the transfer lines connecting the various components of the 300 Area WATS and the 300 Area URO. The piping, located in the Pipe Trench (300-224), includes: (1) the 333 N Fuels process transfer lines to the process acid waste solution storage tanks in the 333 and 334-A Facilities, (2) the waste transfer lines to the waste treatment facilities in the 313 Uranium Recovery/WATS Neutralization Room, (3) the transfer lines to/from the 313 Building to the neutralized acid waste storage tanks in the 311 Tank Farm, (4) ethylene glycol supply and return lines in the Pipe Trench between the 333 Building and the 313 Building used to heat this portion of the Pipe Trench, (5) fresh acid (nitric and sulfuric) lines from the 334 Tank Farm to the 333 Building, and (6) caustic lines from the Tank Farm to the 313 WATS/URO Room. As of 11/1/1998, all process and waste piping inside the associated facilities had been disconnected from the Pipe Trench; only the piping inside the Pipe Trench or outside the facilities (e.g., tank farm piping) remains for pipes associated with the 300 Area WATS or the 300 Area U-Bearing Acid Treatment System.	Accepted	Not Documented	N/A										
300-22	UPR	300-FF-2	6.10 × 2.44	1962	The site is an UPR from a parted hose coupling that contaminated the ground outside the emergency airlock of the 309 Building on 9/20/1962. The site is covered with new asphalt. The asphalt area is roped off and trucks are not allowed on the asphalt. The rupture loop annex is present below ground at the site.	Accepted	EPA, 2001	N/A										
300-257	Process Sewer	300-FF-2	0.91 (diameter)	Unknown – late 1970s	The waste is a pipeline that carried potentially radioactively contaminated water to the river. The site is process sewer piping that was originally connected to the 309 Building's Rupture Loop Holding Tank. The tank was removed in the late 1970s. At the same time the Rupture Loop Holding Tank was removed to a 200 Area burial ground, all RLWS connections were severed and plugged. The area where the Rupture Loop Holding Tank was located is now covered with asphalt and is being used as a parking lot.	Accepted	EPA, 2001	N/A										
300-265	Radioactive Process Sewer	300-FF-2	Length: 213.36	1971	The transfer line carried liquid High Level Waste from spent nuclear fuel processing.	Accepted	EPA, 2001	N/A										
307 RB	Retention Basin	300-FF-2	8.53 × 5.18 × 2.74 The measurements provided above are for one basin. The 307 RB consists of four basins.	1953	The facility consists of four open, epoxy-coated, concrete basins. Each basin has a nominal 94,500 L (25,000-gal) capacity. The RPS line and the 307 Retention Basin systems were installed to collect potentially contaminated liquids from the sinks, drains, and sumps of the laboratory facilities. During FY98, 12 million L (3 million gal) of liquid was received by the retention basins. Liquid effluents that meet process sewer discharge criteria are released to the process sewer. Waste that exceeds discharge limits is held until it can be transported to the 200 Area double-shell tanks. Before 10/1/1998, waste above discharge limits was diverted to the 340 facility holding tanks.	Accepted	Not Documented	N/A										
309-TW-1	Storage Tank	300-FF-2	19,025 L (capacity)	1960-1973	The unit received aqueous nonhazardous radioactive wastes from the operation of the PRTR. Residual contamination may be present in the empty tanks.	Accepted	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
309-TW-2	Storage Tank	300-FF-2	19,461 L (capacity)	1960-1973	The unit received aqueous nonhazardous radioactive wastes from the operation of the PRTR. Residual contamination may be present in the tanks.	Accepted	Not Documented	N/A										
309-TW-3	Storage Tank	300-FF-2	15842 L (capacity)	1960-1973	The unit received aqueous nonhazardous radioactive wastes from the operation of the PRTR. Residual contamination may be present in the tank.	Accepted	Not Documented	N/A										
309-WS-3	Storage Tank	300-FF-2	9.14 × 3.66 × 2.90	1960-1969	The Brine Tank is a below grade, rectangular concrete structure with two chambers. The unit stored brine salt to be used by the process water/brine tanks within the basement of the 309 Building.	Accepted	Not Documented	N/A										
316-3	Trench	300-FF-2	182.88 × 3.05 × 6.10	1953-1963	The site received wastes from the 300 Area Laboratory expansion facilities (329 Biophysics Laboratory, 327 Radiometallurgy Building, 324 Radiochemistry Building, 326 Pile Technology Building, and 329 Mechanical Development Building). The wastes first went through the 307 Retention Basin. Retention Basin waste below discharge limits was released to the trenches.	Accepted	EPA, 2001	N/A										
316-4	Crib	300-FF-2	7.92 × 7.92 × 5.49	1948-1956	The site received hexone-bearing uranium wastes and limited amounts of other uranium-bearing wastes from the 321 Building. Calculations up to and including July 1955 indicated liquid wastes containing a total of 550 kg (1,230 lb) of uranium had been discharged to this site. Additional documentation has been found indicating 12,040 L (3,182 gal) of liquid organic waste was being shipped to the 300 North Cribs in 1962.	Accepted	EPA, 2001	N/A										
400 Process Pond and Sewer System	Pond	300-FF-2	Not Documented	1979-present	This site is the 400 Area Secondary Cooling Water (400 Area Process Sewer). The unit consists of underground piping, a control structure, and two percolation ponds known as 4608B and 4608C. The process sewer, which empties into the process ponds, is for discharge of water from cooling systems and non-sanitary drains and sumps in the 400 Area facilities, including the FFTF. Water from the FFTF and FMEF cooling towers contains non-regulated quantities of algaecides and other treatment chemicals, including a biocide (Dearcide 702), a microbiocide (sodium hypochlorite), and a softening agent (Dearborn 878). Chemicals used for secondary cooling water testing (Dearborn Code 550, 562, 595, 899, 904) are also present in unregulated quantities.	Accepted	Not Documented	N/A										
300-11	UPR	300-FF-2	0.84 (length) × 0.91 (diameter) 548.82 L capacity	1943-1992	The site was releases to the soil that were discovered following the removal of an underground gasoline tank in September 1992. The tank had failed a leak test. The tank was removed; however, the contaminated soil has not been cleaned up. The site is not marked in the field and currently appears as a graveled lot adjacent to the 382 Building.	Accepted	EPA, 2001	N/A										
300-110	Injection/ Reverse Well	300-FF-2	0.61 (depth) × 0.41 (diameter)	Not Documented	The site is a 0.41 m (1.3-ft-) diameter drain with a metal grate labeled "Internal Radioactive Contamination" due to its proximity to the WIDS Site 618-1 Burial Ground. The drain has a dirt bottom that is approximately 0.61 m (2 ft) below the surface of the asphalt and an overflow line that drains to the process sewer.	Accepted	EPA, 2001	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-121	French Drain	300-FF-2	1.37 (diameter)	Not Documented	The site received condensate from the air receivers inside the 3621D Building. It may also have received any spills that reached the floor drains. There is a potential for contamination from petroleum and ethylene glycol.	Accepted	EPA, 2001	N/A										
300-123	French Drain	300-FF-2	0.69 (diameter)	Not Documented	The site is a French drain that received steam condensate from the 366 Building fuel oil bunker loading station. The French drain is a metal culvert that is covered with a 0.69 m (2.25-ft-) diameter diamond plate metal cover.	Accepted	Not Documented	N/A										
300-16	UPR	300-FF-2	Not Documented	Not Documented	On three occurrences, radioactive contamination (yellow cake uranium) was discovered on the bottom ends of several utility poles that had been removed.	Accepted	EPA, 2001	N/A										
300-175	French Drain	300-FF-2	0.36 (diameter)	1995	The site is a concrete French drain with a metal cover. The waste was non-dangerous/ nonradioactive steam condensate only. The flow rate when the site was active was less than 0.038 L/min (0.01 gal/min).	Accepted	EPA, 2001	N/A										
300-224	Trench	300-FF-2	243.84 (length)	1960-1988	The site is a subsurface, concrete pipe trench with concrete block and metal plate covers. The pipe trench has several sections that allow piping connections to be made between process operations in the 313 Building, the 303 -F Building, the 311 Tank Farm, the 333 Building, the 334-A Building, and the 334 Tank Farm. The pipe trench and subsurface soil have become contaminated due to multiple releases into the trench. Releases included acids, bases, and solvents. Some of released acids contained dissolved uranium.	Accepted	EPA, 2001	N/A										
300-24	UPR	300-FF-2	Not Documented	Not Documented	This site is contaminated soil near the 314 Building. Soil samples of the dirt in the trench near the 314 Building found mostly uranium and a trace of Cs-137. The gross alpha count was 896 pCi/g.	Accepted	EPA, 2001	N/A										
300-249	Process Unit/Plant	300-FF-2	Not Documented	1952-1995	This site is the residual radioactive contamination at the 304 Building that was not closed out as part of the 304 Concretion Facility. Residual uranium contamination remains in the building from its past use as a concretion facility.	Accepted	Not Documented	N/A										
300-251	UPR	300-FF-2	Not Documented	1943	The site consists of uranium-contaminated soil around and under the 303-K Building (also known as the 303-K CWS). The 303-K Building was removed and clean closed on 7/22/2002.	Accepted	EPA, 2001	N/A										
300-255	UPR	300-FF-2	23.64 × 21.70	1960-1969	The site is contaminated soil located inside the 309 Building Tank Farm fenced area. The source of the contamination was probably the piping related to tanks 309-TW-1, 309-TW-2 and 309-TW-3. Potential radioactive COCs are Cs-137, Co-60, and Am-241. Potential hazardous contaminants are barium, cadmium, chromium, lead, and selenium. The related contaminated structures, e.g., tanks, valve pit, and ancillary piping will need to be removed under a D&D action before soil remediation.	Accepted	EPA, 2001	N/A										
300-256	UPR	300-FF-2	57.91 × 48.77	1956	The site is contaminated soil under and around the 306E Building. The area around the 306E Building is paved and posted as having underground radioactive contamination.	Accepted	EPA, 2001	N/A										

Table A-1. Summary of 300 Area Waste Sites

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-258	Trench	300-FF-2	73.00 (length)	1960-1975	The site is an abandoned subsurface concrete pipe trench. The pipe trench was used to house acid transfer piping from the 334 Tank Farm to the 306E Building chemical processing bay in the northeast corner of this facility. From about 1972 to1975, waste etch solution may have been transferred from the 306E Building chemical bay to the 333/334 WATS.	Accepted	EPA, 2001	N/A										
300-259	UPR	300-FF-2	102.87 × 52.58	Not Documented	In March 1991, partially buried debris was observed protruding from the ground north of the 618-1 Burial Ground marker posts. Leather gloves were removed from the area that read 30,000 dpm beta/gamma and 2,000 dpm alpha. Additional areas of soil contamination were identified on the east side of the 618-1 Burial Ground Markers that read 20,000 dpm beta/gamma and 1,400 dpm alpha. The debris was removed and placed into a Radioactive Waste box. Some contaminated soil was also removed.	Accepted	EPA, 2001	N/A										
300-260	UPR	300-FF-2	34.90 × 29.87	Not Documented	The date that this area was first identified as a contaminated soil site is not known. The soil exceeded regulatory limits for lead and barium. Since lead and barium were used in the fuel fabrication process, it is not unusual to find it in this location. Before the area being covered with asphalt, slag may have possibly been stockpiled in this area before being sent to a burial ground.	Accepted	EPA, 2001	N/A										
300-263	Catch Tank	300-FF-2	77070.99 (capacity)	1969	The site is an inactive catch tank. Hazardous or radioactive waste was never transferred from the 324 Building to the tank. The tank is isolated and the pipelines are capped. Sample results indicated Cs-137 to be 509 pCi/L. Gross beta was 1,700 pCi/L. At the time the site was sampled, 15.2 cm (6 in.) of rainwater. The water is believed to have come from intrusion because many of the flange bolts were missing. The contamination is believed to be from surface contamination. This site lies in the middle of WIDS Site 316-3, 307 Disposal Trenches.	Accepted	EPA, 2001	N/A										
300-268	Foundation	300-FF-2	9.14 × 4.27	1944-1956	The contamination related to this building were a result of passive dust from machining irradiated uranium, graphite, and other metallic samples from the 305 Test Pile. The contamination, if remaining, would be associated with any remaining concrete foundation.	Accepted	EPA, 2001	N/A										
300-269	Foundation	300-FF-2	31.40 × 14.50	1972-1995	The site is a rectangular concrete building foundation. The 331-A Building was used for biological research and demolished in 2000. Residual contamination may be on the pad from past releases at the building.	Accepted	EPA, 2001	N/A										
300-270	UPR	300-FF-2	Not Documented	2000	The UPR is a milky-white flow of water that came out of a pipe located below the loading dock on the east side of the 313 Building. The dock is used by Richland Specialty Extrusions to store metal cylinders. The pipe drains stormwater from the roof of the 313 Building. The release was on to the surface of the ground, in an area of compacted gravel and soil. The stormwater is non-dangerous and nonradioactive. Soil collected from the area near the pipe showed elevated levels of lead. The contaminated soil was not caused by the milky-white liquid. The source of the lead contamination is unknown.	Accepted	EPA, 2001	N/A										

Table A-1. Summary of 300 Area Waste Sites

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-273	Product Piping	300-FF-2	Length: 53.00 Diameter (Large): 0.12	1964-1998	The site is an encased underground pipeline. The encased pipeline contains two 7.6 cm (3-in.-) diameter stainless steel lines. The underground pipeline transferred fuel oil from the 366 Fuel Oil Bunkers (300-6) to the underground Fuel Oil Day Tanks (300-223) to run the 384 Powerhouse.	Accepted	Not Documented	N/A										
300-274	Dumping Area	300-FF-2	Not Documented	Not Documented	Transite pipe, treated wood, insulation, and various forms of transite were identified during the OU walk down. The debris was determined to be potential asbestos containing material.	Accepted	Not Documented	N/A										
300-275	Sanitary Landfill	300-FF-1	Not Documented	Not Documented	The site has been described as having areas of surface and subsurface debris. The surface areas contain sparsely scattered surface debris, including small fragments of potential asbestos containing shingles and concrete. The underground debris is of unknown type.	Interim Closed Out	Not Documented	N/A										
300-276	Sanitary Sewer	300-FF-2	Not Documented	1943-1996	The original 300 Area SSS serviced all existing 300 Area Buildings and a process line from the 313 Building with vitrified clay sanitary sewer pipes. The system fed into a large septic tank with a connection to a tile drainage field. The site includes the surface and subsurface sewer system. In 1947, capacity was increased by adding a new tile field, overflow ditch, and connecting ditch. It was at this time that uranium contamination was discovered in the sanitary sewer sludge and water. The system was expanded again in 1951 to cope with the increasing number of 300 Area facilities by adding two more septic tanks and north and south leaching trenches to replace the old tile field. The system continued to be used until 1996 when the 300 Area SSS was tied into Richland's municipal water treatment system. The SSS potentially contains radioactive and chemical contaminants.	Accepted	Not Documented	N/A										
300-28	UPR	300-FF-2	168.00 × 6.50	1994	The site is contaminated asphalt and soil beneath Ginko Street. Patches of new asphalt are visible where utility trenches were excavated. The oxide burner operations caused contamination to spread and be deposited around the 314 Building area. Uranium metal dust from the fuel fabrication activities provided a pathway for heavy metal dust to become airborne and accumulated in the soils throughout the northern portion of the 300 Area.	Accepted	EPA, 2001	N/A										
300-33	UPR	300-FF-2	57.91 × 48.77	Not Documented	The site is the contaminated soil around and under the 306W Building. The area around the 306W Building is paved and posted as having underground radioactive contamination.	Accepted	EPA, 2001	N/A										
300-34	UPR	300-FF-2	3.66 (depth)	1995	The site was a release to soil that was discovered during excavation to install a new manhole (PS-87). Soil contaminated with radioactive material was found at about the 3.65 m (12-ft) depth. Maximum soil contamination levels were beta/gamma 10,000 dpm. Soil sample results reported 525 pCi/g total beta and 91 pCi/g total alpha.	Accepted	EPA, 2001	N/A										
300-39	Storage	300-FF-2	12.19 × 6.10 × 10.36	1960-1974	The waste is radioactively contaminated equipment and structures.	Accepted	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-4	UPR	300-FF-2	19.50 × 21.30	1943-1990	The site consists of the contaminated soil inside the southwest corner of the fenced (active) electrical substation. The waste is uranium-contaminated soil. According to the referenced document, there is a potential for spillage of PCB to the soil. This statement was based on four samples that contained PCBs in the range of 1 to 3 mg/kg. EPA (2001) also lists solvents as a potential contaminant at this site.	Accepted	EPA, 2001	N/A										
300-40	UPR	300-FF-2	Not Documented	1980	This section of pipe was part of the 300 Area process sewer until it was isolated. This leg of pipe collected rainwater drainage from the 311 Tank Farm and the 303-F Floor Drains. The piping also collected effluent from the 311 Stillhouse. Potential wastes received in this piping system would consist of chemicals used in the 313 Building fuels manufacturing process. These include nitric acid, sodium hydroxide, alcohol, TCE, phosphoric acid, Duponol-M-3, hydrofluorosilicic acid, thorium, uranium, and cutting oils.	Accepted	EPA, 2001	N/A										
300-41	Neutralization Tank	300-FF-2	2.18 (diameter)	Not Documented	The site includes a neutralization tank and valve pit. The valve pit is constructed of concrete and is covered by a 2.18 m (7.15-ft-) diameter metal lid. The neutralization tank and valve pit intercepted and neutralized nitric acid-bearing chemical wastes before discharge to the process sewer. The lime pit is said to contain uranium and thorium sludge.	Accepted	Not Documented	N/A										
300-43	UPR	300-FF-2	Not Documented	1972-1989	The waste is uranium-contaminated soil remaining following operations of the 304 CF and 304 SA facilities. Sampling and analysis during TSD closure activities for the 304 CF and 304 SA showed uranium contamination at levels up to 256 µg/g for shallow soils at the exterior storage pad.	Accepted	EPA, 2001	N/A										
300-46	UPR	300-FF-2	Not Documented	Not Documented	Contamination of the area surrounding the 3706 Building is believed to have resulted primarily from the operations and associated spills and releases. Although radiological surveys near and around the 3706 Building have not detected any radiologically contaminated soil, subsurface contamination is suspected.	Accepted	EPA, 2001	N/A										
300-131	French Drain	300-FF-2	0.42 (diameter)	Not Documented	The site receives drainage from the fire sprinkler system at a rate of less than 3.8 L/min. (1 gal/min.). Fire sprinkler water is exempt from permitting. However, based on past practice activities at the 3706 Building and potential releases to the soil column, the disposal structure and soil should be surveyed to determine if radioactive contamination is present. The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-132	French Drain	300-FF-2	Not Documented	Not Documented	The site has been described as a French drain that received steam condensate. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.). During the 11/18/1998 walk down, there did not appear to be an engineered structure at the site's location. The site appears to be a rock and cobble-filled depression next to the 3706 Building. The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-133	French Drain	300-FF-2	0.66 × 0.66	Not Documented	The site is a French drain that used to receive steam condensate. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.) of steam condensate only. The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-134	French Drain	300-FF-2	0.66 × 0.66	Not Documented	The site is a French drain that received steam condensate. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.) of steam condensate only. The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-135	French Drain	300-FF-2	0.77 (diameter)	Not Documented	The site is a French drain that received steam condensate. The drain is a clay pipe that abuts the north wall of the 3706 Building. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.). The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-136	French Drain	300-FF-2	0.85 (diameter)	Not Documented	The site is a French drain that received steam condensate. The drain is a clay pipe and covered by a metal lid with some perforations. The site is surrounded by sand and gravel, some of which partially covers the lid. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.). The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-137	French Drain	300-FF-2	Not Documented	Not Documented	The site has been described as a French drain that received steam condensate. During the 11/20/1998 walk down, an engineered structure could not be discerned. It could not be ascertained if the condensate stream was active or not. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.). The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										

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300-138	French Drain	300-FF-2	0.66 × 0.66	Not Documented	The site is a French drain that received steam condensate. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.) of steam condensate only. The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-139	French Drain	300-FF-2	0.77 (diameter)	Not Documented	The Site is a French drain that received steam condensate. The drain is a clay pipe covered by a 0.77 m (2.53-ft-) diameter metal lid. When the site was active, the flow rate was less than 0.19 L/min. (0.05 gal/min.) of steam condensate only. The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-140	French Drain	300-FF-2	0.82 × 0.60	Not Documented	The site is a French drain that received steam condensate. When the site was active, the flow rate was less than 0.19 L/min. (0.05 gal/min.). The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-141	French Drain	300-FF-2	0.91 (diameter)	Not Documented	The site is a French drain that received steam condensate. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.) of steam condensate only. The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-142	French Drain	300-FF-2	0.55 (diameter)	Not Documented	The site is a French drain that received steam condensate. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.). The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-143	French Drain	300-FF-2	0.66 × 0.66	Not Documented	The site is a French drain that received steam condensate. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.). The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-144	French Drain	300-FF-2	0.85 (diameter)	Not Documented	The site is a French drain that received steam condensate. When the site was active, the flow rate was less than 0.19 L/min. (0.05 gal/min.) of steam condensate only. The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-145	French Drain	300-FF-2	0.78 (diameter)	Not Documented	The site is a French drain that received steam condensate. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.). The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-146	French Drain	300-FF-2	0.90 × 0.45	Not Documented	The site is a French drain that receives stormwater runoff. According to DOE/RL-95-82c, the flow is less than 0.04 L/min (0.01 gal/min). The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-147	French Drain	300-FF-2	0.90 × 0.45 × 0.90	Not Documented	The site is a French drain that receives stormwater runoff. The drain is made of concrete and appears to be approximately 0.9 m (3 ft) deep. During the 11/11/1998 walk down, the drain appeared to be dry, its bottom covered by debris. According to DOE/RL-95-82c, the flow is less than 0.038 L/min. (0.01 gal/min.). The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-148	French Drain	300-FF-2	0.90 (diameter)	Not Documented	The site is described by DOE/RL-95-82c as a French drain that collects stormwater runoff at a flow less than 0.038 L/min. (0.01 gal/min.). The pipe appears to be filled with gravel and large rocks to within centimeters of its top. During the 10/26/1998 walk down, the site appeared to be a steam condensate site as opposed to a stormwater site. The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-149	French Drain	300-FF-2	0.88 (diameter)	Not Documented	The site is a French drain that received steam condensate. The French drain is a concrete pipe covered perforated metal lid. When the site was active, the flow rate was less than 0.038 L/min. (0.01 gal/min.) of steam condensate only. According to DOE/RL-95-82c, the site is inactive, source abandoned. The site falls within WIDS Site 300-46, which estimates the extent of extensive uranium, TRU, and chemical contamination of the 3706 Building and the surrounding area.	Consolidated	EPA, 2001	N/A										
300-150	French Drain	300-FF-2	1.25 (diameter)	Not Documented	The site is a French drain that is a clay pipe. When the site was active, it received less than 0.038 L/min. (0.01 gal/min.) of steam condensate only. According to DOE/RL-95-82c, the site is inactive, source abandoned.	Consolidated	EPA, 2001	N/A										
300-48	UPR	300-FF-2	14.68 × 8.69	1949-1970	The handling of thorium powder targets spread fine and particulate contamination throughout the 3732 Building. Decontamination practices included hosing down the facility floors and walls, allowing contaminated liquid to be released to the surrounding soil.	Accepted	EPA, 2001	N/A										
300-5	UPR	300-FF-2	1892 L capacity	Unknown-1992	The site was two underground fuel tanks, the pump island, ancillary piping, and contaminated soil. An unknown quantity of contaminated soil, under the fuel dispensing island at the 3709-A Building (300 Area Fire Station) was discovered on 4/10/1992. These tanks were removed on 4/14/1992.	Accepted	EPA, 2001	N/A										

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300-6	Storage Tank	300-FF-2	64.0 × 8.1	1964-1998	The four concrete bunkers (USTs) were removed during summer 2001. In September 2001, the soil adjacent the sidewalls of the bunkers were separated into two categories: soil that visually appears to be contaminated with hydrocarbons and soil that visually appears not to be contaminated with hydrocarbons. The soil was staged at the site to await sampling and disposition.	Accepted	Not Documented	N/A										
300-80	French Drain	300-FF-2	1.22 × 1.22	Not Documented	The site is a square concrete structure adjacent to the 314 Building and next to a fenced stairway leading down. The site is covered by a steel plate marked with a sign "Radioactive material, internally contaminated." The purpose of this structure in not clear. The site appears to have become contaminated.	Accepted	EPA, 2001	N/A										
300-9	Burial Ground	300-FF-2	Not Documented	1943-1945	The location of the site referred to as the Early Burial Ground is not well documented. Uranium-contaminated aluminum shavings are scattered on the surface of the site. Other surface contaminants may include aluminum-silicon alloy and beryllium-contaminated aluminum. Actual burial inventory is unknown. Process knowledge suggests the waste would consist of the uranium-contaminated waste from very early 300 Area experimental processes.	Accepted	EPA, 2001	N/A										
303-M SA	Storage	300-FF-2	13.66 × 10.61 × 0.13	1983-1987	The 303-M Storage Area is an inactive curbed 15 cm (6-in.) concrete pad adjacent to the west side of the 303-M Uranium Oxide Facility. The area was used for storage of pyrophoric uranium and zirconium fines awaiting treatment in the 303-M Oxidation Facility. The metal turnings were stored underwater in 114–L (30-gal) metal drums. The drums of uranium fines were stored in a spaced array defined by painted yellow circles on the pad. An estimated 115,300 kg (127 tons) of uranium were treated during the 303-M Facilities operation.	Accepted	EPA, 2001	N/A										
313 ESSP	Storage	300-FF-2	Not Documented	Not Docu-mented	The 313 East Side Storage Pad is a large concrete pad with an asphalt ramp that connects the pad to Ginko Street. The area was used to stage mixed waste including byproduct waste materials from the fuels fabrication process and neutralized solids from the 313 Recovery Operations process.	Accepted	EPA, 2001	N/A										
323 TANK 1	Storage Tank	300-FF-2	16.15 (length) × 3.05 (depth) × 106,370 L (capacity)	1944-1953	The tank received neutralized uranium-contaminated water and/or basic aluminum cladding waste solutions from reprocessing R&D activities in the 321 Building and the 3706 Building (via the hot sink drains in the 321 Building laboratories), including those related to bismuth phosphate chemical separations, REDOX, Uranium Metal Recovery, PUREX, RECUPLEX, the Thorex program, and medical isotope extraction. The tank was emptied in 1952 or 1953.	Accepted	Not Documented	N/A										
323 TANK 2	Storage Tank	300-FF-2	16.15 (length) × 3.05 (depth) × 106,370 L (capacity)	1944-1953	The tank received neutralized uranium-contaminated water and/or basic aluminum cladding waste solutions from reprocessing R&D activities in the 321 Building and the 3706 Building (via the hot sink drains in the 321 Building laboratories), including those related to bismuth phosphate chemical separations, REDOX, Uranium Metal Recovery, PUREX, RECUPLEX, the Thorex program, and medical isotope extraction. The tank was emptied in 1952 or 1953.	Accepted	Not Documented	N/A										

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323 TANK 3	Storage Tank	300-FF-2	16.15 (length) × 3.05 (depth) 106,370 L (capacity)	1944	The tank received neutralized uranium-contaminated water and/or basic aluminum cladding waste solutions from reprocessing R&D activities in the 321 Building and the 3706 Building (via the hot sink drains in the 321 Building laboratories), including those related to bismuth phosphate chemical separations, REDOX, Uranium Metal Recovery, PUREX, RECUPLEX, the Thorex program, and medical isotope extraction. The tank was emptied in 1952 or 1953.	Accepted	Not Documented	N/A										
323 TANK 4	Storage Tank	300-FF-2	16.15 (length) × 3.05 (depth) × 106,370 L (capacity)	1944-1987	The tank received neutralized uranium-contaminated water and/or basic aluminum cladding waste solutions from reprocessing R&D activities in the 321 Building and the 3706 Building (via the hot sink drains in the 321 Building laboratories), including those related to bismuth phosphate chemical separations, REDOX, Uranium Metal Recovery, PUREX, RECUPLEX, the Thorex program, and medical isotope extraction. The tank was emptied in 1952 or 1953. Between 1968 and 1987, the tank received waste from the 323 Building, including the hot cell drain, the cleanup box drain, and overflow from the process water sump. The tank has not received waste since 1987. In 1987, the tank contained liquid and sludge. Significant uranium and aluminum were detected, but no thorium was detected in either the liquid or the sludge. The uranium and aluminum contamination would have entered the tank before 1967.	Accepted	Not Documented	N/A										
331 LSLDF	Drain/Tile Field	300-FF-2	45 × 12	1970-1974	The 331 LSLDF unit consists of an abandoned drain field. The unit is fed by one diversion box and four septic tanks. The unit discharged sanitary wastewater, and potentially animal waste, from the 331-A and 331-B Buildings for discharge into the soil column. The site was abandoned in place after the waste system was connected to the 300 Area Sanitary Sewer. The waste line has been capped west of the septic tanks.	No Action	EPA, 2001	N/A										
331 LSLT1	Trench	300-FF-2	2.13 (depth) × 2.13 (Overburden)	1966-1969	The unit received sanitary wastewater and animal waste from the animal waste pit. Since most of the animal studies involved the use of radio isotopes, animal waste was segregated on the bases of activity. Solid animal waste, exceeding 200 pCi/g specific activity, was transported to 100-F trenches regularly. All other solid animal waste (less than 200 pCi/g specific activity) was allowed to flush into the 331 Waste System. However, specific cases of contamination have occurred at the 331 Complex.	Accepted	EPA, 2001	N/A										
331 LSLT2	Trench	300-FF-2	2.13 (depth) × 2.13 (Overburden)	1966-1974	The unit received liquid animal waste from the animal waste pit. Animal wastes were the most prominent wastes, in terms of volume, generated by the 331 Complex. Originally, liquid animal wastes from the complex including wash downs from the "hog and dog runs" were disposed to a large, unlined pit, east of the 331-D Building. Sewers carrying animal waste from the 331 Complex were also connected to this pit.	Accepted	EPA, 2001	N/A										
333 East Side Hazardous Waste Storage Area	Storage	300-FF-2	Not Documented	1964	The area contained small quantities of miscellaneous waste oils, cutting lubricants, chemicals, and solvents stored in containers. In previous years, the area was used for miscellaneous radioactive and HW storage. Currently, this area is used only to store miscellaneous non-hazardous solid building waste.	Accepted	EPA, 2001	N/A										

Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)			95% UCL (pCi/g, mg/kg)		
													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
333 White Sands Test Facility	Storage Tank	300-FF-2	6 × 4.21 × 0.40	1972	The Waste Oil Tank was used for storage of oil from the extrusion press sump. It was verified that the oil did not contain PCBs and was not ignitable before removal. No known releases have been reported. The Uranium Bearing Acid tanks stored spent acid containing uranium. The uranium was a recoverable asset for recycling.	Accepted	Not Documented	N/A										
340 Complex	Storage Tank	300-FF-2	Not Documented	1953-Active	The 340 Complex consists of Buildings 340, 340-A, 340-B, 3707-F, office trailers, the 307 Retention Basins, two tanks in an underground vault, six tanks in 340A, underground transfer pipes, load-out and decontamination equipment, instrumentation, and before 1963, the 316-3 Trenches, which disposed of retention process waste that met release criteria. The Complex was built from 1951 to 1953 to support the 325, 326, 237, and 329 Buildings, relieve stress on the South and North Process Ponds, and provide a method for disposing of potentially contaminated "retention" waste liquids. The waste liquids passed through the RPS line to the 307 Retention Basins to wait until the radioactivity was below a threshold value before being sent to the 307 Trenches. Liquid with radioactivity above the threshold value was transferred to 56,781 L (15,000-gal) collection tanks in the 340 Building before being hauled to the 200 Area for disposal. Allowable discharge to the basins was 4 g/L gross beta and 0.5 g/L plutonium. Later, the limit became 50,000 pCi/L. The RLWS collected liquid process waste from the laboratories and the 308, 309, and 324 Buildings and sent the wastes directly to the 340 Building tanks. The 307 Trenches operated from 1953 to 1963 during which time they received 1 million L (264,172 gal) of uncontaminated low-level radioactive waste waters from the 307 Retention Basins once the waste streams were below the discharge limits. After the 307 Trenches were removed from service in 1963, waste liquids went to the process sewer for disposal in the Process Ponds. The 307 Trenches were excavated; the contaminated soil was sent to the 618-10 Burial Ground. In 1965 the trenches were backfilled with 7,645 m^3 (25,082 ft^3) of uranium-contaminated sediment from the SPP and fly ash. During normal operations, leaks occurred at transfer points of the 340 Building and at the 340-B rail load-out facility. A leak test in 1976 of the single-walled RLWS network showed widespread leaks. The system was replaced in 1978 to 1979 with double-walled, stainless steel pipes, and a leak detection system. During replacement, some contaminated soil was removed, but the RLWS piping and low radioactive level soil remains.	Accepted	Not Documented	N/A										
3712 USSA	Storage	300-FF-2	Not Documented	1961-Present	The building is used to store uranium fuel elements, fuel fabrication components, and uranium scraps from the 313 and 333 fuel fabrication efforts.	Accepted	Not Documented	N/A										
400-37	Storage Tank	300-FF-2	Not Documented	Not Documented	The site is an underground fuel oil tank. No visual evidence of the tank exists on the surface. The tank supplied diesel fuel to a standby electric generator. Drawing H-4-152061 has a written notation that the fuel oil tank was abandoned in place and that the exact location of the fuel line is unknown. It is believed to have been filled with sand.	Accepted	Not Documented	N/A										

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400-38	Storage Tank	300-FF-2	Not Documented	Not Documented	The site is an underground fuel tank that supported 4722A. There is no visual evidence of the tank on the surface. Drawing H-4-152061 has a notation reading "buried fuel tank." It is possible the tank has been filled with sand, but documentation has not been found.	Accepted	Not Documented	N/A										
600-243	Surface Impoundment	300-FF-2	48.46 × 38.71	Not Documented	The site is a treatment facility for petroleum-contaminated soil. The waste is petroleum-contaminated soil from Project LO-44, UST Removals.	Interim Closed Out	Not Documented	N/A										
600-58	French Drain	300-FF-2	Not Documented	1988	The oil/water separator receives drainage from eight floor drains in the maintenance headquarters building shop and two drains located on either side of the fuel island. The oil/water separator is designed to remove petroleum, oil, and lubricants from incoming water. It has a 454 L (120-gal) capacity. Drainage from the separator as well as drainage from two catch basins south of the maintenance headquarters building, flow into the dry well south of the maintenance building. The oil-water separator is precast concrete with a bottom elevation of about 4.6 m (15 ft) below the surface.	Accepted	Not Documented	N/A										
600-59	Storage	300-FF-2	6.10 × 4.57	1976	The storage facility is southwest of the maintenance headquarters building. The 6.1 m (20-ft) by 4.6 m (15-ft) generator storage area inside the HW storage portion of the building has a double floor.	Accepted	Not Documented	N/A										
600-60	Electric Substation	300-FF-2	Not Documented	1976	The H.J. Ashe Substation is an active, operating electrical switchyard facility. The H.J. Ashe Substation consists of two large structures, a control house, and a maintenance building, and yard areas with smaller buildings used for dry chemical storage and a vehicle fuel station with two underground gasoline tanks.	Accepted	Not Documented	N/A										
600-62	UPR	300-FF-2	Not Documented	1948	The waste is soil potentially contaminated with PCBs, insulating oil. On 4/1/1994, an informal environmental audit was conducted at the Ashe Substation and the Benton Switch facilities. The audit found that most of the releases were caused by leaking valves or from maintenance operations. No indications of large volume spills were noted. Characterization soil samples were collected on 4/15/1994, and analyzed for PCB and TPH. The PCB results were not detectable. The TPH results ranged from 360 to 16,000 ppm.	Accepted	Not Documented	N/A										
600-63	Laboratory	300-FF-2	39.6 × 39.6	1978-2007	The site is potentially contaminated soil and equipment. The site is enclosed within a chain link fence with barbed wire top and a locked gate. Outside the fence, there is a considerable amount of debris. A trace amount of Co-60 was mixed in 1 cm (0.4 in.) of soil and placed 60 cm (24 in.) below the surface of two of the drainage lysimeters. Trace amounts of tritium were placed in two other lysimeters. The migration of the contaminants was monitored. There is buried equipment, including caissons, lysimeters, associated instrumentation, and solar panels. It is unknown if any of this equipment is contaminated. If it were, contaminants of potential concern would certainly include Co-60 and tritium.	Accepted	Not Documented	N/A										

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618-1:1/2	Storage & Neutralization Tank	300-FF-2	Pit#1: 2.76 × 2.76 Pit#2: 4.88 × 4.88	Not Documented	Consists of two subsites: WIDS Site 333 ESHTSSA stored containers of solidified heat-treat salt waste from the fuels fabrication facility. The waste consisted of sodium chloride, potassium chloride, sodium nitrite, sodium nitrate, and potassium nitrate. Approximately 30 to 50 208 L (55-gal) drums accumulated each year (1964 to 1987). The subsite is two Limestone Neutralization Pits. The neutralization pits would have received waste acid from fuels manufacturing processes. The pipe trench and subsurface soil have become contaminated due to multiple releases into the trench. Releases included acids, bases, and solvents. Some of released acids contained dissolved uranium.	Accepted	EPA, 2001	N/A										
333 ESHTSSA	Storage	300-FF-2	Not Documented	1964-1987	This area is no longer used for storing HW. In the past, it stored containers of solidified waste heat treat salts from the Fuels Fabrication Facility. The waste consisted of sodium chloride, potassium chloride, sodium nitrate, and potassium nitrate. Approximately, 30 to 50 208 L (55-gal) drums accumulated each year.	Consolidated	Not Documented	N/A										
333 LHWSA	Storage Pad (<90 day)	300-FF-2	Not Documented	1971	The fixed contamination area, that is, concrete and asphalt, which was the result of storing radioactive materials in the past, will be addressed as part of 618-1 Burial Ground. The Burial Ground underlies the 333 LHWSA.	Consolidated	Not Documented	N/A										
UPR-300-13	UPR	300-FF-2	3.7 (depth) 3.1 (diameter)	1973	The release site was the soil adjacent to the underground spent acid receiver tank that was located east of the 333 Building and adjacent to the 618-1 Burial Ground. The waste contained process acid that included 2,012 kg (4,432 lb) of nitrate, 202.9 kg (447 lb) of copper, and 1.4 kg (3 lb) of uranium. It is possible that some of the contaminated soil was removed when the tank was removed and during excavation for the foundation of the 334-A Building. Remediation of this site will addressed as part of the 618-1 Burial Ground.	Consolidated	Not Documented	N/A										
UPR-300-14	UPR	300-FF-2	Not Documented	1975	The release site was to a limestone pit designed to neutralize spilled acid before the acid was released to the underlying ground. The release consisted of 93% sulfuric acid. Residual contamination from the spill to the limestone neutralization pit and the soil in the 618-1 Burial Ground will be addressed during the remediation of the 618-1 Burial Ground.	Consolidated	Not Documented	N/A										
UPR-300-1	UPR	300-FF-2	7.62 (depth) × 3.66 (diameter)	1969	The site was a release to the soil in the area between the 307 Retention Basins and the 340 Building. The waste discharged to the soil column consisted of process effluent contaminated by TRU fission products including 900 Ci of short-lived radionuclides (mainly promethium-147) and 10 Ci each of Sr-90 and Cs-137. The top 0.61 m (2 ft) of the contaminated soil was placed into drums and taken to a 200 Area Burial Ground. Further removal of contaminated soil was considered a threat to adjacent structures. There is no readily apparent sign of subsurface contamination beneath the gravel-covered area. More than 90% of the contamination is confined to an area 3.66 m (12 ft) in diameter and 7.62 m (25 ft) deep.	Accepted	EPA, 2001	N/A										

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UPR-300-10	UPR	300-FF-2	Not Documented	1977	The site was an UPR to the soil beneath the northwest corner of the 325 Building. UPR-300-10 occurred in the radioactive waste sewer line that served the 325-B Hot Cells, between the west basement wall of Room 32 and the north foundation wall of Room 202 of Building 325. The release included waste from dissolution of highly radioactive samples including irradiated reactor fuels.	Accepted	EPA, 2001	N/A										
UPR-300-11	UPR	300-FF-2	0.61 × 0.91 × 7.62 × 2.13 (depth)	1977	The site was a release to the soil that involved a 1.22 m (4-ft-) diameter column of gravel-covered soil in the 340 Complex yard. The release occurred around and below a leaking flanged-tee that connected the RRLWS to the 340 Vault. Soil samples collected near the broken pipe were analyzed and yielded concentrations of 0.2 µCi/cm^3 Sr-90, 0.24 µCi/cm^3 Eu-155, 0.09 µCi/cm^3 Ce-144, 0.0017 µCi/cm^3 Pu-239/240, and 0.014 µCi/cm^3 Am-241 and Pu-238. Approximately 1 Ci of contamination was left in place.	Accepted	EPA, 2001	N/A										
UPR-300-12	UPR	300-FF-2	12.19 × 0.30	1979	UPR-300-12 occurred in the basement floor of the 325-A Building. The waste migrated through cracks in the floor to the soil beneath the building. The site received radioactive rinse water overflow containing nitrate ions, promethium-147, fission products, and TRU nuclides. The total activity in the rinse water was estimated to be 70 Ci, of which 95% was Pm-147. The rinse water contained nitrate ions, Pm-147, fission products, and TRU radionuclides. Nitrate ions, but no radionuclides, were detected in samples taken from a nearby groundwater monitoring well. PNL) reports that coring through the cement floor of Room 50-A and sampling of the soils below was completed on 1/26/1979. Decontamination efforts on Room 50-A were completed. Removal of the contaminated soil under the building was considered a threat to the integrity of the 325 Building.	Accepted	EPA, 2001	N/A										
UPR-300-17	UPR	300-FF-2	Not Documented	1979	The release site was the asphalt area at the southeast corner of Building 333. The waste consisted oily rags and other waste material, including what was believed to be uranium shavings. The effectiveness of the cleanup was not documented.	Accepted	EPA, 2001	N/A										
UPR-300-2	UPR	300-FF-2	Not Documented	1954	The site appears to be multiple releases from ongoing decontamination and waste handling activities starting in January 1954. It is unknown if this was related to a single event or all events over the period (1954 to date). 10 mCi of Cs-137 is provided in the original source document and is designated as an estimate only.	Accepted	EPA, 2001	N/A										

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UPR-300-38	UPR	300-FF-2	Not Documented	Not Documented	The site is the contaminated soil beneath the 313 Building, as well as the concrete foundation. The full extent of contamination will not be determined until the 313 Building foundation has been removed and soil remediation occurs. The contamination resulted from multiple UPR events. Materials released to the soil beneath the building may have included uranium-bearing acid (nitric and sulfuric acid with uranium in solution), neutralized acid waste (typically sodium fluoride, sodium nitrate, sodium dichromate, and sodium sulfate in solution with precipitates of uranium, chromium, copper, and zirconium), etch acids (nitric, hydrofluoric, sulfuric, and chromic acids), TCE (PCE), sodium hydroxide solutions, and contaminated water.	Accepted	EPA, 2001	N/A										
UPR-300-44	UPR	300-FF-2	Not Documented	Unknown-1985	The release site was to the soil around a section of process sewer line. The release consisted of wastewater and possibly uranium-bearing acid (nitric and sulfuric acid with uranium in solution) or waste-etch acid (nitric, hydrofluoric, and chromic acids with uranium, copper, and zirconium metals in solution) to the soil. The information for this site has been incorporated into WIDS Site UPR-300-38. UPR-300-38 addresses the soil contamination under the 313 Building.	Consolidated	Not Documented	N/A										
UPR-300-39	UPR	300-FF-2	Not Documented	1954	The release site was to the soil adjacent to the caustic storage tanks in the 311 Tank Farm. The waste consisted of caustic solution containing 50 percent sodium hydroxide solution. If the sodium hydroxide were exposed to uranium contamination (likely the case), the resultant contamination will be sodium diuranate ("yellow cake"). In February 2006, the 311 Tank Farm and concrete containment was demolished. Before demolition, the two sodium hydroxide tanks were labeled "Empty." The location and extent of the release is not discernible in the field.	Accepted	EPA, 2001	N/A										
UPR-300-4	UPR	300-FF-2	30.48 × 30.48 × 6.10 (Estimate)	Not Documented	The site is the soil beneath and south of the 321 Building. The site represents a number of releases that occurred from 1945 to 1988. Because removal of all of the contaminated soil was believed to be a threat to the integrity of the 321 Building, it was not attempted. No specific occurrence reports have been identified. The true extent of the soil contamination is unknown.	Accepted	EPA, 2001	N/A										
300-81	Injection/ Reverse Well	300-FF-2	1.03 (diameter)	Unknown - 1996	The drain is a concrete structure with a metal cover. The building source pipe is connected to the drain through the cover. There were no known hazardous or radioactive releases from this steam condensate discharge. The stream was eliminated on July 1996. The source is abandoned. The source has been eliminated but the lines have not been capped. The disposal site has not been permanently abandoned.	Consolidated	Not Documented	N/A										
300-82	Injection/ Reverse Well	300-FF-2	1.04 (diameter)	Unknown - 1996	The site is a French drain with a metal cover. The source piping has been removed. The stream was eliminated on July 1996. The source is abandoned. The source has been eliminated but the lines have not been capped. The disposal site has not been permanently abandoned. The source was eliminated. The source was eliminated July 1996.	Consolidated	Not Documented	N/A										

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300-83	Injection/ Reverse Well	300-FF-2	1.33 × 1.25	Unknown - 1996	The site is a square concrete structure with a metal cover and labeled, F. D. #35. There were no known hazardous or radioactive releases from this steam condensate discharge. The source has been eliminated but the lines have not been capped. The disposal site has not been permanently abandoned. The steam has been shut down. The source was eliminated July 1996.	Consolidated	Not Documented	N/A										
300-84	Valve Pit	300-FF-2	2.29 (depth) 2.44 (diameter)	Unknown - 1996	The site is a semicircular, steel caisson. There were no known hazardous or radioactive releases from this water discharge. The source is permanently abandoned. The source has been eliminated and lines capped, but the disposal site has not been permanently abandoned. The source was eliminated on May 1996.	Consolidated	Not Documented	N/A										
300-92	Injection/ Reverse Well	300-FF-2	0.38 × 0.38	Not Documented	The site is designed to receive stormwater runoff from 321 Building. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Consolidated	Not Documented	N/A										
UPR-300-40	UPR	300-FF-2	Not Documented	1974	The release site was to the soil between the 311 Tank Farm and the 303-F Building. Piping connections were repaired. Apparently, removal of contaminated soil was not pursued. The waste consisted of uranium-bearing acid waste containing nitric and sulfuric acid with uranium in solution and chromic acids with copper and zinc in solution. A comparison of WIDS Sites UPR-300-31 and UPR-300-40 and their reference documents was performed, and the conclusion was that they both represented the same event. It was decided to join them under WIDS Site UPR-300-40.	Accepted	EPA, 2001	N/A										
UPR-300-42	UPR	300-FF-2	Not Documented	10/12/1983	The release was an overflow of No. 6 fuel oil onto the ground adjacent to the Number 2 Day Tank, an UST. The release consisted of approximately 750 to 1135 L (200 to 300 gal) of No. 6 fuel oil. The adjacent day tanks (300-223) have been remediated, but this release was not removed because of concerns regarding the foundation of the building. The surface area around the day tanks was paved with asphalt. This release is not visible.	Accepted	Not Documented	N/A										
UPR-300-45	UPR	300-FF-2	Not Documented	1985	The release site was to the soil beneath the transfer piping, adjacent to the 303-F Building. The leak contained uranium-bearing waste acid identified as nitric and sulfuric with uranium in solution. Analysis showed the solution to contain 3,480 ppm nitrate, 6,960 ppm sulfate, and 920 ppm uranium. Some soil from the release site was exhumed, packaged, and sent to the Low-Level Burial Grounds for disposal. The effectiveness of the cleanup is undetermined. The remaining soil beneath the pipe trench and around the processing facilities is expected to be addressed separately after the RCRA closure plan activities are completed.	Accepted	EPA, 2001	N/A										

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UPR-300-46	UPR	300-FF-2	Not Documented	1989	The release site was a layer of radioactively contaminated soil found during a pipe trench excavation. The contaminated soil was analyzed, and it was determined that the soil did not contain any significant quantities of hazardous chemicals. The truckload of contaminated soil was disposed of as low-level waste. The contamination was likely caused by a spill of uranyl nitrate. There is currently no visual evidence of the release.	Accepted	EPA, 2001	N/A										
UPR-300-48	UPR	300-FF-2	Not Documented	1991	The site received radioactive liquid from a leak in the process sewer drainpipe. The site was discovered during dye testing of drains during development of the Facility Effluent Monitoring Plan development for the 325 Building. The contamination may have resulted from routine releases and accumulated in the soil under the crack. Radioactivity up to 1,700 dpm alpha was detected. The TCLP results were below regulatory limits. Radioactivity levels were sufficiently low to permit fixing the contamination in place. This activity was reported as an off normal occurrence in October 1991 (RL-PNL-325-1991-1023).	Accepted	EPA, 2001	N/A										
UPR-300-5	UPR	300-FF-2	1.22 × 6.10 × 0.46	1973	The site was a release that contaminated the storage basin area, the filter vault, the stack base, the truck stall, and the truck ramp outside the 309 Building. The waste was low-level radioactive water. The primary isotope was Cs-137.	Accepted	EPA, 2001	N/A										
UPR-600-22	UPR	300-FF-2	138.0 × 92.0	Not Documented	The site consists of a series of small parallel berms. Before 1972, the area was contaminated with particulate fallout from burial activities in the 618-11 Burial Grounds. The contaminated area was covered by scraping the affected ground into windrows. On 10/24/1972, a backhoe was used to cut across each windrow at a spacing of every 15 m (50 ft) to a depth of 15 cm (6 in.) below ground level. Radiological surveys were made of all soils removed and of the walls of each cut. No beta, gamma, or alpha radioactivity was detected above the normal background of 100 counts/min.	Accepted	EPA, 2001	N/A										
300-7	Burial Ground	300-FF-2	83 × 75	Not Documented	The site contains solid construction debris, such as concrete, metallic waste, asbestos, and uranium contamination. Surface debris piles can be seen and subsurface disturbances have been identified with GPR. Currently, the site is covered with natural vegetation.	Accepted	EPA, 2001	N/A										
618-1	Burial Ground	300-FF-2	97.54 × 45.72 × 2.44	1945-1951	The site is an early solid waste burial ground and consists of at least two trenches. The burial ground received waste from early 300 Area facility operations, including the 305 Reactor, 3706 Laboratory, and the 3741 Building. The site contains large quantities of uranium (14,500 kg [about 16 tons]) from the fuel fabrication activities and small quantities of plutonium and fission products from laboratory operations. Radiological readings indicated 6,000 dpm alpha and 15 mr/hr beta/gamma. A monthly report from August 1946 mentions the burial of a bronze crucible that read 170 millirems/hr (179 millirads/hr) and 5.5 millirems/hr (5.5 millirads/hr) at 10.2 cm (4 in.).	Accepted	Not Documented	N/A										

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618-7	Burial Ground	300-FF-2	12.0 × 202.4 × 3.7 (fence area) 160 × 30 × 3.7 (trenches) 137 × 9.1 (pit)	1960-1973	The burial ground consists of two east-west-oriented trenches and one "V-shaped" pit. Most of the waste in this burial ground originated from the 313 and 333 Buildings. Miscellaneous contaminated equipment and hundreds of 114 L (30-gal) drums of zircaloy chips contaminated with moderate amounts of beryllium and uranium were buried in the trenches from 1960 to 1973.	Interim Closed Out	EPA, 2001	N/A										
618-10	Burial Ground	300-FF-2	Trenches range in size from: (97 × 21 × 7.6) to (15 × 12 × 7.6) Vertical pipe: 4.6 (length) × 0.6 (diameter)	1954-1963	The site consists of 12 trenches and 94 vertical pipe units. The site contains a broad spectrum of low- to high-level dry wastes, primarily fission products and some TRU from the 300 Area. Low-level wastes are buried in trenches, and medium- to high-level beta/gamma wastes are mostly in the vertical pipe units. Some higher activity wastes were placed in concrete-shielded drums and disposed in the trenches. The site was surface stabilized with clean backfill material in 1983.	Accepted	EPA, 2001	N/A										
UPR-600-1	UPR	300-FF-2	274 (length)	1961	The release originated in the 618-10 Burial Ground. It contaminated the environment near the burial ground, extending 274 m (300 yd) out from the burial ground fence, with radioactive particulates. The waste consisted of burned CWS filters and an unknown amount of other materials.	Consolidated	EPA, 2001	N/A										
UPR-600-2	UPR	300-FF-2	1.5 (diameter)	1963	Contamination from this incident was identified around the burial receptacle in the 618-10 Burial Ground, an area in front of the burial ground access gate, and a spot in front of the 300 Area Powerhouse. Contamination detected at the time of the release ranged from 60,000 to 80,000 counts/min around the barrel in the 618-10 Burial Ground, 40,000 counts/min in front of the 300 Area Powerhouse, and 80,000 counts/min in front of the burial ground access gate.	Consolidated	Not Documented	N/A										
UPR-600-3	UPR	300-FF-2	55.7 m^2	1963	The release site was an area of soil around a burial barrel within the 618-10 Burial Ground. The release area was surface stabilized with the rest of the burial ground in 1983. The waste consisted of radioactive dust that was improperly containerized. The burial ground is fenced and posed as an URMA.	Consolidated	Not Documented	N/A										
618-11	UPR	300-FF-2	304.8 × 114.3 × 7.6 (fenced burial ground) 274.3 × 15.2 × 7.6 (trenches)	1962-1967	The site consists of three "V"-shaped trenches, two large diameter caissons and 50 vertical pipe storage units. The burial ground received a variety of waste from the 300 Area operations. Low-level activity waste and large items were placed in the burial trenches. Some high-activity waste liquid waste or plutonium contaminated liquid was placed inside barrels and sealed with concrete. The burial ground was surface stabilized with additional clean dirt and planted with wheat grass in 1983.	Accepted	EPA, 2001	N/A										
UPR-600-4	UPR	300-FF-2	92.9 m^2	1964	The release consisted of an area of soil contamination in the 618-11 Burial Ground. The release site was surface stabilized along with the rest of the burial ground in 1983. The release consisted of radioactive waste from the High-Level Radiochemistry Facility. The waste had readings of up to 10,000 counts/min.	Consolidated	EPA, 2001	N/A										

Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)			95% UCL (pCi/g, mg/kg)		
													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
UPR-600-5	UPR	300-FF-2	167 m^2	1964	The release site consisted of an area of soil in the 618-11 Burial Ground. The release consisted of gross fission products with beta and gamma contamination. The wastes were generated in the Radio Chemistry Building (325 Building) and packaged in cars. The release site was covered with a layer of clean material immediately after the release.	Consolidated	EPA, 2001	N/A										
UPR-600-6	UPR	300-FF-2	130 m^2	1965	The release contaminated an area of soil within the 618-11 Burial Ground. The waste consisted of ruthenium-103 and zirconium-niobium-95 with readings from 100 counts/min to 200 millirads/hr. The 618-11 Burial Ground was surface stabilized in 1983.	Consolidated	EPA, 2001	N/A										
UPR-600-7	UPR	300-FF-2	Not Documented	1965	The release site was an area of ground in the 618-11 Burial Ground. The waste was generated at the high-level radiochemistry building (327 Building). The waste consisted of a dust from a highly contaminated filter. The 618-11 Burial Ground was surface stabilized in 1983.	Consolidated	EPA, 2001	N/A										
UPR-600-8	UPR	300-FF-2	2.8 m^2	1967	The release contaminated an area of soil in the 618-11 Burial Ground. The waste consisted of, in part, aluminum rupture cans that had been inspected in the High-Level Radio Chemistry Facility (327 Building). Following the release, the area was covered with a layer of clean gravel. The 618-11 Burial Ground was surface stabilized in 1983.	Consolidated	EPA, 2001	N/A										
UPR-600-9	UPR	300-FF-2	228.6 × 137.2	1967	UPR-600-9 contaminated a fan-shaped area that extended northeast from the dump chute in the 618-11 Burial Ground. The release consisted of airborne contamination from corroded aluminum rupture cans and pieces of an N Reactor safety rod from the 327 Building.	Consolidated	EPA, 2001	N/A										
UPR-600-10	UPR	300-FF-2	36 m^2	1963	The release contaminated an area of soil in the northeast corner of the 618-11 Burial Ground. The release consisted of high-level beta and gamma contamination with readings of up to 1.4 rads/hr at 7.6 cm (3 in.). The 618-11 Burial Ground was surface stabilized in 1983.	Consolidated	EPA, 2001	N/A										
618-13	Burial Ground	300-FF-2	38.1 × 15.2 × 7.6	1950	The unit consists of a mound of soil. The site was originally a single-use disposal site for contaminated soil removed from the 303 Building perimeter in 1950. It is believed that the mound of soil later served as a safety shield (blast shield) for drums of hexone stored in buildings on the west side of the berm before being buried in the 618-9 Burial Trench in 1954. This site received uranium contaminated topsoil removed from around the 303 Building area. Total activity buried in the site is not known.	Interim Closed Out	EPA, 2001	N/A										
300-218	Fabrication Shop	300-FF-2	60.96 × 27.43 × 12.19	1943-1996	The site is the 314 and 314A Buildings. This site has been demolished down to the slab. This building is one of the original World War II-era 300 Area, Manhattan Engineering District/ DuPont structures. Exterior walls and partitions are concrete block. The floor is reinforced-concrete with test pits and a basement room at the west end. A small second floor or mezzanine exists at the west end of the building.	Accepted	Not Documented	N/A										

Table A-1. Summary of 300 Area Waste Sites

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-25	Laboratory	300-FF-2	71.48 × 61.87 × 13.70	1966	The 324 Building is a substantial concrete and steel structure. The remaining slab has a number of penetrations into the soil column, including pipe trenches, sumps, and pits. Portions of the building are covered under a RCRA Closure Plan with ongoing closure activities in progress.	Accepted	Not Documented	N/A										
300-264	Laboratory	300-FF-2	Not Documented	1953	The 327 Building is also known as the Postirradiation Testing Laboratory. The facility is in a stabilization and deactivation phase, where radioactive material and contamination is being removed and cleaned to allow for future D&D activities. While the post-irradiation tests that the building was intended for are no longer active, the stabilization and deactivation work is in progress. A 1995 assessment showed most gamma activity was due to Cs-137, Cs-134, Eu-154, and Co-60. Approximately 170 g (maximum) of plutonium is estimated to be in the ducts, piping and other locations in the building, with an additional 314 g estimated to be in the cells.	Accepted	Not Documented	N/A										
300-32	Fabrication Shop	300-FF-2	85.59 × 42.46	1961	The site is the remaining contaminated components of the former 333 Building, including the concrete pad, any subgrade soils and piping. Chemical wastes included nitric, sulfuric, hydrofluoric, chromic-nitric-sulfuric, and other acids, along with degreasers TCE in the 1960s and early 1970s and PCE and 111-TCA in the 1970s and 1980s. Heat treatment salts included sodium nitrate, sodium and potassium nitrite, and sodium and potassium chloride. Additionally, many alcohol and acetone cleansers were used throughout the building's history.	Accepted	Not Documented	N/A										
303-M UOF	Process Unit/Plant	300-FF-2	Not Documented	1983	The oxidation process feed material was pyrophoric uranium and zircaloy-2 fines. Approximately 115,300 kg (127 tons) of material was oxidized during operations. Waste currently at the facility may include residual radiological and chemical contamination in the process equipment, on surfaces, and in the process sewer.	Accepted	EPA, 2001	N/A										
305-B SF	Storage	300-FF-2	36.88 × 11.58 × 5.49	1978	The facility is used to store, segregate, repackage, and sample hazardous and RMW generated by PNNL Research Laboratories in the 300 Area. Chemical and radiological contamination may be present in and around the facility, due to the operation of the Physical Constants Test Reactor and the Thermal Test Reactor that operated in the building before 1978. In 1978, the building became a waste assembly area/satellite storage area for the 300 Area R&D facilities in the 300 Area. Hazardous and radioactive waste has been stored, repackaged and/or consolidated (mostly in 208 L [55-gal] drums) in the 305-B Building high bay and basement. The designed storage capacity is 113, 562 L (30,000 gal).	Closed Out	Not Documented	N/A										

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309-WS-1	Process Unit/Plant	300-FF-2	Inside dimensions of the upper vault (overburden): 4.27 × 4.27 × 4.88 × 0.61 m Inside dimensions of the lower circular vault: 6.49 m (depth) 4.72 m (diameter)	1961-1969	Following deactivation activities, residual radiological contamination and chemical contamination from the ion exchange resin may be present on surfaces in the vault. COCs are Cs-137 and Sr-90. The rainwater (in the lower vault) and ion exchange columns were removed in 1995.	Accepted	Not Documented	N/A										
309-WS-2	Process Unit/Plant	300-FF-2	7.97 × 4.82 × 4.88	1960-1969	The 309-WS-2 Ion Exchange Vault is an underground, reinforced concrete structure. Stabilized radiological contamination is present on vault surfaces. COCs are TRU, Cs-137, and Co-60. Before stabilization, survey reports indicate radiological contamination levels were as high as 70,000 dpm cm^2 beta/gamma and 28,000 dpm cm^2 alpha and with contact dose rates up to 2.5 rem/hr. After cleanout and stabilization, contamination levels were less than 1,000 dpm/cm^2 beta/gamma, less than background (3 counts/min) alpha, and a dose rate of less than 0.5 millirem/hr.	Accepted	Not Documented	N/A										
325 WTF	Process Unit/Plant	300-FF-2	Not Documented	1953	The waste treatment facilities treated radioactive-mixed wastes generated in R&D activities. The 325 Waste Treatment Facility also served to test and evaluate the effectiveness of various waste treatment technologies.	Accepted	Not Documented	N/A										
437 MASF	Maintenance Shop	300-FF-2	88.4 × 29.0 × 12.5 (main building) 19.6 × 10.7 (wing)	1982-present	MASF consists of a main building and a two-story service wing. MASF is a multipurpose service center that supports the specialized maintenance and storage requirements of the 400 Area facilities. This facility is currently being used for the decontamination of radioactive and/or sodium contaminated FFTF equipment, the repair of contaminated manipulators from the FFTF Reactor Containment Building, the staging of large pieces of equipment to be stored, repaired, or tested; and the temporary storage of low level radioactive solid and liquid wastes before shipment.	Accepted	Not Documented	N/A										
600-117	Process Unit/Plant	300-FF-2	143.26 × 91.44	1994-Present	The site includes the main treatment building (310 Building); three modular/mobile offices (MO443, MO744, MO745); two exterior Diversion Tanks (19 m [62 ft] in diameter each); one exterior Equalization Tank (13.7 m [45 ft] in diameter); two exterior Clarifier Tanks (9.1 m [30 ft] in diameter each); two drum storage areas; and one chemical storage area. The site treats and disposes of process sewer effluent from the 300 Area. Treatment includes chemical precipitation, selective ion exchange, and UV/peroxide oxidation to destroy organics and cyanide.	Accepted	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
600-276	Laboratory	300-FF-2	200 × 175	1982	The site is a large open field with a high mound of soil in the center. Several pipes extend vertically through the surface of the soil in some areas. A small pallet containing damaged bags of bentonite is located in the southeast corner of the area adjacent to some vertical pipes. Two steel hinged plates cover access holes to underground culverts used as monitoring stations for buried waste tests. Only simulated buried waste was placed into this test site.	Accepted	Not Documented	N/A										
300 SSS	Sanitary Sewer	300-FF-2	Not Documented	1944-present	The sewer system is composed of underground sewer lines inside the 300 Area that connect to the City of Richland sewer system. The sanitary sewer receives sanitary wastes from throughout the 300 Area.	Not Accepted	Not Documented	N/A										
600-255	Pond	300-FF-2	90 × 30	1980	The site receives stormwater runoff from the northwest section of the 300 Area. The site is a very large, unlined basin. It has a gravel bottom and coble covered sloped sides. There are two effluent pipes protruding from the east wall of the basin. Using the contour patterns, it was determined the site is approximately 90 m (295-ft) long and 30 m (98-ft) wide.	Not Accepted	Not Documented	N/A										
600-64	Sanitary Sewer	300-FF-2	3 miles (length) 0.23 (diameter)	1997-present	This underground, gravity flow line begins at the inlet to the 4607 Sanitary Sewer septic tanks and connects the 400 Area sanitary sewer main (also known as the 4903 Sanitary Sewer Main) with the Washington Public Power Supply System sewage treatment facility. The sewer line route appears as a disturbed area covered with sand and little vegetation. Washington Public Power Supply System signs posted along the route mark the existence of an underground sewer line.	Not Accepted	Not Documented	N/A										
300 IFBD	Depression/Pit (nonspecific)	300-FF-2	Not Documented	1987-1987	This site was a temporary disposal area for filter backwash from the 300 Area Filter Water Plant. A large, depressed area on the east side of the Gravel Pit 6 property forms a natural basin.	Rejected	Not Documented	N/A										
300 PHWSA	Satellite Accumulation Area	300-FF-2	4.9 × 2.4	1991-1995	The site was a HW storage area used to store nonradioactive solid waste. When active, the unit staged non-regulated waste oil and water treatment chemicals. Other small quantities of HW were also stored. The area is no longer used to accumulate HW. The waste stored here was moved to the 328 Building 90-Day Storage Area and the 3707-D Satellite Accumulation Area in 1995.	Rejected	Not Documented	N/A										
300-100	French Drain	300-FF-2	0.69 × 0.61 × (22.9-25.4) depth	Not Documented	The site drains stormwater from the chiller pad to the ground. The stream was eliminated and deleted from the *Inventory of Miscellaneous Streams* in March 1995. The Stream Status is categorized as SA, source abandoned.	Not Accepted	Not Documented	N/A										
300-101	Depression/Pit (nonspecific)	300-FF-2	0.4 × 0.5	Not Documented	The site is a roadway drain, with a perforated steel cover. The cover is visible, but the structure is full of sand and gravel. The site drains stormwater from a loading dock and a large area of asphalt parking apace. The steam condensate component for this site has been routed to the sanitary sewer. According to DOE/RL-95-82c, the site is active for stormwater only. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										

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300-102	Injection/ Reverse Well	300-FF-2	0.96 (diameter)	Unknown – 1998	The site is an injection well that received steam condensate. DOE/RL-95-82c states the site is inactive and the source has been abandoned. It was eliminated from the active list of streams in June 1998.	Rejected	Not Documented	N/A										
300-103	French Drain	300-FF-2	0.635 × 0.457	Unknown – 1995	The site is a storm drain covered with a steel grating that drains stormwater from the surrounding area. There are no contamination postings near the site. The stream was eliminated March 1995. The stream was routed to the process sewer.	Not Accepted	Not Documented	N/A										
300-104	French Drain	300-FF-2	0.635 × 0.457	Unknown – 1995	The site is a storm drain covered with a steel grating that drains stormwater from the surrounding area. There are no contamination postings near the site. The stream was deleted March 1995. Currently, the stream drains to the process sewer.	Not Accepted	Not Documented	N/A										
300-105	French Drain	300-FF-2	2.74 × 2.74 × 3.66	Not Documented	The site is a steam pit. Several shutoff valves are visible and a hatch cover provides access to the site. All locks have been removed from the valves. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216, because Ecology considers the WAC 173-218 registration to be sufficient for sites that received steam condensate only.	Rejected	Not Documented	N/A										
300-106	French Drain	300-FF-2	0.61 × 0.61 × 1.22	Not Documented	The site is a drain line (not an injection well) that drains stormwater and possibly steam condensate from what appears to be a steam pipe near the drain. The site is not an injection well or a French drain. Water level in the drain was observed just below the top of the grating. DOE/RL-95-82c lists the source as deleted and the disposal structure as not an injection well.	Rejected	Not Documented	N/A										
300-107	French Drain	300-FF-2	0.88 (depth) 0.7 (diameter)	Not Documented	The site is a French drain constructed of concrete and covered with a steel lid. The drain has two 10.2 cm (4-in.-) diameter pipes entering the drain at the bottom. Presumably, the site drains stormwater from drains located near two nearby entrances to the 331 Building. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-108	French Drain	300-FF-2	0.64 × 0.51 × 0.38	Not Documented	The site is a stormwater French drain that drains the surrounding paved area and roof drains from the 331 Building at a low point. There is no known contamination within the drainage area. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-111	French Drain	300-FF-2	about 1.2 (depth) × 0.70 (diameter)	Not Documented	The site drains stormwater from the asphalt alley way used to access the trash and recycled cardboard pickup containers, and provide pedestrian access to the 337 Building. DOE/RL-95-82c says this site is a "non-engineered structure" and "deleted" but it does not appear to be either case.	Not Accepted	Not Documented	N/A										

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300-112	Injection/ Reverse Well	300-FF-2	0.61 (diameter)	1996	The drain is located at the bottom of the RPS Pump Pit (P-3 Pump Pit). The pumps and piping have been removed. The pump was flushed with clean service water during routine freeze protection maintenance. When the site was active, it received flush water drainage and pump leakage. The source of the water was uncontaminated potable water. The flow rate was less than 0.038 L/min (0.01 gal/min).	Rejected	Not Documented	N/A										
300-113	Injection/ Reverse Well	300-FF-2	0.46 (diameter)	1996	The site received steam condensate before the steam was shut off in the building. When the site was active (steam condensate), the flow rate was less than 0.038 L (0.01 gal)/min. Currently, the site is set up to receive overflow from the water heater located inside the 340 Building. The flow rate for this activity is unknown. The effluent from the water heater is non-dangerous/nonradioactive potable water.	Rejected	Not Documented	N/A										
300-114	Injection/ Reverse Well	300-FF-2	Not Documented	1996	When the site was active, it received less than 0.038 L (0.01 gal)/min. of steam condensate. The drain area was backfilled with clean gravel when the steam system was removed from the building. The site was eliminated from the list of active streams in DOE/RL-95-82a. The building steam has been turned off.	Rejected	Not Documented	N/A										
300-115	Injection/ Reverse Well	300-FF-2	Not Documented	1996	The drain would have received non-dangerous/ nonradioactive (potable) water if there were a failure of the service water backflow preventer. There has been no known failure of the backflow preventer. Thus, this site would not have received any discharge. The drain was covered with clean gravel when the source was abandoned in 1996. The stream source has been abandoned. The site was eliminated from the list of active streams in DOE/RL-95-82a.	Not Accepted	Not Documented	N/A										
300-116	French Drain	300-FF-2	0.48 × 0.48	Not Documented	When the site was active, it received less than 0.038 L/min. (0.01 gal/min.) of steam condensate only. According to DOE/RL-95-82c, the site is inactive, source abandoned.	Rejected	Not Documented	N/A										
300-117	French Drain	300-FF-2	2.10 × 1.06	1998	When the site was active, it received less than 0.038 L/min. (0.01 gal/min.) of steam condensate only. DOE/RL-95-82c lists the source as abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-118	Valve Pit	300-FF-2	0.81 × 0.81	1998	The site is a valve pit with a dirt floor. Steam condensate was discharged onto the floor of the pit. When the site was active, it received less than 0.38 L/min. (0.1 gal/min.) of steam condensate only. DOE/RL-95-82c states that the site received steam condensate from leaking valves. The steam source has been shut off and this stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-119	Injection/ Reverse Well	300-FF-2	0.34 (diameter)	Unknown-1996	The drain is an open corrugated metal pipe filled with rocks. The source pipe exits the building wall and has a 90-degree elbow to connect the pipe to the French drain. According to DOE/RL-95-82c, the site has potentially received hydrocarbons. During a site walk down on 2/4/1999, it was verified that the stream source is blow down from air receivers (tanks) within the building. A facility contact has stated that the blow down line is still in use.	Rejected	Not Documented	N/A										

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300-12	Storage Tank	300-FF-2	2.13 × 1.22 1892.71 (capacity)	1992	The tank was used to store diesel fuel for an emergency generator located beside the 325 Building. There are no known leaks or spills associated with this tank. The tank was removed on 10/14/1992. The tank was inspected for leaks. The tank appeared to be in very good condition.	Not Accepted	Not Documented	N/A										
300-120	Injection/ Reverse Well	300-FF-2	0.90 (diameter)	Unknown-1998	The site receives air and small amounts of condensate from the air starter motors in the 3621D Building. The air and condensate may contain small quantities of oil. DOE/RL-95-82c lists the stream source as cooling water from the emergency diesel engines. The report lists the source as abandoned. According to the report, this stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-122	French Drain	300-FF-2	0.65 (diameter)	1998	The site is a French drain that received steam condensate from the 366 Building fuel oil bunker loading station. Only a small portion of the French drain's pipe is exposed.	Rejected	Not Documented	N/A										
300-124	French Drain	300-FF-2	0.33 (diameter)	1998	The site is a French drain that received steam condensate from steam lines on top of the 366 Building fuel oil bunker. This site was removed during excavation and removal of the Bunker Tanks (300-6).	Rejected	Not Documented	N/A										
300-125	French Drain	300-FF-2	Not Documented	Unknown-1997	The site was a French drain that collected steam condensate. No evidence of the site remains. DOE/RL-95-82c states the site is inactive and the "Disposal Site Permanently Abandoned." This stream was "eliminated" on 7/2/97. The disposal site was removed during demolition.	Rejected	Not Documented	N/A										
300-126	French Drain	300-FF-2	Not Documented	Not Documented	The site was a French drain that collected steam condensate. No evidence of a French drain was visible during the site walk down. DOE/RL-95-82c lists the site as inactive and "Source Permanently Abandoned." This site is listed as "eliminated"; the building it serviced has been demolished.	Rejected	Not Documented	N/A										
300-127	French Drain	300-FF-2	Not Documented	Not Documented	The site is a French drain located in a soil and gravel covered area. According to DOE/RL-95-82c, this French drain does not have surface access. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-128	French Drain	300-FF-2	Not Documented	1997	The site is a French drain that collected stormwater runoff. According to DOE/RL-95-82c, the stream is "Not Active" and the "Disposal Site Permanently Abandoned."	Not Accepted	Not Documented	N/A										
300-129	French Drain	300-FF-2	Not Documented	Not Documented	The site is a French drain located in a cobble-covered area. A roof drain is visible nearby. According to DOE/RL-95-82c, this French drain does not have surface access. No drain was visible during the site walk down. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-13	UPR	300-FF-2	Not Documented	Not Documented	The site is an UPR to the 300 Area SSS. The site was sanitary sewage contaminated by latex paint. The site was discovered during routine surveillance and maintenance of the 350 Building Sanitary Sewer Lift Station.	Not Accepted	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-130	French Drain	300-FF-2	Not Documented	Not Documented	The site is a French drain that collects stormwater runoff. According to DOE/RL-95-82c, the French drain does not have surface access. No drain was visible during the site walk down.	Not Accepted	Not Documented	N/A										
300-14	Depression/Pit (nonspecific)	300-FF-2	28.0 × 22.3 × 7.6	1974-1977	This site includes the unlined pit east of the building, a backwash storage tank, and six diversion chambers that are located north of the pit. Originally, the animal waste collection tanks were located in a pit just east of the 331-D Animal Waste Treatment Building. The tanks have been removed. Eight concrete tank pedestals remain at the bottom of the pit. A backwash storage tank remains between the 331-D Building and the pit. Water was observed at the bottom of the pit. Six diversion chambers for the sewer system are located northwest of the pit.	Rejected	Not Documented	N/A										
300-151	French Drain	300-FF-2	0.86 (diameter)	Not Documented	The site is a French drain that is a clay pipe 0.86 m (2.82 ft) in diameter. DOE/RL-95-82c states that this site previously received steam condensate from the main steam line at pit U57 (300-152, stream No. 326), but now receives condensate from a Johnson Controls, Inc. air compressor. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received steam condensate only.	Rejected	Not Documented	N/A										
300-152	French Drain	300-FF-2	1.30 (diameter)	Unknown - 1996	The site is a French drain. The base of this drain is constructed of corrugated metal and is covered by a 1.3 m (4.27-ft) metal lid. DOE/RL-95-82c lists the source as abandoned. This stream was "eliminated" in July 1996.	Rejected	Not Documented	N/A										
300-153	French Drain	300-FF-2	Not Documented	Unknown - 1996	The site is a French drain that received steam condensate. DOE/RL-95-82c lists the source as abandoned. This stream was "eliminated" in August 1996.	Rejected	Not Documented	N/A										
300-154	French Drain	300-FF-2	Not Documented	Unknown - 1998	The site is not an engineered structure. No pipe or lid was evident during the 10/13/1998 walk down. A pipe descending from the overhead steam line discharged directly onto the ground. DOE/RL-95-82c lists the source as abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-155	French Drain	300-FF-2	Not Documented	Unknown - 1996	The site is a French drain that received steam condensate. DOE/RL-95-82c states "Disposal Site Permanently Abandoned." This stream was "eliminated" in August 1996. The site was removed during the demolition of the 3707C Building.	Rejected	Not Documented	N/A										
300-156	French Drain	300-FF-2	1.1 (diameter)	Unknown - 1996	The site is a French drain covered by a metal lid. DOE/RL-95-82c states "Disposal Site Permanently Abandoned." This site was "eliminated" in August 1996.	Rejected	Not Documented	N/A										
300-157	French Drain	300-FF-2	0.76 (diameter)	Unknown - 1996	The site is a French drain that is a clay pipe. DOE/RL-95-82c lists the site as inactive and the "Source Permanently Abandoned." This stream was "eliminated" in August 1996.	Rejected	DOE/RL-95-82c	N/A										

Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)			95% UCL (pCi/g, mg/kg)		
													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-158	French Drain	300-FF-2	Not Documented	Unknown - 1996	The site is a French drain that received steam condensate. No evidence of the site remains. DOE/RL-95-82c states "Disposal Site Permanently Abandoned." This stream was "eliminated" in August 1996. The site was removed during the demolition of the 3707C Building.	Rejected	Not Documented	N/A										
300-159	French Drain	300-FF-2	Not Documented	Unknown - 1996	The site is a French drain that received steam condensate. DOE/RL-95-82c states "Disposal Site Permanently Abandoned." This stream was "eliminated" in August 1996.	Rejected	Not Documented	N/A										
300-160	Injection/ Reverse Well	300-FF-2	1.60 × 1.30	Not Documented	The site is a rectangular concrete structure. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received steam condensate only. The site is a rectangular concrete structure.	Rejected	Not Documented	N/A										
300-161	Injection/ Reverse Well	300-FF-2	0.68 (diameter)	Not Documented	The site is a drain with a perforated metal cover. The site receives surface runoff from a paved area adjacent to the 3707D Building.	Rejected	Not Documented	N/A										
300-162	Injection/ Reverse Well	300-FF-2	0.23 (diameter)	Not Documented	The site receives surface runoff from a paved area adjacent to the 3707D Building.	Rejected	Not Documented	N/A										
300-163	French Drain	300-FF-2	Not Documented	Not Documented	The French drain is a vitrified clay pipe buried vertically. The unit received steam condensate from the 3708 Building. DOE/RL-95-82c lists the source as abandoned.	Rejected	Not Documented	N/A										
300-164	French Drain	300-FF-2	1.46 (diameter)	Unknown - 1998	The site is a French drain that appears to be a concrete pipe and is covered by a metal lid. DOE/RL-95-82c lists the source as abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-165	Injection/ Reverse Well	300-FF-2	0.5 (diameter)	Unknown - 1996	The site is an injection well that received air compressor condensate. DOE/RL-95-82c lists the site as inactive, source as abandoned. This stream was "eliminated" on 2/26/1996.	Rejected	Not Documented	N/A										
300-166	Injection/ Reverse Well	300-FF-2	1.47 (diameter)	Unknown - 1998	The site is an injection well that was a steam trap. DOE/RL-95-82c lists the site as inactive, source abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-167	French Drain	300-FF-2	Not Documented	Unknown - 1997	The site is a French drain that received steam condensate. DOE/RL-95-82c lists the source as abandoned. This stream was "eliminated" on 7/2/1997.	Rejected	Not Documented	N/A										
300-168	French Drain	300-FF-2	1.13 (diameter)	Unknown - 1997	The site is a French drain that is a concrete pipe. DOE/RL-95-82c lists the source as abandoned. This stream was "eliminated" on 7/2/1997.	Rejected	Not Documented	N/A										
300-169	French Drain	300-FF-2	0.48 (diameter)	Not Documented	This site is a French drain that receives steam condensate. According to technical personnel responsible for the site, this site was mistakenly identified as a miscellaneous stream site. According to M-3901, an abandoned helium line travels through this site, not a steam condensate line.	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-17	Ditch	300-FF-2	44.20 × 2.44	Not Documented	The site is a ditch that runs from the southeast corner of the 331-D Building to the top of the west bank of the Columbia River. The ditch is fed by an underground pipe that drains stormwater from the roadway. The site is identified as a point source conveyance to Outfall A in WHC-SD-EN-EV-021. This plan addresses all potential pollution to the Columbia and Yakima Rivers that might occur because of stormwater runoff.	Not Accepted	Not Documented	N/A										
300-170	French Drain	300-FF-2	Not Documented	Not Documented	This site was a French drain that received steam condensate.	Rejected	Not Documented	N/A										
300-171	French Drain	300-FF-2	0.32 (diameter)	Unknown - Present	The site is a French drain that currently receives only stormwater. DOE/RL-95-82c lists the steam source as abandoned. However, the site continues to receive stormwater. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										
300-172	Injection/ Reverse Well	300-FF-2	0.40 (diameter)	Unknown - 1998	The site has been described as an injection well. DOE/RL-95-82c lists the source as abandoned. HPD-TRP-018 used to discharge into this French drain. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-173	French Drain	300-FF-2	1.14 (diameter)	Unknown - 1998	The site is a French drain covered by a 1.14 m (3.74-ft) metal lid. DOE/RL-95-82c lists the site is inactive, source abandoned. HPD-TRP-019 used to discharge into the French drain. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-174	French Drain	300-FF-2	0.94 (diameter)	Unknown - Present	The site is a French drain that currently receives stormwater. DOE/RL-95-82c lists the steam source as abandoned. However, the site continues to receive stormwater. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										
300-176	Valve Pit	300-FF-2	1.30 × 1.11	Unknown - 1998	The site is a rectangular valve pit with a dirt floor. Steam condensate was discharged onto the floor of the pit. DOE/RL-95-82c states that the site is inactive, source abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-177	Injection/ Reverse Well	300-FF-2	0.90 (diameter)	Unknown - 1998	The site is an injection well that received steam condensate. DOE/RL-95-82c lists the site as inactive, source abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-178	French Drain	300-FF-2	0.25 (diameter)	Not Documented	The site is a French drain that is a clay pipe. The drain is not active. The drain lines are no longer present. Based on this information, the site was changed to inactive.	Rejected	Not Documented	N/A										
300-179	French Drain	300-FF-2	0.39 (diameter)	Unknown - Present	The site is a French drain that is a clay pipe. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received steam condensate only.	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-180	French Drain	300-FF-2	0.77 (diameter)	Not Documented	The site is a French drain that is a clay pipe covered by a perforated metal lid. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-181	French Drain	300-FF-2	0.66 (diameter)	Not Documented	The site is a French drain covered by an eight-sided metal lid. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received steam condensate only.	Rejected	Not Documented	N/A										
300-182	French Drain	300-FF-2	0.66 × 066	Unknown - Present	The site is a French drain with a square concrete base. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received steam condensate only.	Rejected	Not Documented	N/A										
300-183	French Drain	300-FF-2	0.89 (diameter)	Unknown - 1998	The site is a French drain that received steam condensate. DOE/RL-95-82c lists the site as inactive, source abandoned. This stream was "eliminated" in June 1998; the steam source has been shut off.	Rejected	Not Documented	N/A										
300-184	French Drain	300-FF-2	0.1 (diameter)	Not Documented	Twin 10 cm (4 in.) galvanized pipes drain each of two roofs that slope into each other in the center of the building. While DOE/RL-95-82c says that it is an injection well, there is no injection well; the stormwater runoff ultimately empties into a "non-engineered structure" (the bare ground). The waste is stormwater runoff only.	Not Accepted	Not Documented	N/A										
300-185	French Drain	300-FF-2	0.74 (diameter)	Unknown - 1998	The site is a French drain that is a metal pipe. Stormwater runoff may be able to enter this drain from the surrounding area. Two lines from the overhead steam line enter the ground nearby. One line is associated with HPD-TRP-013 and the other is associated with HPD-TRP-014. DOE/RL-95-82c states the source is abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-186	French Drain	300-FF-2	0.48 × 0.48 × 0.76	Not Documented	The site is a steel grate square with two pipes emptying into it. Note that DOE/RL-95-82c lists the site "Active." According to the responsible contractor, the document is not correct, as the site is inactive.	Rejected	Not Documented	N/A										
300-187	French Drain	300-FF-2	0.102 (diameter)	Not Documented	The site is two pipes coming out of ground, with valves near each. The pipes are connected with a tee in the middle leading to a pipe that goes into the 3730 Building. Note that DOE/RL-95-82c lists the site "Active." According to the responsible contractor, the document is not correct, as the site is inactive. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received steam condensate only.	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-188	French Drain	300-FF-2	0.84 (diameter)	Unknown - 1995	The site is covered by a rusted steel plate and with a pipe running into the northeast part of plate. The source release to the disposal unit was eliminated 9/28/95 and rerouted to the process sewer.	Rejected	Not Documented	N/A										
300-189	French Drain	300-FF-2	0.76 (depth) × 0.09 (diameter)	Not Documented	The site is a French drain. Note that DOE/RL-95-82c lists the site as an active steam condensate drain. According to the responsible contractor, the document is not correct, as the site should be listed as an inactive steam condensate site.	Rejected	Not Documented	N/A										
300-190	French Drain	300-FF-2	0.18 (diameter)	Not Documented	The site is a French drain that is a 17.8 cm (7-in.) PVC pipe through the asphalt paving against the 3731 Building. The drain receives only stormwater from the roof of the 3731 Building, which is a closed facility. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-191	French Drain	300-FF-2	0.18 (diameter)	Not Documented	The site is a French drain that is an 18 cm (7-in.) PVC pipe through the asphalt that surrounds the building. The drain receives only roof stormwater runoff. The 3731 facility is closed. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-192	French Drain	300-FF-2	0.98 × 0.98	Unknown - 1997	The site is a French drain that received steam condensate from a quench tank. DOE/RL-95-82c lists the site as inactive, source abandoned. This stream was "eliminated" on 7/2/1997.	Rejected	Not Documented	N/A										
300-193	French Drain	300-FF-2	0.98 (diameter)	Unknown - 1997	The site is a French drain that received steam condensate. DOE/RL-95-82c states that the site is inactive, source abandoned. This stream was "eliminated" on 7/2/1997.	Rejected	Not Documented	N/A										
300-194	French Drain	300-FF-2	Not Documented	Unknown - 1997	The site is a French drain. The site is associated with the 3734 Building, which has been demolished. The 3734 Building's concrete pad is still in place and is surrounded by soil and gravel. There are two small areas of Fixed Contamination adjacent to the pad. No drain was visible during the site walk down. DOE/RL-95-82c states the stream status is "Not Active" and the "Disposal Site Permanently Abandoned." This stream was "eliminated" on 7/2/1997.	Rejected	Not Documented	N/A										
300-195	French Drain	300-FF-2	Not Documented	Not Documented	The site is a French drain that received steam condensate. No drain was visible during the site walk down. DOE/RL-95-82c lists the stream status as "Not Active" and the "Disposal Site Permanently Abandoned." This stream has been "eliminated," the building has been demolished.	Rejected	Not Documented	N/A										
300-196	Sump	300-FF-2	0.98 × 0.98	Not Documented	The site is a condensate sump constructed of concrete with an access cover. DOE/RL-95-82c lists the source as abandoned.	Rejected	Not Documented	N/A										
300-197	French Drain	300-FF-2	1.37 (diameter)	Not Documented	Two pipes exit the 3745 Building and enter the site. One of the pipes appears to be condensate from steam and the other pipe is unknown. DOE/RL-95-82c lists the source as abandoned.	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-198	Injection/ Reverse Well	300-FF-2	0.91 (diameter)	Not Documented	The site is a vertical vitrified clay pipe with a steel lid and received steam condensate waste. DOE/RL-95-82c lists the source as abandoned.	Rejected	Not Documented	N/A										
300-199	French Drain	300-FF-2	0.61 × 0.46 × 0.61	Not Documented	The French drain is a 0.6 × 0.45 m (2 × 1.5-ft) rectangular concrete pit with a perforated steel cover. Site appears to receive stormwater runoff still. DOE/RL-95-82c lists the source as abandoned.	Rejected	Not Documented	N/A										
300-200	French Drain	300-FF-2	1.22 × 1.22 × 0.91	Not Documented	The site is a square concrete pit, 1.2 m (4 ft) on a side, covered with a solid steel plate. This site received steam condensate only. DOE/RL-95-82c lists the site as inactive, source eliminated. The source has been routed to the process sewer.	Rejected	Not Documented	N/A										
300-201	French Drain	300-FF-2	0.5 (depth × 1.0 (diameter)	Not Documented	The site is a concrete pipe in the gravel roadway. DOE/RL-95-82c says the site is active. However, the 3762 Building is posted as a closed facility, and most (or all) of the old steam lines in the area have been abandoned, so the site may actually be inactive. The site status has been changed to inactive to reflect information provided by the responsible contractor.	Rejected	Not Documented	N/A										
300-202	Injection/ Reverse Well	300-FF-2	Not Documented	Not Documented	The drain is not visible. DOE/RL-95-82c states the drain received HVAC condensate and the source has been permanently abandoned. The stream was "eliminated" from the inventory based on information provided on 8/1/97 that the discharge had been routed to the process sewer. Since the 3765 Building was demolished in 1996, this information may be in error.	Rejected	Not Documented	N/A										
300-203	French Drain	300-FF-2	1.22 (depth) × 0.66 (diameter)	Not Documented	This drain is visible as an iron plate exclusive of the frame. While DOE/RL-95-82c lists the drain as active, the former facilities manager of DynCorp said that the steam lines have been disconnected and thus the drain is inactive. The facility is closed.	Rejected	Not Documented	N/A										
300-204	French Drain	300-FF-2	0.77 (diameter)	Not Documented	The site is a French drain constructed of concrete pipe. According to DOE/RL-95-82c, the site receives stormwater from the drain at the bottom of the east stairwell and three drains in the 3790 courtyard. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-205	French Drain	300-FF-2	1.16 (diameter)	Not Documented	The site is a French drain constructed of concrete pipe and covered with a steel lid. A roof drainpipe is visible near the French drain. The site receives stormwater from 3790 Building roof drains. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-206	French Drain	300-FF-2	1.14 (diameter)	Not Documented	The site is a French drain constructed of concrete pipe and covered with a 1.14 m (3.75-ft) steel lid. The site receives stormwater from 3790 Building roof drains. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-207	French Drain	300-FF-2	1.15 (diameter)	Not Documented	The site is a French drain constructed of concrete pipe and covered with a steel lid. The site receives stormwater from 3790 Building roof drains. According to DOE/RL-95-82c, this site also receives drainage from a nearby stairwell. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-208	French Drain	300-FF-2	1.15 (diameter)	Not Documented	The site is a French drain constructed of concrete pipe and covered with a steel lid. The site receives stormwater from 3790 Building roof drains. According to DOE/RL-95-82c, this site also receives drainage from a nearby stairwell. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-209	French Drain	300-FF-2	0.31 (diameter)	Unknown - 1998	The site is a drain that receives stormwater runoff. It is located at the bottom of a covered stairwell in the 3790 Building. The drain is covered by a metal grid and is surrounded by concrete. According to DOE/RL-95-82c, this stream was "deleted" in 6/98; it discharges to miscellaneous stream No. 375 (WIDS Site 300-207) and not a separate disposal structure. No standing water was visible on a 10/1/98 visit.	Not Accepted	Not Documented	N/A										
300-21	Neutralization Tank	300-FF-2	14,380 L (capacity)	1961-1973	The site was an UST that held limestone used to neutralize acid wastes. The WATS Limestone Neutralization Tank leaked in 1973 and was removed. Some contaminated soil was removed at the time of removal of the failed underground tank in 1973. Additional contaminated soil was removed during the excavation for the 3 m (10-ft) deep tank pit for the 334-A Facility that was constructed over the former site of the failed underground limestone tank.	Not Accepted	DOE/RL-99-11, *300 Area Waste Acid Treatment System Closure Plan*	N/A										
300-210	French Drain	300-FF-2	0.3 (diameter)	Unknown - 1997	The site is a drain that received stormwater located at the bottom of a covered stairwell in the 3790 Building. The drain is covered by a metal grate and is surrounded by concrete. According to DOE/RL-95-82c, this stream was "deleted" in 9/97; it discharges to miscellaneous stream No. 376 (WIDS Site 300-208) and not a separate disposal structure. No standing water was visible on a 10/1/98 visit.	Not Accepted	Not Documented	N/A										
300-211	French Drain	300-FF-2	1.12 (diameter)	Not Documented	The site is a French drain that receives steam condensate. The drain is a clay pipe covered by a metal lid. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received steam condensate only.	Rejected	Not Documented	N/A										
300-212	French Drain	300-FF-2	1.22 (diameter)	Not Documented	The site is a 121.9 cm (48-in.) condensate sump, constructed of concrete and covered with a steel plate. DOE/RL-95-82c lists the source as abandoned.	Rejected	Not Documented	N/A										
300-213	French Drain	300-FF-2	1.0 × 1.0	Unknown-1998	The site is a French drain that received steam condensate and overflow from a water tower. DOE/RL-95-82c states this stream was "eliminated" in 6/98. The stream is inactive and the "Source Permanently Abandoned."	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-215	Dumping Area	300-FF-2	1,518,925.00 (m^2)	Not Documented	The site is very large and includes many different features. Much of the site is covered with vegetation such as cheatgrass and sagebrush. There is some construction debris in a dumping area. There appeared to be no HW dumped in the area.	Rejected	Not Documented	N/A										
300-217	Storage	300-FF-2	90.0 × 70.0	Not Documented	The area is currently in use as a laydown area for construction materials. Several vehicles were also stored at the site. No wood utility poles were observed and no stains were observed on the soil from temporary storage of wood utility poles. Most material is stored off the ground on racks. An electrical structure is located in the northwest part of the site.	Not Accepted	Not Documented	N/A										
300-220	Depression/Pit (nonspecific)	300-FF-2	8,318.00 (m^2)	Not Documented	The site is a manmade depression identified as Gravel Pit No. 7. The pit was used as a source of sand and dirt for backfill material. The use of the pit was discontinued because the area surrounding the pit was found to be contaminated. A large radiologically controlled area was posted north of 300 Area that included Pit No. 7.	Not Accepted	Not Documented	N/A										
300-222	Sump	300-FF-2	5.18 × 3.05	1977-1998	The brine pit, a concrete underground storage pit, was cleaned out and filled with sand/gravel in May 1998.	Rejected	Not Documented	N/A										
300-225	French Drain	300-FF-2	0.3 (diameter)	Unknown - 1997	The site is a drain that received stormwater. It is located at the bottom of a stairwell that is covered with a corrugated metal roof. According to DOE/RL-95-82c, this stream was "deleted" in September 1997. It discharges to miscellaneous stream #378 (WIDS Site 300-204). No standing water was visible on a 10/1/98 visit.	Not Accepted	Not Documented	N/A										
300-226	Injection/ Reverse Well	300-FF-2	1.83 (depth) 1.47 (diameter)	Not Documented	The site is a drip station for the underground steam line that supplies steam for the 3709A Building. DOE/RL-95-82c lists the source as abandoned.	Rejected	Not Documented	N/A										
300-227	Injection/ Reverse Well	300-FF-2	1.37 (depth) 1.49 (diameter)	Not Documented	The site is a drip station for the underground steam line that supplies steam for the 3709A Building. DOE/RL-95-82c lists the source as abandoned.	Rejected	Not Documented	N/A										
300-228	French Drain	300-FF-2	1.47 (diameter)	Unknown - 1998	The site is a French drain that received steam condensate. The drain is a concrete pipe covered with a perforated metal plate. DOE/RL-95-82c states the site is inactive, source abandoned. This stream was "eliminated" in June 1998; the steam source was shut off.	Rejected	Not Documented	N/A										
300-230	Valve Pit	300-FF-2	1.22 (depth) 1.73 (diameter)	Unknown - 1998	The site is covered with a diamond plate steel cover. The below grade section is constructed of concrete with a dirt floor. The interior of the pit contains valves that released steam condensate to the floor. Steam condensate was discharged to the floor of the pit. DOE/RL-95-82c states the site is inactive, source abandoned. This stream was "eliminated" in June 1998; the steam source was shut off.	Rejected	Not Documented	N/A										
300-235	French Drain	300-FF-2	0.76 (diameter)	Not Documented	The site is a French drain that currently receives only stormwater. DOE/RL-95-82c states the steam source has been shut off.	Rejected	Not Documented	N/A										

Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)			95% UCL (pCi/g, mg/kg)		
													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-236	Valve Pit	300-FF-2	1.31 × 1.31	Unknown - 1998	The site is a valve pit that received steam condensate. DOE/RL-95-82c states the site is inactive, source abandoned. This stream was "eliminated" in June 1998; the steam source was shut off.	Rejected	Not Documented	N/A										
300-237	French Drain	300-FF-2	Not Documented	Not Documented	The site is described as a French drain that received steam condensate. An engineered structure was not evident in the field. DOE/RL-95-82c states the site is inactive, source abandoned. This stream was "eliminated" in June 1998; the steam source was shut off.	Rejected	Not Documented	N/A										
300-238	French Drain	300-FF-2	1.55 (diameter)	Unknown - 1998	The site is a French drain that received steam condensate from an underground steam line. The drain is a concrete pipe covered by a metal lid. DOE/RL-95-82c lists the site as inactive, source abandoned. This stream was "eliminated" in June 1998; the steam source was shut off.	Rejected	Not Documented	N/A										
300-239	French Drain	300-FF-2	0.61 (diameter)	Unknown - 1998	The site is a French drain that received steam condensate. The drain appears to be a rust stained concrete pipe covered by a metal lid. DOE/RL-95-82c states the site is inactive, source abandoned. This stream was "eliminated" in June 1998; the steam source was shut off.	Rejected	Not Documented	N/A										
300-240	French Drain	300-FF-2	0.64 (diameter)	Not Documented	The site is a French drain that receives stormwater runoff. The drain appears to be constructed of concrete and is covered by a metal grate.	Not Accepted	Not Documented	N/A										
300-241	French Drain	300-FF-2	0.61 (diameter)	Not Documented	The site is a sprinkler valve pit. There is a water valve inside. The lawn around the 320 Building has underground sprinklers. This water valve operates the system. DOE/RL-95-82c states that this site receives water evacuated from the sprinkler system when the system is drained for winter.	Not Accepted	Not Documented	N/A										
300-242	French Drain	300-FF-2	0.9 × 0.9 × 0.6	Not Documented	The site is a concrete box that received drainage from the 325 Building. The concrete pit is identified in DOE/RL-95-82c as stream #791. The inventory documents this site as a stormwater runoff site.	Not Accepted	Not Documented	N/A										
300-243	French Drain	300-FF-2	0.67 × 0.57	Not Documented	The drain receives stormwater runoff from the 318 Building. The site is a rectangular grate in the pavement.	Not Accepted	Not Documented	N/A										
300-244	French Drain	300-FF-2	0.42 (diameter)	Not Documented	The site is a horizontal, metal culvert that protrudes from the ground in a gravel depression. The pipe runs under the asphalt driveway, westward toward the 318 Building.	Not Accepted	Not Documented	N/A										
300-248	Sump	300-FF-2	1.22 (diameter)	Not Documented	Steam was used to decontaminate rail cars at the 340B Building. The steam condensate sump collected condensate from the process steam. The contaminated solution that resulted from steam cleaning the railcars was flushed into a different drain that led to the Process Sewer. Originally, the sump was open to the ground under the building. Later the bottom was filled with concrete.	Rejected	Not Documented	N/A										
300-250	Valve Pit	300-FF-2	1.42 × 1.12	Not Documented	The site is a valve pit for a sanitary water line. The overhead steam line terminates and is capped at the north edge of the 3717B Building.	Not Accepted	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-261	Process Sewer	300-FF-2	0.61 (diameter)	Not Documented	The sewer is constructed of a vitrified clay pipe from the building to the riverbank. The waste is a process sewer pipeline that received overflows and filter backwash from the 315 Filter Plant. Treatment chemicals included alum (aluminum sulfate), chlorine, and separan (a polyacrylamide-flocculent). The site no longer receives material from the 315 Filter Plant. It can receive stormwater.	Rejected	Not Documented	N/A										
300-26	UPR	300-FF-2	Not Documented	1991	The site was an UPR. An offsite vendor's fuel oil truck spilled #6 fuel oil during departure onto the gravel and paved road. The trucking firm was contacted to perform final cleanup activities. According to the occurrence report, the trucking company has completed these activities. There is no information in the occurrence report to indicate the volume of material spilled or the methods that were used for the cleanup. There is no visible evidence of the No. 6 fuel oil spill in the area.	Rejected	Not Documented	N/A										
300-266	French Drain	300-FF-2	Not Documented	Not Documented	The site is just a patch of soil that a pipe occasionally released water to; it does not have a well-defined boundary. The drainpipe is connected to a sink where containers are filled with de-ionized water. The de-ionized water system is also connected directly to the drainpipe, and contributes water to the pipe when the system undergoes maintenance. The water is site service water with trace amounts of sodium hypochlorite and hydrogen peroxide, used to disinfect the system.	Rejected	Not Documented	N/A										
300-267	French Drain	300-FF-2	0.61 × 0.61	Not Documented	The site is a concrete slab with a square pit at the end. A galvanized, 3.2 cm (1.25-in.) pipe comes from the building and enters the pit. The French drain receives water from the HVAC system for the 3728 Building.	Rejected	Not Documented	N/A										
300-27	UPR	300-FF-2	Not Documented	1991	Radioactive contamination was found at the site during a routine survey on 8/14/1991. The site is an area of crushed rock gravel with no vegetation located near the outside wall of the 329 Building. All contaminated soil was removed via a 208 L (55-gal) drum (approximately one 5-gal. pail's worth of soil). Work was completed on 11/8/1991.	Rejected	Not Documented	N/A										
300-271	Storage Pad (<90 day)	300-FF-2	7.01 × 2.59	1997-2000	Dangerous waste was kept in a connex box commercially manufactured for storing wastes. The box has a spill containment system in that the waste was stored on a grate at the level of the door threshold, and any spills would be contained under the grate so they could not spill out the door. Wastes stored at this 90-day pad include absorbed gasoline, oils (possibly contaminated with heavy metals), ice melt (sodium chloride), toluene, and PCBs. All dangerous wastes and waste residues have been removed. There were no spills at this pad. The box is still in place, but is now used to store hazardous material intended for future use, such as roofing material, propylene glycol (trade name Dow Frost), and oils.	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-36	UPR	300-FF-2	0.65 (diameter)	1995	The site was an UPR to a French drain. The French drain received condensate return from the steam heating system that went to the fuel oil bunkers. The oil contaminated rocks and soil were placed into 208 L (55-gal) drums and removed for disposal. The contaminated French drain, WIDS Site 300-122, is in WIDS as a separate site. The occurrence report states that No. 6 fuel oil is not considered a hazardous material.	Not Accepted	Not Documented	N/A										
300-47	UPR	300-FF-2	One tank: 4.04 (length) 1.22 (diameter) 4542 (capacity)	1989	The site was identified as two locations of potential contamination near the 3708 Building that resulted from tank leakage. The first location of concern was an underground chemical storage tank located at the northwest corner of the building. According to WHC-MR-0388, the tank was removed in 1989. The second location of concern is where an underground oil storage tank had been located. According to WHC-MR-0388, the tank was removed "when the building was excavated."	Not Accepted	Not Documented	N/A										
300-55	Storage Tank	300-FF-2	3.05 × 12.19 Capacity: 340,687.1	1960-1970s	The tank was an UST. Liquid waste routed to this tank was sampled. If it was contaminated it was sent to the 340 Complex. If the waste was not contaminated, it was diverted to the Columbia River. Although an exact date cannot be determined, the tank was removed sometime in the 1970s and buried in a 200 Area burial ground. All RLWS connections were cut and plugged. The abandoned river outfall line was cut near the 3906 pump station.	Rejected	Not Documented	N/A										
300-56	Storage Pad (<90 day)	300-FF-2	7.01 × 2.74 × 2.71	Not Documented	The site is a steel storage container designed to contain hazardous materials or waste. The site was previously used as a 90-day waste storage area and received waste from the 306-E Building. The site is currently in use as a hazardous material storage area. Materials currently stored include laboratory chemicals, a 208 L (55-gal) drum for waste oil recycling, and 320 kg (700 lb) of peanut butter (sludge simulant).	Rejected	Not Documented	N/A										
300-58	French Drain	300-FF-2	0.91 (diameter)	Not Documented	The site is a French drain, identified as miscellaneous stream No. 449. No pipes to the drain are visible. DOE/RL-95-82c lists the source as abandoned.	Rejected	Not Documented	N/A										
300-59	Injection/ Reverse Well	300-FF-2	1.29 (diameter)	Unknown - 1998	The site is an injection well covered by a 1.29 m (4.23-ft) metal lid. DOE/RL-95-82c lists the site as inactive, source abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-60	Injection/ Reverse Well	300-FF-2	Not Documented	Not Documented	The site is described as an injection well that receives steam condensate. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received steam condensate only. DOE/RL-95-82c describes the site as active. However, the overhead steam line terminates and is capped at the north edge of the 3717-B Building.	Rejected	Not Documented	N/A										
300-61	Injection/ Reverse Well	300-FF-2	Not Documented	Not Documented	The site has been described as an injection well. DOE/RL-95-82c states this site is inactive, source abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-64	Injection/ Reverse Well	300-FF-2	2.45 × 0.90	Not Documented	The site is an HVAC steam condensate return to the WATS Pipe Trench (WIDS Site 300-224). DOE/RL-95-82c lists the site as inactive, "Source Permanently Abandoned." This stream has been "eliminated."	Rejected	Not Documented	N/A										
300-65	French Drain	300-FF-2	0.80 (depth) 0.35 (diameter)	Not Documented	The site is a steel pipe in the ground. The drain is covered with a steel plate with notches and holes for vents and two steam condensate pipes to enter. According to DOE/RL-95-82c, the stream has been eliminated because the steam source has been shut off. Signs on the 303J Building say that it is a closed facility, and no material is stored inside.	Rejected	Not Documented	N/A										
300-66	Injection/ Reverse Well	300-FF-2	0.91 (diameter)	Not Documented	The site is an open concrete French drain. Two pipes exit from about the ceiling level of the 303J Building and discharge to the drain. DOE/RL-95-82c lists the site as active as a steam condensate site. The responsible contractor believes the site to be an HVAC condensate drain (as it was listed in the previous DOE/RL 95-82b). This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received condensate only.	Rejected	Not Documented	N/A										
300-67	Injection/ Reverse Well	300-FF-2	1.90 × 0.82	Unknown - 1998	The site is an injection well that received steam condensate. DOE/RL-95-82c states that the site is currently inactive, source abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-68	Injection/ Reverse Well	300-FF-2	1.91 (diameter)	Unknown - 1998	The site is an injection well. DOE/RL-95-82c lists the source as abandoned. This site used to discharge to HDP-TRP-017, inside the pit. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-69	Injection/ Reverse Well	300-FF-2	0.74 (diameter)	Unknown - 1998	The site is an injection well covered by a 0.74 m (2.43-ft) metal lid. DOE/RL-95-82c lists the site as inactive, source abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-70	Injection/ Reverse Well	300-FF-2	0.51 (diameter)	Unknown - 1998	The site is an injection well covered by a metal lid. DOE/RL-95-82c lists the site as inactive, source abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-71	Injection/ Reverse Well	300-FF-2	0.54 (diameter)	Unknown - 1998	The site is an injection well that used to receive HVAC condensate. DOE/RL-95-82c states the site is inactive, source abandoned. This stream was "eliminated" in June 1998.	Rejected	Not Documented	N/A										
300-72	Injection/ Reverse Well	300-FF-2	0.66 (diameter)	Not Documented	The site is an injection well that receives stormwater runoff from the surrounding area. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999. DOE/RL-95-82c states "Disposal site within 300 ft of an active/inactive crib, ditch, or trench." The site is within 91 m (300 ft) of 316-3 Trench.	Not Accepted	Not Documented	N/A										
300-73	Injection/ Reverse Well	300-FF-2	0.18 (diameter)	Not Documented	The site is an injection well that received stormwater runoff from the surrounding area. DOE/RL-95-82c lists the site as inactive, source abandoned. This stream has been "Eliminated." It does not state if the stream was re-routed or plugged.	Not Accepted	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-74	Injection/ Reverse Well	300-FF-2	0.64 × 0.64	Unknown - 1996	The site is an injection well that received stormwater runoff. DOE/RL-95-82c lists the site as inactive, "Disposal Site Permanently Abandoned." This stream was "eliminated" on 6/5/1996; the site was grouted. DOE/RL-95-82c also states "Disposal site within 91.4 m (300 ft) of an active/inactive crib, ditch, or trench."	Not Accepted	Not Documented	N/A										
300-75	Injection/ Reverse Well	300-FF-2	1.11 (diameter)	Not Documented	The site is an injection well that received stormwater runoff and water from a chiller. DOE/RL-95-82c states that the drain has been permanently plugged and the stream has been routed to a process sewer. The document lists the site as inactive, "Source Permanently Abandoned." This stream has been "eliminated."	Rejected	Not Documented	N/A										
300-76	French Drain	300-FF-2	0.76 (diameter)	Not Documented	The site is a French drain that is a concrete pipe almost flush with the ground surface. DOE/RL-95-82c says the site is inactive, source abandoned.	Rejected	Not Documented	N/A										
300-77	Injection/ Reverse Well	300-FF-2	0.26 × 0.21	Unknown - 1997	The site is an injection well that received stormwater runoff. DOE/RL-95-82c states that the drain has been permanently plugged. The document lists the site as inactive, "Source Permanently Abandoned." This stream was "eliminated" 8/15/1997.	Not Accepted	Not Documented	N/A										
300-78	Injection/ Reverse Well	300-FF-2	1.25 × 1.22	Unknown - 1997	The site is a rectangular shaped below grade concrete box that is covered with two steel plates that received steam condensate. According to DOE/RL-95-82c, the stream was eliminated on 7/2/1997.	Rejected	Not Documented	N/A										
300-79	Injection/ Reverse Well	300-FF-2	1.40 (depth) 1.14 (diameter)	Not Documented	The site is a drywell that receives stormwater from six catch basins located to the south and the surrounding 313 Building Parking Lot area. The site is related to stormwater discharge that will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-85	Valve Pit	300-FF-2	1.52 (diameter)	Not Documented	The site appears to be a valve pit. The source and the disposal site are active. The injection well is tied to the package boiler operated by Johnson Controls. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received steam condensate only.	Rejected	Not Documented	N/A										
300-86	Depression/Pit (nonspecific)	300-FF-2	2.0 (depth) 2,676.0 m^2	Not Documented	The site is a basin that collects stormwater from the main 300 Area south parking lot. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										
300-87	French Drain	300-FF-2	0.22 (diameter)	Not Documented	The site is a French drain that received stormwater runoff. It is located at the bottom of a covered stairwell and is surrounded by concrete. DOE/RL-95-82c lists the site as inactive, "Source Permanently Abandoned." The document also states that the site has been permanently plugged. This stream has been "eliminated."	Not Accepted	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-88	French Drain	300-FF-2	0.61 (diameter)	Not Documented	The site is a French drain that is constructed of concrete and covered with a steel lid. The site receives water from the evacuation of irrigation lines when the lines are drained in the fall. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient.	Rejected	Not Documented	N/A										
300-89	French Drain	300-FF-2	0.61 (diameter)	Not Documented	The site is a French drain that is constructed of concrete and covered with a steel lid. The site receives water from the evacuation of irrigation lines around the 320 Building when the lines are drained in the fall. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient.	Rejected	Not Documented	N/A										
300-90	French Drain	300-FF-2	0.61 (diameter)	Not Documented	The French drain is constructed of concrete and covered with a steel lid. The site receives water from irrigation lines when lines are drained in the fall. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient.	Rejected	Not Documented	N/A										
300-91	French Drain	300-FF-2	0.61 (diameter)	Unknown - 1995	The French drain is constructed of concrete and covered with a steel lid. The site received water from irrigation lines when lines are drained in the fall. DOE/RL-95-82c lists the source as inactive and eliminated as of 9/28/1995.	Rejected	Not Documented	N/A										
300-93	Injection/ Reverse Well	300-FF-2	0.65 × 0.47	Not Documented	The site is a grate in the asphalt parking area on the south side of the 324 Building. DOE/RL-95-82c identifies this stream source as permanently abandoned. The source has been eliminated and the lines capped, but the disposal site has not been permanently abandoned. Before March 1995, while functioning as an injection well, the unit received only uncontaminated stormwater.	Not Accepted	Not Documented	N/A										
300-94	French Drain	300-FF-2	0.63 × 0.53	Not Documented	The site is a network of a drywell and a catch basin network installed to eliminate flooding on the east side of the 324 Building. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-95	French Drain	300-FF-2	1.37 (diameter)	Not Documented	The site is a French drain that receives stormwater runoff and steam condensate. There were no known hazardous or radioactive releases from the steam condensate discharge. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received steam condensate only. This site is also related to stormwater discharge that will be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										
300-96	Injection/ Reverse Well	300-FF-2	1.32 (diameter)	Not Documented	The site is a French drain constructed of concrete and covered with a steel lid that received steam condensate. DOE/RL-95-82c lists the source as abandoned.	Rejected	Not Documented	N/A										
300-97	French Drain	300-FF-2	0.46 × 0.46	Not Documented	The site is a drain that is covered by a rusted perforated steel plate. Stormwater disposal to engineered structures are managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-98	French Drain	300-FF-2	0.13 × 0.13	Not Documented	The site is a square floor drain at the bottom of a stairwell that drains stormwater from a leaky roof. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
300-99	Injection/ Reverse Well	300-FF-2	Not Documented	Not Documented	DOE/RL-95-82c lists this site as a steam condensate injection well. However, according to PNNL Effluent Management, the site received blow down from a liquid nitrogen tank, but is no longer active.	Rejected	Not Documented	N/A										
315 RSDF	Drain/Tile Field	300-FF-2	15.24 (length) 1893 L (capacity)	1950-1978	The 315 RSDF is an abandoned septic tank and drain field. The unit received unknown amounts of sanitary wastes from the 315 Water Filter Plant. The system was abandoned in 1978 when the sanitary sewer was routed to the 3906 Lift Station. The authors of BHI-00012 speculated that water treatment chemicals may have been discharged to the site, but no supporting documentation for this has been found. According to Dyncorp, the only chemicals used at the facility were alum (nonhazardous) and chlorine gas.	Rejected	Not Documented	N/A										
331-C HWSA	Storage Pad (<90 day)	300-FF-2	Not Documented	1972-1996	The 90-day storage pad was originally set up under RCRA for the management of HW generated from animal research in the 331 complex. The RCRA 90-day storage area is inactive and all hazardous materials were removed by 9/30/1996. The site is now managed as low-level radioactive non-HW accumulation area. It is managed according to DOE Order. The former 331-C HWSA is now a steel building and fenced laydown yard (331-C Building).	Rejected	Not Documented	N/A										
335 & 336 RSDF	Drain/Tile Field	300-FF-2	0.2 (diameter)	1973-1978	The 335 and 336 RSDF is a below grade waste site consisting of a septic tank and drain field that have been abandoned in place. Only a riser from the septic tank is visible in the field. There is no evidence of a drain field. The unit disposed of sanitary waste generated in the 335 and 336 Buildings.	Rejected	Not Documented	N/A										

Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]/ ACL	Max Concentration (pCi/g, mg/kg) Deep[b]/ BCL	Max Concentration (pCi/g, mg/kg) UCL Area	95% UCL (pCi/g, mg/kg) Shallow[a]/ ACL	95% UCL (pCi/g, mg/kg) Deep[b]/ BCL	95% UCL (pCi/g, mg/kg) UCL Area
340 CHWSA	Storage Pad (<90 day)	300-FF-2	Not Documented	Not Documented	Hazardous waste was stored for less than 90 days at various areas throughout the 340 Complex yard. This area is no longer used to stage HW. Site personnel do not know when the less-than-90-day storage activities ceased.	Rejected	Not Documented	N/A										
350 HWSA	Storage Pad (<90)	300-FF-2	Not Documented	1982-Present	The 350 HWSA is inside the 350-D Building and on an asphalt pad in front of the building. The staging area is used to store HW temporarily. Combustible liquids and PCB containing waste are stored inside the building. Used oil is stored in a 1,140 L (300-gal) tank behind the 350-D Building. Other waste is stored on the pad in front of the building. No UPRs have occurred at the unit.	Rejected	Not Documented	N/A										
3713 SSHWSA	Satellite Accumulation Area	300-FF-2	Not Documented	1984-1987	The site was a HW satellite accumulation area. It is no longer in existence. Hazardous wastes are no longer staged at this facility. The area accumulated miscellaneous small quantities of nonsolvent waste solutions from sign shop operations.	Rejected	Not Documented	N/A										
3713 PSHWSA	Satellite Accumulation Area	300-FF-2	7.9 × 4.9	1984-1987	The site was a HW satellite accumulation area. Today, the site is a concrete pad surrounded by a fiberglass and wood fence. There is a drain in the center of the pad. Items stored in this area include nonhazardous materials, such as ladders, hoses, and pipe. Currently, the 3713 Building is being used as a carpenter's shop.	Rejected	Not Documented	N/A										
400 FD1A	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The unit is a concrete or vitrified clay pipe filled with gravel. The condensate is collected by the HVAC unit and drained to the French drain. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received condensate only.	Rejected	Not Documented	N/A										
400 FD1B	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The unit is a 1.5 m (5-ft-) long, 1.2 m (4-ft-) diameter concrete or PVC pipe filled with gravel. The condensate is collected by the HVAC unit and drained to the French drain. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received condensate only.	Rejected	Not Documented	N/A										
400 FD2	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The unit is a concrete or PVC pipe filled with gravel. The site receives both stormwater runoff and HVAC condensate. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										
400 FD3	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The unit is a concrete or vitrified clay pipe filled with gravel. DOE/RL-95-82c states that this site receives both stormwater and potable water. However, there is no source of potable water to the 408-A DHX and stormwater is the only known contributor to the stream. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
400 FD4	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The unit is a 1.5 m (5-ft-) long, 1.2 m (4-ft-) diameter concrete or vitrified clay pipe filled with gravel. The site receives both stormwater runoff and HVAC condensate. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										
400 FD5	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The unit is a concrete or PVC pipe filled with gravel and located in a gravel and cobble covered field. The site receives both stormwater runoff and heat exchanger condensate from the 491W Heat Transport Building. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										
400 FD 6	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-1995	The site was a concrete or vitrified clay pipe, filled with gravel and cobble, and located in a gravel and cobble covered field. The stormwater from 408C and the heat exchanger condensate have been rerouted to an injection well.	Rejected	Not Documented	N/A										
400 FD7	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The unit is a concrete or PVC pipe filled with gravel. The French drain is not visible from the surface. The site receives potable water and stormwater from several sources. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										
400 FD8	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The unit is a concrete or PVC pipe filled with gravel. The site receives HVAC condensate from the 4621W Auxiliary Equipment Building. This site is exempt from permitting under WAC 173-216 because Ecology considers the WAC 173-218 registration to be sufficient for sites that received condensate only.	Rejected	Not Documented	N/A										
400 FD9	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The unit consists of a concrete or vitrified clay pipe filled with gravel. The site receives sanitary water from pump seal leaks, and salt water from water softener back flushing from the 481 Pumphouse. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered (listed) as underground injection wells.	Rejected	Not Documented	N/A										
400 FD10	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The site is either a concrete or vitrified clay pipe filled with gravel. The disposal structure is not visible in the field. The site receives stormwater runoff from the 482A/T-58 Water Storage Tank and Equipment Room Structure. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
400 FD10A	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The site is either a concrete or vitrified clay pipe filled with gravel. The disposal structure is not visible in the field. The site receives stormwater runoff from the 482B/T-87 Water Storage Tank and Equipment Room Structure. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
400 RFD	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	Not Documented	The sites cannot be positively described, although most French drains in the 400 Area are 1.5 m (5-ft-) long, 1.2 m (4-ft-) diameter concrete or vitrified clay pipes filled with gravel. The retired French drains received unknown amounts of water used during construction for washing components before to installation. The combined hazardous chemical inventory for the drains reportedly includes 40 kg (88 lb) of sodium dichromate. Based on reviews of available technical information, this information has not been substantiated.	Not Accepted	Not Documented	N/A										
400 RSP	Pond	300-FF-2	152.4 × 152.4	1972-1979	This site was one component of a SSS that supported the temporary facilities during construction of the FFTF. The unit received 45,420 L (12,000 gal) per day of aqueous wastes from a portable sanitary sewage treatment plant that was located several hundred meters away from the pond. Nonhazardous sludges were taken offsite for disposal while the plant and pond were operating. The portable treatment plant was removed from the site after retirement. The retired sanitary pond was backfilled and abandoned. The septic tanks and sanitary sewer pipelines were abandoned in place.	Rejected	Not Documented	N/A										
400 RST	Septic Tank	300-FF-2	Not Documented	1979-1983	Three septic tanks are shown on Drawing H-4-152051 and are listed as inactive waste disposal units in DOE/RL-88-30. The three septic tanks were installed to supplement the 4607 Sanitary Sewer. The units received unknown amounts of sanitary wastes from office buildings. There are no signs to mark the septic tanks. Surface features in the locations include two steel manhole covers near the southeast portion of 4702.	Rejected	Not Documented	N/A										
400 SS	Septic Tank	300-FF-2	Not Documented	1983-1998	The unit is a septic tank with a 11,355 L (3,000-gal) capacity. Site personnel report the unit may have received waste. The tank received 2,839 L (750 gal) of sanitary waste each day from various trailers. Effluent from this septic tank was discharged to the 4608 Sanitary Tile Field. The tank was abandoned in June 1998. No samples were taken because the tank serviced only office trailers.	Rejected	Not Documented	N/A										
400 SBT	Trench	300-FF-2	61.0 × 0.91 × 0.3	1979-unknown	A concrete-lined trench is covered with steel grating. The site collects overflow water from the 483 Cooling Tower pad and directs it to the process sewer. There is no known contamination or postings at the site. Because the trench simply transports nonhazardous cooling tower blowdown to the process sewer, rather than discharging it to the environment through a sand bottom, it is not considered a waste site.	Not Accepted	Not Documented	N/A										
400 STF	Drain/Tile Field	300-FF-2	Not Documented	1983-1998	The unit received liquid wastes from the 4608 Sanitary Sewer septic tank. The septic tank (400 SS) was abandoned in place by being backfilled with sand in June 1988. This action has eliminated the flow to the tile field.	Rejected	Not Documented	N/A										
400-1	Dumping Area	300-FF-2	91.4 × 30.5	Not Documented	The site is an area of soil mounds containing waste material. The site contains piles of soil, concrete, and rubble, a small amount of miscellaneous materials such as traffic markers and landscape rocks, and a few pieces of concrete asbestos board. Approximately six 208 L (55-gal) drums (cut in half) are also present.	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
400-3	Trench	300-FF-2	91.4 × 9.1 × 6.1	Unknown-present	Site personnel report that the unit receives storm runoff from various drains throughout the 400 Area. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
400-4	Burial Ground	300-FF-2	30.5 × 15.2	Not Documented	The site visit done in 1994 to support BHI-00012 indicated the site appeared to be possibly a closed burial ground that had been covered with soil. Vegetation on the mound is sparse. Some waste, such as a glove and an electrical cable, were partially visible. A radiological survey of the area was done in 1995 as part of the 300-FF-2 Limited Field Investigation. No contamination was identified.	Rejected	Not Documented	N/A										
400-6	Dumping Area	300-FF-2	91.4 × 61.0	Not Documented	The site consists of a building foundation, sidewalks, and construction and demolition debris. In October 1998, the appearance of the site was unchanged from the 1994 site visit description.	Rejected	Not Documented	N/A										
400-7	Septic Tank	300-FF-2	Not Documented	1978-1997	Site personnel report that this unit receives all sanitary wastes from 400 Area buildings except the wastes from a few trailers serviced by the 4608 Sanitary Sewer. During deactivation, the inlet valve to the tank was closed and the inlet line was grouted. Septage within the tank was disposed at the 100-N Sanitary sewage lagoon. The accessible surfaces in the interior of the tank were pressure washed. The residual wastewater after pressure washing was also disposed of at the 100-N Sanitary Sewage lagoon.	Rejected	Not Documented	N/A										
400-8	Dumping Area	300-FF-2	30.5 × 30.5	Not Documented	Currently, the dumping area appears as a field that is a partially covered with vegetation and strewn with debris. The debris consists primarily of construction and demolition waste. There are no boundaries to define the size of the dumping area clearly.	Rejected	Not Documented	N/A										
400-9	Sanitary Sewer	300-FF-2	Not Documented	1972-1979	The site was a temporary sanitary sewage treatment plant. The site received sanitary wastes from several toilet facilities and drains in the eastern and southern portions of the area. The treatment plant was removed from the site after it ceased operation, and the pond was backfilled. However, the underground lines were abandoned in place.	Rejected	Not Documented	N/A										
400-10	French Drain	300-FF-2	Not Documented	1979-unknown	The unit receives stormwater from the 453-B Switchgear Pad. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
400-11	Pond	300-FF-2	22.9 (diameter)	1986-1996	The site is a sanitary sewer lagoon that is currently dry. When the 400 Area Septic System was closed, the pond was covered with approximately 0.3 m (1 ft) of soil to minimize the potential for exposure to pathogens.	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
400-12	Drain/Tile Field	300-FF-2	0.1 (diameter)	1978-1986	The tile field received liquid effluent from the 4607 Sanitary Sewer septic tank. The tile field consisted of perforated PVC pipe that discharged sanitary effluent by gravity. Numerous problems were encountered with the tile field. Septic tank effluent repeatedly surfaced in the area of the tile field and overflowed into a natural depression nearby (Site Code 400-11). In 1986, the drain field failed completely, causing effluent to overflow through a manhole and enter the depression through a drainage ditch. A valve pit diversion box was installed to permanently divert the waste stream to the depression. The drain/tile field was abandoned in-place when it originally failed. The tie-in has been plugged.	Rejected	Not Documented	N/A										
400-13	Dumping Area	300-FF-2	3 acres	Not Documented	The site is a dumping area. Tree limbs, bags of leaves, and other debris are scattered in several locations along the east side of a dirt access road. Additional areas farther away from the road contain fire bricks, black rubber gloves, metal buckets, rusted tin cans, broken glass jars, electrical wiring, metal mesh screening, caulking guns, wood scraps, large chunks of building concrete, semi-circular wooden wall sections, and other waste materials.	Rejected	Not Documented	N/A										
400-14	Burn Pit	300-FF-2	30.5 × 15.2 × 4.6	Not Documented	The site was a large burn pit containing some visible, fire-scarred debris at the east end. Fire-scarred metal mesh screening, rags, wood scraps, and fire bricks are visible within the pit. The unit's appearance indicated it has not been used for some time.	Rejected	Not Documented	N/A										
400-15	UPR	300-FF-2	15.2 × 9.14 × 9.75	1986-1994	The site was a petroleum UPR, discovered during the removal of two fuel tanks 400-FS-40 and 400-FS-4. One tank held diesel fuel and one tank held unleaded gasoline. The two tanks have been removed and the contaminated soil has been excavated. In December 2004, Ecology concurred the cleanup was complete (Price, 2004).	Not Accepted	Not Documented	N/A										
400-16	Storage	300-FF-2	15.2 × 12.19	Not Documented	The building is used to store flammable or combustible products, including lubricants and alcohols. In 1998, all regulated waste containers were removed from the outdoor, concrete pad. The pad is no longer used for the storage of non-regulated waste or empty containers. The building is still used to store flammable or combustible products.	Rejected	Not Documented	N/A										
400-17	Burial Ground	300-FF-2	Not Documented	1977-1979	Site employees report that construction wastes were buried in this unit from "about 1977" to "about 1979." The area is shown to be covered by the 4843 Building and the 4843 Laydown Area. There is no visible evidence of a burial ground at this location.	Rejected	Not Documented	N/A										
400-18	Burial Ground	300-FF-2	Not Documented	1972-1974	Site employees report that construction wastes were buried in this unit from "about 1977" to "about 1979." The area is shown to be partially covered by the 4831 Flammable Storage Facility. There is no visible evidence of a burial ground at this location.	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
400-19	Storage Pad (<90 day)	300-FF-2	18.3 × 6.10 × 3.66	1993-present	This facility consists of a tan-painted clearspan steel structure on a concrete pad. The 440 Hazardous Waste Treatment Storage Facility (WIDS Site Code 400-19) replaced the 4831 LHWSA as the 400 Area less than 90-day storage area for HW. The 4831 LHWSA was used to stage oils and other HW, including solvents and ethylene glycol. Empty drums that had previously held cooling water treatment chemicals, such as the acutely hazardous Endcor 4690, were also staged at the site. In August 1994, the main portion of the facility contained a white box, labeled "Spill Kit," along with wooden crates and metal cabinets. The "Spill Cleanup Equipment Area" contained several 208 L (55-gal) drums.	Rejected	Not Documented	N/A										
400-20	French Drain	300-FF-2	Not Documented	Not Documented	The site was listed as a French drain located under Altitude Valve Pit T-58. Stormwater runs into the drain at the bottom of the stairs and is routed to the French drain, 400 FD10. DOE/RL-95-82c lists the stream as deleted as of August 1997 as a duplicate of Miscellaneous Stream #25 (WIDS Site Code 400 FD10).	Not Accepted	Not Documented	N/A										
400-22	French Drain	300-FF-2	Not Documented	Not Documented	The site was listed as a French drain located under Altitude Valve Pit T-330. Earlier DOE/RL-95-82 reports and BHI-00012 have described the Altitude Valve Pits as being French drains. This mistake has been corrected in the current report. DOE/RL-95-82c lists the stream as eliminated and that it discharges directly to the process sewer.	Not Accepted	Not Documented	N/A										
400-23	French Drain	300-FF-2	0.5 × 0.5 × 0.2	Not Documented	The site is a square opening in the concrete floor of the 480-A Pumphouse. The French drain receives pump packing leakage from the P-14 well pump. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered as underground injection wells.	Rejected	Not Documented	N/A										
400-24	French Drain	300-FF-2	0.5 × 0.3 × 0.3	Not Documented	The site is a rectangular opening in the concrete floor of the 480-B Pumphouse. This French drain receives groundwater well water leakage from pump P-15. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered as underground injection wells.	Rejected	Not Documented	N/A										
400-25	French Drain	300-FF-2	0.5 (depth) 0.7 (diameter)	Not Documented	The site is an active French drain constructed of concrete and covered with a steel lid. There is no known contamination at the site, and there were no postings. It receives groundwater well pump packing leakage from the P-16 pump. Disposal structures meeting the definition of "underground injection control," as stated in WAC 173-218, are registered as underground injection wells.	Rejected	Not Documented	N/A										
400-26	French Drain	300-FF-2	0.5 (depth) 0.1 (diameter)	1979-present	This site consists of two drains located in the bottom of Electrical Manhole No. 1. This unit receives intermittent discharges of stormwater from the 451-A Substation and the 400 Area B/N plant. It has a normal flow rate of zero.	Not Accepted	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
400-28	UPR	300-FF-2	Not Documented	Not Documented	The sites are "fugitive airborne emissions" from eight centrifugal chiller units at the FFTF. These units are used to provide cooling for personnel and equipment. Each chiller unit contained up to 1,361 kg (3,000 lb) of dichlorodifluoromethane. In FY 1998, the R-12 refrigerant in all eight chillers was replaced with R-134A, which is nonhazardous and non-ozone depleting.	Not Accepted	Not Documented	N/A										
400-29	Control Structure	300-FF-2	Not Documented	Not Documented	The sites are the 19 electrical transformers within the FFTF complex containing PCBs. All of the transformers are/were located within buildings or on the roof of buildings. Five of the transformers have been removed and disposed of in accordance with *Toxic Substances Control Act of 1976* regulations.	Not Accepted	Not Documented	N/A										
400-32	French Drain	300-FF-2	Not Documented	Not Documented	The site is a large gravel filled excavation that is labeled as "U.G. Drywell." The gravel-filled excavation was used to dispose of water that collected in the bottom of the 400 Area foundation excavations during construction. The drywell is a subsurface structure and is not visible at the surface.	Rejected	Not Documented	N/A										
400-33	French Drain	300-FF-2	Not Documented	Not Documented	The site is a large gravel-filled excavation that is labeled as "U.G. Drywell." The gravel-filled excavation was used to dispose of water that collected in the bottom of the 400 Area foundation excavations during construction. The water was pumped to the drywells through hoses. The dry well is a subsurface structure and is not visible at the surface.	Rejected	Not Documented	N/A										
400-34	Ditch	300-FF-2	Not Documented	1982-unknown	Although the drainage structure is on several drawings, it was never constructed. A site visit in October 1998 found no evidence of a ditch at this location. Only natural drainage occurs in this area. Stream #733 is listed in DOE/RL-95-82c as deleted.	Not Accepted	Not Documented	N/A										
400-35	Ditch	300-FF-2	Not Documented	1982-present	A surface water drainage system exits the southwest section of the 400 Area. This system collects surface water runoff from the area west of the reactor area. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Not Accepted	Not Documented	N/A										
400-39	Surface Impoundment	300-FF-2	23.8 × 22.6	1994-2004	The bioremediation pad contains petroleum contaminated soil that was found when the fire station fuel tanks 400-FS-40 and 400-FS-41 were removed (see Site Code 400-15). Eleven soil samples were collected in April 2001. A letter report provided statistical analysis to verify the cleanup has been attained per regulatory requirements. In December 2004, Ecology concurred the cleanup was complete.	Rejected	Not Documented	N/A										
403 FD	Injection/ Reverse Well	300-FF-2	1.22 (diameter)	1979-unknown	The unit may receive, or may have received air washer blowdown, HVAC system condensate, and stormwater from the 403 Building, as well as janitorial solutions of water and detergents. The site has been removed from the active list of DOE/RL-95-82c because the site does not discharge to an engineered disposal unit. The site is part of the 400 Area Stormwater Collection System.	Rejected	Not Documented	N/A										

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													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
4713-B FD	French Drain	300-FF-2	1.0 (depth) 0.7 (diameter)	1979-present	The site is associated with wastewater discharges (miscellaneous stream No. 33) from the 4713B Maintenance Building. In 1996, the sink was disabled to prevent discharge of gray water (wastewater excluding sewage) to the French drain. Remaining inputs are infrequent discharges from the 4713B fire sprinkler system and eyewash station. The site is related to wastewater discharge that will likely be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										
4713-B HWSA	Storage Pad (<90 day)	300-FF-2	6.1 × 6.1	1980-1993	The site was used as an accumulation area to store waste in cabinets and drums. The wastes were small quantity items related to FFTF maintenance activities. A review of the inspection records covering the period from 1991 to 1993 did not indicate any evidence of past leakage at the site. Metal cabinets, 208 L (55-gal) drums and a wooden storage box were located on the pad in May 1994.	Rejected	Not Documented	N/A										
4713-B LDFD	French Drain	300-FF-2	Not Documented	Not Documented	The site is a circular metal grate located in an asphalt-paved area east of the 4713-B loading dock. DOE/RL-95-82c states that the site collects stormwater and discharges it to the 400 Area stormwater collection system. The site is related to wastewater discharge that will likely be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										
4721 FD	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	The unit is a concrete or vitrified clay pipe filled with gravel. DOE/RL-95-82c states that the site routes stormwater from floor drains to an injection well on the west side of the building. The unit may have received janitorial solutions of water and detergents. There are no known spills. Stormwater disposal to engineered structures will be managed under a permit issued by Ecology in 1999.	Rejected	Not Documented	N/A										
4722-B FD	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-unknown	Cramer (1987) states that this French drain received 3,785 L (1,000 gal) of wastewater from lunchroom sinks in the 4722-B Building. In 1994, site personnel stated the 4722-B Building was remodeled and that lunchroom sinks discharge to a sanitary sewer line, not to this French drain. DOE/RL-95-82c does not list this French drain as a stream source.	Rejected	Not Documented	N/A										
4722-C FD	French Drain	300-FF-2	1.52 (depth) 1.22 (diameter)	1979-1985	The site receives wastewater from a sink inside the 4722-C Facility. The source of the discharge to the French drain was eliminated on 1/28/99. The water was disconnected.	Rejected	Not Documented	N/A										
4722 PSHWSA	Storage Pad (<90 day)	300-FF-2	Not Documented	1980-present	The Hazardous Waste Storage Area is three metal cabinets that are located on a curbed, concrete pad outside the 4722-C Building. The site is a staging area primarily for paint solvents. Signs indicate that solvent rags, antifreeze, and absorbent materials (for spill cleanup) may also be present. The lean-to shed is still on the north side of the building but is currently used as a brush washing station.	Rejected	Not Documented	N/A										
600-155	Dumping Area	300-FF-2	1.8 × 1.2 × 0.6 (one part)	Not Documented	The site consists of an old rusty machine parts. A field visit on 7/19/1999, verified that the large piece of equipment had been removed. A small piece of metal (approximately 0.46 m [18-in.] long) remained half-buried in the soil.	Not Accepted	Not Documented	N/A										

Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg) Shallow[a]/ ACL	Max Concentration Deep[b]/ BCL	Max Concentration UCL Area	95% UCL (pCi/g, mg/kg) Shallow[a]/ ACL	95% UCL Deep[b]/ BCL	95% UCL UCL Area
600-210	Outfall	300-FF-2	609.6 (length) × .25 (diameter)	1994 - unknown	The outfall discharges effluent from the 300 Area TEDF. The influent to the 300 TEDF is generated by facilities discharging to the 300 Area process sewer. The outfall line is a PVC pipeline that is routed to the shore of the Columbia River. A NPDES permit was granted for this discharge on 9/30/1994. An aquatic land-lease was obtained from the WDNR. When this site was originally added to WIDS, it was located in the 600 Area. The site is now within the 300 Area because of a change to the 300 Area boundary.	Not Accepted	Not Documented	N/A										
600-244	Depression/Pit (nonspecific)	300-FF-2	Not Documented	Not Documented	The pit is a source for gravel used for bedding and backfill material. The fenced equipment storage area is controlled by BHI. The drums stored on pallets containing sodium bisulfate and sulfuric acid are associated with the 200 Area groundwater pump and treat projects. The drums and the equipment are inspected routinely on a monthly surveillance schedule. The equipment and chemicals stored here were scheduled to be removed in spring 1999.	Not Accepted	Not Documented	N/A										
600-245	Depression/Pit (nonspecific)	300-FF-2	Not Documented	Not Documented	The gravel pit is an irregular shaped depression. No waste of any kind was found in the pit.	Not Accepted	Not Documented	N/A										
600-248	Depression/Pit (nonspecific)	300-FF-2	Not Documented	Not Documented	Gravel Pit No. 11 is a large, rocky excavated area north of the WYE Barricade. It is actively being used as a source of gravel for backfill. During operations, clean material is being removed from the north end of the pit. The southwestern portion of the pit was previously used as a miscellaneous debris dumping area. The debris (WIDS Site Code 600-23) has been backfilled with soil and is not visible. This area is avoided when obtaining backfill material from the pit.	Not Accepted	Not Documented	N/A										
600-249	Dumping Area	300-FF-2	Not Documented	Not Documented	The site contains miscellaneous debris and ash pit sludge. Visible debris includes metal pipes, PVC pipes, concrete, and tires. In February 1999, the discarded tires and other debris were removed from the area. Eventually, the area reserved for the ash became filled. The area was covered with dirt. This is the same area where a bioremediation pad was located (WIDS Site 600-243).	Rejected	Not Documented	N/A										
600-265	Depression/Pit (nonspecific)	300-FF-2	0.05 (diameter)	Not Documented	The site is two stainless steel pipes protruding from the ground. Each stainless steel pipe has a rusted pipe inserted in the center that extends above ground. These pipes will be evaluated to determine their classification as wells (e.g., not part of an underground pipeline), and if a well, be assigned a well identification number, surveyed, added to the Hanford Well Inventory and scheduled for decommissioning.	Not Accepted	Not Documented	N/A										
600-96	Depression/Pit (nonspecific)	300-FF-2	Not Documented	Not Documented	The site is sandy and mostly unvegetated. The site has been scraped for material to cover the adjacent burial ground. No waste was observed in the area in 1995, except for a large pile of tumbleweeds that were removed from the fence surrounding the 618-10 Burial Ground.	Not Accepted	Not Documented	N/A										
600-97	Depression/Pit (nonspecific)	300-FF-2	0.6 × 0.3	Not Documented	The site is located in a slight depression where 0.3 to 0.6 m (1 to 2 ft) of soil has been removed to cover the 618-11 Burial Ground. No waste or evidence of the presence of hazardous substances was observed during the site investigation.	Not Accepted	Not Documented	N/A										

Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)			95% UCL (pCi/g, mg/kg)		
													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
UPR-300-18	UPR	300-FF-2	Not Documented	8/27/1962	UPR-300-18 was located inside one of the 321 Tank Farms. On 8/27/1962, an employee was sprayed by a release from a low-level Cs-134 waste line. The employee was decontaminated. There was no mention of any cleanup to the environment.	Not Accepted	Not Documented	N/A										
UPR-300-31	UPR	300-FF-2	See UPR-300-40	See UPR-300-40	This site is a duplicate of UPR-300-40. A comparison of UPR-300-31 and UPR-300-40 and their reference documents was performed and the conclusion was that they both represented the same event.	Not Accepted	Not Documented	N/A										
UPR-300-43	UPR	300-FF-2	Not Documented	1986	The site is an UPR to the soil adjacent to the 329 Building. The release consisted of solvent-refined coal (light fraction) that was spilled to the ground. All discolored soil was removed from the site. No occurrence report could be found for this site.	Rejected	Not Documented	N/A										
UPR-400-1	UPR	300-FF-2	Not Documented	Not Documented	The site was an UPR that occurred during the construction of FFTF. The waste consisted of approximately 189.3 L (50 gal) of a coolant solution consisting of 50% water and 50% ethylene glycol. The site cannot be visually identified at its reported approximate location. There are no signs present to mark the site of the UPR.	Rejected	Not Documented	N/A										
600-1	Dumping Area	300-FF-2	30.48 × 15.24 × 3.05	1976	The site was used by the 300 Area Westinghouse facilities. It was used mostly to dispose of the tumbleweeds that accumulated on the 300 Area fences. Some wood, pallets, and miscellaneous debris may have also been placed in this trench.	Rejected	Not Documented	N/A										
600-246	Burial Ground	300-FF-2	460.0 × 155.0 × 12.0	Not Documented	Gravel Pit #9 is a large depression where gravel has been extracted. The gravel pit is now used as an inert landfill for non-dangerous/nonradioactive wastes. A bio-remediation pad (WIDS Site Code 600-287) is located in the east section of the pit. The waste includes concrete, wood, and asphalt. Soil was removed from around the 384 Fuel Oil Day Tanks and placed in Pit 9 in 1999. Soil sample results showed a plutonium spike, so the bio-remediation pad was posted as a soil contamination area.	Rejected	Not Documented	N/A										
600-247	Burial Ground	300-FF-2	Not Documented	Not Documented	The site is an old gravel pit. Once extraction operations were completed, the site was then used as a solid waste landfill for inert and demolition waste. Waste includes wood, concrete, and asphalt. Gravel Pit No. 10 has been closed and backfilled to grade.	Rejected	Not Documented	N/A										
618-6	Burial Ground	300-FF-2	Not Documented	1943-1944	In 1943 to 1944, the burial ground containing low-level dry waste was located in the southeast corner of the 300 Area (original 300 Area boundary). The total activity of the waste buried in this location is not known. The waste was exhumed and relocated twice to allow for 300 Area construction expansions. In 1962, the contents were permanently moved to the 618-10 Burial Ground.	Rejected	Not Documented	N/A										

Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)			95% UCL (pCi/g, mg/kg)		
													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-30	Process Unit/Plant	300-FF-2	28.65 × 20.73 × 7.01	1963 - unknown	From 1963 through the early 1970s, the building was used to process personnel dosimetry badges and meters. Since then, the facility provided photographic services. Within the facility is the silver reclamation unit that is used to treat the spent photo processing chemicals to recover silver for recycling. All process sewer connections were capped when the building was remodeled, probably between 1988 and 1990. The silver depleted liquid effluent produced from the silver reclamation process is a non-regulated, non-hazardous waste that is no longer discharged to the sanitary sewer. It is collected in drums and then sent offsite for disposal. Wash water and overflow from the developers is sent to the City of Richland sanitary sewer. Before 1998, this waste stream went to the 300 Area Sanitary Sewer Trenches (WIDS Site 300 SSS).	Rejected	Not Documented	N/A										
300-42	Fabrication Shop	300-FF-2	57.9 × 56.1 × 7.6	1972-present	The site is the 306E Building. Currently, the building is occupied by COGEMA Engineering Corporation. The building is being used for instrument development and computer aided design support. The 306E Building (currently an active facility) must be removed to remediate contaminated soil (WIDS Site 300-256) beneath the facility.	Not Accepted	Not Documented	N/A										
313 CRO	Process Unit/Plant	300-FF-2	Not Documented	1973-1988	The 313 Copper Remelting Operation was performed in the southern end of the 313 Building. Copper-silicon alloy scrap materials from the fuel fabrication process were collected, melted, cast, and machined for reuse in the N Reactor fuel fabrication operations.	Not Accepted	Not Documented	N/A										
3746-D SR	Process Unit/Plant	300-FF-2	18.29 × 6.40	1984-1996	The 3746-D Silver Recovery unit is a piece of equipment located in the 3746-D Building, a Quonset hut. The electrolytic portion of the silver recovery unit is present; however, the ion exchange columns are not. The recovery unit is currently inactive. A large white basin drains into the SSS and is the only drain in the building. This drain is not part of the 3746-D Silver Recovery equipment.	Rejected	Not Documented	N/A										
400-2	Process Unit/Plant	300-FF-2	85.3 × 51.8	1972-unknown	Site personnel state the batch plant was used for concrete mixing during the construction phase of the FFTF in the 1970s. The batch plant has since been removed, although building foundations and raw material bins remain. BHI-00601 states that the site requires no CERCLA action.	Not Accepted	Not Documented	N/A										
300-62	French Drain	300-FF-2	0.02 m (diameter)	Not Documented	The site is two 2.5 cm (1-in.) metal pipes from steam drain lines entering the ground at the base of the steam support structure. No engineered drain structure is visible. The stream has been eliminated because the source has been shut off. The site received steam condensate from steam lines passing by the 303C Building. Steam is produced from sanitary water that has been sent through a water softener system to remove minerals (calcium and magnesium). The treated water is introduced into boilers to produce steam. This steam is superheated before distribution to facilities for heating and process use. Non-regulated chemicals are added to dechlorinate the water, prevent scale, and control erosion.	Rejected	Not Documented	N/A										

Table A-1. Summary of 300 Area Waste Sites

Site Code	Site Type	OU	Site Dimensions (m)	Dates of Operation	Site History	WIDS Classification Status	Decision Document	Remedial Action Start Date	Remedial Action End Date	Contaminated Waste Volume to ERDF (metric tons)	Max. Depth of Remedial Action (m)	COC	Max Concentration (pCi/g, mg/kg)			95% UCL (pCi/g, mg/kg)		
													Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area	Shallow[a]/ ACL	Deep[b]/ BCL	UCL Area
300-63	Injection/ Reverse Well	300-FF-2	0.46 (height) × 0.61 (diameter)	Not Documented	The site is a 0.6 m (2-ft-) diameter concrete French drain, 0.5 m (1.5-ft) deep, with a perforated steel plate cover, flush with the alley road. About 0.3 m (1 ft) from the top is a 6 cm (3-in.-) diameter drainpipe that goes toward the west. It is not clear if water drains out of this pipe to French drain, or out of French drain into this pipe when drain is full. Several steel lockers marked "Flammable Liquids" and "Poison" are adjacent to the south wall of building. They are each marked "empty," are on skids, and appear to have been moved to the location for storage, not use. They do not appear to have leaked. The site appears to be stormwater runoff.	Not Accepted	Not Documented	N/A										
400-21	French Drain	300-FF-2	Not Documented	Not Documented	The site was listed as a French drain located under Altitude Valve Pit T-58. This site is the source location for WIDS Site 400 FD10A. Stormwater runs into the drain at the bottom of the stairs and is routed to the French drain, 400 FD10A. The Altitude Valve Pit T-87 is located beneath the 482-B Water Storage Tower.	Not Accepted	Not Documented	N/A										
600-290	UPR	300-FF-2	18.00 (length) × 6.10	Not Documented	The site is a contaminated foundation near the soil mound identified as Waste Site 618-13. The structure had two components, a pad, and the loading dock. A gravel road leads to the pad on the north side where a truck could back up on the pad to the loading dock and offload drums of waste. Rust colored patterns in the shape of 308 L (55 gal) drums suggest that these were once stored on the loading dock. The site is located in the 300-FF-2 OU due west of Building 3720 at the end of a gravel road approximately 730 m (0.45 mi) west of Stevens Drive.	Discovery	Not Documented	N/A										

Notes:

a. Shallow zone: soil above 4.6 m (15 ft) below ground surface.

b. Deep zone: soil below 4.6 m (15 ft) below ground surface.

J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.

U = The analyte was analyzed for, but was not detected to be greater than or equal to the estimated quantitation limit.

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Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
301	Storage	300	300-FF-2	12.3 × 9.3 × 5.3	Demolished	1944	1993	The janitorial storage facility was a one-story building originally used to store metal to create new tools and to provide a location for machining these tools. In 1964, it was used to store various labor service tools, including equipment for removing snow and spreading salt on the roads, machinery for cleaning and drying venetian blinds, and an auxiliary fire tanker truck. In 1983, the building was used to store materials needed for the 384 Building.
304	Manufacturing Facility	300	300-FF-2	8 × 15	Demolished	1944	2006	The original 304 structure was a small concrete block structure that was built in 1944 and used to store sodium metal and dismantled and removed by 1946 (HAN-10970). A new 304 Building was completed in 1952, and was a sheet metal Butler building that rested on a concrete pad. The building housed nickel-plating pilot plant operation from the late 1950s to mid-1960s. From 1972 until 1986, beryllium/zircaloy-2 alloy and zircaloy-2 chips and fines were concreted in containers to reduce their ignitability. These containers were buried in the 200 Areas burial grounds. From 1975 to spring 1988, depleted uranium alloy chips and fines from PNNL were concreted into billets and returned to PNL for subsequent shipment to the 200 Areas burial grounds. In spring 1994, pyrophoric metal waste from dismantling of the 300 Area fuel processing equipment was concreted in drums to reduce ignitability, and was the final treatment activity for the 304 Facility.
305	Reactor	300	300-FF-2	67.6 × 26.5	Demolished	1943	2006	The 305 Test Pile is a two-story and high bay steel-framed concrete structure. The 305 BA Building (Boiler Annex) is located at the southwest corner of the building to provide steam. The 305 Building housed the 305 Test Pile AKA. Hanford Test Reactor (1943-1973) and later was used to support cold mechanical development for the Hot Cell Verification Facility (1979-1985). From 1985-2001, several cold mechanical test programs were conducted for testing Waste Receiving and Processing waste containers (1991), a flexible radiation detection system (1993), and several mechanical systems for the K-Basin Spent Fuel Storage Project (1993-1996) such as, the fuel retrieval manipulator, sludge sucker, and gas-liquid samplers for K-Basin canisters.
307	Retention Basin	300	300-FF-2	8.5 × 5.2 × 2.7	Inactive	1953	September 2013 (Scheduled)	The 300 Area Retention Basins and Trenches consist of four open, epoxy-coated, concrete basins and two trenches. Each basin has a nominal 94,500 L (25,000-gal) capacity. The RPS ties into the basins on the north side, passing through a sample pit northwest of retention basin No. 1. The 300 Area Process Sewer and the RLWS drain from the south side of the basins. The trenches were backfilled in 1965 and are no longer visible. A large portion of the location has been paved and fenced. The site consisted of two trenches, each 180 m (600-ft) long, 9.1 m (30-ft) wide at the east end, tapering to 3.0 m (10-ft) wide at the west end. The depth varied from 3.7 m (12 ft) to 8.2 m (27 ft). The trenches ran in an east and west direction, approximately 6.1 m (20-ft) apart. Each contained a 13 cm (5-in.) vitrified clay pipe that ran the entire length of the unit.
308	Laboratory	300	300-FF-2	42.9 × 43.4 × 10.1	Inactive	1960	September 2013 (Scheduled)	The Fuels Development Laboratory (308 Building) was constructed in 1960 and was expanded several times between 1965 and 1980 (Steffen, 1996). From 1960 until 1968, it supported the PRTR mission to evaluate the use of plutonium as a nuclear fuel. Between 1968 and 1972, the 308 Building's primary mission changed from support for the PRTR and nuclear fuel research to support fuel fabrication for the FFTF reactor. In 1970, a fuel rod fabrication area, Room 154, was added to the north end of the 308 Building. In 1975-1977, the 308A wing was added to the northeast corner of the 308 Building to support FFTF fuel bundle assembly including quality control measurements and testing. The quality inspection equipment included neutron radiography using a TRIGA reactor installed in Room 160 of the 308A Building. In 1979, a shipping and receiving annex was added on the south side of 308A; the annex had a bridge crane for handling fuel assembly shipping containers. The TRIGA reactor first went critical on 3/25/1975 and made its last power run on 5/4/1989. The enriched uranium fuel rods were removed in 1995. Plutonium oxide pellet fabrication activities were discontinued in 1986. Test pin and fuel assembly fabrication activities were discontinued in 1990. Special nuclear material removal was completed in May 1992, except for the TRIGA reactor fuel that was removed and shipped in 1995. The 308 Building deactivation work begun in 1986 was completed on 6/24/1996 (Steffen, 1996) with the transition of the 308 and 308A Buildings from Westinghouse Hanford Company to BHI for surveillance and maintenance pending removal and remedial action (BHI-01676).

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
309	Laboratory	300	300-FF-2	109.7 × 176.8	Inactive	1960	September 2013 (Scheduled)	The 309 Buildings include the 309 Building PRTR containment vessel, its connected wings and annexes, the associated below-grade vaults (e.g., ion exchange, brine tank, waste storage, exhaust air filters, etc), and the main exhaust stack. The significant history for restoration of the 309 Buildings relates to the radiological contamination remaining from the operation of the PRTR from 1960 to 1968. A complete history of the PRTR and Plutonium Recycle Critical Facility is provided in WHC-MR-0388). The 309 Building is classified as a Type II facility. It is considered potentially contaminated by past PRTR operations and processes that used hazardous or radioactive materials, and represents a potential for a release to the environment during D4 activities. The facility history provided here relates to the planned demolition and restoration activities. In 9/29/1965, a serious (Type A) fuel failure accident occurred. Fission gases released during the rupture traveled through the helium system and into the HEPA filtration system for the process off-gases. The most serious contamination was within the primary and secondary coolant systems due to the fuel material released. Towards the end of the cool-down period, some contaminated light water was disposed to the ground east of the 309 Building parking lot, approximately beneath the present site of the 3763 Building (slab). In 1986 to 1987, a new space technology development program known as SP-100 was assigned to the 309 Building. The implementation of the SP-100 Ground Engineering System Test Facility was subsequently terminated by the DOE in November 1993, which brought about the transition of the facility for deactivation. The Nuclear Facility Preliminary Hazard Assessment issued in 2001 states that the 309 Building remains a "low hazard radiological facility" following the completion of the transition and stabilization activities (WHC-SD-SP-PHA-001).
310	Process Unit/Plant	300	300-FF-2	143.3 × 91.4	Active	1994	Not Documented	The 310 Building houses the TEDF, which treats and disposes of process sewer effluent from the 300 Area. Treatment includes chemical precipitation, selective ion exchange, and UV/peroxide oxidation to destroy organics and cyanide. After treatment, the effluent is disposed of at a submerged, single-port outfall in the Columbia River (Site 600-210). Chemicals used in this treatment include hydrogen peroxide, sodium hydroxide, sulfuric acid, ferric chloride, and ion exchange resins. Equipment located within the building includes chemical storage tanks for hydrogen peroxide, sodium hydroxide, sulfuric acid, and ferric chloride; pumps for transporting process effluent into a chemical mixing tank also located within the building; tanks to house a selective ion exchange resin system; and a UV/peroxide purification system.
311	Storage Tank	300	300-FF-2	3 × 3 × 3.2	Demolished	1944	2006	The 311 TF was designed to store product makeup sodium hydroxide, nitric acid, and methanol. Methanol management involved use of a still. Subsequently, multiple chlorinated hydrocarbons were substituted for methanol for degreasing billets and fuel rods. The alcohol tanks and still were removed. A waste acid tank was installed to reduce discharges to the chemical sewer. The 311 TF had two outdoor, concrete basins, which contain above ground tanks for product sodium hydroxide and waste acid. Below the 311 Tank Farm, underground tanks were installed in 1944 to contain methanol.
312	Pump Station	300	300-FF-2	9.6 × 5.5x 17.1	Inactive	1959	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 312 River Pump Station consisted of three different components, including a pump structure, an intake structure, and a concrete pad with electrical transformers. The pump structure was building located 16 m (52 ft) away from the intake structure, which was on the shore of the river. The pumphouse contained three pumps that extended to a depth of 17 m (56 ft). The intake structure was located on the shore of the Columbia River. It extended 11.3 m (37 ft) into the river. A "trash rack" extended all the way to the bottom of the river to prevent large objects from entering the pump system. An underground tunnel connected the bottom of the intake structure to the pump structure. A transformer pad was located next to the 312 Pump Structure Building.
313	Fabrication Shop	300	300-FF-2	55.6 × 148.1	Demolished	1943	2005	The original 313 Building was constructed in 1943 to support the reactor operations in the 100 Areas. The building was used to machine fuel rods into slugs or cores that were then jacketed or canned, which involved the use of several hazardous chemicals, including acenaphthene, carbon tetrachloride, TCE, phosphoric acid, methanol, sodium hydroxide, sodium nitrate and acetone. In 1954, the fuel canning process was switched to a different process called the "lead-dip" process, which introduced lead into the 313 Building waste stream. Airborne contamination readings within and near the 313 Building were frequently high and uranium, lead, cadmium, bismuth, aluminum, barium, and other heavy metals accumulated in the soils and facilities of the 300 Area during the years 1944 to 1971. The WATS, a RCRA permitted waste treatment system, was located in the southeast end of the 313 Building. The WATS has been RCRA clean-closed.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
314	Manufacturing Facility	300	300-FF-2	60.8 × 27.6 × 12.2	Demolished	1943	2006	The 314 Building has supported the fuel fabrication process as well as used as a R&D laboratory. The fuel fabrication activities included autoclave testing of canned fuel elements and uranium scrap recovery. The 314B Building was added in the early 1960s to support the R&D efforts, which included corrosion testing and development of mechanical equipment such as reactor fuel charging machines and reactor auxiliary equipment, and equipment mock-ups. The R&D work during the late 1980s and early 1990s included: waste vitrification experiments; stress corrosion cracking testing for naval reactor components using the autoclaves; crushing of empty napalm containers; welding remedies using the high-pressure high-temperature pipe test loop; N Reactor NDE work; corrosion testing of depleted uranium penetrators for the U.S. Army; cruise missile NDE; surface coating research using plasma coatings; and metal forming using a rolling mill.
315	Process Unit/Plant	300	300-FF-2	14.9 × 37.8	Inactive	1960	July 2012 (Scheduled)	The 315 Building was constructed in 1960 to support the Plutonium Test Reactor project by treating raw river water. In 1975, the 315 Building was modified to produce potable water. The size of the building was increased, and new equipment was added for introducing chlorine and other chemicals into the water. The 315 Complex provided potable water for the entire 300 Area until it was shut down in 1998. The 315 Water Filter Plant was concrete building and included three sedimentation basins, a clearwell storage area, and a small laboratory.
318	Laboratory	300	300-FF-2	4.9 × 15.2	Inactive	1967	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The main 318 Building was constructed during 1966 to 1967 to house the HTLTR, a reactor designed to test very high-temperature fuel performance in gas-cooled reactors. The 318 Building also contained a three-story steel paneled service wing west of the reactor enclosure. Its roof was metal framed and covered with built-up roofing asphalt. The reactor itself, along with its control room computer, was removed between 1978 and 1982. The 318 Building has been used since that time as a PNL site services facility to house offices, computers, and work involving the calibration of dosimeters and survey instruments. An ancillary detector building designated as 318-A was located approximately 10.4 m (34 ft) south of the reactor enclosure of the 318 Building. More recently the 318-A Building was used for storage and laboratory space. In 1982, after the HTLTR had ceased operations and been removed, the 318 Building received a one-story prefabricated steel frame addition on the south side. This annex was erected on concrete footings and slab and had an insulated metal roof.
320	Laboratory	300	300-FF-2	43.9 × 25.6	Inactive	1966	February 2011 (Scheduled)	The 320 Building's original mission was to house analytical chemistry services and plant support for work involving low-level and nonradioactive samples. The original work performed in the 320 Building included gamma ray spectrographic analysis, physical measurements with instruments, and various types of radiochemical separations processes similar to those performed in the 325 Building but involving samples with low levels of radioactivity. Among these processes were solvent extraction, ion exchange, carrier precipitation, and electrodeposition. Some analytical support also was provided to environmental monitoring and bioassay samples, again on materials with lower radioactivity levels than those analyzed in the 329 Building. R&D included radiometric techniques, new mass spectrometric techniques, combined (simultaneous) atomic absorption/mass spectrometric analysis, and laser-based spectrometric techniques.
321	Laboratory	300	300-FF-2	11.0 × 14.6	Demolished	1944	September 2013 (Scheduled)	The 321 Separation Building was constructed as a pilot scale plant for testing chemical "process improvements" using unirradiated or low-activity substances. It was a windowless two-story facility with a reinforced concrete frame, and concrete block exterior and interior walls. Pilot scale process tests of the bismuth phosphate (uranium-plutonium separation) process were performed from January 1945 to 7/7/1945. In August 1945, the bismuth phosphate process equipment was cleaned out and placed in standby condition. In January and February 1947, the bismuth phosphate process equipment was removed, the associated piping and facilities were decontaminated, and, except for the hot lab in the north wing, the 321 Building was released (plutonium-free) for "cold" separations and separations waste management pilot plant support activities. The 321 Building (except for the small hot lab on the north side) was operated as a "cold" separations pilot plant facility after the 1947 cleanout. From 1944 through 1967, the chemicals used were uranium, thorium, and the chemicals associated with the Hanford Site chemical separations processes and the chemical separations waste management processes. From 1968 until it was shutdown in 1988, the 321 Building was used as a hydromechanical test facility in support of the FFTF Project (Jacques, 2006).
323	Laboratory	300	300-FF-2	12.2 × 24.4 × 3.7	Demolished	1960	2008	The 323 (321-A) Building was brought to the 300 Area to be an annex for 321 Building chemical testing operations. However, after the 321 Building lost its waste vitrification mission in 1968, the 321-A Building was converted to the Metals Creep Laboratory. As such, the facility conducted tensile tests on metal samples of FFTF components, including the fuel subassembly, reactor vessel, and primary system weldments. For this work, the building underwent modifications and equipment upgrades throughout the 1970s. It was later renumbered the 323 Building and transferred to PNL in 1987.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
324	Laboratory	300	300-FF-2	62.5 × 71.6 × 13.7	Inactive	1965	September 2013 (Scheduled)	Major construction of the 324 Building in the 300 Area of the Hanford Site was completed in 1965. Significant additions to the building since the original construction include the high-bay, shop, and office additions. The 324 Building contains laboratories, hot cells, support facilities, and office space designed to pursue technical studies that range from laboratory scale to pilot-plant scale. These studies involved the use of materials having levels of radioactivity from natural background to full process levels (i.e., spent nuclear fuel and high-level tank waste). The 324 Complex was operated by PNNL until 1996, when the facility was transferred to B&W Hanford Company for interim operation and eventual stabilization and deactivation in preparation for building decommissioning. PNNL continued limited operations in the 324 Complex until October 1998.
325	Laboratory	300	300-FF-2	Too many dimensions	Active	1953	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 325 Radiochemistry Building, completed in 1953, was built to safely house and handle multi-curie level chemical development work with high-activity substances. During 1959 to 1960, a large addition known as the high-level radiochemistry wing was constructed, making the overall building the largest among the Hanford Site's laboratories. The entire ventilation system was engineered in a reverse flow, which was a state-of-the-art concept in the 1950s. The original 325 Building contained eight hot cells and three larger hot cells were added in the 1959 to 1960. The central RLWS connection was located on the northeast side of the building. Additionally, a transfer line between the 324 and 325 Buildings to facilitate waste vitrification work was installed in 1971. Work in the 325 Building, especially in the high-level radiochemistry addition, was conducted on highly radioactive materials. Plutonium Reclamation Facility process development introduced dibutyl butyl phosphonate, one of the most corrosive chemicals ever used on the Hanford Site, into 325 Building waste streams. Additionally, cell decontamination chemicals and reagents including nitric acid, ethanol, acetone, many commercial products of the Turco Corporation, and other cleansers were blended into the high-activity waste streams. Over the years, there have been numerous liquid and airborne contamination spreads outside of designated radiation zones inside the 325 Building. In addition to events involving contamination spreads within the 325 Building, some contamination releases to the environment over the years have resulted from facility operations in the form of stack emissions. Other environmental releases from the 325 Building have occurred primarily in the form of leaks to the soil from the old RLWS pipes and from other drains, pipes, and cell and basement encasements.
326	Laboratory	300	300-FF-2	57.9 × 54.9 × 11.6	Active	1953	September 2013 (Scheduled)	The 326 Building was constructed to support and study of reactor components and fuel elements The earliest and most intense radioactive work in the 326 Building was the operation of exponential piles in the basement beginning in 1953 to 1954. However, pile operations, like 305 and 305-B Building activities, produced little environmental contamination. Wastes generated by metallurgical work in the 326 Building consisted primarily of chemicals and heavy metals. As in other HW buildings, work with uranium and with other fuel and jacketing materials was conducted with few precautions in the early years. The 326 Building was connected to the RLWS network upon its original construction, and a diverter line allowing liquid wastes from the 329 Building to flow through the 326 RLWS connection was installed in 1968. In general, however, wastes and contamination in and around this structure are less serious than those at most 300 Area Manhattan Project buildings and/or at the 325 and 327 Buildings.
327	Laboratory	300	300-FF-2	65.5 × 42.7 × 9.8	Inactive	1953	September 2013 (Scheduled)	The 327 Building opened in 1953 to house the examining and testing of irradiated materials, particularly fuel elements and fuel cladding materials. The very nature of the work performed in the 327 Building involved and generated extremely high-activity wastes. Irradiated materials, including ruptured or failed fuel rods containing plutonium and fresh fission products, were examined while they were "green" (i.e., when they had experienced very little decay or stabilization time). The irradiated fines generated by this work were swept up and treated as solid waste, but powdery dusts left behind clogged air filters, sifted through the canyon, or were flushed into the RLWS as liquid wastes. There they collected in "hot spots" in cell drains, pipes, and around the weld joints where they were periodically discharged using strong chemicals and by mildly shaking the RLWS line with rivet guns. Intense waste and contamination problems developed in the 327 Building almost as soon as it opened, especially in connection with high airborne radiation readings and with sample and waste transfers. Sometimes airborne contamination from irradiated uranium and graphite fines was discharged outside of the 327 Building. Some of the most severe instances of contamination spreads within the 327 Building occurred as the result of the transfer of radioactive materials and of wastes in and out of hot cells and/or radioactive materials storage basins. Cell, drain, and waste piping leaks also accounted for some of the contamination events and waste losses to the environment that occurred in 327 Building history. In some cases, explosions and/or fires spread contamination in and around the 327 Building.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
328	Maintenance Shop	300	300-FF-2	3644.4 m^2	Demolished	1952	2007	The 328 Engineering Services and Safety Shop, called the Mechanical Development Building when it was constructed in 1952, were built to contain craft, equipment, and fabrication services for the 300 Area laboratories. The building was never connected to the RLWS, and there are virtually no known instances of radioactive contamination. On a few occasions, contaminated pieces of equipment found their way into the facility from other structures, and on two occasions, radioactive contamination incidents in other buildings affected the 328 Building. The 328 Building was a "cold" facility not equipped or permitted to contain radioactive materials. It housed a main metal and machine shop, two mock-up shops, a drafting room, as well as welding, paint, carpentry, and glass-blowing shops.
329	Laboratory	300	300-FF-2	66.3 × 37.0 × 10.4	Active	1953	September 2013 (Scheduled)	The 329 Biophysics Laboratory was built in 1952 to 1953 to support the pioneering HW environmental and bioassay programs. The primary, original mission of the 329 Building was to house the preparation and counting of radioactivity levels in samples taken of the air, vegetation, soil, wildlife, river and well water, and various types of bioassay samples. Other building functions included the development of new sample counting procedures and method, the invention and improvement of radiation monitoring instruments, and the application of industrial hygiene techniques from other industries to the Hanford Site's health physics needs. This bolted steel framework facility had no basement and had a second story over only part of the building. Wastes and contamination in the 329 Building resulted both from the chemicals used to separate various isotopes before analysis and counting could be done and from occasional spreads of fission product activity from contaminated samples that were brought in from the field. Sometimes acids were not neutralized, and they damaged the facility's RLWS and process pipes on several occasions. The building was connected to the RPS or "diverter" system, and this system was activated in several incidents when radioactive substances were disposed to process pipes. The RLWS line from the 329 Building was routed through a connection in the 326 Building in 1968, and this line needed to be replaced because of corrosion in 1986. At that time, strict procedures for use of 329 Building drains leading to the RLWS were instituted. On numerous occasions during 1988 to 1990, instrument malfunctions and improper disposals resulted in the deposition of hazardous and radioactive components in the RPS line. In February 1989, radioactive wastewater backed up through a drain and flooded the 329 Building basement. Today, radioactive waste disposal from this structure requires the permission of a supervisor to unlock the specified sink.
331	Laboratory	300	300-FF-2	38.7 × 87.5	Active	1970	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The functions of the 331 Building and its many ancillary facilities always have involved biological and botanical research. The 331 Life Sciences Building, constructed in 1970 to replace the old HW Biology Laboratory (108-F Building), is a three-part structure. Animal wastes were the most prominent wastes, in terms of volume, generated by 331 Complex operations. Originally, liquid animal wastes were disposed to a large, unlined pit located along the Columbia River just south of the 331 Building. All radioactive solid animal wastes from the 331 Complex also were transported to the 100-F Area trenches regularly. When the 331-D Animal Waste Treatment Facility was constructed during 1973-74, use of the 331 Complex waste pit along the Columbia River was discontinued. Nonradioactive solid animal wastes (primarily animal carcasses) originally were incinerated outdoors in a roofed, locked enclosure just east of the 331 Building until a modern incinerator was installed in the 331-J Building about 1988. Contaminated animal carcasses were considered solid radioactive waste and were placed in barrels and buried in 200 Area burial grounds. Chemical and radioactive laboratory wastes, along with fish tank waters, constituted the other categories of wastes generated in noteworthy amounts by 331 Complex operations. The 331 Building was connected to the 300 Area sanitary, process and RPS sewers, and the ancillary buildings within the complex were connected only to the sanitary and process sewers. Some of the smaller, early structures, including the 331-B Building, also had French drains for waste drainage into the ground. Radioactive wastes were removed via containers and casks. Laboratory operations included the use of several radiation sources (radionuclides in various forms) used for animal exposure. Laboratory chemicals and cleansers included a standard array of acids, caustics, reagents, alcohols, germicidal soaps, commercial bleaches, and acetone. There have been several instances of the loss of control of radioactive and chemical materials within the 331 Building Complex.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
332	Laboratory	300	300-FF-2	6.1 × 6.1	Inactive	1984	September 2010 (Scheduled)	The 332 Building is pre-engineered metal building on a 15 cm (6-in.) slab with footings. The 332 Building was temporarily used to store nonradioactive HW. It began to operate on 3/1/1984 as a less than 90-day storage area. A Part A Permit Application was filed in 1988 to allow for longer storage of waste. However, the 305B Building was also permitted for long-term storage and the 332 Building was never used for this purpose. It was closed on 4/21/1997 (WIDS 332SF) as a less than 90-day storage area. Its final mission was a testing facility for U.S. Department of Transportation shipping packages. Currently, the building is inactive per PNL, and the facility is a closed out WIDS site with Ecology (332SF). Electrical service to the building has been disconnected.
333	Fabrication Shop	300	300-FF-2	13.1 × 3.0 × 2.7	Demolished	1960	2006	The 333 Building was built during 1959 and 1960 to manufacture fuel elements for the N Reactor using the co-extrusion process. The 333 Building was a large steel frame building with double metal insulated panel exterior walls. The foundation and floors are concrete. There was a tank farm located on the west side of the 333 Building. The tank farm contained three cylindrical tanks that stand upright within a concrete containment basin. The containment basin is attached to the outside of the 333 Building. In 1973, the WATS began operating to treat waste acids from the 333 Building operations. The 300 Area WATS components of the 333 Building were tanks 7 and 11, and a 5.1 cm (2-in.) PVC drain piping from these tanks and from non-WATS tanks that drained waste acid to the 334-A Building storage tanks.
334	Monitoring Station	300	300-FF-2	4.6 × 6.1	Demolished	1960	2005	The 334 Building and 334TF were built in 1960 to support fuel fabrications operations at the 333 N Fuels Manufacturing Building (333 Building). The 334 Building housed control instrumentation for the 333 Buildings acid system and instrumentation for volume measurements of the tanks in the 334TF. The building was also used for storage of minor amounts of chemicals used in the fuels fabrication process. The 334TF consisted of four above ground 22,710 L (6,000 gal) tanks. The tanks are numbered, south to north, 1, 2, 3, and 4. The tanks were used for the storage of nitric and sulfuric acid that was used in the fuel fabrication process. In 1989, the WATS became a RCRA TSD facility. Partial closure of the non-soil portions of the 300 Area WATS started in the late 1990s. The WATS portion of the 334TF was clean closed as part of the 300 Area WATS partial closure in December 2001.
335	Laboratory	300	300-FF-2	30.5 × 18.3 × 7.3	Inactive	1968	July 2012 (Scheduled)	The 335 Building was known initially as the FRTE Facility. Almost immediately, a concrete block addition 6.1 × 7.4 × 3.0 m (20 × 24.3 × 10 ft) was built to house a change room, giving the 335 Building a total area of 707 m^2 (7,610 ft^2). 335-A was built in 1971 to house the TTL, which also stretched into the 336 Building through inter-connecting piping. This loop was used primarily to test and qualify small valves for use in FFTF. A 3,180 L (840-gal) sodium blowdown tank was located in a pit area within the building. The control panel for the TTL loop was housed in the 335 Building. In 1977, the TTL was shut down, and the 335-A Building has since been removed.
336	Laboratory	300	300-FF-2	15.2 × 15.2 × 19.8	Inactive	1969	Not Documented	The 336 Building, completed in 1969, was originally constructed to house experimental equipment for the study of the properties of sodium. It was known as the Core Segment Development Facility and supported FFTF developmental studies. The sodium test loops were deactivated in 1977 and finally removed in 1983 to 1984. The building was transferred to PNNL in 1986. The building has most recently been used for basic research related to multiphase flow phenomena and to experimentally address issues related to the Hanford Site such as waste retrieval, transport and disposal using non-radioactive simulates. Facility equipment and systems include numerous tanks (about 10) with capacities to 45,400 L (11,993 gal). A 7.6 cm (3-in.) -diameter pipe slurry test loop is installed. There was a small laboratory built in the early 1990s to support the high bay testing. It houses state-of-the-art flow measuring instruments.
337	Laboratory	300	300-FF-2	50.3 × 15.2 × 15.4	Inactive	1970	September 2012 (Scheduled)	The 337, 337B and 3718M Buildings were constructed in the early 1970s for Project BAP-048, the HTSF. These buildings provided space and facilities for engineering studies in support of FFTF and the LMFBR program at the Hanford Site.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
338	Maintenance Shop	300	300-FF-2	24.4 × 57.9 × 9.1	Inactive	1955	August 2012 (Scheduled)	The 338 Building provided space to receive, mock up, test and store components and certified materials for use in the HTSF. An equipment development, fabrication and sodium maintenance shop also was included. The 338 Building served in its initial functions of varied LMFBR equipment support activities through the early 1980s. In 1978, a Remote Maintenance Evaluation Facility was emplaced in the 338 Building. By 1981, FFTF developmental work had diminished greatly, and the 338 Building was converted that year to house the Secured Automated Fabrication Cold Test Facility, a nonradioactive demonstration project for oxide fuel processing line operations for the FMEF. In 1988, the facility was converted to a chemical and hazardous materials storage area. Today, the 338 Building is known as the Maintenance Building and continues to serve as a less than 0-day storage facility for hazardous materials.
340	Process Unit/Plant	300	300-FF-2	12.2 × 13.0	Inactive	1953	September 2013 (Scheduled)	Completed in 1953, the 340 Building, along with the initial RLWS piping system, the 307 Basins, and the RPS piping system, represented an attempt to deal with radioactive effluents from several new laboratories in a modern, controlled manner. The original 340 Building contained a sampling room with sample wells and an air compressor for instrument air and an operating gallery with a caustic tank and control panels for operating flows to and from two stainless steel tanks located below the building. Equipped with agitators, valves and transfer pumps, they were built to receive and sample liquid wastes from 300 Area laboratories. Radioactive wastes would then be taken by tanker truck to the 200 Area disposal facilities (usually cribs), and nonradioactive wastes could be disposed to the 307 Trenches. The tanks in the 340 Complex were fed by the RLWS. In 1976, a comprehensive leak test of the RLWS network was conducted. The results of these tests led to a decision to replace the entire RLWS piping network with double-walled stainless steel pipes, a leak detection system, many new valve boxes, and other system parts. Many segments of contaminated dirt throughout the RLWS piping network were removed at that time. However, the old RLWS pipes themselves were abandoned in place, and portions of soil contaminated by their leaks remain.
342	Sump	300	300-FF-2	3.7 × 5.7	Active	1993	April 2011 (Scheduled)	The 342 Site included several different components and was designed for pumping wastewater from the 300 Area to the 310 TEDF. The 342 structure itself was an underground sump. A set of three pumps were located at the bottom of the sump, near the southern wall of the structure. The 342-A Building was designed as a Sump Control Room and was located directly over the 342 Collection Sump. Equipment originally located within the structure included a sampling pump, control panel, and transfer switch. A pump control cabinet and junction box were located up against the exterior of the building. The 342-B facility was a transformer pad that was located approximately 3 m (10 ft) north of the 342 Collection Sump. The concrete pad housed a single 75-kVA transformer along with a power vault. The 342-C facility was a generator pad that was located about 0.5 m (1.5 ft) north of the 342 Collection Sump. It included a generator set inside a protective casing and a 1,135 L (300-gal) dike tank for storing fuel.
350	Maintenance Shop	300	300-FF-2	24.4 × 62.2	Active	1981	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 350 Complex served as the central craft shop for the 300 Area, with offices for supervisory and support personnel. The main 350 Building contained shop areas for plastics, carpentry, electrical/instrument, machine, welding, grinding, and pipefitting/millwright work. As of 1984, approximately 70 personnel worked either in or out of the facility providing service and craft functions. The 350-A Building provided space for spray-painting and sandblasting. The 350-B Building was used to store miscellaneous equipment and supplies. The 350-C Building functioned as a storage building for lumber used by the various shops. The 350-D Building served as a storage location for hazardous chemicals, primarily oil.
361	Monitoring Station	300	300-FF-2	3.7 × 10.1	Active	1999	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 361 Building was used in support of *Comprehensive Nuclear Test Ban Treaty* studies. The 361 Building was used for R&D of the air monitoring equipment as well as a training facility for personnel that used these systems worldwide. The 361 Building was constructed of prefabricated concrete. Two small stacks were located on the top of the building.
363	Loading Dock	300	300-FF-2	7 × 2.44 × 1.83	Demolished	1944	1953	This structure consisted of a 1.8 m (6-ft) deep reinforced concrete wall with wing walls. The 363 structure was presumably used to transfer cargo onto and off trucks for transportation. The 303-D facility was later expanded into the 3707-D Building, which extends over this site.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
366	Storage Tank	300	300-FF-2	8 × 64 × 3.5	Demolished	1964	2001	The 366 Fuel Oil Bunker consisted a small shack above-grade along with four fuel storage tanks (bunkers) below-grade. The total capacity of the tanks was 1,678,000 L (444,000 gal). The above-ground shack contained pumping equipment. The four concrete bunkers (USTs) were removed during summer 2001. Some low level radioactivity was detected the source of radioactive contamination is unknown. After the bunker tanks were removed, the soil contaminated with hydrocarbons was excavated to a depth of 4.6 m (15 ft) below grade level. This soil was removed from the site and staged. Visual observations confirmed hydrocarbon contamination of the soil at 4.6 m (15 ft) below grade level.
377	Laboratory	300	300-FF-2	12.2 × 10.9	Demolished	1981	2006	The 377 Building was known as the Steam Generator Examination Facility and the GEL. The 377 Building was composed of two distinct sections, north and south, with a common wall. The building was designed to conduct nondestructive testing, inspection, examination, and destructive testing of a steam generator from a commercial nuclear power plant. The examination activities took place between 1983 and 1987, and then the building was decontaminated in 1990. It was then used as a characterization laboratory for the testing of the Hanford Site soil samples until 1995. The 377 Building had no drain connections to the process sewer. Any liquid wastes or solid wastes generated by the GEL were collected in appropriate containers and shipped as need. The building's only pipeline connections were for sanitary water and the sanitary sewer. The building also had the following piping systems: bottle-fed argon and nitrogen, breathing air, vacuum, and service/instrument air system.
382	Pump Station	300	300-FF-2	15.5 × 12.5	Active	1943	Not Documented	The 382 Facility was originally designed to provide treated, potable water for use in the 300 Area. The area water supply originated from wells near the 300 Area. Water was pumped from the wells and treated with chlorine before being used throughout the 300 Area. Later on it was used to store and distribute sanitary water as a backup from the normal 300 Area supply, which was provided by the 315 Facility. It consisted of the following: 382 Pump Station , 382-A Ground Tank, 382-B Ground Tank, 382-B Fire Pump Station, 382-C Ground Tank, 382-D Ground Tank, 382 Sand Separator.
383	Storage Tank	300	300-FF-2	Not recorded	To Be Constructed	2008	N/A	This facility is scheduled to be constructed on the north side of the 325 Building.
384	Process Unit/Plant	300	300-FF-2	63.4 × 8.8	Demolished	1943	2008	The original construction of the 384 Building consisted of steel framing, reinforced concrete, and concrete block. The 384 Building's original construction consisted of steel framing, reinforced concrete, and concrete block. The original equipment configuration consisted of two 300-hp cross-drum boilers with horizontal stationary grates. Water softening equipment was located in the west end of the building, and a wooden tank with treated water for the boilers was located outside just west of this equipment. The east ground floor portion of the 384 Building included three coal-fired boilers and two oil-fired boilers; the south front of the building contains offices, change rooms, control room, electrical switchgear room, battery room, and master control consoles; the southwest corner of the building includes a chemical lab, safety shower, chemical storage, air compressor. The basement contained coal transport equipment, ash removal equipment/structures, and condensate equipment.
385	Pump Station	300	300-FF-2	Not recorded	To Be Constructed	Not Documented	N/A	This facility is scheduled to be constructed northwest of the 318 Building.
3106	Storage Tank	300	300-FF-2	Not recorded	Removed	Not Documented	N/A	The 3106 Facility consisted of two large helium tanks, apparently similar to those used in the 100 Areas as the 110 buildings. The 3106 facility was located just east of the 305 Building, south of the 351 substation. An aerial photograph confirms the existence of this facility.
3128	Storage	300	300-FF-2	6.1 × 3.1 × 2.7	Demolished	1977	Not Documented	The 3128 Building was a storage building located near the 328 Building. The facility was constructed on a concrete slab with an asphalt ramp leading up to the entrance. The walls were made of concrete block with metal siding on the exterior. The roof of the building was metal and slightly slanted down towards the back. The 3128 facility provided storage space for gas bottles.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3220	Office	300	300-FF-2	33.5 × 15.8 × 5.9	Active	1992	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 3220 Network Management Center Building was made of concrete. It contained office space, storage space, an equipment room, a conference room, a break room, and restroom facilities. Five HVAC units were located on the east side of the building, while a concrete generator pad was located on the west side. The roof was split into two levels and was composed of 1.5 cm (0.6-in.) plywood decking with a built-up membrane roof cover over open web trusses on 61 cm (24-in.) centers. The 3220 Building was used to house equipment necessary for modern telephone communications. As of 1999, it provided telephone service not only to the 300 Area, but also to HAMMER, the Hanford Patrol Training Academy, SIGMA 5, 345 Hills, the Applied Process Engineering Laboratory building, and the 100 DR Area using fiber-optic digital loop carriers.
3221	Office	300	300-FF-2	81.19 m^2	Demolished	Not Documented	2002	The 3221 facility supported a sandblasting operation in the 300 Area.
3222	Storage	300	300-FF-2	81 m^2	Demolished	Not Documented	2002	The 3222 building was used for storage.
3223	Storage	300	300-FF-2	30.2 m^2	Demolished	Not Documented	2002	The 3223 building was used for storage.
3224	Storage	300	300-FF-2	29.9 m^2	Demolished	Not Documented	2002	The 3224 building was used for storage.
3225	Storage	300	300-FF-2	9.1 × 1.8	Demolished	Not Documented	2005	The 3225 Building open yard bottle dock used to store compressed gas cylinders. The structure consists of a steel frame on individual concrete footings with a steel floor and a metal roof. The storage bays for the gas cylinders are separated by either concrete block walls or metal walls. Bays are not fully enclosed and are open to the weather.
3228	Office	300	300-FF-2	19.6 m^2	Demolished	1975	2002	The 3228 Building was a wooden shed that was constructed in the mid-1970s (Thomson, 2001). The 3228 Building was used as a lunchroom.
3229	Storage	300	300-FF-2	29.0 m^2	Demolished	1978	2004	The 3229 Building was a corrugated steel shed and was constructed in the late 1970s. As of 2000, it contained five cabinets for flammable materials and a connex, all of which belonged to FH. The building included a ceiling-mounted heater. The building was apparently used for storage of chemicals and equipment.
3231	Maintenance Shop	300	300-FF-2	133.8 m^2	Demolished	Not Documented	2004	The 3231 Building contained a ceiling-mounted electric heater and had PCB lighting. The building included storage space for electrical supplies and tools. In 2000, the building had connexes on each side. The building was used to house an electrician shop.
3232	Storage	300	300-FF-2	125.9 m^2	Demolished	Not Documented	2004	The 3232 Building contained storage space for piping, hand tools, and an air compressor. The building also had PCB lighting. In 2000, four connexes were located near the building.
3234	Storage	300	300-FF-2	10.3 m^2	Demolished	Not Documented	2004	The 3234 Building was a fiberglass shack used for storage in the northwestern portion of the 300 Area. In 2000, it contained five storage containers for flammable materials such as gasoline and roof cement. The 3234 Building was used to store various materials, including flammable chemicals.
3235	Storage	300	300-FF-2	Not recorded	Demolished	Not Documented	Not Documented	Paint storage. The complete documentation and history is not available.
3507	Control Structure	300	300-FF-2	3.7 × 3.7	Active	1982	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 3507 Building houses microwave communications equipment and was located directly underneath the large microwave tower. Its construction consists of a metal building, painted concrete floor, no windows, transite siding, and felt roof. Equipment within the building included a UPS, DC charger, battery, and various electrical and communications equipment. The 3507 Building was part of the new microwave communication system that was installed in the early 1980s. It replaced an earlier 30.5 m (100-ft) tower that had been located near the 3709-A Building.
3605	Control Structure	300	300-FF-2	4.1 × 4.1 × 6.7	Demolished	1944	Not Documented	The purpose of the 3605 Guard Towers was to observe the fence boundaries for attempts at sabotage and for fires. Each 3605 Building consisted of an observation room mounted on a four-post wood frame tower. Access to the observation room was obtained by a single- or double-flight open wooden stairway. Heating was provided by an electric space heater in all tower rooms.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3607	Pump Station	300	300-FF-2	A: 2.13 × 1.52 B: 12.19 × 4.88	Active	1944	Not Documented	3607-A and 3607-B were constructed in 1974 to support the 3607 Sanitary Sewer Disposal System that had been in service since 1944. The 3607 Septic System was designed to treat and dispose of sanitary wastewater from the 300 Area. The 3607-A Chlorinator Station consisted of a concrete pad near a retention basin. Presumably, the structure supported a pumping system that transferred chlorine from 3607-B and into the retention basin. The 3607-B facility was designed for storing chlorine for use in water treatment.
3614	Monitoring Station	300	300-FF-2	2 × 2 × 3.45	Demolished	1944	Not Documented	The 3614 Building contained equipment to monitor the air quality in the 300 Area. The 3614 contained one pedestrian door and no windows, with heating provided by an electric space heater.
3621	Electrical Substation	300	300-FF-2	A and C: 1.52 × 2.9 × 3.4 B: 3 × 4.57 × 3.4	Demolished	1944	Not Documented	The 3621 Emergency Generators were designed to house an emergency, gasoline-motor-driven, electric generator set. These sets were provided for buildings requiring continuous lighting service and were equipped for automatic starting in case of power failure. 3621-A was associated with the 3706 Building, 3621-B supported 3719, and 3621-C was for 3707-A. Each building was provided with one single, outside pedestrian door and one single-frame, double-hung window. The fuel storage tank for the gasoline engine was placed outside of the building on concrete saddles of sufficient height to provide a gravity feed. Two facilities known as 3621-B and 3621-C were built near the 384 Building in the 1960s, which appear to be different from the structures described here. The names given to those structures would seem to imply that the original 3621-B and 3621-C Buildings had been removed by the 1960s, while the 3621-A structure may have still existed.
3622	Control Structure	300	300-FF-2	Not Documented	Demolished	Not Documented	Not Documented	This facility was located on a slight hill, providing an ideal viewpoint for a number of the 300 Area buildings, especially PRTR. It was likely used for public relations for visitors to the site during the 1960s and 1970s.
3701	Office	300	300-FF-2	12.5 × 7 × 7	Demolished	1943	Not Documented	The 3701 Building originally served as the sole entry point to the 300 Area. The storeroom within the building was being used as a darkroom in 1945. The original 3701 Gate House was a two-story building. The ground floor consisted of two rooms, a guardroom, and a clock alley. The second floor contained a laboratory, two storage rooms, an office, a lavatory, and a hallway and was accessible from an outside wooden stairway and platform that rested on a concrete base. A small equipment shed was attached to one side of the building and originally was used to house an air compressor and air conditioning unit.
3702	Office	300	300-FF-2	65.84 × 12.19 × 6.1	Demolished	1948	1996	The 3702 Building was used as an office building. It was a one-story rectangular building with a wooden frame and an asphalt shingle roof, asbestos shakes on wooden drop siding, and steel frame casement windows with shade screens. The floor was finished with asphalt tile. A concrete block wall supported the perimeter of the building.
3703	Office	300	300-FF-2	12.2 × 84.1	Demolished	1948	1996	The 3703 Facility provided about 35 offices, a drafting room, a duplicating center, and restrooms. It was a wood frame structure set on a concrete block foundation. The floor was wood covered with asphalt tile, while the roof consisted of roll tarpaper.
3704	Office	300	300-FF-2	132.86 m^2	Demolished	1944	2004	The 3704 Building was originally the TC-36 Division Engineers' Office during the initial HEW construction work. The facility was kept on as a permanent building and served as the area supervisor's office. The construction of this facility is unknown. Based on similar buildings in other areas, it was likely a wood-framed facility built on a concrete pad.
3705	Office	300	300-FF-2	28.6 × 20.7	Demolished	1963	2006	The 3705 Building was initially designed to process film badges worn by Hanford Site employees, and to store personnel exposure records. In the early 1970s, this building's mission was changed to a photography shop. It housed equipment to recover silver from spent film processing chemicals. The 3705 Building was a rectangular one-story concrete building with corrugated metal sided equipment room and penthouse with a built-up tar and gravel roof, a concrete floor and no windows. The effluent from the silver recovery equipment was initially disposed of to the process sewer until around 1988, when the effluent was disposed of in the sanitary sewer in the 3746D Building, if it met discharge limits. Wash water and overflow from the developers was also disposed of in the sanitary sewer.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3706	Laboratory	300	300-FF-2	99.8 × 42.7	Demolished	1943	2007	The 3706 Building was the original radiochemistry and radiometallurgy laboratory on the Hanford Site and housed development work for REDOX, PUREX, and RECUPLEX processes. In 1954, the 3706 Building underwent a major decontamination and remodeling effort to convert laboratories to office space. The control (sampling) laboratory for uranium fuel fabrication continued to operate into the mid-1960s. In 1964, the 3706 Building housed some analytical laboratories, but most of the space was support services. All laboratory work was phased-out during the 1970s and 1980s.
3708	Laboratory	300	300-FF-2	22.8 × 15.6	Demolished	1948	2006	The 3708 Building was originally an optical and electrical repair shop or possibly as a vehicle maintenance shop. In around 1969, it was modified by Douglas United Nuclear for use as a transuranium pilot facility where neptunium oxide fuel targets were produced and canned in aluminum as well as combining neptunium oxide with graphite into a pellet form and canning them in aluminum. The north end of the building in the early 1970s was used for the experimental canning of americium and curium oxide fuel blends. It was subsequently used as a radioanalytical laboratory for the analysis of environmental samples. The building consisted of a 0.15 m (6-in.) concrete slab foundation with footings, concrete block walls, and a concrete slab roof.
3709	Maintenance Shop	300	300-FF-2	20.1 × 14.3	Demolished	1944	Not Documented	The 3709 Building was the 300 Area firehouse until replaced by a new firehouse in 1964. The building was then expanded and became the Experimental Mechanics Laboratory for stress testing, accelerometer testing, and pure bend fixture. In around 1978, it was expanded again and the tower was removed, and it became the paint shop. Large volumes of paint and solvents were also stored there. No historical evidence was found that nuclear material was ever introduced into the building. It was a one-story wood frame structure on a concrete slab, asbestos-shaked exterior walls, and a wood-based roof with built-up felt, tar, and gravel surface.
3710	Storage	300	300-FF-2	5.3 × 4.1	Demolished	1959	2001	The 3710 Facility was used for storing various solvents and other chemicals, including oil. The 3710 Building was a concrete block building on a 10 cm (4-in.-) thick concrete slab. The only utility the building received was electricity, which was provided from the 3707-D Building. Equipment within the structure included a metal cabinet for oil storage, a drum truck, and barrel pumps.
3711	Maintenance Shop	300	300-FF-2	24.4 × 12.2	Demolished	1960	2006	The 3711 Building was used as a general shop. More recently, it was used as a storage building for property owner materials. It was metal frame with corrugated aluminum siding and an aluminum truss with corrugated covering roof, and a 0.9 m (3-ft-) high concrete block foundation on a concrete slab floor. The building was steam heated, had electrical power, and a sanitary water supply that was likely used for water fountains and the roof swamp cooler, as there were no connections to either a sanitary or a process sewer.
3712	Storage	300	300-FF-2	27.4 × 32.9	Demolished	1959	2006	The 3712 Building was used as a storage building for green (unirradiated) fuel. It was a one-story, steel frame structure with metal panel siding and roof, a concrete floor and foundation. There was no cooling equipment and minimal heating, but the building did have an automatic fire sprinkler system.
3713	Maintenance Shop	300	300-FF-2	36.6 × 12.2 × 5.2	Demolished	1944	2006	The building was originally a receiving storeroom. This building was later converted to a carpenter, painting, and sign shop. It had a 10.16 cm (4-in.) reinforced concrete slab floor supported by concrete block foundation walls with concrete spread footings.
3714	Storage	300	300-FF-2	7.3 × 12.8 × 3.7	Inactive	1955	Not Documented	The 3714 Building was used to store laboratory solvents, lubricants, and flammable chemicals used in the 300 Area. Later, the 3714 Building doubled as an organic chemistry laboratory, with a hydrogenation facility being added to the east end of the facility. It was a one-story building with reinforced concrete walls, roof, and floor.
3715	Storage	300	300-FF-2	24.4 × 24.4 × 3.6	Demolished	1959	2006	The 3715 Building is a metal building constructed from 1959 to 1961 to store green (unirradiated) fuel, reactor fuels component parts, aluminum silicate billets, and related materials. It was one story steel frame structure, and was built on grade with corrugated metal siding and roof, a concrete slab floor, and incandescent lighting.
3716	Maintenance Shop	300	300-FF-2	12.2 × 24.4	Demolished	1944	2006	The 3716 Building originally served as the automotive repair and maintenance shop. In 1962, the building was relocated (its original site is now underneath the expanded 313 Building's footprint) and repurposed as a process development laboratory for alternate fuel fabrication process development. Later it was used as a storage building for uranium fuel supplies and fabrication equipment. It was a one story, metal frame structure with insulated aluminum siding and roof, and concrete floor slab on grade.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3717	Maintenance Shop	300	300-FF-2	22.3 × 50.3 × 7.3	Demolished	1943	2006	The primary use of the 3717 Building has been for maintenance and craft construction support. It was a tall one-story 5 × 15 cm (2 × 6-in.) wood frame structure, on grade with pitched, 5 × 20 cm (2 × 8-in.) wood truss roof, built on concrete foundation with concrete slab floor. Exterior walls were covered with asbestos shakes. The building contained offices and rest rooms; an instrumentation fabrication and repair room; a general small equipment repair and test shop; a valve repair assembly and test shop; a tool crib; a chrome-plating room; a metallizing (wire-fed, hot metal coating) work station; a welding room for arc and gas welding; and storage areas including pipe and plate racks adjacent to the building.
3718	Storage	300	300-FF-2	24.4 × 12.2 × 5.5	Demolished	1959 – 1962	2008	Photographs show a sign on the 3718 Building, that it was part of the FRTE Facility, which was in support of the FFTF. It is unknown as to the specifics of its use. It is a prefabricated metal storage building with gable roof, set on a 10.2 cm (4-in.) reinforced concrete slab foundation with footings. An office facility was added to the northeast corner of the building around 1963.
3719	Office	300	300-FF-2	21.9 × 12.2	Demolished	1944	June 2007	The original structure was used as the first aid station until 1955. During the 1960s, it was used as fire protection headquarters. In the 1970s, it served as a transportation dispatching office. The original structure was removed, and a new building constructed on the same site during 1977 and 1978. The original building was replaced in 1977 to 1978 with a one-story modular construction building with a poured concrete slab foundation. The exterior walls are polyurethane insulated core placed between reinforced pre-cast concrete. The new building was utilized as a document storage facility and then a computer facility. The building is currently administered by Lockheed Martin Information Technology and contains active computer and telecommunications equipment.
3720	Laboratory	300	300-FF-2	73.2 × 30.5	Demolished	1964	2007	The 3720 Building was originally constructed as the Consolidated Service Facility – Maintenance and Quality Control Laboratory. It provided analytical chemistry support for nuclear fuels fabrication. The 3720 Building was connected to the 300 Area Process Sewer (WIDS 300-15) and the 300 SSS. The underlying soil beneath the 3720 Building and beneath the surfaces around the 3720 Building is a below ground uranium contamination area.
3721	Process Unit/Plant	300	300-FF-2	6.1 × 4.5 × 3.4	Demolished	1964	2008	The 3721 Building was the Classified Shredder Facility, used to destroy sensitive materials. It is a one-story building composed of concrete block walls, cast-in-place concrete floor, and a built-up asphalt/gravel roof over corrugated steel panels and structural members. The building originally housed an incinerator unit along with ventilation equipment to support it, including an insulated stack with a metal jacket on the roof of the facility. In 1982, the incinerator was replaced with a paper shredder and disintegrator. The modifications included a dust filter for removing particulates. The facility was serviced by electricity, water, and an underground propane line.
3722	Fabrication Shop	300	300-FF-2	42.7 × 12.8 × 8.8	Demolished	1944	February 2006	This facility was originally used as the general shop for the 300 Area, and later served as a fabrication shop for machining, welding and grinding for the Fuels Preparation Building (313) and related facilities. During 1964-1965, the 3722 Building received new equipment and then from 1965-1967, it was used for lithium-aluminate fuel target production. From 1968 -1970, palletized thorium oxide fuel targets were fabricated in the 3722 Building. The building housed a furnace for the "recycling: (reduction) of depleted thorium oxide after it was processed in PUREX. Documentation suggests it was used more recently as a construction shop. The 3722 Building was a one-story wood frame structure with 10 cm (4-in.) concrete reinforced slab floor supported by concrete foundation walls.
3723	Storage	300	300-FF-2	2.7 × 4.9 × 2.7	Inactive	Not Documented	Not Documented	The 3723 Building was used to storage acids, solvents, and the location for waste management and recycling operations, such as a storage location for spent batteries. The 3723 Building was constructed of concrete block walls, with a steel deck roof, and a slab concrete floor.
3726	Storage	300	300-FF-2	Building: 9.14 × 4.11 × 4.42 tank: 6.71 length, 1.42 diameter	Demolished	1944	Not Documented	The 3726 Propane Storage Building was a wood framed, open sided, gable roof structure that was supported by six wooden posts resting concrete piers. The roof was three-ply roll roofing over T&G sheathing. Drop siding extended down from the roof to a point approximately 2 m (7 ft) above ground level. The structure housed a single metal storage tank, which was supported by two concrete piers with spread footings. Later on, the structure over the propane tank appears to have been removed (HEDL-MG-17). In 1957, the tank received new concrete supports, and a chain link barricade was placed around the site (H-3-8798).

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3727	Storage	300	300-FF-2	11.3 × 7.1	Inactive	Not Documented	October 2011 (Scheduled)	Building 3727 was used for the secure storage of classified documents and fuel pins. Printed materials stored in 3727 will either be properly destroyed or reviewed to determine if they can be declassified. The 3727 Building was also equipped with storage racks designed for holding fuel pins until they were needed. Fuel pins held nuclear fuel and were formed when pellets were placed into rods. Fuel pins would be placed into bundles and delivered to the reactors (fuel pins are no longer stored inside). It is a concrete block structure with a concrete floor and flat roof, 0.3 m (1-ft-) thick concrete walls, and the building sits on a poured concrete foundation.
3728	Storage	300	300-FF-2	24.4 × 12.2 × 6.7	Demolished	1980	2008	The 3728 FFTF Test Articles Storage Facility was constructed for storing shipping containers used to transport test articles assemblies associated with FFTF operations. No documentation could be found to determine if 3728 Building storage vaults ever were used to store shipping containers. Modification plans were developed in 1991 for the testing of non-radioactive contaminated soils. It appears that the Geotechnical High-Bay was only used to perform very limited soils testing and that the facility was never modified fully planned but this could not be confirmed. Since 1996, the building was used as an environmental sample storage and shipping facility. Environmental samples with chemical and radioactive contaminants are stored in the refrigerators and are packaged at the workbenches before shipping them to laboratories. A limited amount of chemical reagents and preservatives were stored in the facility also. There have been no reported spills associated with these chemicals. It is a pre-engineered metal building.
3730	Fabrication Shop	300	300-FF-2	41 × 12.0 × 4.0	Inactive	1949	February 2012 (Scheduled)	The steel 3730 Building was built as a temporary melting and fabrication building and likely supported the uranium ingot casting, extruding, and rolling activities in the 313 and 314 Buildings and involved depleted and/or low enriched uranium metal. The 3730 Building was modified in 1955 with an addition to the south end for the Hot Graphite Shop and Storage Building where samples of irradiated graphite and reactor materials were prepared for analysis in the Pile Technology Lab (326 Building) and the Analytical Labs (3706, 325, 329, etc.). There were numerous radiation incidents reported. The original 3730 Building was converted to machining fresh (i.e., cold) graphite components and for the storage of graphite materials and operated from 1956 to about 1966 when the cold graphite work was moved to the 3731A Building. In 1964, its name was changed to the Graphite Laboratory and Shop. Sometime after 1967, the building was renamed the Gamma Irradiation Facility. Over the years, its mission changed to materials testing for the waste management programs and for the FFTF Project.
3731	Storage	300	300-FF-2	24.4 × 12.2	Demolished	Not Documented	May 2007	The south half of the 3731 Building was used to store graphite materials for the adjoining Graphite Machine Shop (3731-A). The 3731 Building was identified as Graphite Storage in 1964. From 1968 to 1987, the 3731 Building was identified as a Fissile Material Storage Facility. The north end of the 3731 Building had a spray paint booth with a criticality alarm system and a fire protection sprinkler system used to paint and store fissile material shipping drums. It is a metal building with aluminum siding, frame, trusses, and roofing and was originally a U.S. Army mess hall that was relocated to the 300 Area. The 3731 Building appears to be in very good condition and should be portable once the 3731A Building is removed.
3732	Laboratory	300	300-FF-2	8.6 × 14.7	Demolished	1949	1997	The 3732 Process Equipment Development Laboratory was constructed as an engineering pilot plant for the triple-dip and lead-dip fuel canning processes. Powdered thorium oxide fuel targets for U-233 products were fabricated in the 3732 Building from 1965 to 1967. From 1968 through 1970, pelletized targets were canned in the 3732 Building. Later on, the building was used for maintenance and custodial storage. It was a one-story metal frame structure with exterior walls and roof of corrugated sheet metal, a concrete foundation, on-grade concrete floor, and interior walls of transite panels and sheetrock.
3734	Storage	300	300-FF-2	7.32 × 3.05 × 3.66	Demolished	1944	1997	The 3734 facility was originally used to store gas cylinders, and contained four small cylinder storage spaces. In the 1950s, the 3734 Building was converted to a storage facility for miscellaneous insulating materials including asbestos and industrial glue and fixants and later for general storage. The 3734 Building was built upon a 10 cm (4-in.-) thick concrete pad and had 20 cm (8-in.) concrete curtain walls. The walls, which were open at both the top and bottom of the structure, consisted of vertical T&G sheathing.
3741	Storage	300	300-FF-2	9.14 × 4.27 × 5.03	Demolished	1943	1956	The 3741 Building was originally used to store and prepare samples of irradiated graphite, flux wires, and uranium from the 305 Test Pile Building. These processes created a large amount of radioactive contamination, which was a cause for concern in the early 1950s. The 3741 Building was a one-story, wooden frame building constructed on top of a 10 cm (4-in.) -thick reinforced concrete slab with a concrete foundation. The 3741 Building was demolished in 1956, after several years of increasing concern over the radioactive contamination levels within the building. Waste Site 300-268 encompasses the foundation/concrete slab that may have been left behind after demolition.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3745	Laboratory	300	300-FF-2	29.6 × 11.0 × 12.2	Demolished	1944	2007	The 3745 Building was built in 1944 to support the calibration of radiation detection instruments. The building experienced contamination and personnel exposure problems from field-contaminated portable survey instruments and/or instruments with faulty cases or shielding. An instrument decontamination area was established in the facility in about 1945 and major shielding upgrades were added in 1956. The 3745 Building was a two-story wood frame rectangular building with a multiple gable, asphalt, and asphalt shingle roof with three large ventilators.
3746	Office	300	300-FF-2	22.1 × 9.3 × 6.6	Demolished	1945	2007	The 3746 provided support space such as offices, lunchroom, and restrooms for personnel associated with health physics and research, and development projects in the 3746-A, 3745-A, and 3745-B Buildings. The function of the building was to perform tests and verify that the composition of various process substances were within specifications. The building was also used to calibrate thermoluminescent dosimeters. The 3746 Building was one-story wooden building with a gable roof that contained 10 rooms. The rooms consisted of a small electronics laboratory, shop, dark room, storage room, two restrooms, four offices, and a corridor.
3760	Office	300	300-FF-2	31.2 × 46.3 × 9.8	Active	1951	Before 2015 (Scheduled)	The 3760 Building housed the Hanford Technical Library in a rectangular, partial two-story structure with no basement. It had a steel framework while the exterior walls were fluted steel insulated panels. The large reading room contained periodical alcoves, open stacks, and private study rooms, while the document files had a microfilm reading room. The facility also provided office space for administrative and drafting personnel and a 100-seat conference room on the second floor. Utilities serving the building included sanitary water and sewer. The 3760 Building is scheduled to be demolished before 2015 as part of the Tri-Party Agreement M-94 milestone (Ecology et al., 1989).
3762	Office	300	300-FF-2	36.4 × 10.1 × 8.2	Demolished	Moved in 1974	2005	The 3762 Building was relocated to the 300 Area to provide additional office space. It was a two-story wood frame structure with drop siding, concrete footings, concrete block foundation walls, wood flooring and a composition shingle roof. The facility was steam heated and cooled by evaporative cooling. Utilities serving the building included sanitary water and sewer, and a 150 kVA transformer was located nearby. The building was protected by a wet-pipe sprinkler system.
3763	Office	300	300-FF-2	21.6 × 26.2 × 2.7	Demolished	1970	2005	The 3763 Building was a one-story concrete block structure with a concrete floor covered with carpet and tile and provided additional office space in the 300 Area. The facility was refrigerated by a central water-cooled unit. A lunchroom was located in the southwest corner of the building, while a conference room addition (constructed in 1975) was attached to the north end of the facility.
3764	Office	300	300-FF-2	36.4 × 10.1 × 8.2	Demolished	Moved from 100D	2005	The 3764 Building was a two-story wood frame structure with drop siding, concrete footings, concrete block foundation walls, wood flooring and composition shingle roof. The building was steam-heated and manually controlled. Most rooms had single air-conditioning units and evaporative cooling units on the roof. The facility had previously been located in the 100-D Area and known as 1760-D. Before that, it had served as a barracks facility.
3765	Office	300	300-FF-2	18.6 × 61.26 × 3.96	Demolished	1974 (moved)	1996	The 3765 Building was a one-story concrete and steel frame structure and provided office space in the 300 Area.
3766	Office	300	300-FF-2	7.3 × 36.6 × 3.0	Inactive	1975	October 2012 (Scheduled)	The 3766 Building was a prefabricated structure and provided office space in the 300 Area The roof, walls, and floor were of plywood construction while the exterior walls had a pebble aggregate finish. There were 17 offices, a conference room, and restrooms in the building. It had refrigerated air conditioning and electric heat.
3767	Office	300	300-FF-2	7.3 × 36.6 × 3.0	Demolished	1975	Not Documented	The 3767 Building was a prefabricated structure and provided office space in the 300 Area. The roof, walls, and floor were of plywood construction while the exterior walls had a pebble aggregate finish. There were 16 offices and 2 restrooms in the building. It had refrigerated air conditioning and electric heat.
3768	Office	300	300-FF-2	7.3 × 36.6 × 3.0	Demolished	1976	2005	The 3768 Building was a prefabricated structure and provided office space in the 300 Area. The roof, walls, and floor were of plywood construction while the exterior walls had a pebble aggregate finish. There were 16 offices and 2 restrooms in the building. It had refrigerated air conditioning and electric heat.
3769	Office	300	300-FF-2	7.3 × 36.6 × 3.0	Demolished	1976	2005	The 3769 Building was a prefabricated structure and provided office space in the 300 Area. The roof, walls, and floor were of plywood construction while the exterior walls had a pebble aggregate finish. There were 16 offices and 2 restrooms in the building. It had refrigerated air conditioning and electric heat.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3770	Office	300	300-FF-2	7.3 × 36.6 × 3.0	Demolished	1976	2005	The 3770 Building was a prefabricated structure and provided office space. The roof, walls, and floor were of plywood construction while the exterior walls had a pebble aggregate finish. There were 16 offices and 2 restrooms in the building. It had refrigerated air conditioning and electric heat.
3790	Office	300	300-FF-2	30.5 × 24.4	Active	1982	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 3790 facility provides office space for security personnel in the 300 Area. It is a one-story structure with a basement. The basement and main floor are reinforced concrete. The main floor walls were bolted steel framework with 1.6 cm (0.625-in.) gypsum sheeting and aggregate faced 0.6 cm (0.25-in.) cement asbestos board.
3906	Pump Station	300	300-FF-2	4.3 × 6.0 × 5.6	Active	Not Documented	Not Documented	The 3906 facility provided a gravity drain collection point in the southeast part of the 300 Area for both the SSS and the process sewer system. The 3906 structure consisted of reinforced concrete, which ranged from 25 to 30 cm (10 to 12-in.) thick. The facility was divided into two separate systems by a wall of concrete. The northern portion of the structure served the sanitary sewer, and contained two 3-hp pumps that could operate at 190 L/min (50 gal/min). The southern portion of the facility contained two 20-hp pumps rated at 2,650 L/min (700 gal/min) and was used for process sewer waste streams.
301-A	Storage	300	300-FF-2	63.32 m^2	Demolished	1943	Not Documented	301-A Storage is removed. Sample preparation activities may infrequently be conducted in an enclosure, depending on the sample activity level or contaminants determined by screening. These practices and controls are considered as low as reasonably achievable with current technology.
303-A	Storage	300	300-FF-2	14.6 × 8.2 × 4.1	Demolished	1943	2006	The 303-A Building was used for the storage of uranium fuel (in the form of rods, billets, or slugs), uranium scrap (contained in 18.9 L [5 gal] buckets, in and around the building), and chemicals used in fuel manufacturing. The 303-A Building was also used for cleaning "dummies," and runoff went to the process/sanitary sewer. The 303-A Building had no connections to the process or SSS. The cleaning is presumed to have occurred at the concrete pad with process sewer drain that is on the west side of the 303-A Building. The building was constructed of reinforced concrete and concrete block set on a 0.13 m (5-in.) reinforced concrete slab with footings. The roof was a 0.15 m (6-in.) reinforced concrete slab with built-up roofing. The building had two doors on one end, a single door on the opposite end, and no windows. A concrete pad with fence, and a catch basin drain at the center of the pad which was connected to the process sewer, was added to the west side of 303-A Building between 1952 and 1953.
303-B	Storage	300	300-FF-2	14.6 × 8.2 × 4.1	Demolished	1943	2006	The 303-B Building was used for the storage of uranium fuel (in the form of rods, billets, or slugs), uranium scrap (contained in 18.9 L [5-gal] buckets in and around the building) and chemicals used in fuel processing. The building was constructed of reinforced concrete and concrete block set on 0.13 m (5-in.) reinforced concrete slab with footings. The roof was a 0.15 m (6-in.) reinforced concrete slab with built-up roofing. The building had two doors on one end, a single door on the opposite end, and no windows.
303-C	Storage	300	300-FF-2	14.7 × 8.3 × 3.1	Demolished	1943	2006	The 303-C Building originally was built and used for the storage of unirradiated uranium billets. In the early 1970s, the building was modified for the storage of special nuclear materials for the Commercial High-Level Waste Fixation Project operated by PNL (BNWI-1017-Del). The original construction consists of concrete block walls on a 0.13 m (5-in.) concrete slab floor with foundation, and a 0.15 m (6-in.) concrete slab roof with built-up roofing material. The south end of the building has two doors and the north end has one. In the original construction of the building, a steam supplied heating unit was located in the northeast corner of the building and condensate from the unit drained to a French drain on the outside of the building. One major radiological incident occurred 3/13/1979 during transfer of a plutonium oxide container from 5,791 shipping containers to one of the buildings wall storage tubes. The following modifications were done after the 3/13/1979 plutonium contamination incident. The north end of the building has two entrances, one welded shut (northwest door) and the other being an airlock type entry. The south end of the building has an airlock entry. The east wall has a separate room for a fume hood and glove box. Before the incident, there were no airlock entries, and no area for glove box or fume hood work.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
303-D	Storage	300	300-FF-2	14.6 × 8.2 × by 4	Demolished	1943	2006	The 303-D Building has had at least three uses and configurations. The first configuration in 1943 was as a fuel storage facility, designated as 303-D, constructed with concrete block walls, concrete foundation and slab floor, and a reinforced concrete roof. About 1953, the original 303-D Building was incorporated into a larger structure, 3707-D, and the facility was reconfigured to the Operations Change House. The facility was expanded to about 23 m (76 ft) by 35 m (115 ft). The 303-D Building remained as the core of the building with additions on the east, west, and south. The new functions included a change building with lockers, showers, a lunchroom, and offices. The additions were primarily made with wood with steel roof beams and internal, small-diameter steel posts. There were about 50 floor penetrations leading to three branches of the sanitary sewer. In 1971, the building was converted to a design center. The original 303-D portion of the building was referred to as the "tracing vault," where drawings were stored. An external fire door was added to the vault. In this configuration, most of the areas were used as offices and rooms for drafting tables. The 3707-D Building, which was built around and includes the 303-D Building, was demolished in 2006.
303-E	Storage	300	300-FF-2	14.6 × 8.2 × 4.1	Demolished	1943	2006	303-E was built to store uranium billets, chemicals, and uranium scrap. It has also been referred to as 303-E Finished Fuel Storage. 303-E is identified as Magazine Storage to support the 306 Building pilot plant. It was constructed with concrete block walls, concrete foundation and slab floor, and a reinforced concrete roof and is one-story, one-room, and rectangular.
303-F	Storage	300	300-FF-2	14.6 × 8.2 × 4.1	Demolished	1943	2006	The 303-F Building was used to store approved and rejected uranium fuel, uranium scrap (contained in 18.9 L [5-gal] buckets, in and around the building), and storage of chemicals used in fuel processing. The building was constructed of reinforced concrete and concrete block set on 0.13 m (5-in.) reinforced concrete slab with footings. The roof was a 0.15 m (6-in.) reinforced concrete slab with built-up roofing. The building had two doors on one end, a single door on the opposite end, and no windows. In the early 1950s, as part of Project CA-514 (300 Area Expansion), 303-F was modified to serve as a chemical makeup facility for the solutions used in the aluminum cleaning, stripping, and anodizing processes performed in the 313 Building (WHC-MR-0388). At this time, floor drains to the process sewer, caustic and nitric acid pumps, caustic mix tanks, caustic tanks, Diversey tanks, chemical storage, a pipe trench, and acid resistant floors were added to the 303-F Building (H-3-10037). In the early 1960s, as part of Project CAF-847 (New Fuel Cladding Facility), a concrete pipe trench was constructed from 333 Building to the 303-F and 311 Tank Farm (H-3-18519, H-3-18530, and H-3-18566), and this trench carried a TCE line and a uranium bearing recovery line. The TCE line was connected to a pump in the 303-F Building and this pump was supplied by a TCE tank (H-3-31396) in the 311 Tank Farm; this TCE was utilized for 333 Building operations. The uranium-bearing recovery line passed through the trench in 303-F Building and into the 313 Building (H-3-18530 sheet 3). In 1973, the 300 Area Waste Acid Trench (WATS) came into service and became a RCRA facility in 1976 (DOE/RL-90-11), and operated as a tank system for treatment and storage of waste acid (containing non-recoverable uranium). It consisted of tanks, ancillary equipment, and secondary containment structures located in portions of the 334-A Building, 303-F Building, 333 Building, 313 Building, and the 311 and 334 Tank Farms. Utilization of the 303-F Building for WATS began in November 1985 (DOE/RL-90-11) when two uranium recovery caustic pumps (H-3-55499), two cartridge filters, two sample ports, and piping were installed in the building to serve Tank 50 and Tank 40. These tanks are in the 311 Tank Farm on the east side of the building, and transfer solutions back to Tank 5 in the 313 Building (DOE/RL-90-11). RCRA closure activities for WATS began in 1996 and were completed in 1999 for portions of this RCRA treatment and storage facility.
303-G	Storage	300	300-FF-2	14.6304 × 8.2296 × 4.1148	Demolished	1944	2006	The 303-G Building was used for the storage of uranium fuel (in the form of rods, billets, or slugs), uranium scrap (contained in 18.9 L [5-gal] buckets, in and around the building), and chemicals used in fuel processing. The building was constructed of reinforced concrete and concrete block set on 0.13 m (5-in.) reinforced concrete slab with footings. The roof was a 0.15 m (6-in.) reinforced concrete slab with built-up roofing. The building had two doors on one end, a single door on the opposite end, and no windows.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
303-J	Storage	300	300-FF-2	16.2 × 19.5 × 8.2	Demolished	1943	2006	The 303-J Building was used to store unirradiated uranium, uranium scrap, and chemicals. Between 1943 and 1954, the exterior of the building was reworked. A full-length, 3.7 m (12-ft) wide extension was added on the east side. The large, sliding, barn-style, side doors were removed and smaller, interior, personnel entry doors were installed. End doors were added on the front. A wooden, ventilation aperture with louvers was added on the front. Process sewers, as well as sanitary sewers, drained the facility. In 1961 under General Electric, the facility was used for layout, mockup, and machining. In 1961, PNL installed an overhead ventilation duct system with some rooms covered by ducts and diffusers. The ventilation system was powered and located in the attic. The press pit and sump within the building were filled in with concrete. Two interior pits near the center of the front side of the building were filed and capped in 1961. In 1968, under Douglas United Nuclear, a copper melter-furnace and a lathe were present. The remainder of the building was used as work areas, receiving and inspection, and storage. Post-1968 history is unknown, other than an oral account that beryllium was machined in the facility in 1969. The 303J facility classifies as a Type II facility. A Type II facility is considered potentially contaminated by operations or processes that used hazardous or radioactive materials that could potentially contaminate the building and represent a potential for a release to the environment criteria during D4 activities. The greatest potential for radiological and beryllium contamination is in the attic and ventilation system in the attic. No information has been identified or collected in the attic. The facility had a fuel fabrication role and may have had a beryllium fabrication role.
303-K	Storage	300	300-FF-2	14.6 × 8.2 × 4.1	Demolished	1943	2001	The 303-K Building was used to store uranium and aluminum-canned uranium from 1943 to 1953. It was constructed in 1943 of reinforced concrete and concrete block set on 0.13 m (5 in.) reinforced concrete slab with footings. The roof was a 0.15 m (6-in.) reinforced concrete slab with built-up roofing. The building had two doors on one end, a single door on the opposite end, and no windows and in 1953, the building was partitioned, floor trench drains and workbenches were installed in the north room. In 1953 and 1978, outdoor storage pads (concrete and asphalt) were constructed to support the decontamination of aluminum reactor spacers until 1971. Beginning in 1953, radioactive and mixed wastes were stored outside the building as well on the concrete, asphalt, and gravel pads. From 1971 to 1977, the north room was used for equipment decontamination and for storage. The interior walls were painted with a lead-based paint in 1977. Between 1977 and fall 1982, the unit was used to cure and test concreted billets of uranium chips and fines from the 304 Concretion Facility. Additional outdoor storage pads were installed in 1978 (asphalt) and in 1979 (concrete). From 1982 to 1986, the building continued to be used for equipment decontamination and storage. After 1986, the building was used to store containers of low-level radioactive waste and mixed waste.
303-L	Storage	300	300-FF-2	4.9 × 7.3	Demolished	1961	1979	The 303-L Building was constructed in 1961 on a concrete slab on the 618-1 Burial Ground. The building itself was made out of sheet metal, with a corrugated steel roof. It was rectangular and measured 5 × 7 m (16.4 × 23 ft). The 303-L Building was used to fully oxidize uranium scrap metal and uranium oxide produced during reactor operations. Burning was stopped in 1971, and the building was removed in 1979. The debris from the 303-L Building was buried in the 200W burial ground. The 303-L Building was replaced by the 303-M Building, which was built on the same spot In 1983.
303-M	Fabrication Shop	300	300-FF-2	9.1 × 10.4	Demolished	1983	2006	The 303-M Building was constructed from 1982 to 1983 and operated from 1983 until 1987. It was a small, pre-stressed concrete structure with a reinforced concrete floor slab supported on reinforced concrete foundation. It located in the northeast of the 300 Area. It was originally used for converting pyrophoric metal (uranium and zircalloy-2) chips and fines to oxide powder. During the 4 years that it was operational, the 303-M Building converted 115 metric tons (127 tons) of uranium scrap into oxide form. The facility contained three rooms: 1) the operations room with six calcinators (in two banks of three each), a chip chopper, and material handling equipment and ventilation ducts; 2) the equipment room with two bag-house filters, two HEPA filter banks, and exhaust system; and 3) the change/monitor room.
305-A	Maintenance Shop	300	300-FF-2	7.3 × 25.6	Demolished	1948	2004	The 305-A Building was initially intended to house electrician and pipefitting shops for support of the 305 Building. However, by 1954, the building was being used entirely for storage. According to WHC-MR-0388, some of the materials stored in the 305-A Building were highly irradiated. From 1954-1955 experiments with highly irradiated boron balls from the Ball 3X project were conducted in the 305-A Building after radiation levels were determined to be too high for the 3706 Building. The 305-A Building was a one-story, wooden frame structure built on a concrete slab. The side of the building was covered with asbestos shaking, and the roof was roll tarpaper.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
305-B	Laboratory	300	300-FF-2	36.9 × 5.5 × 2.6	Demolished	1954	Aug 2006	Because of the various roles it played throughout its 50-year history, the 305-B Building complex was known as the TRF, the Process Engineering Laboratory, and the HWSF. The 305-B TRF is a mostly subsurface structure built in 1954 directly south of the 305 Building. It is an underground, reinforced concrete monolith, measuring 37 × 5.5 × 2.6 m high (121 × 18 × 8.5 ft high), with a flat concrete roof, and is surmounted by a small (13.6 m^2) (146-ft^2) entry building/bathroom. The underground TRF operated from about 1954 to 1978 to support the determination of physical constants for various reactor concepts. The 305-B Office Building is a one-story facility built in 1958, and overlaps about one-half of the western portion of the roof of the TRF. It has a concrete block exterior with structural steel supporting the tar and gravel-topped plywood roof, and measures 21.8 × 12.4 m (71.5 × 40.5 ft). The 305-B Office Building also provided office space and some instrument development capabilities during its lifetime. The 305-B HWSF was constructed in 1980 directly west of, and sharing a common wall with, the Office Building. It also overlaps the last one-quarter of the underground TRF, and a portion of the TRF's roof was removed to provide direct access from the HWSF. It is a high-bay facility measuring 23 × 18 × 8.5 m high (75 × 60 × 28 ft high). It contained an individually exhausted fume hood and environmental chamber, four walled storage cells, and a network of spill curbing and trenches. The building was upgraded in 1989 to house dangerous and RMW wastes. Wastes generated during PNNL's research laboratory activities were brought to the facility for storage, repackaging, and/or waste consolidation. This high bay facility stored dangerous wastes, and flammable RMW.
305-P	Maintenance Shop	300	300-FF-2	71.3 m^2	Removed	Not Documented	2002	The 305-P facility was used as a conference room and training facility. The 305-P Building was a small, prefabricated facility located near the 305 Building. On some drawings, it is labeled as the 305 Annex.
306 T6	Office	300	300-FF-2	7.26 × 20.17	Removed	Not Documented	N/A	MO-057 was a doublewide trailer that was divided into an office, work/training area, a small conference room, restrooms, and a small lunchroom. The work/training area was used as a classroom for radiation protection training. It included a small fume hood, two glove boxes, and a mock radiation zone. The facility was served by hot and cold sanitary water and sewer, with 120 V power.
306 T8	Office	300	300-FF-2	7.24 × 20.12	Removed	Not Documented	N/A	306 T8 (MO-024) was a doublewide mobile office trailer facility in the 300 Area. It was divided into eight offices, a reception area, and two restrooms. It was served by hot and cold sanitary water, sanitary sewer, and 120 V electric power. The MO-024 facility provided additional office space for personnel working in the 306-W facility. It was originally known as 306 T8, but was later renumbered as 306W T2.
306-E	Laboratory	300	300-FF-2	61.0 × 55.2	Demolished	1956	2007	The 306-E Building was completed in 1956 as the Met Semi-Works. It shares a common wall with the 306-W Building. The initial mission included the development and fabrication of experimental fuel elements. In 1960, the 306 Building was expanded to approximately double its original size to contain the pilot plant for the co-extrusion fabrication process for N Reactor fuel elements. The 306 Building continued to support fuel manufacturing until the pilot plant was shut down around 1971. The operational history of the 306-E Building from 1972 varied as to be expected for an engineering laboratory. General operations included prototype equipment design, testing, and development, qualitative and quantitative analytical testing of material in a chemical laboratory, product and equipment testing for R&D. In 1989, the 306-E Building was described as providing large, high clearance and heavy floor loading space for assembling, inspecting, and testing of equipment. The main activities in the 306E Building in 1995 were focused on Hanford Site cleanup work including the setup and checkout of a variety of equipment and systems of the Tank Waste Remediation System, Solid Waste, Spent Nuclear Fuel, and various other groups on the Hanford Site. Operations in the 306-E Building were phased out by 2004 and the 306-E Building was turned over for eventual demolition in late 2004.
306-W	Laboratory	300	300-FF-2	48.8 × 59.7	Demolished	1956	2007	The 306-W Building was completed in 1956 as the Met Semi-Works and shares a common wall with the 306-E Building. In 1960, the 306 Building was expanded to approximately double its original size to contain the pilot plant for the co-extrusion fabrication process for N Reactor fuel elements. Its initial mission of what became 306-W was to support 313 Building operations and to pilot process improvements in single-pass reactor fuel fabrication methods. This included the development and fabrication of experimental fuel elements. With the shutdown of the single-pass reactors in the 1960s, the mission of the 306-W Building transitioned into that of metallurgical R&D. The R&D mission continued until the facility was shutdown in the early 2000s. By early 2004, the 306-W Building had been vacated.

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Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
307-D	Storage Tank	300	300-FF-2	length: 3.05 diameter: 12.19	Removed	1961	N/A	The 307-D tank (Rupture Loop Holding Tank, WIDS 300-55) was a UST, 12.2 m (40 ft) in diameter and 3.05 m (10-ft) tall with a sloping top. The tank was located approximately 61 m (200 ft) northeast of the 309 Facility and southwest of the 324 Building. Liquid waste routed to this tank was sampled. If it was contaminated, it was sent to the 340 Complex through a 7.6 cm (3-in.) underground pipeline. If the waste was not contaminated, it was diverted to the Columbia River by a 1 m (3-ft-) diameter outfall line. Although an exact date cannot be determined, the tank was removed sometime in the 1970s and buried in a 200 Area burial ground. All RLWS connections were cut and plugged. The abandoned river outfall line was cut near the 3906 Pump Station.
308 T2	Office	300	300-FF-2	17 × 7.3	Inactive	1978	2008	This facility (MO-036) is a doublewide trailer located northwest of the 340 Building. It was used by the FH 340 organization to hold pre-job and safety meetings. It housed the technicians who operated 340 and the engineering manager. In the late 1990s the 327 project began using the facility as office space for support staff, and continued using the space for 3 years. The facility has been unoccupied since that time.
310-A	Process Unit/Plant	300	300-FF-2	Not Recorded	Demolished	1959	1974	The 310 Building received waste steam from the 309 PRTR facility. The steam was chilled and condensed back into liquid water within this structure. Cooling was achieved using raw river water provided by the 312 Pump House. After being liquefied, the water was released to a process sewer line that drained directly to the river (H-3-11683). The original 310 Building was a small steam condenser station located east of the 309 Building. It was constructed primarily of concrete, with much of the structure below grade. This facility was known only as 310, not 310-A. The name 310-A is being used here to differentiate this facility from TEDF, which was also assigned the 310 number.
331-A	Laboratory	300	300-FF-2	20 × 6.1	Demolished	1972	2000	The original 331-A Building is a one-story concrete block structure 20 × 6.1 m (67 × 20 ft) with an extension 10 × 13.5 m (33 × 44.25 ft) containing 15 pen areas for large animals. The main portion of this flat-roofed structure originally contained three laboratories, a mechanical equipment room, and an office area, while the pen areas contained swine. An animal crematory was located to the east of the laboratory. The 331-A facility was originally designed to house a miniature variety of swine for use in biology research. The swine were used most often for studying the effects of radiation exposure to skin and hair. In the early 1980s, the facility was converted to a virology lab, which studied the growth of bacteria and viruses in animals. Virology research continued until 1995. Radiologically exposed animals (by ingestion or injection) were generally held in other areas of the 331 Facility outside of the 331-A Building. Their feces were monitored until there was no evidence of radioactivity, and then the animals were returned to their pens in 331-A.
331-B	Laboratory	300	300-FF-2	11 × 44	Demolished	1967	September 2002	The 331-B Buildings were used to support biological research conducted in PNNL's 331 Complex. Specifically, the 331-B Buildings were used to provide an animal housing area where dogs were raised and maintained for use in program activities by PNNL. The 331-B Buildings consist of two roughly rectangular-shaped structures (an eastern structure and western structure), both running north south. The north end of each structure is attached to PNNL's 331 Building. Operations started in 1968, with kennels for about 100 dogs. Additional dog runs were built between about 1970 and 1975, at which time the total kennel space increased to house approximately 650 dogs. Several rooms in the 331-B Laboratory were also equipped to handle exposed dogs, which included the hospital room, surgery room, and clinic room. Exposed dogs were housed in "metabolism cages." These cages were used to isolate the exposed dogs, provide independent air filtration, and collect animal waste for analysis. PNNL's operations in the 331-B Buildings ceased in about 1989. The Hanford Patrol used the dog runs from 1990 to about 1993 as kennels for the Hanford Site guard dogs.
331-BA	Laboratory	300	300-FF-2	Not Documented	Active	1967	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 331-B Buildings were used to support biological research conducted in PNNL's 331 Complex. Specifically, the 331-B Buildings were used to provide an animal housing area where dogs were raised and maintained for use in program activities by PNNL. The 331-B Buildings consist of two roughly rectangular-shaped structures (an eastern structure and western structure), both running north south. The north end of each structure is attached to PNNL's 331 Building. Operations started in 1968, with kennels for about 100 dogs. Additional dog runs were built between about 1970 and 1975, at which time the total kennel space increased to house approximately 650 dogs. Several rooms in the 331-B Laboratory were also equipped to handle exposed dogs, which included the hospital room, surgery room, and clinic room. Exposed dogs were housed in "metabolism cages." These cages were used to isolate the exposed dogs, provide independent air filtration, and collect animal waste for analysis. PNNL's operations in the 331-B Buildings ceased in about 1989. The Hanford Patrol used the dog runs from 1990 to about 1993 as kennels for the Hanford Site guard dogs.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
331-C	Storage	300	300-FF-2	30.5 × 15.2	Active	1972	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 331-C Building was Butler building erected on a concrete slab. It had a low gable metal roof and served as a storage warehouse for the 331 Buildings. Heating was provided by electric space heaters. The 331-C Building provided temporary storage space for equipment and store acquisitions until they were needed by program activities. The building served the entire 331 complex. More recently, the building has been converted to store hazardous chemicals (06-AMRC-0058).
331-D	Laboratory	300	300-FF-2	12.9 × 9.8	Active	1974	Scheduled Remediation Post-RCC Contract Date (Around 2027)	From 1973 to 1974, the 331-D Building, a semi-high bay, prefabricated, metal Butler building was erected on a concrete slab to the southeast of the 331 Building and originally served as the Animal Waste Treatment Facility. It contained a 94,630 L (25,000 gal) per day (net) capacity waste treatment plant that operated to chemically treat, mechanically flocculate and settle, and then gravity filter animal wastes. A sludge dryer also was installed to heat and dry 54 kg (120 lb) per hour of sewage sludge product from the treatment facility and to produce a 65-100% solid waste material that could be buried in 100 and 200 Area trenches. In 1977, when the 331-D Building was converted to electromagnetic studies, "clean" animal sewage was routed to the regular 300 Area SSS for disposal. In 1977, the building was converted into the Biomagnetic Effects Laboratory. Research activities involved exposing small animals (typically rats) to electromagnetic fields. In early 1990, the facility was converted to general storage space.
331-E	Laboratory	300	300-FF-2	9.1 × 15.9	Demolished	1975	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 331-E Building provided an environment in which to grow plants for PNNL's ecosystem studies. It was a wood and metal frame structure covered with translucent, corrugated fiberglass sheets. Located just south of the 331-D Building, this facility had a rounded, Quonset hut-type roof. Utilities included water, normal building power, and propane gas for heating. Two evaporative swamp coolers were located on the east side of the building.
331-F	Storage	300	300-FF-2	21 × 5	Demolished	1975	Scheduled Remediation Post-Rcc Contract Date (Around 2027)	The 331-F Building was a prefabricated metal structure to support a pasture. It provided storage space for equipment and materials used in animal and pasture maintenance. The only utility the building received was electricity.
331-G	Storage	300	300-FF-2	18.3 × 6.1	Active	1975	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 331-G Farrowing Facility was constructed in 1975 and was located just east of the 331-F Building. The flat-roofed structure sat on a concrete slab. Utility services to the building included sanitary water and normal building power. A heat pump provided heating and air conditioning. The 331-G Building was originally used to house laboratory animals (specifically swine) while they were giving birth. Later on, it was converted to an archive for radioactively contaminated animal tissue samples. All samples were removed and disposed of in 1977. More recently, the 331-G Building was being used for radiotracer studies. Small quantities (µCi) of tracer radionuclides were deposited in soil, taken up by vegetation, and then fed to small animals. The animals were temporarily housed in the facility, and their excrements were stored in closed containers within the facility.
331-H	Laboratory	300	300-FF-2	5.4 × 19.7	Active	1979	Scheduled Remediation Post-RCC Contract Date (Around 2027)	In 1979, the 331-H Plant Exposure Facility was constructed just north of the 331-F Building. This one-story concrete block structure provided space to accommodate the exposure equipment required for performing advanced stages of research on plants. Experiments typically involved exposing plants to various aerosols and actinide elements in the wind tunnel. In 1980, metal lean-to was attached to the northwest corner of the 331-H Building. This lean-to contained a wind tunnel room, a growth chamber alcove, two air locks, mechanical and equipment rooms, change rooms, and an entry area. An HVAC lean-to building containing HEPA filters was located on the west side of the building, along with a concrete pad that contained a power transformer and an emergency generator.
331-HB	Barn	300	300-FF-2	3.8 × 2.6	Demolished	1975	Not Documented	The 331 Hoghouses were constructed of corrugated aluminum on a concrete pad and were used to shelter animals in the large pasture to the south of the 331 facility. They were constructed in pairs, and had "guillotine" doors to provide access to the animals. Heating was provided by infrared lamps and hot water circulated within the concrete pads. Drinking water was also provided for the animals. Utilities serving each unit consisted of 120 V AC power and sanitary water.

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Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
331-J	Barn	300	300-FF-2	7.3 × 4.9 × 4.3	Demolished	1984	Not Documented	The 331-J Hay Storage Barn was constructed in 1984 and was located just east of the 331-H Building. It was a beam and column structure that had a roof and cave extension of 0.9 m (3 ft) and a steel framed roof covered with galvanized steel decking. The south end of this hay and bulk feed storage facility was open. A bulk feed bin was located to the east of the barn on a concrete foundation. It was electrically operated auger type with an elevated bin. Power to the feed bin was supplied by the nearby 331-G facility. The purpose of the 331-J facility was primarily to store hay and feed for the large animals being used in the 331 complex. An incinerator for animal carcasses was installed sometime around 1988.
333 T1	Office	300	300-FF-2	173.14 m^2	Demolished	Not Documented	N/A	MO-052 is a double-wide transportable mobile office. The building was used as temporary office space. Standard types of janitorial supplies were stored in the building.
334-A	Storage	300	300-FF-2	6.1 × 12.2	Demolished	1973	2005	In the early to mid-1970s, the WATS was installed to treat acid containing non-recoverable uranium generated from the 333 Building fuels fabrications operations. As part of the WATS installation, a building from the 200 Area was installed over a former limestone neutralization pit in 1973 and designated 334-A Waste Acid Storage Building. The tanks in the 334-A Building replaced a WATS underground tank (the limestone neutralization pit) that had developed a leak to the soil. The 334-A tanks began handling waste in December 1974. The portion above grade in the 334-A Building was used for general storage of products and absorbents, and the portion below grade contained three tanks (A, B, and C) seated in a reinforced concrete pit 3 m (10-ft) deep. Tank A was a vertical cylindrical tank with a capacity of 1,363 L (360 gal). Tank A is constructed of steel with a PVC liner. Tanks B and C are horizontal cylindrical tanks with a capacity of 7,571 L (2,000 gal) each. Tanks B and C are constructed of high-density polyethylene.
337-B	Laboratory	300	300-FF-2	53.9 × 23.3 × 28.4	Inactive	1972	September 2012 (Scheduled)	The 337, 337-B and 3718-M Buildings were constructed in the early 1970s for Project BAP-048, the HTSF. These buildings provided space and facilities for engineering studies in support of FFTF and the LMFBR program at the Hanford Site. The main system in the 337B Building was the Composite Reactor Components Test Activity sodium-environment test system. Additional FFTF development missions performed in the 337-B Building was the invention of a gas tagging system for fuel assemblies to detect ruptures, and sodium and argon cover gas purification methods were developed here. The use of this facility in the support of FFTF continued until the late 1970s. In the early to mid 1990s, the 337-B Building was utilized for the demonstration of a robotic test bed in support of tank waste retrieval. No equipment remains from these tests.
339-A	Control Structure	300	300-FF-2	18.3 × 24.4 × 4.6	Active	1986	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 339-A Building was a one-story building with walls, roof, and floor constructed from pre-stressed concrete. A 2.4 m (8-ft-) tall fence with three layers of barbed wire surrounded the exterior of the building. There were four exterior doors to the facility, and no windows. The interior of the 339-A Building was divided into two functional areas. The administrative area included space for three offices, lunchroom, restrooms, and storage. The secure area was a vault type area comprised of the computer room, tape vault, mechanical/electrical room, communications equipment room, and encryption room. The 339-A Building was a controlled-access facility that was used for sensitive computing purposes. The building included an intrusion detection system and a closed circuit television system to prevent unauthorized access. During unattended operating hours, the building could be accessed using a PIU. Only one of the four doors to the building could be opened from the outside.
340-A	Storage Tank	300	300-FF-2	9.8 × 13.0 × 7.0	Active	1961	April 2011 (Scheduled)	The 340-A Building is a steel frame structure and contains six 30,280 L (8,000 gal) stainless steel tanks. The 340-A Building provided additional storage space for liquid radioactive waste before it was sent to the 200 Area for disposal. The waste originated from several different buildings in the 300 Area, including 308, 325, 326, 327, and 329 and was transported to the 340 Complex through the RPS piping system. Originally, the waste was transported away from the site in trucks, although later on train cars were used.
340-B	Loading Dock	300	300-FF-2	15.2 × 19.5 × 8.5	Active	1965	April 2011 (Scheduled)	In 1965, the 340-B rail load-out facility was constructed as part of a modernization effort that substituted shielded rail cars for tanker trucks in the transport of radioactive effluents from the 340 tanks to the 200 Area. The 340 complex received high-level radioactive liquid waste from several buildings in the 300 Area through the RPS piping system. Before transport to the 200 Area, the waste was stored in tanks located in the 340 and 340-A Buildings. The 340-B Facility was a structure with corrugated steel walls and roof and a total area of 297 m^2 (3,200 ft^2). It had two large roll-top doors on the west side and could accommodate two 75,700 L (20,000-gal) rail tank cars at once.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3506-A	Maintenance Shop	300	300-FF-2	4.6 × 13.4 × 11.0	Demolished	1944	2005	The 3506-A Building originally housed phone service equipment as part of the HEW telephone network installed in 1943-44. The 3506-A Building's function changed at an unknown date in the 1960s or 70s and became the Powerhouse Mechanical Maintenance Shop. It housed maintenance personnel and shop maintenance equipment to support the 384 Power House, which supplies heating and humidification to 300 Area buildings.
3506-B	Maintenance Shop	300	300-FF-2	80.3 m^2	Demolished	Not Documented	2005	The 3506-B Building was a prefabricated metal structure built on a concrete pad and used as a maintenance shop.
3506-C	Office	300	300-FF-2	43.31 m^2	Active	1995	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 3506-C Building was a modular trailer "hut" used to support computing in the 300 Area. It contained several racks for equipment, two UPSs, and fire equipment. An air conditioner unit was attached to one end of the trailer. The 3506-C Building was used for fiber optic network connections to the 300 Area facilities.
351-A	Electrical Substation	300	300-FF-2	21.3 × 11.4	Active	1943	Scheduled Remediation Post-RCC Contract Date (Around 2027)	This Substation consisted of a wooden fenced, gravel-surfaced area, containing wooden frame bus structures, three power transformers, circuit breakers, and terminal structures. The site did not include a switch house. The area contained open-framed, wooden poles extending to a height of 11.4 m (37.5 ft). A wooden ladder and walkway of 30 cm (2-ft) planking provided access to the upper sections of the pole structure where the Oil Circuit Breakers and insulators were located. Concrete foundation pads were provided for the three 250 kVA transformers. The transformer bases contained 1.2 m^3 (1.6 yd^3) of concrete. The 351-A Substation was first energized on 8/6/1943. It served as the major electrical substation for the southern portion of the 300 Area, providing power to a number of important facilities including the 384 Complex.
351-B	Electrical Substation	300	300-FF-2	19.2 × 17.7	Active	1943	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 351-B Substation was designed primarily to support the 305 Reactor Building and was later expanded to service the entire 300 Area. As a result, the facility was upgraded several times during its operation. Originally, the site consisted of a wooden fenced, gravel-surfaced area with a reinforced concrete and concrete block switch house that was located midway along the south fence line. The site was expanded significantly to the south, incorporating the 352-A substation and adding a new metering and testing building, known as 351-A, by 1978. The 351-B switchgear building also received an extension that effectively doubled its size. According to the waste site report for 300-4, the building was actually completely rebuilt in the late 1960s or early 1970s. Later on during site operations, the 351-B Substation was often referred to as the DOE 351 Substation or as 351-A&B.
352-A	Electrical Substation	300	300-FF-2	Not recorded	Inactive	Not Documented	Not Documented	The 352-A facility was constructed in the late 1940s and was located southeast of the original 351-B Primary Substation. The 352-A Electrical Substation originally operated as a 115 kV/2400 V substation in support of the 300 Area. In particular, it was directly associated with the nearby 313 Building. The 352-A substation and the 351-A Meter and Testing Building were both incorporated into the 351-B substation. It consisted of a reinforced concrete pad, which was divided into two main sections with a gap in the middle. Each section housed a transformer and electrical switchgear equipment. Underground electrical ducts connected the 352-A facility to the smaller substation serving the 313 Building. The 351-A Building was a corrugated metal building that housed metering equipment for the 351 Substation. Although the exact date of construction is unknown, it was in place by 1978. The waste site write-up for 300-4 suggests that the 351-A structure was built in 1949. It was located at the south end of the 352-A substation, filling in the gap between the two halves of the 352-A structure's concrete pad.
352-B	Electrical Substation	300	300-FF-2	9.45 × 8.69	Active	1949	Not Documented	The 352-B substation was a fenced-off facility that was located west of the 313 Building in the 300 Area. It consisted of a rectangular concrete pad that housed transformers and other electrical equipment, and included underground cable trenches. An underground cable pit was located within the fenced area, north of the concrete pad. Power cable trenches connected the 352-B substation to the 352-A/351-B substations to the north. Electric lights were located at the edges of the concrete pad. The 352-B facility served as a low-voltage electrical substation in the 300 Area, operating at 2300-440 V.
352-C	Electrical Substation	300	300-FF-2	6.71 × 3.81	Demolished	Not Documented	Not Documented	The 352-C facility served as an electrical substation in the 300 Area. The original 352-C facility was replaced by a new facility in 1982. This metal building contained 2.4 kV switchgear (rated at 5.0 kV) along with a battery bank and charger. In 1985, a small addition was installed on the southwest side of the facility. This pre-fabricated aluminum building housed a breaker panel and was equipped with HVAC.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
352-D	Electrical Substation	300	300-FF-2	12 × 6.1	Inactive	1965	Not Documented	The 352-D Building was designed as an automatic electrical distribution substation for the 321, 321-B and 321-C facilities. In the late 1960s, the 321 Complex was being utilized as a thermal hydraulic (mechanical) pilot plant to support the FFTF project, so the 352-D Building appears to have been constructed to support those activities. In 1990, the facility was converted from an automatic substation to a manually operated switching station. In 2002, the electrical distribution and controls systems were removed from the facility. The building was then reallocated for storing chemicals and renamed 3718-S.
352-E	Electrical Substation	300	300-FF-2	18.4 × 9.8	Active	1972	N/A	The 352-E Building served as a breaker station for facilities in the eastern portion of the 300 Area and was a dust-tight, prefabricated steel building with a gable roof. The largest section of the building was the switchgear room, which was occupied by switchgear equipment, while the northern wall contained a rolling door. The 352-E Building had an extension on the northwest corner of the building that, unlike the rest of the facility, was insulated and was used as a battery room.
352-F	Electrical Substation	300	300-FF-2	9.8 × 6.1 × 3.7	Active	1976		The 352-F Building served as a switch station for various facilities within the 300 Area. The 352-F Building was constructed in 1976 on a concrete slab and was associated with electrical substation C3-S4. The building had a metal roof, metal siding, a metal door, and a sheet metal gutter located above the doorway. In 1984, the 352-F Building was expanded with a new switchgear building constructed on the west side of the existing structure. The new attachment was a prefabricated galvanized steel building. A manhole inside the addition leads down to a cable vault running underneath the facility.
3614-A	Monitoring Station	300	300-FF-2	3.7 × 3.7	Inactive	1959	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 3614-A Building was designed to automatically sample water from the Columbia River for various constituents. Water was diverted from the 312 intake structure and pumped to the 3614-A Building using a suction pump located within the facility. After sampling, water was flushed back to the 312 facility. Equipment within the building included a pump, sampling and counting equipment, and a monitoring tank.
3614-B	Monitoring Station	300	300-FF-2	1.2 × 0.4	Demolished	Not Documented	1997	The 3614-B Sampling Station was used for analyzing water as it was released into the 316-5 Process Waste Trenches. The 3614-B Sampling Station consisted of a steel cabinet that was located on top of the outlet structure at the head of the 300 Area Process Trenches (Waste Site 316-5). Inside the cabinet were containers for storing samples, a pumping system, and various automatic sampling equipment.
3621-B/C	Electrical Substation	300	300-FF-2	3.0 × 9.8 × 4.9	Active	1963	May 2012 (Scheduled)	The 3621-B and 3621-C Buildings were two prefabricated steel structures and were used to provide emergency power. 3621-B housed the generator and 3621-C contained switchgear and control equipment. In 1991, the 3621-C underground fuel oil storage tank was installed south of the 3621-C Building, replacing the original above ground fuel tank that had been in the 3621-C facility. In 1993, the 3621-B and 3621-C Buildings were combined into a single facility, 3621-B/C. In 1993, the two buildings were incorporated into a single new metal building which enclosed all of the equipment from the two original structures.
3621-D	Electrical Substation	300	300-FF-2	24.4 × 12.2 × 5.2	Active	1973	May 2012 (Scheduled)	The 3621-D Building was used to originally house three emergency diesel-powered generators. The original 3621-D Building was constructed as a prefabricated corrugated steel structure on a concrete foundation with an on-grade concrete floor slab. The one-story building consisted of a single room that housed three diesel-powered generators. An addition onto the north side of the building was completed in 1991 to accommodate a fourth, smaller diesel powered generator. The original 3621-D Diesel Storage Tank was removed in December 1994. In addition, diesel-contaminated soil was removed down to a depth of 3 m (10 ft). The replacement tank, 3621-66, was scheduled for removal in 2008.
3701 HUT	Storage	300	300-FF-2	Not recorded	Removed	1953	N/A	A temporary building (3701-A) and historical photographs suggest that this building was a Quonset hut. The location of this building and the period it was active suggests that it was related to the construction of the 305-B Building and perhaps other 300 Area facilities. This hut may have been used for storage space, office space, and/or fabrication shops.
3701-A	Office	300	300-FF-2	2.2 × 2.2	Demolished	1963	1993	The 3701-A was a small shack that replaced the original 3701 Building as the entry point to the 300 Area on Apple Street. It was designed as a facility for verifying the identification of personnel entering the 300 Area. The foundation of the building extended 0.3 m (1 ft) below grade, and the roof was constructed of built up tar and gravel. An air cooler was located on the roof of the building.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3701-AA	Office	300	300-FF-2	5.96 × 4.84	Demolished	1980	1994	The 3701-AA Building was used along with 3701-A to verify the identification of personnel entering the 300 Area. It was usually referred to as 3701-A, even though the original 3701-A was still in existence during the period when this building was active. It was built on top of a concrete slab and the building itself was constructed out of concrete masonry units. The roof of the facility was gravel surfaced.
3701-D	Office	300	300-FF-2	21.0 × 15.0	Demolished	1979	2005	The 3701-D Building provided a headquarters for the Hanford Site patrol, the Security Operations Center, and the Emergency Control Center for emergency situations in the 300/400 Areas, such as evacuations and criticalities. It was constructed in 1979 as a one-story structure with a basement. In 1989, an addition was attached to the south side of the building for use as an emergency control center. It was an underground structure built at the level of the 3701-D basement with reinforced concrete walls.
3701-L	Office	300	300-FF-2	14 × 18.6	Demolished	1952	1980	The 3701-L Building was two-story wood-frame badge house constructed in 1952. It provided security-checking stations, clock alleys for time clock recording, badge racks. The building was modified and expanded in 1953. As of 1964, the first floor contained six clock alleys and security patrol checking stations. There was also one interview room, restroom facilities, and HVAC unit. The second floor contained four offices, a small lunchroom, a storage closet, one small restroom, and a janitor closet. The original 3701-L Building was removed in 1980 and replaced by a new facility with the same name.
3701-LA	Office	300	300-FF-2	4.84 × 5.96	Demolished	1980	1994	The 3701-LA Building was usually referred to as 3701-L, even though it replaced the original 3701-L Building and was used to verify the identification of personnel entering the 300 Area. It was built on top of a concrete slab and was divided into two sections, an inspection area and a guard area. The building itself was constructed out of concrete masonry units and the roof of the facility was gravel surfaced.
3701-N	Office	300	300-FF-2	6.5 × 6.9 × 3	Demolished	1964	Not Documented	The 3701-N Building was a small concrete-block building used to verify the identification of personnel entering the 300 Area. The facility had built-up asphalt roofing with gravel surface over a metal fascia, with an evaporative cooler located on the roof. The building had four doors and contained card racks, time clocks, badge racks on the walls, and a desk and counter.
3701-NA	Office	300	300-FF-2	5.96 × 4.84	Demolished	1980	1994	The 3701-NA Building was used to verify the identification of personnel entering the 300 Area. It was referred to as 3701-N, although it was the replacement for the original 3701-N facility. It was built on top of a concrete slab and was divided into two sections, an inspection area and a guard area. The building itself was constructed out of concrete masonry units. The roof of the facility was gravel surfaced.
3701-R	Office	300	300-FF-2	1.5 × 3	Demolished	Unknown	1980	The construction of the original 3701-R Building is not known with any certainty. The building may have been prefabricated metal guardhouse; there is no conclusive evidence either way.
3701-RA	Office	300	300-FF-2	2.28 × 3.85 × 3.45	Demolished	1980	1994	The 3701-RA Building was used to verify the identification of personnel in vehicles entering the 300 Area. It was constructed in 1980 at a location just west of the old 3701-R facility. The building was constructed of spilt-faced fluted concrete masonry unit for the lowest part of the structure, with tubular steel columns above that. It had an aggregate-faced cement asbestos board fascia below the gravel-surface built-up roof.
3701-S	Office	300	300-FF-2	18.43 m^2	Demolished	Not Documented	1980	3701-S was used to verify the identification of personnel in vehicles entering the 300 Area. This small shack-type facility was replaced by a new facility with the same name (3701-SA).
3701-SA	Office	300	300-FF-2	Not Recorded	Demolished	1980	1994	The 3701-SA Building replaced the original 3701-S Building and was constructed of spilt-faced fluted concrete masonry unit for the lower part of the structure, with tubular steel columns above that. It had an aggregate-faced cement asbestos board fascia below the gravel-surface built-up roof.
3701-T	Office	300	300-FF-2	5.5 × 3.66 × 2.5	Demolished	1975	1994	The 3701-T Building was used as a guard station for controlling access to the 308 Building and surrounding facilities. Later on, it was apparently used as an emergency staging area. It was an aluminum-framed structure with insulated aluminum siding and an insulated metal roof. The interior of the building contained specialized screening equipment and a desk and counter. The facility had five doors for controlling the flow of personnel into and out of the 308 protected area.
3701-TR	Office	300	300-FF-2	7.3 × 20.1	Demolished	Not Documented	Not Documented	The 3701-TR Building was a doublewide mobile office trailer facility that was used as office space for security personnel in the 300 Area.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3701-U	Office	300	300-FF-2	183.54 m^2	Demolished	1978	Not Documented	The 3701-U Building was designed to serve as the guard station for the 308-324-325 Building exclusion area and later was used as an office building. The 3701-U was a one-story facility constructed of concrete block and stucco with a built-up asphalt and gravel roof. The building originally contained a variety of screening equipment.
3701-Z	Office	300	300-FF-2	3.1 × 4.3	Demolished	Not Documented	Not Documented	The 3701-Z Badge House was located outside the 300 Area fence and was used to store badges for construction contractors. It was a one-story concrete building constructed on a concrete pad and had a built-up roof.
3703-A	Office	300	300-FF-2	20.1 × 8.5	Removed	Not Documented	2004	The 3703-A Building was a doublewide modular trailer that provided office space.
3704 HUTS	Storage	300	300-FF-2	Not recorded	Removed	1953	N/A	Six temporary buildings (3704-B, 3704-C, 3704-D, 3704-E, 3704-F, and 3704-G) were located on the western edge of the 300 Area in 1954 near the 3704 Building (H-3-10182). They may have been related to the construction of the 305-B Building and perhaps other 300 Area facilities and may have been used for storage space, office space, and/or fabrication shops.
3704-R	Storage	300	300-FF-2	Not recorded	Demolished	Not Documented	2004	The building was used to support J.A. Jones operations in 1964. Later on, the building appears to have been used for storage of insulator materials. The 3704-R name was never used it is being used here only to differentiate this building from the original 3704 structure. It was a metal frame structure with corrugated aluminum siding and roof and a concrete block foundation. Piping to the building included sanitary water and sewer lines.
3705 T1	Office	300	300-FF-2	7.25 × 17.1 × 3.7	Demolished	1977	Not Documented	The MO-026 mobile office trailer is a doublewide mobile office trailer with power, sanitary water and a sanitary sewer connection. The MO-026 Building was used as office space by photography and graphics personnel until the mid 1990s, and then used as office and storage space to support groundwater sampling.
3707-A	Change House	300	300-FF-2	36.88 × 11.58 × 4.72	Demolished	1944	1989	Originally the 3707-A Building was used as a change house and in 1964, it was converted into a maintenance office. In 1983, the facility was used to provide office space for drafting personnel. It was a one-story, rectangular building built on a 10 cm (4-in.-) thick concrete slab and was supported by a concrete block foundation walls with spread footings.
3707-B	Change House	300	300-FF-2	4.8 × 13.3	Demolished	1944	1996	The 3707-B Building was originally designed to serve as a change house. By 1964, it was being used as an office and storage space for custodial services. Starting in October 1978, the west end of the building was used as an overtime lunch distribution station. It was a one-story wood frame structure on grade with a concrete block foundation and concrete slab floor.
3707-C	Laboratory	300	300-FF-2	53.64 × 12.19 × 5.5	Demolished	1948	1996	The 3707-C Building was added as an annex to the 3706 Building in 1948. The 3707-C Building was originally used to house various facilities that were needed for workers in the attached 3706 Building, including a lunchroom, change rooms, and sanitary restrooms. By 1964, it was used as computer lab and then it provided laboratory space for supporting automation instrumentation and control development. It was a one-story concrete block building with a concrete floor on grade, a gable roof with asphalt shingles, and interior partitions of gypsum board on wooden studs on moveable metal.
3707-D	Office	300	300-FF-2	35.0 × 23.2	Demolished	1943	2006	This facility has had at least three uses and configurations. The first configuration in 1943 was as a fuel-storage facility, designated as 303-D. About 1953, the facility was expanded and reconfigured to the "Operations Change House, with lockers, showers, a lunch room, and offices. In 1971, the building was converted to a design center. In this configuration, most of the areas were used as offices and rooms for drafting tables.
3707-E	Storage	300	300-FF-2	6.1 × 12.2	Demolished	Not Documented	2004	The 3707-E Building provided office space and lunchroom facilities for subcontractors of the J.A. Jones company. Later on, it also served as a storage location for various materials. The 3707-E Building had a metal frame with corrugated aluminum siding and roof, a concrete block foundation.
3707-F	Monitoring Station	300	300-FF-2	3.6 × 3.6	Active	1963	Not Documented	The purpose of the 3707-F Building was to provide a radiation monitoring office and shielded personnel survey space for those involved in the waste handling facilities at the 340 Building. The 3707-F Building was a prefabricated, self-framing galvanized steel-panel structure erected on a concrete slab. In 1978, much of the original equipment was removed from the building, including the shielded cubicle and restroom facilities.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3707-G	Change House	300	300-FF-2	17.8 m^2	Demolished	Not Documented	2001	The 3707-G Building served as a change room supporting operations in 303-K. It was a wood-framed, sheet-metal shack that was constructed adjacent to the 303-K facility.
3707-H	Maintenance Shop	300	300-FF-2	12.2 × 9.1	Demolished	Not Documented	2007	The 3707-H Building served as a change room facility for Operations Support Services crafts. It was a one-story, insulated, modular-type, re-locatable structure placed on a reinforced concrete wall footing.
3709-A	Office	300	300-FF-2	33.5 × 28.9 × 10.1	Active	1964	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 3709-A Building served as the primary fire station for the 300 Area. It has a concrete foundation and a tower that was three stories tall, concrete exterior walls. It includes a garage, bedrooms, offices, equipment storage, restroom, kitchen, hose room, and shop. A fuel-dispensing island was located to the south and east of the east wall of the 3709-A Building, which consisted of two underground fuel tanks and pump equipment. Shortly after the two tanks were observed to be leaking, the fuel island was removed and patched over with asphalt.
3709-B	Storage	300	300-FF-2	8.5 × 6.1 × 3.0	Active	1976	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 3709-B Building was originally constructed as a storage facility for equipment associated with the 3709-A Fire Headquarters. In 1993, it was converted into a weight training room for firefighters stationed at the 3709-A Building. It is a prefabricated, self-framing metal building that was constructed in 1976.
3710-A	Storage	300	300-FF-2	6.1 × 63.66	Demolished	Not Documented	2001	The 3710-A Building was used to store solvents and greases. There were a number of spills and leaks of materials stored in drums in and around this building over the years. It was a one-story sheet metal Butler structure constructed of sheet metal siding, steel frame, a gabled roof covered with sheet steel, and a concrete foundation and floor.
3710-B	Storage	300	300-FF-2	Not recorded	Demolished	Moved 1979		The 3710-B facility was used to store flammable materials in the 300 Area. The 3710-B Building was a prefabricated sheet metal building that was placed on a concrete pad in the 300 Area.
3717-B	Fabrication Shop	300	300-FF-2	12.5 × 51.2 × 4.4	Demolished	1950	2006	The 3717B Building was known as the Standards Laboratory and provided maintenance, calibration, and standards services to the 300 Area, starting in 1950, when it was constructed. It was a one-story, concrete block and metal structure (prefabricated partitions) with an addition in 1964. An addition in the early 1980s added a metrology lab.
3717-C	Storage	300	300-FF-2	14.6 × 14.6 × 4.0	Inactive	1971	April 2013 (Scheduled)	The 3717-C Building was originally constructed as the Sodium Components Sub-Assembly Building. In 1973, the building was repurposed as an archive building for materials relating to the FFTF. It is a square, corrugated sheet metal building with a concrete foundation.
3718-A	Storage	300	300-FF-2	12.2 × 24.4 × 5.5	Demolished	1959	2008	The 3718-A Building was used along with 3718-B and 3718-C for the loan and storage of laboratory equipment. It was used most recently by the Spent Nuclear Fuels MCO Basket Project as a staging facility as indicated by signs currently on the building. 3718-A and 3718-B were constructed similarly of metal framing placed on a reinforced concrete slab with partial concrete walls. The inside is sheet-rocked from the top of the partial wall to where the roof joists start. The outside of the two buildings consists of metal siding. The roof of each building is metal. They were built next to each other and later a concrete slab was poured between the buildings so the two buildings could be joined together with a roofed annex.
3718-B	Storage	300	300-FF-2	12.2 × 24.4 × 5.5	Demolished	1959	2008	The 3718-B building was used along with 3718-A and 3718-C for the loan and storage of laboratory equipment. It was used most recently by the Spent Nuclear Fuels MCO Basket Project as a staging facility as indicated by signs currently on the building. 3718-A and 3718-B were constructed similarly of metal framing placed on a reinforced concrete slab with partial concrete walls. The inside is sheet-rocked from the top of the partial wall to where the roof joists start. The outside of the two buildings consists of metal siding. The roof of each building is metal. They were built next to each other and later a concrete slab was poured between the buildings so the two buildings could be joined together with a roofed annex.
3718-C	Storage	300	300-FF-2	12.2 × 24.4 × 5.5	Demolished	1959	2008	The 3718-C building was used along with 3718-A and 3718-B for the loan and storage of laboratory equipment. It was used from approximately 2001 to 2005 by FH insulators for storage per WCH Site Maintenance and Utilities. This building is of a similar construction as 3718-A and 3718-B. On the east side of the building, a covered area and enclosed storage area were added to the building during the 1960s. The addition is constructed of metal framing and corrugated metal on the sides and roof. The enclosed storage area is insulated with spray-on insulation.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3718-D	Storage	300	300-FF-2	6.1 × 15.24	Demolished	1960	1979	The 3718-D facility may have been used for storage purposes. It was built on a concrete pad. Two additional concrete pads were located on the east side of the building. The 3718-D building was completely removed in 1979 and replaced with the 3728 facility.
3718-E	Storage	300	300-FF-2	30.6 × 9.2	Demolished	1967 (moved)	2008	The 3718-E Building provided storage space for equipment and materials associated with the 324 Building. It is an open truss structure with sheet metal siding and roof and rests on a 0.76 m (2.5 ft) high concrete foundation wall. The floor of the 3718-E Building is a concrete slab.
3718-F	Storage	300	300-FF-2	6.1 × 14.6	Demolished	1968	1996	The 3718-F Facility began treatment (oxication/neutralization) of alkali metal waste in 1968 and ended in June 1987. Storage activities also began in 1968 and continued until May 1989. Initially, spent alcohol and water baths were drained into the process sewer system. Later, after the alcohols were regulated in 1985, the spent alcohol baths were drummed and sent to the 616 Nonradioactive Dangerous Waste Storage Facility for disposal. The spent water baths continued to drain to the process sewer system. It consisted of a one-story corrugated steel storage building, an adjoining loading pad, and an adjoining concrete pad. A burn shed with accompanying fume scrubber, two reaction tanks for cleaning equipment, and a safety shower were located on the adjoining concrete pad. It also included two reaction tanks.
3718-G	Storage	300	300-FF-2	12.2 × 30.5 × 3.0	Demolished	1978	2008	The 3718-G Building was used for storing various chemicals and equipment. It was associated with the 324 Complex, which was located south of the building. The 3718-G Building was a rectangular one-story, all metal pre-manufactured building erected on concrete foundations and slab. Utility services included normal building power, electric heat, sanitary water, and a sanitary sewer floor drain system. An isolated chemical storage area was located within the building and contained a safety shower and floor drain plus an aerated eye/face wash.
3718-M	Storage	300	300-FF-2	26.3 × 7.1 × 3.8	Inactive	1970	May 2012 (Scheduled)	The 337, 337B and 3718M Buildings were constructed in the early 1970s for the HTSF. These buildings provided space and facilities for engineering studies. The building is set on a foundation that has 0.38 m (1.25-ft-) thick walls and 0.5 m (1.5-ft) floor, all composed of reinforced concrete. The walls of the building, above grade, are composed of 0.2 m (8-in.) concrete block.
3718-N	Maintenance Shop	300	300-FF-2	22.3 × 12.3 × 4.3	Demolished	1975	2008	The original purpose of the building was to support electrical maintenance personnel with offices, storage, and equipment. From 1989 to 1995, the building was used as an insulator shop. The most recent usage of the building was by FH's vegetation management operations, where herbicides were stored for about a year before turnover of the building to WCH in August 2005. This building is a prefabricated metal storage building with a flat roof and sloped sides. The building is set on a 15 cm (6-in.) reinforced concrete slab with footings.
3718-O	Storage	300	300-FF-2	4.8 × 15.2	Demolished	Not Documented	Not Documented	The 3718-O Building may have been used to store HEPA filters during the late 1980s and early 1990s. It was a prefabricated galvanized steel facility that was originally the 318-A Building in the southern portion of the 300 Area. It was relocated to a site northwest of the 3731 Building in the late 1980s and renamed as 3718-O.
3718-P	Storage	300	300-FF-2	60 × 18	Active	1996	2007	The 3718-P Building was used as a storage facility. By 2007, the building had been vacated. However, it was then reoccupied and once again used as a storage facility. Two connexes were placed near the facility in 2007. 3718-P was a metal building on a concrete slab with a gable type metal roof. Services included a fire protection system and normal electrical power. Most of the floor space was used for storage, although a small office was located in the northwest corner of the building.
3719-A	Office	300	300-FF-2	8.5 × 20.1	Removed	1994	1999 (Moved)	The 3719-A facility served as a first aid station when it was in the 300 Area. It was a doublewide modular office trailer facility.
3722 HUTS	Storage	300	300-FF-2	Not recorded	Removed	1953	N/A	Two temporary buildings (3722-B, 3722-C) were located near the 3722 Building in 1954. Historical photographs suggest that the buildings were Quonset huts, similar to other temporary facilities used throughout the Hanford Site. The location of these buildings and the period they were active suggest that they were used to support construction activities in the mid-1950s, a period of major expansion in the 300 Area. Based on the use of TC buildings associated with other reactor facilities, these huts may have been used for storage space, office space, and/or fabrication shops.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3722-A	Maintenance Shop	300	300-FF-2	1125.64 m^2	Demolished	1944	Late 1950s	The 3722-A Building was originally the TC-36 Receiving M.S. Warehouse, a TC building. The construction of this building is unknown. Although originally a temporary building, the 3722-A structure was retained as a permanent facility. Since it had originally been designed for storage, various shop equipment must have been installed circa 1945 when the facility was repurposed to be one of the two maintenance shops in the 300 Area. Contaminated items scheduled for burial were stockpiled just north of this facility in the late 1940s.
3726-A	Storage	300	300-FF-2	3.7 × 3.7	Demolished	1979	Not Documented	The 3726-A Building was used to store compressed air cylinders for use in the event of an emergency. Its walls were 20 cm (8-in.-) thick fluted, split-faced CMU and the roof was built-up with gravel surfacing.
3731-A	Storage	300	300-FF-2	24.4 × 12.2	Demolished	1966	May 2007	The 3731A Graphite Machine Shop was used to work on cold (nonradioactive) graphite. The facility machined graphite and provided storage of graphite material until 1995 when it was placed in standby condition. It is a concrete block building on a concrete slab with a 4:12 pitched wooden truss roof. The concrete block east wall of the 3731A Building was built flush to the metal west wall of the 3731 Building. There is a doorway through the adjoining wall to the 3731A Building.
3734-A	Storage	300	300-FF-2	9.1 × 7.9 × 4.3	Demolished	1944	1997	The 3734-A Building was originally used as a cylinder storage building, similar to the 3734 Building. In the 1950s, it was converted into the 300 Area paint storage facility, and continued to serve in that role into the 1990s. Materials stored within the building included paints, paint thinners, paint removers, and solvents. It was a one-story wooden building on a 10 cm (4-in.) reinforced concrete slab.
3745-A	Laboratory	300	300-FF-2	22.3 × 5.3	Demolished	1947	2007	The 3745-A Building was a shielded laboratory space for health physics research on ion bombardment. The accelerator program was terminated in 1995 and the particle accelerators were removed. After which, the 3745-A Building was used primarily for storage space. It was a rectangular with concrete block walls, concrete shielding walls, and a concrete slab floor.
3745-B	Laboratory	300	300-FF-2	7.9 × 4.6	Demolished	1949	2007	The original 3745-B Building was constructed in 1949 to provide a shielded accelerator laboratory and was used for instrument calibration and research. It was a rectangular concrete and wood frame building with a high bay center section with north, south, and west additions of concrete/concrete block. Experimental work was shutdown in 1995.
3746-A	Laboratory	300	300-FF-2	29.5 × 15.8	Demolished	1948	2007	The 3746-A Building (Radiological Physics Laboratory) provided laboratory and office space for PNNL's Radiological Science Department. Operational history is not well documented. It was originally constructed in 1948 on a concrete foundation with an on-grade concrete floor slab and contained a total of four offices, seven laboratories and support rooms, a water purification room, and a mechanical room, of various sizes. An addition was constructed in 1981 similar to the original structure that added four offices and two laboratories. Utilities serving the building include sanitary water and sewer and the process sewer line.
3746-D	Laboratory	300	300-FF-2	17.3 × 6.4	Demolished	1960	2006	In 1960, the 3746-D Building was constructed originally as the Craft Training Hutment. It was a Quonset-type arched facility with corrugated sheet metal except the ends are plywood. It was used to conduct training classes for crafts workers in the maintenance of instruments and electrical equipment. The 3746-D Building became a storage treatment facility (Technical Service Annex) in support of the 3705 Building. In about 1984, the building was used to recycle silver from photochemical wastes to recover silver. The effluent from the silver recovery equipment was initially disposed of to the sanitary sewer. Starting around 1992, the containerized process effluent was shipped offsite. Piping for silver waste input or output between 3705 and 3746-D has not been identified and it is inferred that wastewater was handled in containers before and after treatment. The 3746-D Building was demolished, the concrete slab was removed, and the site was leveled without the need for clean fill material. The area is posted as an URMA.
3760 T3	Office	300	300-FF-2	7.25 × 17.1 × 3.7	Removed	Not Documented	N/A	The MO-929 facility was a doublewide trailer that contained seven offices of various sizes, a work area, and a small restroom. Space was provided to accommodate eight personnel. Utilities serving the building included sanitary water, sanitary sewer, and electricity.
3802-A	Process Unit/Plant	300	300-FF-2	3.0 × 3.0 × 2.4	Inactive	1964	Not Documented	The 3802-A facility provided steam to 337 and related buildings and consisted of a small building and an underground substructure. Waste steam from the 309 PRTR facility was routed to this facility through underground piping, where it would be reduced in pressure before being piped to the 337 facility. The facility may also have been used for introducing chemical additives into the steam. The 3802-A facility consisted of a small building and an underground substructure.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
3902-A	Storage Tank	300	300-FF-2	6.1 × 7.6	Demolished	1943	2002	The 3902-A facility was an elevated steel water tank, the base of which was 38.4 m (126 ft) off the ground. The tank had a capacity of 283,900 L (75,000 gal). The 3902-A tank provided a water supply for fire protection purposes in the 300 Area. According to HAN-10970, water was chlorinated before it was stored in the tank. At first, the entire 300 Area water supply was obtained from two wells, which were located near the southeastern edge of the original area boundary. After 1975, the water in these tanks was most likely supplied by the 315 Building. A valve pit was located under the tank, which was accessible by a manhole. A steam heating system was in place to protect water in the tank from freezing.
3902-B	Storage Tank	300	300-FF-2	8.5 × 8.5	Demolished	1949	2002	The 3902-B facility was an elevated steel water tank, the base of which was 38.4 m (126 ft) off the ground. The tank had a capacity of 378,500 L (100,000 gal). A valve pit was located under the tank, which was accessible by a manhole. A steam heating system was in place to protect water in the tank from freezing. A sump was located in the bottom of the valve pit. The 3902-B tank provided a water supply for fire protection purposes in the 300 Area. According to HAN-10970, water was chlorinated before it was stored in 3902-A, and presumably also for 3902-B when it was installed. At first, the entire 300 Area water supply was obtained from two wells, which were located near the southeastern edge of the original area boundary. After 1975, the water in these tanks was most likely supplied by the 315 Building.
3906-A	Pump Station	300	300-FF-2	5.64 depth	Active	Not Documented	Not Documented	The 3906-A facility served as a gravity collection point and lift station for the sanitary and process sewer systems. The lift station consisted of an at-grade concrete pad and a 5.6 m (18.5-ft) -deep concrete pit with walls up to 0.3 m (1-ft) thick.
3906-B	Pump Station	300	300-FF-2	9.83 m^2	Active	Not Documented	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 3906-B facility served as a gravity collection point and lift station for the sanitary and process sewer systems.
3906-C	Pump Station	300	300-FF-2	2.6 × 1.4 × 2.1	Active	Not Documented	Scheduled Remediation Post-RCC Contract Date (Around 2027)	The 3906-C Sanitary Sewer Sample Station was an in-ground vault that had a sanitary sewer line that ran through the bottom of the vault to Richland.
Boiler Annex	Manufacturing Facility	300	300-FF-2	Not recorded		1997-1998	Scheduled Remediation Post-RCC Contract Date (Around 2027)	There are 16 Boiler Annexes in the 300 Area: 305-BA, 306E-BA, 318-BA, 320-BA, 323-BA, 324-BA, 325-BA, 326-BA, 327-BA, 328-BA, 331-BA, 337-BA, 3705-BA, 3706-BA, 3720-BA, and 382-BA. The boiler annexes are pre-engineered metal buildings on concrete slabs. The annexes contain sumps varying in size and each one contains a sump pump. Each annex has 7.6 cm (3-in.) curbing around the sump and water softener. Ten of the annexes contain one package boiler each while the remaining six contain two package boilers each. All of the boilers are natural gas fired steam boilers.
MO-265	Laboratory	300	300-FF-2	173.43 m^2	Active	Not Documented	Not Documented	The RCF, composed of MO-265 and MO-423, is a minor source for potential diffuse and fugitive radionuclide emissions resulting from the preparation and counting of radiological samples (for example, soil or smears) from CERCLA projects, within the 300 Area, the 100 Area, and the ERDF. Since this facility receives only samples associated with CERCLA response actions, it will continue to operate under CERCLA authority in accordance with DOE/RL-2005-87. Yasek (2006) replaced terms and conditions in AOP-00-05-06 and the Washington State Department of Health License.
MO-391	Storage	300	300-FF-2	2.4 × 9.8	Active	2005	Not Documented	The facility is a singlewide mobile office facility placed so that it could remain mobile and move south as demolition activities proceed, and is used to store H-1 drawings and measuring and test equipment cabinets.
MO-423	Laboratory	300	300-FF-2	121.6 m^2	Active	Not Documented	Not Documented	The RCF, composed of MO-265 and MO-423, is a minor source for potential diffuse and fugitive radionuclide emissions resulting from the preparation and counting of radiological samples (for example, soil or smears) from CERCLA projects, within the 300 Area, the 100 Area, and the ERDF. Since this facility receives only samples associated with CERCLA response actions, it will continue to operate under CERCLA authority in accordance with DOE-RL, 2006. WHC (2006) replaced terms and conditions in AOP-00-05-06 and the Washington State Department of Health License.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
MO-741	Office	300	300-FF-2	7.3 × 3.0	Inactive	1993	2008	The facility was a singlewide trailer that contained one main room used as an office and no internal partitions, installed next to the 340 Building complex. The facility was used as office space by radiological control technician and nuclear chemical operator personnel until the late 1990s.
MO-767	Office	300	300-FF-2	3.7 × 17	Active	2008	Not Documented	The facility is a singlewide mobile office facility used as a D-4 conference trailer.
MO-779	Office	300	300-FF-2	8.5 × 19.5	Active	2008	Not Documented	MO-779 is a doublewide mobile office trailer facility located southeast of the 324 Building used to support D-4 Project personnel.
MO-827	Office	300	300-FF-2	7.3 × 18.3	Active	2008	Not Documented	MO-827 is a doublewide mobile office trailer facility located southeast of the 324 Building and provides office space for D-4 Project personnel.
MO-905	Office	300	300-FF-2	7.3 × 18.3	Active	1997	Not Documented	This doublewide trailer was used by the Field Remediation Radiological Controls group as a temporary office space, meeting room, and lunch area. One room of the trailer was also used for counting radiological air samples and smears, and performing source checks. The building was not subject to loose contamination, and removal of samples and instrumentation at building turnover will remove radiological inventory and controls. The MO-905 information reviewed was from 1997 service dates to present. No prior information for this facility was found. MO-905 is a doublewide, 7.3 × 18.2 m (24 × 60 ft) transportable metal clad building on a steel frame located in the north central region of the 300 Area.
401	Office	400	300-FF-2	Not recorded	Demolished	Not Documented	1996	FFTF Visitor's Center.
402	Storage	400	300-FF-2	27.74 × 27.43 × 9.14	Active	1995	Not Documented	The SSF was designed to receive liquid sodium containing trace amounts of potassium through batch transfers from FFTF by way of transfer lines connecting the two facilities. However, this building was never used.
403	Storage	400	300-FF-2	34 × 27 × 12	Inactive	Not Documented	Not Documented	The principal equipment in the Fuel Storage Facility is a below ground cell containing a carbon steel storage vessel for storing up to 466 FFTF spent fuel assemblies in liquid sodium.
405	Reactor	400	300-FF-2	1330 m^2	Inactive	Not Documented	Not Documented	FFTF reactor containment building.
408	Process Unit/Plant	400	300-FF-2	53.3 × 30 (each)	Inactive	Not Documented	Not Documented	The HTS DHX East, South, and West each are pits containing four DHX modules tied together with structural steel framing in the form of a cross (referred to as the cruciform area). At the ends of the structures is a partial roof providing weather protection for the DHX fans and fan motors. The sodium piping and components in the DHXs contain internal contamination from the tritium in the secondary sodium.
409	Process Unit/Plant	400	300-FF-2	Not recorded	Inactive	Not Documented	Not Documented	The Closed Loop DHXs 1 and 2 contain sodium-to-air heat exchangers designed to transfer heat from the sodium to the atmosphere by forced convection. The closed loop systems were never put into operation.
427	FMEF	400	300-FF-2	4950 m^2	Inactive	Not Documented	Not Documented	FMEF.
432-A	Storage	400	300-FF-2	27 × 37	Inactive	Not Documented	Not Documented	The 400 Area Interim Storage Area has been designated for above ground dry cask storage of spent fuel.
436	Training Facility	400	300-FF-2	37 × 12	Inactive	Not Documented	Not Documented	The facility provides classrooms and the reactor control room simulator that was used for operator training certification.
437	Maintenance Shop	400	300-FF-2	88 × 29	Active	Not Documented	Not Documented	The MASF has a deep subgrade structure to provide shielded pits for specialized storage, sodium cleaning, and maintenance services. It also contains three decontamination suites equipped with negative pressure ventilation for low-level decontamination of small tools, components, and miscellaneous equipment. The facility has provisions for the collection and temporary storage of contaminated liquids. It is also used for equipment modification and assembly, testing, and training for the 200 Area Tank Farms. Current plans for the facility include use of the sodium removal systems for disposition of sodium residuals.
440	Storage	400	300-FF-2	18 × 6	Active	Not Documented	Not Documented	The 90-day storage pad is a covered and enclosed pad for the accumulation of HW.

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
451-A	Substation	400	300-FF-2	1221.4 m^2	Active	Not Documented	Not Documented	The 115 kV/13.8 kV Substation is a typical electrical substation with the equipment mounted on spread footings and equipment pads.
453	Transformer Station	400	300-FF-2	6 × 2 (each)	Inactive	Not Documented	Not Documented	The Transformer Stations 2.4 kV East, South, and West are located on 6 × 2 m (20 × 6.6-ft) concrete transformer pads. The power distribution system consists of switchgear units that feed plant equipment such as the primary and secondary sodium pumps, DHX fan motors, and ex-contaminated chilled water chillers.
4621E	Auxiliary Equipment Building	400	300-FF-2	40 × 18	Active	Not Documented	Not Documented	The building contains plant control, auxiliary equipment, radiation monitoring, access control, and an emergency diesel generator.
4621W	Auxiliary Equipment Building	400	300-FF-2	37 × 15	Inactive	Not Documented	Not Documented	The building contains electrical distribution and switchgear areas plant control, auxiliary electrical equipment rooms, and an emergency diesel generator.
4701-A	Guard Station	400	300-FF-2	18 × 9	Inactive	Not Documented	Not Documented	The Kentucky Boulevard Guard Building is used by security personnel and to control access to the FFTF-protected area.
4703	Control Structure	400	300-FF-2	27 × 24	Active	Not Documented	Not Documented	The building houses the Reactor Control Room, a computer room, lockers and restrooms, and office space on the ground level. A cable spreading room, control rod drive mechanism cabinet room, and a telephone equipment room are located in the basement.
4710	Office	400	300-FF-2	96 × 37	Active	Not Documented	Not Documented	The building provides office space for FFTF Engineering, Operations and other support staff.
4713-A	Riggers and Drivers Operations Facility	400	300-FF-2	495 m^2	Inactive	Not Documented	Not Documented	Office space for maintenance and craft personnel.
4713-B	Maintenance Shop	400	300-FF-2	2796 m^2	Inactive	Not Documented	Not Documented	Used for maintenance activities.
4713-C	Storage	400	300-FF-2	389 m^2	Inactive	Not Documented	Not Documented	Equipment storage.
4713-D	Storage	400	300-FF-2	651 m^2	Inactive	Not Documented	Not Documented	Equipment storage.
4716	Rigging Loft	400	300-FF-2	123 m^2	Active	Not Documented	Not Documented	This area provides storage of tools and equipment used for plant maintenance.
4717	Reactor Service Building	400	300-FF-2	46 × 15	Active	Not Documented	Not Documented	The Reactor Service Building has underground cells for offsite cask loading and for storage and processing of radioactive gases and waste. The building includes cell atmosphere processing system cells and pipe ways, and access for trucks and railroad cars to the equipment airlock.
4718	Storage	400	300-FF-2	1072 m^2	Active	Not Documented	Not Documented	
4721	Emergency Generator Building	400	300-FF-2	26 × 15 × 6.7	Active	Not Documented	Not Documented	The Emergency Turbine Generator Building contains the Oil Fired Turbine Generator and its associated switchgear that provides emergency power.
4722-D	Carpenter Shop	400	300-FF-2	Not recorded	Demolished	Not Documented	1986	
4722-E	Rigging Loft	400	300-FF-2	Not recorded	Inactive	Not Documented	Not Documented	

Table A-2. Summary of 300 Area Facilities

Facility Code	Facility Type	Area	Operable Unit	Site Dimensions (m)	Facility Status	Construction Date	Demolition Date	Facility Description
4722-F	Fabrication Shop	400	300-FF-2	Not recorded	Removed	1976	N/A	The facility was originally used to provide workspace for boilermakers in the 400 Area. Later on, it appears to have been used as a warehouse facility.
4734-A	Storage Pad	400	300-FF-2	12 × 14	Active	Not Documented	Not Documented	The Nitrogen Dewar Pad is a concrete pad on which the dewar tanks are mounted. Nitrogen is used as the atmosphere for cells and pipe ways that house primary sodium piping and/or equipment to prevent a fire should a primary sodium leak occur.
481	Pump House	400	300-FF-2	12 × 11	Active	Not Documented	Not Documented	The two Water Pump House Buildings (481 and 481A) contain pumps that distribute water to meet requirements for sanitary, fire protection, and process water usage at FFTF and other 400 Area Buildings.
482	Storage Tank	400	300-FF-2	1,136 m^3 each	Inactive	Not Documented	Not Documented	The 482A, 482B, and 482C Water storage tanks have a capacity of 1,136 m^3, and store well water.
483	Chemical Addition Building	400	300-FF-2	30 × 23	Inactive	Not Documented	Not Documented	This facility includes the cooling tower and attached chemical addition building. There are eight modular forced draft evaporative cooled, closed loop cooling towers that were used to support auxiliary cooling to primary sodium cells and certain components that could be impacted by the high operating temperatures of the reactor and HTS.
484	Water Equipment Building	400	300-FF-2	37 × 15 × 8	Inactive	Not Documented	Not Documented	The In-Containment Chilled Water Equipment Building encloses four chiller units with associated pumps, tanks, and piping.
4742-B	Switchgear Building	400	300-FF-2	Not recorded	Inactive	Not Documented	Not Documented	
491	HTS Service Buildings E & W	400	300-FF-2	40 × 30	Inactive	Not Documented	Not Documented	The HTS Service buildings are structurally connected and contain the secondary sodium pumps and piping as well as other portions of the HTS and Closed Loop System sodium equipment, switchgear, controls, and electrical equipment. The secondary sodium is slightly radioactive due to tritium that has diffused into the system.
491S	HTS Service Building South	400	300-FF-2	24 × 15	Inactive	Not Documented	Not Documented	This building contains the cesium trap, equipment for primary sodium sampling (including a small remote operation hot cell), closed loop sampling, cover gas monitoring and sampling, decontamination, and building inert gas cooling. This building is primarily a radioactive materials area in accessible locations. There are also some radiation areas where primary sodium piping is located. There is only one known contamination area, Cell 490, the sodium sampling cell.
MO-929-400	Office	400	300-FF-2	Not recorded	Removed	Not Documented	N/A	The doublewide trailer contained seven offices, a work area, and restroom. Sometime before 1984, the facility was removed from the 400 Area and installed near the 3760 Building in the 300 Area.

Notes:

Stewardship Information System, as of 1/09/2009.

WCH-181, *300 Area Building Retention Evaluation Mitigation Plan.*

J = The analyte was positively identified and the associated numerical value is the approximate concentration of the analyte in the sample.

U = The analyte was analyzed for, but was not detected to be greater than or equal to the estimated quantitation limit.

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Appendix B

300 Area (Industrial Complex) Maps Showing Waste Sites and Facilities

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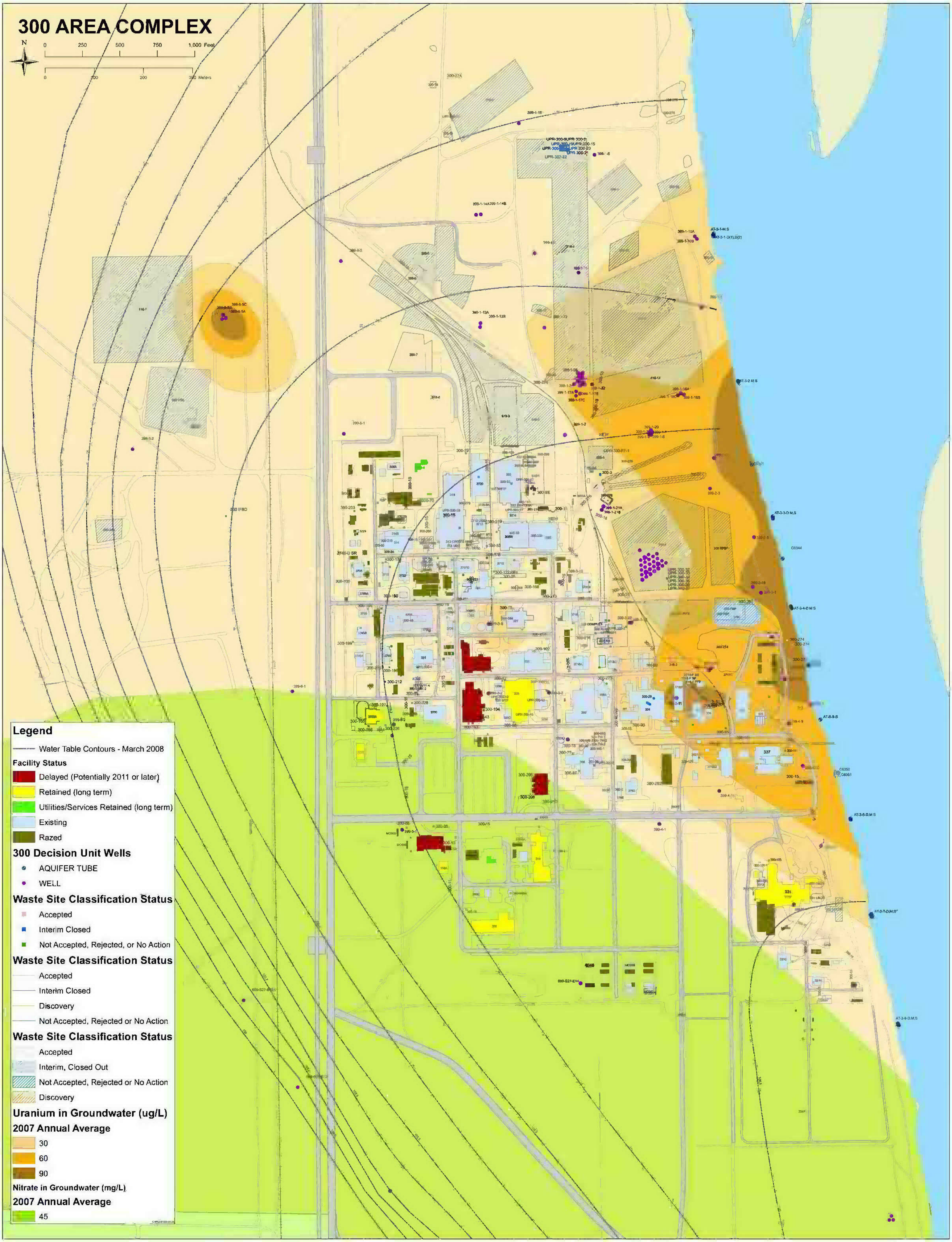
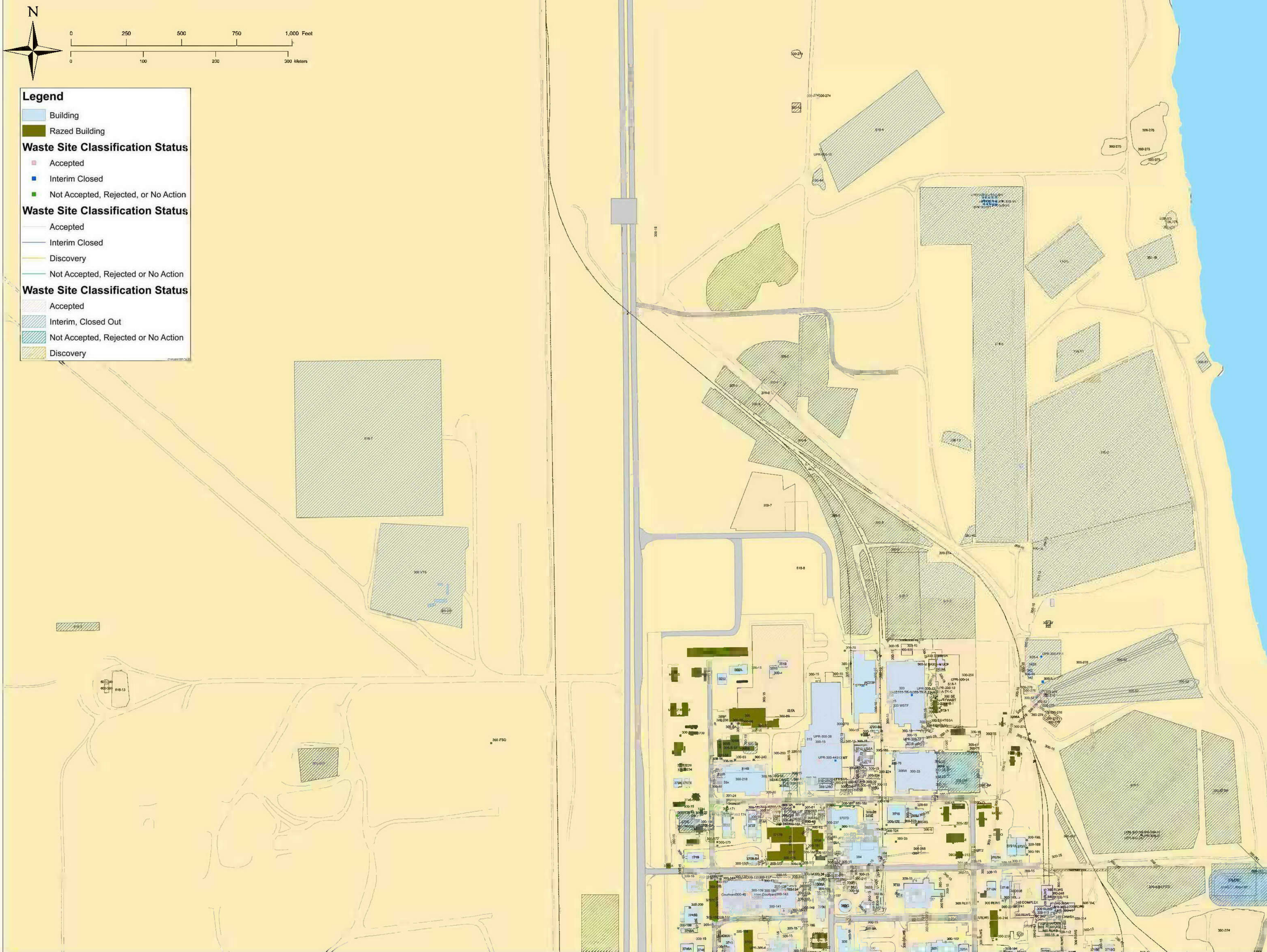
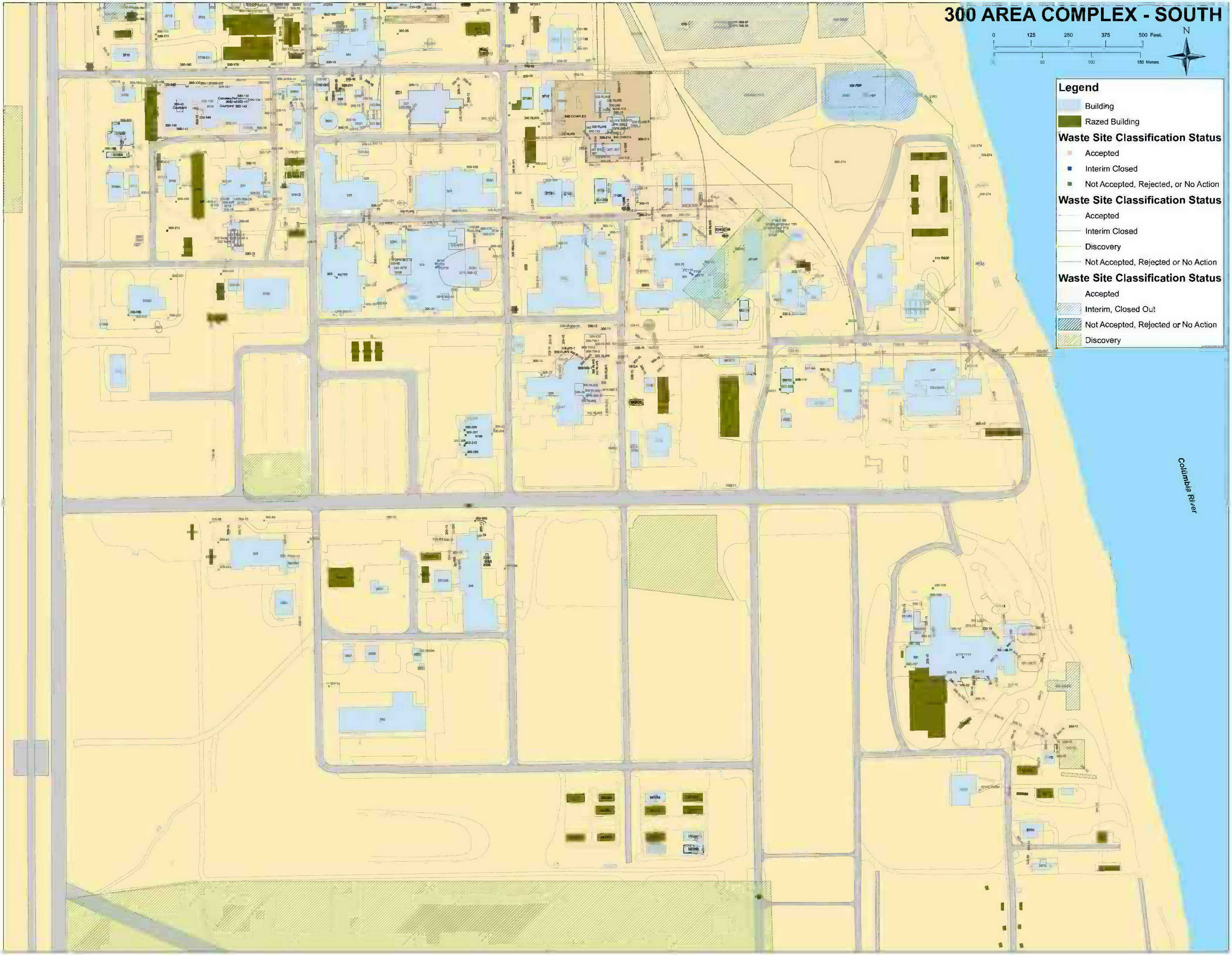

300 AREA COMPLEX
N
0 250 500 750 1,000 Feet
0 100 200 300 Meters
Legend
Water Table Contours - March 2008
Facility Status
Delayed (Potentially 2011 or later)
Retained (long term)
Utilities/Services Retained (long term)
Existing
Razed
300 Decision Unit Wells
AQUIFER TUBE
WELL
Waste Site Classification Status
Accepted
Interim Closed
Not Accepted, Rejected, or No Action
Waste Site Classification Status
Accepted
Interim Closed
Discovery
Not Accepted, Rejected or No Action
Waste Site Classification Status
Accepted
Interim, Closed Out
Not Accepted, Rejected or No Action
Discovery
Uranium in Groundwater (ug/L)
2007 Annual Average
30
60
90
Nitrate in Groundwater (mg/L)
2007 Annual Average
45

300 AREA COMPLEX - NORTH




300 AREA COMPLEX - SOUTH
0 125 250 375 500 Feet
N
Legend
Building
Razed Building
Waste Site Classification Status
Accepted
Interim Closed
Not Accepted, Rejected, or No Action
Waste Site Classification Status
Accepted
Interim Closed
Discovery
Not Accepted, Rejected or No Action
Waste Site Classification Status
Accepted
Interim, Closed Out
Not Accepted, Rejected or No Action
Discovery
Columbia River

Appendix C

Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Remedial Action Sites

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Table C-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Potential Relevancy	Possible Application
		Chemical-Specific ARARs		
		***Safe Drinking Water Act of 1974*; 40 CFR 141, "National Primary Drinking Water Regulations"**		
40 CFR 141.61/141.50, "Maximum Contaminant Levels for Organic Contaminants/Maximum Contaminant Level Goals for Organic Contaminants"	Establishes MCLs and nonzero MCL goals as criteria for groundwater and surface water that are or may be used for drinking water. The standards/goals are designed to protect human health from adverse effects of organic contaminants in the drinking water.	Groundwater in the 300 Area contains contaminants that require remediation; it is not currently used for drinking water but is a potential drinking water source and it discharges into the Columbia River (which is used for drinking water).	ARAR	Groundwater remediation and management (e.g., discharge of treated groundwater, in situ remediation of groundwater, and MNA).
40 CFR 141.62/141.51, "Maximum Contaminant Levels for Inorganic Contaminants/Maximum Contaminant Level Goals for Inorganic Contaminants"	Establishes MCLs and nonzero MCL goals as criteria for groundwater and surface water that are or may be used for drinking water. The standards/goals are designed to protect human health from adverse effects of inorganic contaminants in the drinking water.	Groundwater in the 300 Area contains contaminants that require remediation; it is not currently used for drinking water but is a potential drinking water source and it discharges into the Columbia River (which is used for drinking water).	ARAR	Groundwater remediation and management (e.g., discharge of treated groundwater, in situ remediation of groundwater, and MNA).
40 CFR 141.66/141.55, "Maximum Contaminant Levels for Radionuclides/ Maximum Contaminant Level Goals for Radionuclides"	Establishes MCLs and nonzero MCL goals as criteria for groundwater and surface water that are or may be used for drinking water. The standards/goals are designed to protect human health from adverse effects of inorganic contaminants in the drinking water.	Groundwater in the 300 Area contains contaminants that require remediation; it is not currently used for drinking water but is a potential drinking water source and it discharges into the Columbia River (which is used for drinking water).	ARAR	Groundwater remediation and management (e.g., discharge of treated groundwater, in situ remediation of groundwater, and MNA).

Table C-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Potential Relevancy	Possible Application
***Clean Water Act;* 40 CFR 131, "Water Quality Standards"**				
40 CFR 131.10, "Designation of Uses"	Establishes numeric water quality criteria for the protection of human health and aquatic organisms. Toxic criteria for the protection of aquatic life is provided in the water quality criteria regulations 40 CFR 131.36(b)(1), "EPA's Section 304(a), Criteria for Priority Toxic Pollutants," which supersede criteria adopted by the state, except where the state criteria are more stringent than the federal criteria.	Groundwater in the 300 Area contains contaminants that require remediation; groundwater also discharges into the Columbia River.	ARAR	Groundwater remediation and management (e.g., discharge of treated groundwater, in situ remediation of groundwater, and MNA).
***Toxic Substances Control Act (TSCA);* 40 CFR 761, "Polychlorinated Biphenyls Manufacturing, Processing, Distribution in Commerce, and Use Prohibitions"**				
40 CFR 761.50(b)1, 2, 3, 4 and 7, "Applicability," "PCB Waste" 40 CFR 761.50(c), "Applicability," "Storage for Disposal"	Establishes General PCB disposal requirements for the storage and disposal of PCB wastes including liquid PCB wastes, PCB items, PCB remediation waste, PCB bulk product wastes, and PCB/radioactive wastes at concentrations greater than 50 ppm.	PCB wastes may be encountered and or generated during the RI and subsequent remediation of the 300 Area.	ARAR	Soil excavation and remediation, equipment and debris handling and disposal, and IDW management and disposal.
"Disposal Requirements," 40 CFR 761.60(a), "Disposal Requirements" "PCB liquids" 40 CFR 761.60 (b), "Disposal Requirements" "PCB Articles" 40 CFR 761.60 (c), "Disposal Requirements" "PCB Containers"	Establishes requirements applicable to the handling and disposal of PCB liquids, PCB articles, and PCB containers.	PCB liquids, articles, and/or containers may be encountered and/or generated during the RI and subsequent remediation of the 300 Area.	ARAR	Equipment and debris handling, storage, and disposal; IDW management and disposal.

Table C-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Potential Relevancy	Possible Application
40 CFR 761.61, "PCB Remediation Waste"	Provides cleanup and disposal options for PCB remediation waste based on the concentration at which the PCBs are found.	PCB remediation wastes may be encountered and/or generated during the RI and subsequent remediation of the 300 Area.	ARAR	Soil remediation, RTD, and IDW management and disposal.
***Clean Air Act of 1977;* 40 CFR 60, "Standards of Performance for New Stationary Sources"**				
40 CFR 60, "Standards of Performance for New Stationary Sources"	Applies to specific stationary sources that emit toxic air pollutants where construction or modification of the facility commences after the effective date of any standard promulgated in this regulation.	Target analytes detected in soil and groundwater within the 300 Area include constituents that would constitute hazardous air pollutants if released to the air.	ARAR	Soil and groundwater remediation activities such as treatment systems that have the potential to emit regulated hazardous air pollutants and are considered a new source.
***Clean Air Act of 1977;* 40 CFR 61, "National Emission Standard for Hazardous Air Pollutants"**				
40 CFR 61.01, "Lists of Pollutants and Applicability of Part 61" 40 CFR 61.05, "Prohibited Activities" 40 CFR 61.12, "Compliance with Standards and Maintenance Requirements" 40 CFR 61.14, "Monitoring Requirements"	Provides general requirements for facility operations that emit regulated hazardous air pollutants. The regulation applies to any stationary source for which a standard has been prescribed.	Target analytes detected in soil and groundwater within the 300 Area include constituents that would constitute hazardous air pollutants if released to the air.	ARAR	Soil and groundwater remediation activities such as treatment systems that have the potential to emit regulated hazardous air pollutants subject to this part.
40 CFR 61.92,Standard, "National Emission Standards for Emissions of Radionuclides Other than Radon from Department of Energy Facilities"	Requires that emissions of radionuclides to the ambient air from DOE facilities shall not exceed amounts that would cause any member of the public to receive in any year an effective dose equivalent of 10 mrem/yr.	Target analytes detected in soil and groundwater in the 300 Area include constituents that would constitute radionuclides regulated as hazardous air pollutants.	ARAR	Soil and groundwater remedial activities (e.g., RTD, soil vapor extraction, decontamination, and demolition) implemented during the RI/FS that have the potential to emit hazardous radionuclides.

Table C-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Potential Relevancy	Possible Application
***Clean Air Act of 1977;* 40 CFR 61 Subpart M, "National Emission Standard for Asbestos"**				
40 CFR 61.140, "Applicability" 40 CFR 61.145, "Standard for Demolition and Renovation"	Defines regulated ACM and regulated removal and handling requirements. Specifies sampling, inspection, handling, and disposal requirements for regulated sources having the potential to emit asbestos. Specifically, no visible emissions are allowed during handling, packaging, and transport of ACM.	Encountering ACM on pipelines or buried asbestos within the 300 Area is possible during the RI and/or during remediation activities.	ARAR	Site investigation and remediation activities that include demolition and/or renovation and associated handling, packaging, and transportation of ACM, including IDW management and disposal.
40 CFR 61.150, "Standard for Waste Disposal for Manufacturing, Fabricating, Demolition, Renovation, and Spraying Operations"	Identifies requirements for the removal and disposal of asbestos from demolition and renovation activities.	Encountering ACM on pipelines or buried asbestos within the 300 Area is possible during the RI and/or during remediation activities.	ARAR	Site investigation and remediation activities that include demolition and/or renovation and associated handling, packaging, and transportation of ACM including IDW management and disposal.
***Clean Air Act of 1977;* 40 CFR 50, "National Primary and Secondary Ambient Air Quality Standards"**				
40 CFR 50.7, "National Primary and Secondary Ambient Air Quality Standards for $PM_{2.5}$"	Establishes primary and secondary air quality standards for particulate matter, which are 15 $\mu g/m^3$ annually or 65 $\mu g/m^3$ per 24-hour average concentration. This requirement is applicable to airborne releases of radionuclides and criteria pollutants.	Soil and groundwater target analytes detected in the 300 Area include radionuclides that may be generated during characterization or remedial actions. Although national primary and secondary ambient air quality standards for particulate matter are not an ARAR, it should be considered if RIs or treatment operations raise emissions above the standard.	TBC	Soil and groundwater remediation (e.g., RTD).

Table C-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Potential Relevancy	Possible Application
		Radionuclide ARAR Dose Compliance Concentrations for Superfund		
Establishment of Cleanup Levels for CERCLA Sites with Radioactive Contamination, August 22, 1997, OSWER No. 9200.4-18 *Distribution of OSWER Radiation Risk Assessment Q & A's Final Guidance,* December 17, 1999, OSWER No. 9200.4-31P	This memorandum presents clarification for establishing protective cleanup levels in media for radioactive contamination at CERCLA sites. EPA has determined that the dose limits established by the NRC in 62 FR 39058, "Radiological Criteria for License Termination Final Rule" (25 mrem/yr, which is equivalent to 5×10^{-4} increase lifetime risk) will not provide a protective basis for establishing PRGs under CERCLA. A dose of 15 mrem/yr effective dose (approximately equivalent to 3×10^{-4} increase in lifetime risk) is preferred as the maximum dose limit for humans. In the final guidance, EPA further clarifies that 15 mrem/yr is not a presumptive cleanup level under CERCLA. Rather, site decision makers should continue to use the CERCLA risk range when ARARs are not used to set cleanup levels. This is for several reasons, as using dose-based guidance would result in unnecessary inconsistency regarding how radiological and nonradiological (chemical) contaminants are addressed at CERCLA sites.	Target analytes detected in soil and groundwater in the 300 Area include constituents that would constitute radionuclides regulated as NESHAPs.	TBC	Development of media cleanup levels.
		Location-Specific ARARs		
		Archaeological and Historic Preservation Act		
40 CFR 6.301(c), "Applicant Requirements"	Requires that remedial actions do not cause the loss of any archaeological or historic data. This act mandates preservation of the data; it does not require protection of the actual waste site or facility.	Archaeological and historic sites have been identified within the 300 Area.	ARAR	Investigation and remediation activities that occur in areas near archeological or historic sites.

Table C-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Potential Relevancy	Possible Application
		National Historic Preservation Act of 1966		
36 CFR 800, "Protection of Historic Properties" 40 CFR 6.301(b), "Applicant Requirements" Executive Order 11593, *Protection and Enhancement of the Cultural Environment* 36 CFR 65, "National Historic Landmarks Program" 36 CFR 60, "National Register of Historic Places"	Requires federal agencies to consider the impacts of their undertaking on cultural properties through identification, evaluation and mitigation processes, and consultation with interested parties.	Cultural and historic sites have been identified within the 300 Area.	ARAR	Investigation and remediation activities that occur in areas near cultural or historic sites.
		***Native American Graves Protection and Repatriation Act of 1990;* 43 CFR 10, "Native American Graves Protection and Repatriation Regulations"**		
43 CFR 10, "Native American Graves Protection and Repatriation Regulations"	Establishes federal agency responsibility for discovery of human remains, associated and unassociated funerary objects, sacred objects, and items of cultural patrimony. Requires Native American consultation in the event of discovery.	Native American archaeological, cultural, and historic sites have been identified within the 300 Area; Native American remains and associated objects may be present.	ARAR	Investigation and remediation activities that occur in areas near Native American archaeological, cultural, and historic sites that contain associated remains and objects.
		Endangered Species Act of 1973		
50 CFR 402, "Interagency Cooperation—Endangered Species Act of 1973, as amended" 40 CFR 6.302(h), "Responsible Official Requirements"	Prohibits actions by federal agencies that are likely to jeopardize the continued existence of listed species or result in the destruction or adverse modification of habitat critical to them. Mitigation measures must be applied to actions that occur within critical habitats or surrounding buffer zones of listed species, in order to protect the resource.	Federal endangered and/or threatened species including fish, plants, and animals are found within the 300 Area.	ARAR	Remediation actions and investigation activities that occur within critical habitats or designated buffer zones of federal listed species.

Table C-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Potential Relevancy	Possible Application
		Executive Order 11988, Floodplain Management		
Federal, Executive Order 11988, *Floodplain Management* 40 CFR 6, Appendix A 10 CFR 1022, "Compliance with Floodplain and Wetland Environmental Review Requirements"	Take action to avoid adverse effects, minimize potential harm, and restore and preserve natural and beneficial values of the floodplain.	Some of the waste sites within the 300 Area subject to remediation are located within the Columbia River floodplain.	ARAR	Remedial actions will occur in the floodplain.
		Action-Specific ARARs		
		***Safe Drinking Water Act of 1974;* 40 CFR 144, "Underground Injection Control Program"; and 40 CFR 146, "Underground Injection Control Program: Criteria and Standards"**		
40 CFR 144, "Underground Injection Control Program" 40 CFR 146, "Underground Injection Control Program: Criteria and Standards"	Establishes criteria and standards for an underground injection control program.	Groundwater in the 300 Area contains contaminants that require remediation; treated groundwater may be discharged through underground injection wells.	ARAR	Groundwater remedial activities may involve underground injection.
		***Clean Air Act of 1977;* 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants"**		
40 CFR 61.05, "Prohibited Activities"	Identifies prohibited activities from stationary sources of air pollutants including operating a stationary source that is in violation of any national emission standard unless specifically exempted; or operating any existing source that is subject to national emission standards, in violation of the standards.	Target analytes detected in soil and groundwater in the 300 Area include constituents that would be subject to NESHAPs requirements.	ARAR	Investigative and remedial actions from stationary sources that have the potential to emit regulated hazardous air pollutants (e.g., vapor extraction systems, decontamination stations, and waste storage structures).

Table C-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Potential Relevancy	Possible Application
40 CFR 61.12, "Compliance with Standards and Maintenance Requirements"	Requires the owner and operator of each stationary source to maintain and operate the source and associated air pollution control equipment in a manner that minimizes emissions.	Target analytes detected in soil and groundwater in the 300 Area include constituents that would be subject to NESHAPs requirements.	ARAR	Investigative and remedial actions from stationary sources that have the potential to emit regulated air pollutants (e.g., vapor extraction systems, waste decontamination stations, and waste storage structures).
40 CFR 61.14, "Monitoring Requirements"	Requires the owner and operator to maintain and operate each monitoring system in a manner consistent with air pollution control practices for minimizing emissions.	Soil, air, and groundwater in the 300 Area contain target analytes that include NESHAPs-regulated hazardous air pollutants that will need to be monitored.	ARAR	Investigative and remedial soil, air, groundwater monitoring systems, decontamination and stabilization of contaminated structures, treatment of sludge, and operation of exhausters and vacuums, that may produce airborne emissions of radioactive particulates to unrestricted areas.
40 CFR 61.92, "National Emission Standards for Hazardous Air Pollutants"	Limits exposure of radioactive contamination release to an equivalent of 10 mrem/yr for an offsite receptor.	Soil, air, and groundwater in the 300 Area contain target analytes (radionuclides) that if released into the air, would be subject to radionuclide emission requirements.	ARAR	Remediation activities including decontamination and stabilization of contaminated structures, treatment of sludge, and operation of exhausters and vacuums, each of which may provide airborne emissions of radioactive particulates to unrestricted areas.

Table C-1. Identification of Potential Federal Applicable or Relevant and Appropriate Requirements and to be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Potential Relevancy	Possible Application
40 CFR 61.93, "Emission Monitoring and Test Procedures"	Specifies that radionuclide emission measurements shall be made at all release points that have the potential to discharge radionuclides to the air in quantities that cause an effective dose equivalent in excess of 1% of the standard. The regulation also requires that all radionuclides that could contribute greater than 10% of the potential dose equivalent for a release point be measured.	Soil, air, and groundwater in the 300 Area contain target analytes (radionuclides) that if released into the air, would be subject to NESHAPs radionuclide emission requirements.	ARAR	Remediation activities including decontamination and stabilization of contaminated structures, treatment of sludge, and operation of exhausters and vacuums, each of which may provide airborne emissions of radioactive particulates to unrestricted areas.

Notes:

The references cited in this table are included in the references section of this appendix.

µg/m3	=	microgram(s) per cubic meter
ACM	=	asbestos-containing material
ARAR	=	applicable or relevant and appropriate requirement
CERCLA	=	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CFR	=	Code of Federal Regulations
DOE	=	U.S. Department of Energy
EPA	=	U.S. Environmental Protection Agency
FS	=	feasibility study
IDW	=	investigation-derived waste
MCL	=	maximum contaminant level
MNA	=	monitored natural attenuation
mrem/yr	=	millirem per year
NESHAPs	=	National Emissions Standards for Hazardous Air Pollutants
NRC	=	U.S. Nuclear Regulatory Commission
OSWER	=	Office of Solid Waste and Emergency Response
PCB	=	polychlorinated biphenyl
$PM_{2.5}$	=	particulate matter less than 2.5 micrometers in aerodynamic diameter
ppm	=	parts per million
PRG	=	preliminary remediation goal
RI	=	remedial investigation
RTD	=	removal, treatment, and disposal
TBC	=	to be considered

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
Chemical-Specific ARARs				
***Model Toxics Control Act;* WAC 173-340, "Model Toxics Control Act – Cleanup"**				
WAC 173-340-740, "Unrestricted Land Use Soil Cleanup Standards"	Establishes soil cleanup levels where residential land use represents the reasonable maximum exposure under both current and future site use conditions. Cleanup standards requires specification of the following: hazardous substance concentrations that protect human health and the environment (cleanup levels), the location of the site where cleanup levels must be attained ("points of compliance"), and other regulatory requirements that apply to the cleanup action because of the type of action or location of the site. These requirements are specified in the applicable state and federal laws and are generally established in conjunction with the selection of a specific cleanup action.	Soil in the 300 Area contains contaminants that require remediation. The human health conceptual exposure model for the 300 Area (which includes all of the 300 Area covered by this work plan) is considered rural-residential land use. This land use assumes the reasonable maximum exposure to soil will be unrestricted by future users and, therefore, corresponds to Method B soil cleanup levels.	ARAR	Soil cleanup actions where concentration of hazardous substances in the soil exceed Method B cleanup levels at the point of compliance.
WAC 173-340-747, "Deriving Soil Concentrations for Ground Water Protection"	Establishes soil cleanup levels where residential land use represents the reasonable maximum exposure under both current and future site use conditions. Cleanup standards requires specification of the following: hazardous substance concentrations that protect human health and the environment (cleanup levels), the location of the site where cleanup levels must be attained ("points of compliance"), and other regulatory requirements that apply to the cleanup action because of the type of action or location of the site. These requirements are specified in the applicable state and federal laws and are generally established in conjuncture with the selection of a specific cleanup action.	Soil in the 300 Area contains contaminants that require remediation. The human health conceptual exposure model for the 300 Area (which includes all of the 300 Area covered by this work plan) is considered rural-residential land use. This land use assumes the reasonable maximum exposure to soil will be unrestricted by future users.	ARAR	Soil cleanup actions where concentration of hazardous substances in the soil exceeds soil concentration for protection of groundwater at the point of compliance.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
WAC 173-340-720, "Ground Water Cleanup Standards" WAC 173-340-720(4) "Method B Cleanup Levels for Potable Ground Water" WAC 173-340-720(7), "Adjustments to Cleanup Levels"	Groundwater cleanup levels are based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future site use conditions. Groundwater cleanup levels are established at concentrations that do not directly or indirectly cause violations of surface water, sediments, soil, or air cleanup standards.	Groundwater in the 300 Area contains contaminants that require remediation; it is not currently used for drinking water but is a potential drinking water source and it discharges into the Columbia River (which is used for drinking water).	ARAR	Groundwater remediation and management (e.g., discharge of treated groundwater, in situ remediation of groundwater, and MNA).
WAC 173-340-730, "Surface Water Cleanup Standards"	Surface water cleanup levels are based on estimates of the highest beneficial use and the reasonable maximum exposure expected to occur under both current and potential future site use conditions.	Groundwater in the 300 Area contains contaminants that require remediation and discharges into the Columbia River. The Columbia River is a current and future source of drinking water.	ARAR	Soil, groundwater, and surface water remediation activities that impact surface water.
WAC 173-340-7490, "Terrestrial Ecological Evaluation Procedures" WAC 173-340-7493, "Site-Specific Terrestrial Ecological Evaluation Procedures" WAC 173-340-7494, "Priority Contaminants of Ecological Concern"	Defines goals and procedures for determining whether a release of hazardous substances to soil may pose a threat to the terrestrial environment. Characterizes existing or potential threats to terrestrial plants or animals exposed to hazardous substances in soil; and establishes site-specific cleanup standards for the protection of terrestrial plants and animals.	Soil in the 300 Area contains contaminants that require evaluation to determine if ecological exposures have the potential to cause significant adverse effects.	ARAR	Soil remediation activities including containment, RTD, and MNA.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
RCW 70,105, "Hazardous Waste Management"; WAC 173-303, "Dangerous Waste Regulations"				
WAC 173-303-645(3), "Releases from Regulated Units,""Ground Water Protection Standard"	Provides standards for groundwater protection including background, MCLs, and ACLs. The MCLs are established at the same levels as SDWA MCLs, and where SDWA MCLs do not exist, health-based ACLs may be established that are protective of human health and environment.	Some parts of the 300 Area are regulated under state dangerous waste regulations and require groundwater remediation.	ARAR	Groundwater remediation and management (e.g., discharge of treated groundwater, in situ remediation of groundwater, and MNA).
RCW 90.48, "Water Rights—Environment," "Water Pollution Control"; WAC 173-201A, "Water Quality Standards for Surface Waters of the State of Washington"				
WAC 173-201A-240(3), "Toxic Substances"	Establishes water quality standards for surface waters of the State of Washington consistent with public health and public enjoyment of the waters and the propagation and protection of fish, shellfish, and wildlife.	Groundwater in the 300 Area contains contaminants that require remediation and discharges into the Columbia River. The use designations for the Columbia River include aquatic life use (spawning and rearing), primary contact recreation, water supply (drinking, irrigation, and agriculture), and miscellaneous uses (wildlife habitat, harvesting, commerce, boating, and aesthetics).	ARAR	Soil, groundwater, and surface water remediation activities that impact surface water.
Location-Specific ARARs				
RCW 77.12.655, "Fish and Wildlife," "Powers and Duties," "Habitat Buffer Zone for Bald Eagle—Rules"; WAC 232-12-292, "Permanent Regulations," "Bald Eagle Protection Rules"				
WAC 232-12-292, "Bald Eagle Protection Rules"	Protects eagle habitat to maintain eagle populations so the species is not classified as threatened, endangered, or sensitive in Washington State.	Bald eagles nest, feed, and overwinter along the shores of the Columbia River.	ARAR	Investigative and remediation activities that impact bald eagle habitat.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
Action-Specific ARARs				
***Hazardous Waste Management Act of 1976;* WAC 173-303, "Dangerous Waste Regulations"**				
WAC 173-303-016, "Identifying Solid Waste" WAC 173-303-017, "Recycling Processes Involving Solid Waste"	Establishes criteria for solid and recycled solid wastes.	Solid wastes and/or recycled solid wastes may be generated during the 300 Area RI/FS.	ARAR	Investigative and remediation activities.
WAC 173-303-070, "Designation of Dangerous Waste"	Establishes the method for determining if a solid waste is a dangerous waste (or an extremely hazardous waste).	Dangerous/hazardous waste may be generated during the 300 Area RI/FS.	ARAR	Investigative and remediation (including waste treatment) activities that generate wastes (e.g., drums, barrels, tanks, containers, bulk wastes, debris, and contaminated soil).
WAC 173-303-073, "Conditional Exclusion of Special Wastes"	Establishes the conditional exclusion and the management requirements of special wastes, as defined in WAC 173-303-040, "Definitions."	Special wastes may be generated during the 300 Area RI/FS.	ARAR	FS remediation activities (disposal, storage, recycling, and onsite treatment) that manage special wastes consistent with the requirements of the *Washington Administrative Code*.
WAC 173-303-077, "Requirements for Universal Waste"	Identifies those wastes exempted from regulation under WAC 173-303-140, "Land Disposal Restrictions," and WAC 173-303-170, "Requirements for Generators of Dangerous Waste," through 173-303-9907, "Reserved" (excluding WAC 173-303-960, "Special Powers and Authorities of the Department"). These wastes are subject to regulation under WAC 173-303-573, "Standards for Universal Waste Management."	Universal wastes may be generated during the 300 Area RI/FS.	ARAR	FS remediation activities (disposal, storage, recycling, and on-site treatment) that manage universal wastes consistent with the requirements of the *Washington Administrative Code*.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
WAC 173-303-120, "Recycled, Reclaimed, and Recovered Wastes" WAC 173-303-120(3), "Recycled, Reclaimed, and Recovered Wastes" WAC 173-303-120(5), "Recycling of Used Oil"	These regulations define the requirements for the recycling of materials that are solid and dangerous waste. Specifically, WAC 173-303-120(3), "Recycled, Reclaimed, and Recovered Wastes," provides for the management of certain recyclable materials, including spent refrigerants, antifreeze, and lead-acid batteries. WAC 173-303-120(5), "Recycling of Used Oil," provides for the recycling of used oil.	Recycled, reclaimed, and recovered wastes may be generated during the 300 Area RI/FS.	ARAR	FS remediation recycling activities consistent with the requirements of the *Washington Administrative Code* and are not otherwise subject to CERCLA as hazardous substances.
WAC 173-303-140, "Land Disposal Restrictions"	This regulation establishes treatment requirements and disposal prohibitions for land disposal of dangerous waste and incorporates by reference (WAC 173-303-140[2)][a], "Applicability") the federal land disposal restrictions of 40 CFR 268, "Land Disposal Restrictions," that are applicable to solid waste that is designated as dangerous or mixed waste in accordance with WAC 173-303-070(3), "Designation Procedures."	On-site land disposal may be a selected remedy for 300 Area dangerous waste and debris.	ARAR	Investigative and remediation wastes destined for onsite land disposal.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
WAC 173-303-170, "Requirements for Generators of Dangerous Waste"	Establishes the requirements for dangerous waste generators. WAC 173-303-170(3), "Requirements for Generators of Dangerous Waste," includes the substantive provisions of WAC 173-303-200, "Accumulating Dangerous Waste On-Site," by reference. WAC 173-303-200, "Accumulating Dangerous Waste On-Site," further includes certain substantive standards from WAC 173-303-630, "Use and Management of Containers," and -640, "Tank Systems," by reference. Specifically, the substantive standards for management of dangerous/mixed waste are relevant and appropriate to the management of dangerous waste that will be generated during the remedial action.	Dangerous wastes may be generated from the RI/FS of the 300 Area.	ARAR	IDW and remediation wastes (contaminated soil and groundwater, personnel protective equipment, treatment chemicals, etc.).
WAC 173-303-200, "Accumulating Dangerous Waste On-Site"	Establishes the requirements for accumulating wastes onsite. WAC 173-303-200, "Accumulating Dangerous Waste On-Site," further includes certain substantive standards from WAC 173-303-630, "Container Management," and -640, "Tank Systems," by reference.	Dangerous waste may be generated from the RI/FS of the 300 Area.	ARAR	Management of dangerous waste during remedial and investigative actions.
WAC 173-303-64610, "Purpose and Applicability" WAC 173-303-64620, "Requirements"	Establishes requirements for corrective action for releases of dangerous wastes and dangerous constituents including releases from solid waste management units.	Releases of dangerous wastes and dangerous constituents have occurred within the 300 Area that may present a threat to human health and the environment.	ARAR	Investigative and remediation of dangerous wastes and dangerous constituents from solid waste management units and spill sites. Corrective action can also be applied at TSD units whenever a release occurs.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
WAC 173-303-610(2), "Closure and Post-Closure"	Establishes closure requirements applicable to all dangerous waste facilities and post-closure care requirements applicable to all regulated units (as defined in WAC 173-303-040, "Definitions") at which dangerous wastes will remain after closure (including tank systems, landfills, surface impoundments, waste piles, and miscellaneous units).	Dangerous wastes may remain in the 300 Area after closure.	ARAR	Remedial design and operation of regulated units that contain dangerous wastes and that will remain in the 300 Area after closure.
WAC 173-303-665(6), "Landfills," "Closure and Post-Closure Care"	Specifies closure and post-closure requirements for landfills.	The FS may propose containment as a preferred remedy.	ARAR	Design and operation of an engineered landfill cover.
RCW 18.104, "Businesses and Professions," "Water Well Construction"; WAC 173-160, "Minimum Standards for Construction and Maintenance of Wells"				
WAC 173-160-161, "How Shall Each Water Well Be Planned and Constructed?"	Identifies well planning and construction requirements.	Groundwater monitoring and treatment wells and borings occur in the 300 Area.	ARAR	Investigative and remediation activities that require siting, installation, construction, operation, maintenance, and decommissioning of wells and borings.
WAC 173-160-171, "What Are the Requirements for the Location of the Well Site and Access to the Well?"	Identifies the requirements for locating a well.	Groundwater monitoring and treatment wells and borings occur in the 300 Area.	ARAR	Investigative and remediation activities that require siting, installation, construction, operation, maintenance, and decommissioning of wells and borings.
WAC 173-160-181, "What Are the Requirements for Preserving the Natural Barriers to Ground Water Movement Between Aquifers?"	Identifies the requirements for preserving natural barriers to groundwater movement between aquifers.	Groundwater monitoring and treatment wells and borings occur in the 300 Area.	ARAR	Investigative and remediation activities that require siting, installation, construction, operation, maintenance, and decommissioning of wells and borings.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
WAC 173-160-400, "What Are the Minimum Standards for Resource Protection Wells and Geotechnical Soil Borings?"	Identifies the minimum standards for resource protection wells and geotechnical soil borings.	Groundwater monitoring and treatment wells and borings occur in the 300 Area.	ARAR	Investigative and remediation activities that require siting, installation, construction, operation, maintenance, and decommissioning of wells and borings.
WAC 173-160-420, "What Are the General Construction Requirements for Resource Protection Wells?"	Identifies the general construction requirements for resource protection wells.	Groundwater monitoring and treatment wells and borings occur in the 300 Area.	ARAR	Investigative and remediation activities that require siting, installation, construction, operation, maintenance, and decommissioning of wells and borings.
WAC 173-160-430, "What Are the Minimum Casing Standards?"	Identifies the minimum casing standards.	Groundwater monitoring and treatment wells and borings occur in the 300 Area.	ARAR	Investigative and remediation activities that require siting, installation, construction, operation, maintenance, and decommissioning of wells and borings.
WAC 173-160-440, "What Are the Equipment Cleaning Standards?"	Identifies the equipment cleaning standards.	Groundwater monitoring and treatment wells and borings occur in the 300 Area.	ARAR	Investigative and remediation activities that require siting, installation, construction, operation, maintenance, and decommissioning of wells and borings.
WAC 173-160-450, "What are the Well Sealing Requirements?"	Identifies the well sealing requirements.	Groundwater monitoring and treatment wells and borings occur in the 300 Area.	ARAR	Investigative and remediation activities that require siting, installation, construction, operation, maintenance, and decommissioning of wells and borings.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
WAC 173-160-460, "What is the Decommissioning Process for Resource Protection Wells?"	Identifies the decommissioning process for resource protection wells.	Groundwater monitoring and treatment wells and borings occur in the 300 Area.	ARAR	Investigative and remediation activities that require siting, installation, construction, operation, maintenance, and decommissioning of wells and borings.
RCW 70.94, "Public Health and Safety," "Washington Clean Air Act"; WAC 173-400, "General Regulations for Air Pollution Sources"				
WAC 173-400, "General Regulations for Air Pollution Sources"	Defines methods of control to be employed to minimize the release of air contaminants associated with fugitive emissions resulting from materials handling, construction, demolition, or other operations. Emissions are to be minimized through application of best available control technology.	Soil and groundwater remedial actions implemented in the 300 Area have the potential to emit emission subject to these standards because soil and groundwater target analytes detected in the 300 Area include covered hazardous air pollutants.	ARAR	Actions performed at the 300 Area that could result in the emission of hazardous air pollutants, including decontamination, demolition, and excavation activities implemented during the RI/FS that have the potential to emit visible, particulate, fugitive, and hazardous air emissions and odors.
WAC 173-400-040, "General Standards for Maximum Emissions"	All sources and emissions units are required to meet the general emission standards unless a specific source standard is available. General standards apply to visible emissions, particulate fallout, fugitive emissions, odors, emissions detrimental to health and property, sulfur dioxide, and fugitive dust.	Soil and groundwater remedial actions implemented in the 300 Area have the potential to emit emission subject to these standards because target analytes detected in the 300 Area include covered regulated hazardous air pollutants.	ARAR	Remedial actions that have the potential to release hazardous air emissions.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
WAC 173-400-075, "Emission Standards for Sources Emitting Hazardous Air Pollutants"	Establishes national emission standards for hazardous air pollutants. Adopts, by reference, 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," and appendices.	Soil and groundwater target analytes detected in the 300 Area include covered regulated hazardous air pollutants.	ARAR	Actions performed at the 300 Area that could result in the emission of hazardous air pollutants, including decontamination, demolition, and excavation activities implemented during the RI/FS that have the potential to emit visible, particulate, fugitive, and hazardous air emissions and odors.
Water Pollution Control Act; **WAC 173-218, "Underground Injection Control Program"**				
WAC 173-218, "Underground Injection Control Program"	Protects groundwater quality by regulating the discharge of fluids into underground injection control wells.	Groundwater in the 300 Area contains contaminants that require remediation. Treated groundwater may be discharged through underground injection wells.	ARAR	Groundwater remedial activities may involve underground injection.
RCW 70.95, "Solid Waste Management—Reduction and Recycling"; WAC 173-350, "Solid Waste Handling Standards"				
WAC 173-350, "Solid Waste Handling Standards," -025, "Owner Responsibilities for Solid Waste," -040, "Performance Standards," -300, "On-Site Storage, Collection and Transportation Standards," and -900, "Remedial Action"	Establishes minimum functional performance standards for the proper handling and disposal of solid waste. Requirements for the proper handling of solid waste materials originating from residences, commercial, agricultural, and industrial operations, and other sources, and identifies those functions necessary to ensure effective solid waste handling programs at both the state and local level.	Solid, nondangerous waste will be generated during the implementation of the 300 Area RI/FS.	ARAR	Investigative and remedial actions that generate solid, nondangerous waste.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
***Clean Air Act;* WAC 173-460, "Controls for New Sources of Toxic Air Pollutants"**				
WAC 173-460-010, "Purpose" WAC 173-460-030, "Applicability" WAC 173-460-060, "Control Technology Requirements" WAC 173-460-150, "Table of ASIL, SQER and De Minimis Emission Values" WAC 173-460-160, "Class B Toxic Air Pollutants and Acceptable Source Impact Levels"	Establishes control of new sources emitting toxic air pollutants to prevent air pollution, reduce emissions to the extent reasonably possible, and maintain such levels of air quality as will protect human health and safety. Toxic air pollutants include carcinogens and noncarcinogens listed in WAC 173-460-150, "Class A Toxic Air Pollutants: Known, Probable and Potential Human Carcinogens and Acceptable Source Impact Levels," and WAC 173-460-160, "Class B Toxic Air Pollutants and Acceptable Source Impact Levels." Three major requirements of this regulation include (1) implementation of best available control technology for toxics, (2) quantification of toxic air pollutant emissions, and (3) health and safety protection demonstration.	Target analytes detected in soil and groundwater in the 300 Area include constituents that would constitute toxic air pollutants if released to the air.	ARAR	Groundwater and soil remediation activities such as treatment systems that have the potential to emit hazardous air emissions and would be considered a new source.
***Clean Air Act ;* WAC 173-470, "Ambient Air Quality Standards for Particulate Matter"**				
WAC 173-470-100, "Ambient Air Quality Standards"	Sets maximum acceptable levels for particulate matter in the ambient air at 150 µg/m^3 over a 24-hour period, or 60 µg/m^3 annual geometric mean. It also sets the 24-hour ambient air concentration standards for particles less than 10 µm in diameter (PM_{10}), which are set at 105 µg/m^3 and 50 µg/m^3 geometric mean.	Although ambient air quality standards for particulate matter is not an ARAR, it should be considered if RIs or treatment operations raise emissions above the standard.	ARAR	Investigative and remediation activities (e.g., excavation, RTD, containment) that have the potential to emit particulate matter above maximum acceptable levels.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
WAC 173-470-110, "Particle Fallout Standards"	Establishes the standard for particle fallout not to exceed 10 g/m^2 per month in an industrial area or 5 g/m^2 per month in residential or commercial areas. Alternative levels for areas where natural dust levels exceed 3.5 g/m^2 per month are set at 6.5 g/m^2 per month, plus background levels for industrial areas and 1.5 g/m^2 per month, plus background in residential and commercial areas.	Particulates and dust can be generated during RI/FS actions.	ARAR	Investigative and remediation activities (e.g., excavation, RTD, containment) that have the potential to emit particulate matter above maximum acceptable levels.
Clean Air Act; **WAC 173-480; "Ambient Air Quality Standards and Emission Limits for Radionuclides"**				
WAC 173-480-040, "Ambient Standard"	Defines the maximum allowable level for radionuclides in the ambient air, which shall not cause a maximum accumulated dose equivalent of 25 mrem/yr to the whole body or 75 mrem/yr to any critical organ. However, ambient air standards under 40 CFR, Subparts H and I are not to exceed amounts that result in an effective dose equivalent of 10 mrem/yr to any member of the public.	Target analytes detected in soil and groundwater in the 300 Area include radionuclides that could be emitted to ambient air during RI/FS actions.	ARAR	Investigative and remediation activities (e.g., excavation, RTD, demolition, ventilation, vacuuming/exhaust) that have the potential to emit radionuclides above maximum acceptable levels.
WAC 173-480-050, "General Standards for Maximum Permissible Emissions"		The potential for fugitive and diffuse emissions due to demolition and excavation and related activities will require efforts to minimize those emissions. This requirement is action-specific.	ARAR	
WAC 173-480-070, "Emission Monitoring and Compliance Procedures"	Requires that radionuclide emissions shall be determined by calculating the dose to members of the public using Department of Health approved sampling procedures at the point of maximum annual air concentration in an unrestricted area where any member of the public may be.	Target analytes detected in soil and groundwater in the 300 Area include radionuclides that could be emitted to unrestricted areas during RI/FS actions.	ARAR	Investigative and remediation activities (e.g., excavation, RTD, demolition, ventilation, and vacuuming/exhaust) that have the potential to emit radionuclides to unrestricted areas above maximum acceptable levels.

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
WAC 173-480-060, "Emission Standards for New and Modified Emission Units"	Requires that construction, installation, or establishment of new air emission control units utilize BARCT.	Target analytes detected in soil and groundwater in the 300 Area include radionuclides that could be emitted from air emission control units during RI/FS actions.	ARAR	Investigative and remediation activities (e.g., excavation, RTD, demolition, ventilation, and vacuuming/exhaust) that require air pollution control equipment and have the potential to emit radionuclides.
RCW 70.98, "Nuclear Energy and Radiation"; WAC 246-247, "Radiation Protection -- Air Emissions"				
National Standards Adopted by Reference for Sources of Radionuclide Emission. WAC 246-247-035 (1)(a)(ii), "National Standards Adopted by Reference for Sources of Radionuclide Emissions," "40 CFR Part 61, Subpart H – National Emission Standards for Emissions of Radionuclides Other Than Radon From Department of Energy Facilities"	Established requirements equivalent to 40 CFR 61, Subpart H, by reference. Radionuclide airborne emissions from the waste site shall be controlled so as not to exceed amounts that would cause an exposure to any member of the public of greater than 10 mrem/yr effective dose equivalent.	Substantive requirements of this standard are applicable because the remedial action may include activities such as excavation, decontamination, and stabilization of contaminated areas, which may provide airborne emissions of radioactive particles.	ARAR	Investigative and remedial activities.
WAC 246-247-040(3), "General Standards" WAC 246-247-040(4), "General Standards"	Requires that emissions be controlled to ensure emission standards are not exceeded.	Target analytes detected in soil and groundwater in the 300 Area reactor sites include radionuclides that could be emitted during RI/FS actions.	ARAR	Investigative and remediation activities (e.g., RTD, excavation, demolition, and ventilation).

Table C-2. Identification of Potential State of Washington Applicable and Relevant or Appropriate Requirements and to Be Considered for the Remedial Action Sites

Citation	Description of Requirement	Rationale for Use	Relevancy	Possible Action(s)
WAC 246-247-075, "Monitoring, Testing and Quality Assurance"	Establishes the monitoring, testing, and quality assurance requirements for radioactive air emissions. Emissions from non-point and fugitive sources of airborne radioactive material shall be measured. Measurement techniques may include, but are not limited to, sampling, calculation, smears, or other reasonable method for identifying emissions as determined by the lead agency.	Target analytes in the 300 Area reactor sites include radionuclides that could be emitted as airborne radioactive material during RI/FS actions.	ARAR	Investigative and remediation activities (e.g., RTD, excavation, demolition, and ventilation) that could be emitted from fugitive sources.

Notes:

The references cited in this table are included in the references section of this appendix.

µm = micrometer(s)

µg/m^3 = microgram(s) per cubic meter

ACL = alternative concentration limit

ARAR = applicable or relevant and appropriate requirement

BARCT = best available radionuclide control technology

CERCLA = Comprehensive Environmental Response, Compensation, and Liability Act of 1980

CFR = Code of Federal Regulations

FS = feasibility study

g/m2 = grams per square meter

IDW = investigation-derived waste

MCL = maximum concentration (or contaminant) level

MNA = monitored natural attenuation

mrem/yr = millirem per year

PM_{10} = particulate matter less than 10 micrometers in aerodynamic diameter

RI/FS = remedial investigation/feasibility study

RTD = removal, treatment, and disposal

SDWA = Safe Drinking Water Act of 1974

TSD = treatment, storage, and disposal

WAC = Washington Administrative Code

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