Appendix H

Pipelines Remedial Evaluation

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Terms

ARAR	applicable or relevant and appropriate requirement
bgs	below ground surface
BRA	baseline risk assessment
CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CFR	Code of Federal Regulations
COC	contaminant of concern
COPC	contaminant of potential concern
CS	carbon steel
D&D	decontamination and decommissioning
DOE	U.S. Department of Energy
EPA	U.S. Environmental Protection Agency
ERDF	Environmental Restoration Disposal Facility
FS	feasibility study
GRA	general response action
IC	institutional controls
IDMS	Integrated Document Management System
ISS	in situ stabilization
MCL	maximum contaminant level
NCP	National Contingency Plan
NPH	normal paraffin hydrocarbon
O&M	operations and maintenance
OU	operable unit
PFP	Plutonium Finishing Plant
PRG	preliminary remediation goal
RAO	remedial action objective
RCRA	*Resource Conservation and Recovery Act of 1976*
RI	remedial investigation

ROD	record of decision
RTD	removal, treatment, and disposal
SS	stainless steel
SVE	soil vapor extraction
TBD	to be determined
TBP	tributyl phosphate
TEDF	Treated effluent disposal facility
TRU	transuranic
TSD	treatment, storage, and disposal
UPR	unplanned release
VCP or VC	vitrified clay piping
WAC	*Washington Administrative Code*
WIDS	Waste Information Data System

H1 Introduction

This appendix describes the inactive subsurface pipelines associated with the feasibility study (FS) addressing the 200-PW-1, 200-PW-3, and 200-PW-6 operable unit (OU) waste sites, and the 200-CW-5 OU waste sites. The 200-PW-1, 200-PW-6, and 200-CW-5 OUs are located in the 200 West Area of the Hanford Central Plateau. Pipelines 200-W-174-PL, 200-W-205-PL, 200-W-206-PL, 200-W-207-PL, 200-W-208-PL, 200-W-210-PL, and 200-W-220-PL are located near the Plutonium Finishing Plant (PFP) (Figure H2-1, at the end of Appendix H). All pipelines were used to transport and convey process liquid waste or cooling water and steam condensate liquids from the PFP to the respective OU waste sites.

The 200-PW-3 OU is located in the 200 East Area of the Hanford Central Plateau. Although 200-PW-3 is mentioned in this section, its associated waste sites and pipelines will be addressed in the 200-IS-1 OU (DOE/RL-2002-14, Rev. 1, *Tanks/Lines/Pits/Boxes/Septic Tank and Drain Fields Waste Group Operable Unit RI/FS/Work Plan and RCRA TSD Unit Sampling Plan; Includes 200-IS-1 and 200-ST-1 Operable Units*). 200-PW-3 is described in this section for information only.

To identify the pipelines included in the decision for these OUs, a rules set was developed as follows:

1. The pipeline had a classification status of "Accepted" or "Accepted (Proposed)" in Waste Information Data System (WIDS).
2. The pipeline had an OU assignment of "to be determined" (TBD) meaning it is not associated with an OU.
3. The pipeline had conveyed liquid waste to a 200-PW-1, 200-PW-3, 200-PW-6, or 200-CW-5 waste site for disposal.
4. Segments of pipelines that are still in active use are excluded from the 200-PW-1, 200-PW-3, 200-PW-6 OU, and 200-CW-5 remedial alternative decision.
5. Systems and equipment regulated under *the Resource Conservation and Recovery Act of 1976* (RCRA) are excluded from the 200-PW-1, 200-PW-3, 200-PW-6 OU, and 200-CW-5 remedial alternative decision.
6. Geographic logistics (i.e., overlapping pipelines) will be considered on a pipeline-specific basis, which may alter the selection.

Pipelines within the footprint of the remedial action for an individual waste site would be remedied according to the decisions in the respective feasibility study (FS) for each OU waste site, and therefore are not included in this evaluation.

For a brief history of the waste sites, refer to Chapter 1.0 of DOE/RL-2007-27 for 200-PW-1, 200-PW-3, and 200-PW-6 OUs, and Chapter 1.0 of DOE/RL-2004-24, *Feasibility Study for the 200-CW-5 (U Pond/Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units*, for 200-CW-5.

The waste site pipelines of interest were investigated using a variety of research tools including Arc Geographic Information System (ArcGIS), WIDS, Query Map (Qmap), and the Integrated Document Management System (IDMS). These tools provided limited histories of each pipeline and waste site as well as historical engineering drawings. The researched documents were compared and verified amongst themselves for engineering and historical consistency. The documents were not field-verified. One unplanned release (UPR) has been identified for these pipelines. No information is available regarding any additional pipeline leaks.

H1.1 Purpose

The purpose of this assessment is to develop and evaluate alternatives for remediation of the pipelines connected to waste sites in the 200-PW-1, 200-PW-3, 200-PW-6, and 200-CW-5 OUs. Because some of the pipelines in whole or part are already addressed in the 200-IS-1 OU, this document identifies which pipelines will be remediated under the decision for these OUs, and provides remedial alternatives with analysis, as appropriate. The format of the waste site FS (DOE/RL-2007-27, Rev. 0) is followed to maintain consistency. The pipelines are categorized under the following waste types:

- High-Salt Pipeline(s): 200-W-174-PL, 200-W-206-PL
- Low-Salt Pipeline(s): 200-W-205-PL, 200-W-208-PL, 200-W-210-PL, and 200-W-220-PL
- Z-Ditch Pipeline(s): 200-W-207-PL

H1.2 Scope

This assessment evaluated existing information and data for the pipelines associated with the 200-PW-1, 200-PW-3, 200-PW-6, and 200-CW-5 OU waste sites. The scope includes all or portions of the following pipelines: 200-W-174-PL, 200-W-205-PL, 200-W-206-PL, 200-W-207-PL, 200-W-208-PL, 200-W-210-PL, and 200-W-220-PL. Specifically, each pipeline's boundary is described in detail in Chapter 2. The scope involves waste piping and the surrounding soil deemed necessary to evaluate in order to meet remediation goals. In some cases, the remediation activity may need to terminate at a particular junction—building wall/slab, diversion box, or tank. The ancillary equipment may not be included in the pipeline scope, and is described as follows.

The scope does not include tanks, vessels, valve pits, diversion boxes, French drains, and/or equipment that are RCRA-regulated units. Nor does it evaluate pipelines associated with water, utilities, inert gases, sanitary sewers, sanitary water, stormwater, aboveground pipelines, or active pipelines. Some pipelines will be addressed in the 200-IS-1 OU and are not included in this remedial evaluation. These pipelines include the following:

- Pipelines associated with 200-PW-3 including 200-E-164-PL, 200-E-165-PL, 200-E-182-PL, 200-E-183-PL, and 200-E-186-PL
- Pipeline 200-W-204-PL to 216-Z-10
- Pipelines 200-W-202-PL to 216-Z-5
- Pipeline 200-W-209-PL

The one known UPR (UPR-200-W-103) has been documented. This release is associated with the 200-W-174-PL pipeline and the remediation of this release is being addressed under the 200-MG-2 OU.

In order to properly assess the pipelines, the following assumptions were made:

- Pipelines were installed per historical record drawings, unless noted otherwise.
- Pipelines are intact and are not currently leaking at fittings (joints, welds, elbows, and/or valves) or anywhere else along the pipeline.
- Pipelines were properly cleaned and flushed per operational history and, therefore, do not contain significant inventories of liquid or sludge that would cause plugging.
- Pipelines are assumed to have little or no residual volume and transuranic (TRU) waste is not anticipated to be present (less than 100 nCi/g).

H1.2.1 Document Content and Relationship to 200-PW-1, 200-PW-3, 200-PW-6 Operable Unit Feasibility Study, and 200-CW-5 Operable Unit Feasibility Study

Historically, the pipelines were constructed in conjunction with and for the purposes of conveying the same materials that were disposed in the OU waste sites. Therefore, much of the background information (i.e., physical setting, land use) associated with these pipelines has already been discussed in the applicable FS for each OU and will not be repeated in this assessment. Table H1-1 provides a cross-walk showing the location in the OU FS where the particular FS component can be found.

Table H1-1. Crosswalk for Feasibility Study Components in 200-PW-1, 200-PW-3, 200-PW-6 Operable Unit, and 200-CW-5 Operable Unit

Feasibility Study Component	200-PW-1, 200-PW-3, and 200-PW-6 OU Locations (DOE/RL-2007-27)	200-CW-5 Location (DOE/RL-2004-24)
Physical Setting	Section 2.1	Section 2.2
Natural Resources	Section 2.3	Section 2.3
Plutonium Fate and Transport	Section 2.5	N/A
Land Use	Section 3.1	Section 3.1
Baseline Risk Assessment	Section 3.2	Section 3.2
Contaminants of Concern	Section 3.5	Section 3.3
ARARs	Section 3.6	Section 3.4
Remedial Action Objectives	Section 3.7	Section 3.6
Preliminary Remediation Goals	Section 3.8	Section 3.7

Notes:

ARARs = applicable or relevant and appropriate requirements

N/A = Not applicable

DOE/RL-2004-24, *Feasibility Study for the 200-CW-5 (U Pond/Z Ditches Cooling Water Waste Group), 200-CW-2 (S Pond and Ditches Cooling Water Waste Group), 200-CW-4 (T Pond and Ditches Cooling Water Waste Group), and 200-SC-1 (Steam Condensate Waste Group) Operable Units.*

This appendix contains the following chapters:

- Chapter H1 Introduction: Introduces OU scope, purpose, assumptions, and document content.
- Chapter H2 Pipeline Background and Description: Discusses the pipeline locations, description, and access issues.
- Chapter H3 Identification and Screening of Remedial Technologies: Discusses general response actions, and technologies.
- Chapter H4 Remedial Action Alternatives: Develops and describes the remedial technology.
- Chapter H5 Detailed Analysis of Alternatives: Describes evaluation criteria, and analyzes each of the alternatives in detail.
- Chapter H6 Comparative Analysis of Alternatives: Compares the alternatives per the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA) evaluation criteria.
- Chapter H7 Uncertainties Related to Decision-making: Discusses uncertainties and their potential impacts.
- Chapter H8 References: Summarizes the reference documents.

H2 200-PW-1, 200-PW-6, and 200-CW-5 Pipeline Descriptions and Considerations

This section describes each waste pipeline associated with the 200-PW-1, 200-PW-6, and 200-CW-5 OUs. In general, most of the 200-PW-1, 200-PW-6, and 200-CW-5 pipelines are buried underground, except where a pipeline may enter a building or building slab. The proximity of the pipelines to one another and to other waste sites is depicted in Figure H2-1 (at the end of Appendix H). All piping is considered unpressurized and flows downhill towards the waste sites—typical of gravity drains with slopes between one-half to 3 percent. The piping usually consists of a mix-match of the following materials: carbon steel (CS), stainless steel (SS), and vitrified clay pipe (VCP, or VC).

H2.1 Pipeline Descriptions

Descriptions of each pipeline are presented in the following subsections. For ease of review, the pipelines have been grouped according to the materials conveyed by each pipeline: High-Salt waste, Low-Salt waste, or the cooling water and steam condensate discharged to the Z-Ditches. The groups consist of the following:

- High-Salt – in general, this acidic aqueous waste was a concentrated nitrate solution containing dissolved metal (aluminum, calcium, sodium, and magnesium) nitrates, plutonium, and other TRU elements. At times, significant volumes of organics (principally carbon tetrachloride, tributyl phosphate [TBP], and lard oil), both entrained in the aqueous phase waste streams and as separate, nonaqueous phase waste streams were conveyed in the same pipeline with the High-Salt waste stream.
- Low-Salt – this waste stream included neutral to basic aqueous materials that contained plutonium and americium, with negligible amounts of organics and no nonaqueous phase liquids. This aqueous waste was primarily a dilute sodium fluoride and sodium nitrate solution when discharged.
- Cooling Water/Steam Condensate (Z-Ditches) – this aqueous waste stream typically consisted of process cooling water and steam condensate water from PFP processes, but known to show similarities in characterization to the Low-Salt materials. The Z-Ditches are associated with the 200-CW-5 OU. However, they are included as part of the FS for 200-PW-1/3/6 because there is only one pipeline (200-W-207-PL) of concern that is connected to 216-Z-19. Since 200-CW-5 OU is being combined with the 200-PW-1/3/6 in the Proposed Plan and the record of decision (ROD), it is more efficient to evaluate that Z-ditch pipeline along with the other 200-PW-1/3/6 pipelines.

In addition, each pipeline discussion has an assessment of the aboveground and underground features that may present unique challenges during remedial action implementation.

H2.1.1 High-Salt Pipelines

The High-Salt pipelines (200-W-174-PL and 200-W-206-PL) are presented in this section.

Pipeline 200-W-174-PL: This pipeline connects to the 200-PW-1 OU waste site 216-Z-18 Crib and 216-Z-1A Tile Field. Figure H2-2 shows this pipeline and associated waste units. Pipeline 200-W-174-PL consists of two parallel pipelines designated 1035 and 1036. Pipeline 200-W-174-PL begins as two 5 cm (2 in.) diameter SS pipelines (1035 and 1036) that run underground heading south from the south wall of Building 234-5Z near Building 2727-Z, and underneath the 241-ZB Structure. The pipeline continues bypassing the 241-Z-361 Settling Tank, 216-Z-1&2, and 216-Z-3 Cribs into the 216-Z-1A Tile Field area where it turns and heads southwest. The pipelines then merge and enlarge to an 8 cm (3 in.) diameter

common SS header. The combined single 8 cm (3 in.) pipeline runs the length of the 216-Z-18 pipeline and separates into several discharge headers.

The 216-Z-1A Tile Field was once fed by pipelines 200-W-174-PL (1035) and 200-W-174-PL (1036). Pipeline 200-W-174-PL (1036) extends into the 216-Z-1A Crib area where it terminates inside a 20 cm (8 in.) VCP line. Pipeline 200-W-174-PL remediation scope consists of the same piping as described previously, including the portion running back to its point of origin in the 234-5Z Building, with the exception of the section of piping that exists within the waste site boundaries. Most of this pipeline consists of two parallel pipes of SS. Pipeline 200-W-174 (1036) that connects to the 234-5Z Building, with the exception of the section of piping that exists within the waste site boundaries. Most of this pipeline consists of two parallel pipes of SS.

The 200-W-174-PL consists of two segments, each having a different depth and slope. The pipeline 200-W-174-PL (1036) that connects to the 216-Z-1A Tile Field appears to be a maximum 2.6 m (8.5 ft) below surface with a slope between 0.57 to 2.0 percent. The pipeline 200-W-174-PL (1035) that connects to the 216-Z-18 Crib appears to be a maximum 4.6m (15 ft) below surface with a slope between 0.5 to 2 percent.

Aboveground access to this pipeline may be restricted by fences, roads, and buildings. Belowground access to this pipeline may be restricted by electrical utilities, RCRA pipelines, and sanitary water pipelines.

Pipeline 200-W-174-PL has the following aboveground restrictions/obstructions listed in order, starting at the 234-5Z Building and ending at the 216-Z-1A Tile Field and the 216-Z-18 Crib:

- The pipeline crosses underneath Cispus Loop Road and another unnamed service road near the 216-Z-18 Crib.
- The pipeline runs underground alongside the 2727-Z Building, the 243-ZB Structure, and the 243-ZA Structure.
- The pipeline runs underneath the 241-ZB Structure.
- The pipeline runs underground near the 241-Z Building's asphalt walkway and tank vault.
- Security fences are located near each of the destination 216-Z-18 Crib and 216-Z-1A Tile Field.

Pipeline 200-W-174-PL has the following belowground restrictions/obstructions listed in order, starting at the 234-5Z Building and ending at the 216-Z-1A Tile Field and the 216-Z-18 Crib:

- The pipeline runs near electrical power lines near the south side of the 234-5Z Building.
- The pipeline crosses a sanitary water pipeline after crossing Cispus Loop Road.
- The pipeline crosses RCRA Pipeline 200-W-178-PL. It is unclear whether the pipeline runs over or under RCRA Pipeline 200-W-178-PL.
- No known waste units are associated with the 241-Z Building and structures (UPR-200-74, UPR-200-W-75, and UPR-200-W-79).
- The pipeline runs near the 241-Z-361 Settling Tank and 200-W-58 Z-Plant Diversion Box No. 1.
- The pipeline crosses the 200-W-208-PL pipeline and then the 200-W-207-PL pipeline before entering the 216-Z-1A Tile Field. It continues on, crossing under another unnamed service road, and enters into the 216-Z-18 Crib.

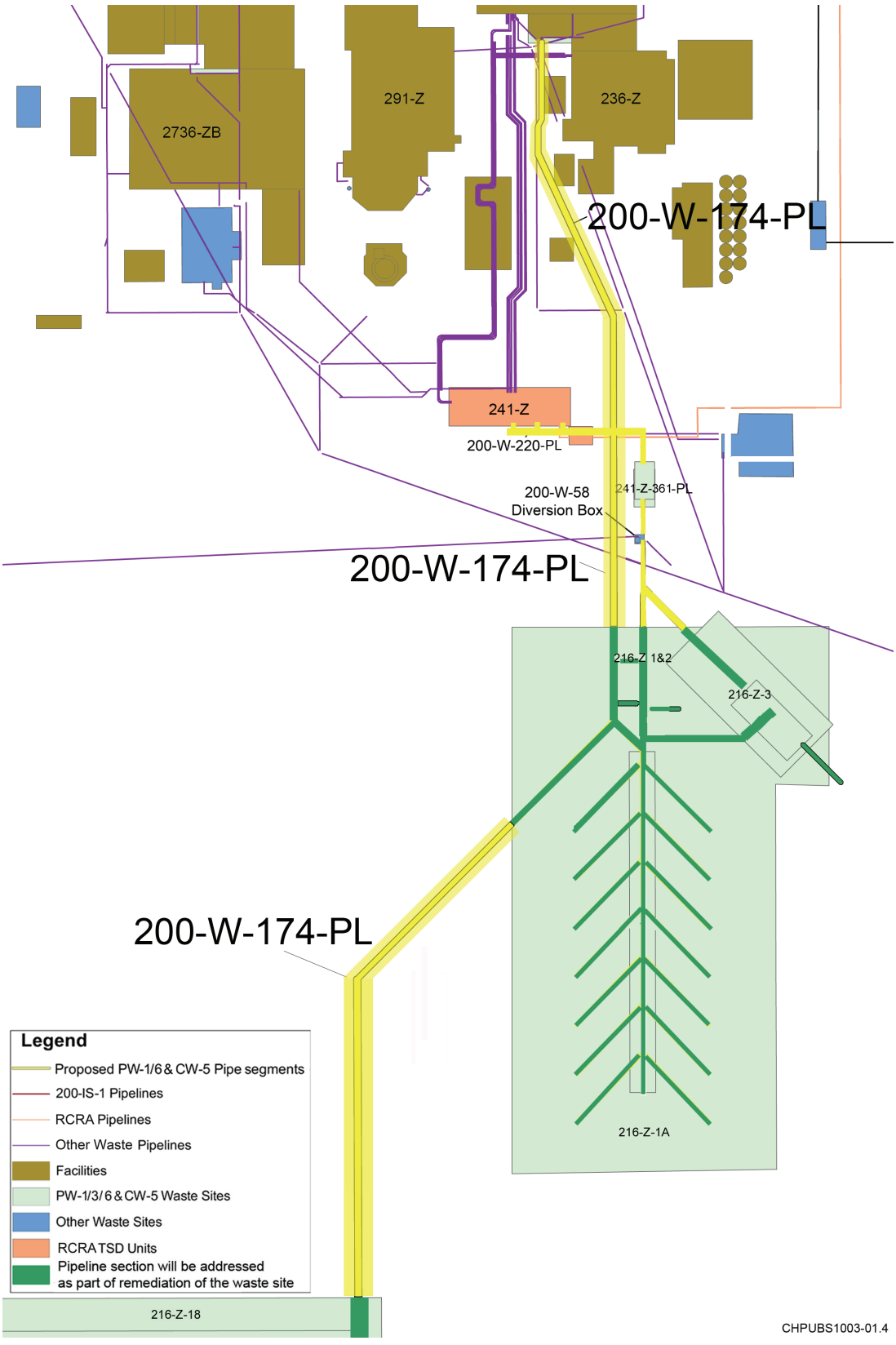

Figure H2-2. Pipeline 200-W-174-PL

Pipeline 200-W-206-PL: This pipeline connects to the 200-PW-1 OU waste site 216-Z-9 Crib. Figure H2-3 shows this pipeline and associated waste units. The 200-W-206-PL pipeline consists of two 3.8 cm (1.5 in.) diameter SS pipelines that run underground heading east from the east wall of Building 234-5Z and underneath Building 2725-Z to 216-Z-9 Crib. The lines run in the same soil trench as the 200-W-205-PL pipeline lines for the first 61 m (200 ft) before diverging. The remediation scope of the 200-W-206-PL pipeline would include the piping described previously, except the piping within the 216-Z-9 Crib back to its point of origin at the Building 234-5Z wall. The pipeline consists of two parallel SS pipes. The section of the pipeline 200-W-206-PL that connects to the 216-Z-9 Crib appears to be a maximum 1.8 m (6 ft) below surface with a slope between 1 to 2 percent.

Aboveground access to this pipeline may be restricted by fences, roads, and buildings. Belowground access to this pipeline may be restricted by electrical utilities, RCRA pipelines, sanitary water pipelines, and sewer pipelines.

Pipeline 200-W-206-PL pipeline has the following aboveground restrictions/obstructions listed in order, starting at the 234-5Z Building and ending at the 216-Z-9 Crib:

- The pipeline runs underneath Building 234-5ZA (east of Building 234-5Z) and near Storage Building 2725-Z.
- The pipeline crosses underneath Cispus Loop Road.
- Security fences are located near the destination 216-Z-9 Crib.

Pipeline 200-W-206-PL has the following belowground restrictions/obstructions listed in order, starting at the 234-5Z Building and ending at the 216-Z-9 Crib:

- The pipeline runs near electrical power lines near the east side of Building 234-5Z.
- The pipeline crosses sanitary water pipeline near the east side of Building 234-5Z.
- The pipeline crosses sewer water pipeline just east of Cispus Loop Road.
- The pipeline crosses RCRA Pipeline 200-W-178-PL.
- The pipeline crosses a sanitary water pipeline for a second time before making its way near and passing by the 241-Z-8 Settling Tank and then the 216-Z-8 French Drain.
- The pipeline crosses pipeline 200-W-125-PL.
- The pipeline crosses the 216-Z-1D Ditch.
- The pipeline runs in parallel with the 200-W-205-PL pipeline up to the 241-Z-8 Settling Tank.

H2.1.2 Low-Salt Pipelines

The Low-Salt pipelines (200-W-205-PL, 200-W-208-PL, 200-W-210-PL, and 200-W-220-PL) are discussed as follows.

Pipeline 200-W-205-PL: This pipeline connects to the 200-PW-6 OU waste site's 241-Z-8 Settling Tank and 216-Z-8 French Drain. Figure H2-3 shows this pipeline and associated waste units. The 200-W-205-PL pipeline consists of two parts. One is the inlet to the 241-Z-8 Settling Tank; the other is the outlet of the 241-Z-8 Settling Tank that discharges to the 216-Z-8 French Drain. The first part is two 3.8 cm (1.5 in.) diameter SS pipelines heading east from the east wall of Building 234-5Z underneath

Building 2725-Z to the 241-Z-8 Settling Tank (inlet). The second part is a 10 cm (4 in.) diameter CS pipeline that runs between the overflow of the 241-Z-8 Settling Tank and the 216-Z-8 French Drain. The lines run in the same soil trench as the 200-W-206-PL pipelines for the first 61 m (200 ft) before diverging. The remediation scope of the 200-W-205-PL pipeline would be the piping described previously back to the point of origin at the Building wall. The pipeline consists of two parallel SS pipes. The section of pipeline 200-W-205-PL that connects to the 241-Z-8 Settling Tank and the 216-Z-8 French Drain appears to be a maximum of 1.8 m (6 ft) below surface with a slope between 1 to 2 percent.

Aboveground access to this pipeline may be restricted by fences, roads, and buildings. Belowground access to this pipeline may be restricted by electrical utilities, RCRA pipelines, sanitary water pipelines, and sewer pipelines.

Pipeline 200-W-205-PL has the following aboveground restrictions/obstructions listed in order, starting at the 234-5Z Building and ending at the 216-Z-8 French Drain:

- The pipeline runs underneath Building 234-5ZA (east of Building 234-5Z) and near Storage Building 2725-Z.
- The pipeline crosses underneath Cispus Loop Road.
- Security fences are located near the destination 241-Z-8 Settling Tank and the 216-Z-8 French Drain.

Pipeline 200-W-205-PL has the following belowground restrictions/obstructions listed in order, starting at the 234-5Z Building and ending at the 241-Z-8 French Drain:

- The pipeline runs near electrical power lines near the east side of Building 234-5Z.
- The pipeline crosses the sanitary water pipeline near the east side of Building 234-5Z.
- The pipeline crosses the sewer water pipeline just east of Cispus Loop Road.
- The pipeline crosses RCRA pipeline 200-W-178-PL.
- The pipeline crosses a sanitary water pipeline for a second time before making its way to the 241-Z-8 Settling Tank and then the 216-Z-8 French Drain.
- The pipeline runs parallel with the 200-W-206-PL pipeline for the full extent of the run.

Pipeline 200-W-208-PL: This pipeline connects to the 200-PW-1 OU waste site 216-Z-12 Crib. Figure H2-4 shows this pipeline and associated waste units. This pipeline is discussed as part of the 200-IS-1 OU. This pipeline will be remediated to the isolation valve inside the 200-W-59 (Diversion Box No. 2), and the remainder of the pipeline will be handled through the 200-IS-1 OU. Pipeline 200-W-208-PL is a 15 cm (6 in.) SS pipeline that originates at the 200-W-58 (Diversion Box No. 1) and connects to 200-W-59 (Diversion Box No. 2). It transitions to a 30 cm (12 in.) VCP pipeline at the 216-Z-12 Crib. Both diversion boxes should be addressed with the 200-IS-1 OU. Inside of 200-W-59 (Diversion Box No. 2), 200-W-208-PL splits into two segments to feed the 216-Z-12 Crib. The original segment comes in at the north end of the crib and the other segment bypasses the north side of the crib and extends to just short of half the distance of the west side of the crib. The original segment transitions from 15 cm (6 in.) SS to 30 cm (12 in.) VCP at the 200-W-59 (Diversion Box No. 2). The bypass section, which was installed to resolve plugging, transitions from 15 cm (6 in.) SS to 30 cm (12 in.) VCP inside the crib. The remediation of the 200-W-208-PL pipeline would include a segment of the piping described

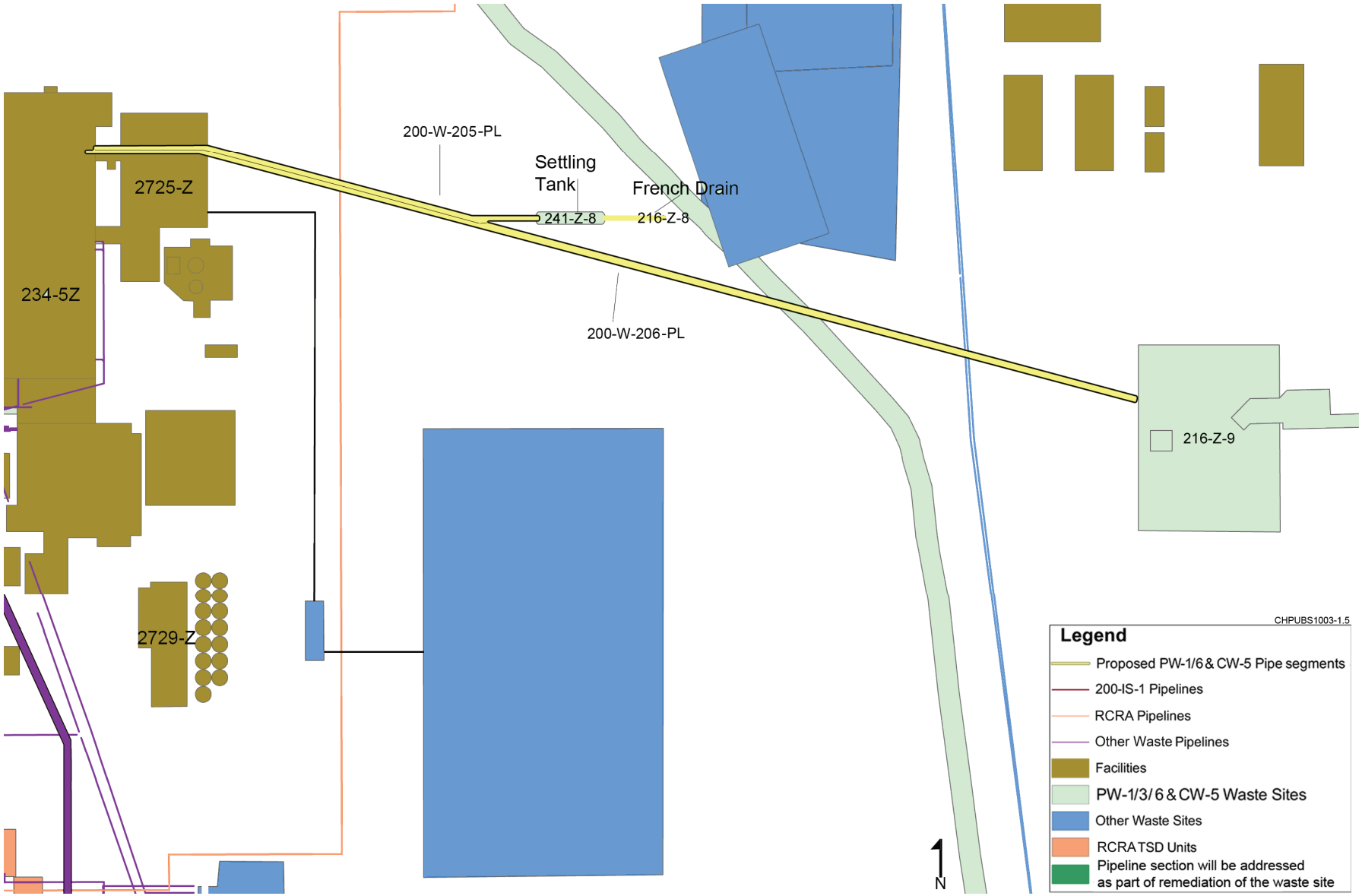

Figure H2-3. Pipeline 200-W-205-PL and 200-W-206-PL

previously. Piping within the footprint of the remedy selected for the 216-Z-12 Crib would be addressed as part of the remedy for the crib. The pipe will be remediated between the 216-Z-12 Crib and the 200-W-59 (Diversion Box No. 2) up to the isolation valves inside 200-W-59 (Diversion Box No. 2). The pipeline consists of one SS pipe. Pipeline 200-W-208-PL that connects to the 216-Z-12 Crib appears to be a maximum of 4.6 m (15 ft) below surface with unknown slope. Aboveground access to this pipeline may be restricted by fences. Belowground access to this pipeline is not restricted.

Pipeline 200-W-208-PL has the following aboveground restrictions/obstructions listed in order, starting at the 200-W-59 Z-Plant Diversion Box No. 2 and ending at the 216-Z-12 Crib:

- Security fences are located near the destination 216-Z-12 Crib.

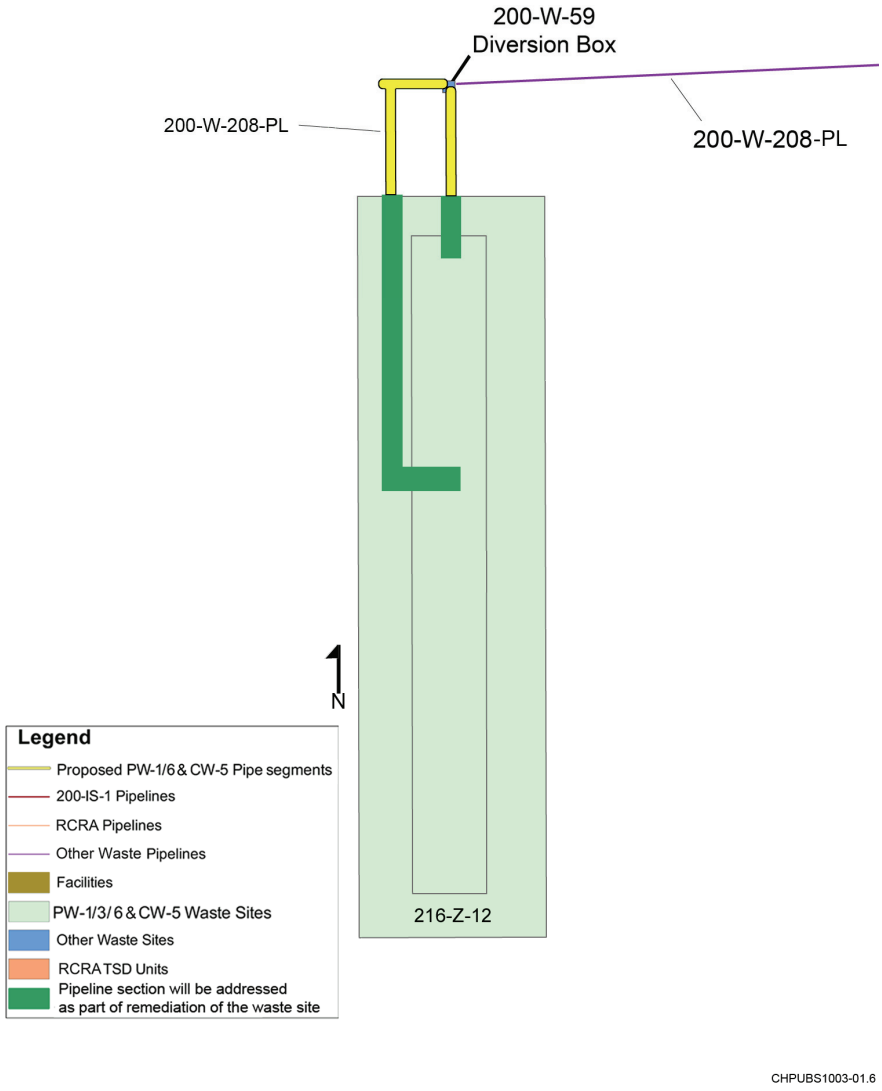

Figure H2-4. Pipeline 200-W-208-PL

Pipeline 200-W-210-PL: This pipeline connects to the 200-PW-1 OU waste sites 216-Z-1&2, and 216-Z-3 Cribs, and the 216-Z-1A Tile Field. Figure H2-5 shows this pipeline and associated waste units. This pipeline is discussed as part of the 200-IS-1 OU. This pipeline feeds the 216-Z-1&2, and 216-Z-3 Cribs, and 216-Z-1A Tile Field by way of the 241-Z-361 Settling Tank, and through the 200-W-58 Diversion box (Diversion Box No. 1). Pipeline 200-W-210-PL is a 20 cm (8 in.) diameter SS pipeline that originates at the 241-Z-361 Settling Tank and splits to the 216-Z-1&2 Cribs , and then to the 216-Z-3 Crib. For each crib, the line transitions to a 20 cm (8 in.) VCP pipeline. A second 20 cm (8 in.) VCP line exits the 216-Z-3 Crib and overflows to the 216-Z-1A Tile Field.

Given the proximity to the 216-Z-1A site and the 241-Z-361 Settling Tank, the section of the 200-W-210-PL pipeline from the cribs to 200-W-58 (Diversion Box No. 1) is included. Care should be taken when in proximity to the 200-W-207-PL pipeline, as it is active and is part of the Treated Effluent Disposal Facility (TEDF) system. From the data available in the PFP subgrade Engineering Evaluation/Cost Analysis (EE/CA) (HNF-30862, *Engineering Evaluation/Cost Analysis for the Plutonium Finishing Plant Sub-Grade Structures and Installations*) it appears as if the 200-W-210-PL pipeline is below the 200-W-207-PL pipeline. The remediation of pipeline 200-W-206-PL would include the piping described previously, except piping within the 216-Z-1&2, and 216-Z-3 Cribs, and 216-Z-1A Tile Field, back to its point of origin at the 241-Z-361 Settling Tank. The pipeline consists of several pipe segments of SS and VCP. Pipeline 200-W-210-PL to the 216-Z-1&2, and 216-Z-3 cribs and 216-Z-1A Tile Field appears to be between 6.75 and 3 m (22 and 10 ft) below surface with unknown slope.

Aboveground access to this pipeline may be restricted by fences. Belowground access to this pipeline may be restricted by process pipelines in the vicinity, particularly the active portion of pipeline 200-W-207-PL.

Pipeline 200-W-210-PL has the following aboveground restrictions/obstructions listed in order, starting at the 241-Z-361 Settling Tank and ending at the 200-W-210-PL to 216-Z-1&2, and 216-Z-3 Cribs, and the 216-Z-1A Tile Field:

- Security fences are located near the destination 200-W-210-PL to 216-Z-1&2, and 216-Z-3 Cribs, and 216-Z-1A Tile Field.

Pipeline 200-W-210-PL has the following belowground restrictions/obstructions listed in order, starting at the 241-Z-361 Settling Tank and ending at the 200-W-210-PL to 216-Z-1&2, and 216-Z-3 Cribs, and the 216-Z-1A Tile Field:

- The pipeline begins and runs near the 241-Z-361 Settling Tank.
- The pipeline runs through the 200-W-58 (Diversion Box No. 1).
- The pipeline crosses the active portion of Pipeline 200-W-207-PL. It is unclear whether the pipeline runs over or under pipeline 200-W-207-PL.

Pipeline 200-W-220-PL: This pipeline connects to the 200-PW-1 OU waste site 241-Z-361 Settling Tank. Figure H2-5 shows this pipeline and associated waste units. 200-W-220-PL is a 15 cm (6 in.) diameter SS pipeline that originates at the 241-Z Building as three outlets that are connected with a manifold and run to the 241-Z-361 Settling Tank. Care should be taken when in proximity to the 200-W-178-PL pipeline, as it is an inactive RCRA pipeline. Remediation of 200-W-220-PL would include piping described previously, starting at the 241-Z-361 Settling Tank, back to its point of origin at the 241-Z Building. The pipeline consists of several SS pipe segments. Pipeline 200-W-220-PL to the 241-Z-361 Settling Tank appears to be between 2.06 and 3 m (6.75 and 10 ft) below surface with unknown slope.

Aboveground access to this pipeline may be restricted by fences. Belowground access to this pipeline may be restricted by process pipelines in vicinity, particularly the inactive portion of RCRA-regulated pipeline 200-W-178-PL.

Pipeline 200-W-220-PL has the following aboveground restrictions/obstructions listed in order, starting at the 241-Z Building and ending at the 241-Z-361 Settling Tank:

- Security fences are located near Building 241-Z.

Pipeline runs underground near the 241-Z Building's asphalt walkway and tank vault.

Pipeline 200-W-220-PL has the following belowground restrictions/obstructions listed in order, starting at the 241-Z Building and ending at the 241-Z-361 Settling Tank:

- The pipeline starts and runs near Building 241-Z.
- The pipeline runs near and parallel to the inactive RCRA-regulated pipeline 200-W-178-PL.

The pipeline ends and runs near the 241-Z-361 Settling Tank.

H2.1.3 Z-Ditch Pipeline

The Z-Ditch pipeline 200-W-207-PL, which is associated with 200-CW-5 OU, is discussed below.

Pipeline 200-W-207-PL: This pipeline connects to the 200-CW-5 OU waste sites 216-Z-1D, 216-Z-11, 216-Z-19, and 216-Z-20 Ditches (Z-Ditch system). Figure H2-6 shows this pipeline and associated waste units. The Z-Ditch system was fed by two pipelines: 200-W-207-PL and 200-W-125-PL. The 200-W-125-PL pipeline should be addressed by the 200-IS-1 OU.

Pipeline 200-W-207-PL is still an active piece of the TEDF system. It is connected to the 600-291 drainline to the TEDF. The active portion is not considered for remediation. The portion of 200-W-207-PL considered in this location is the downstream, inactive, capped portion of the junction at the 600-291 pipeline in the C-1 manhole. From this point, the 200-W-207-PL is a 38 cm (15 in.) diameter VCP that runs underground and splits amongst the 216-Z-1D, 216-Z-11, 216-Z-19, and 216-Z-20 ditches. The remediation scope of the 200-W-207-PL would be all the piping downstream of the manhole to the waste site boundaries. The pipeline consists of one VCP pipe. Pipeline 200-W-207-PL to the Z-Ditch system appears to be 1.5 m (5 ft) below surface with a slope between 2 to 3 percent.

Aboveground access to this pipeline may be restricted by fences and roads. Belowground access to this pipeline may be restricted by process pipelines in the vicinity.

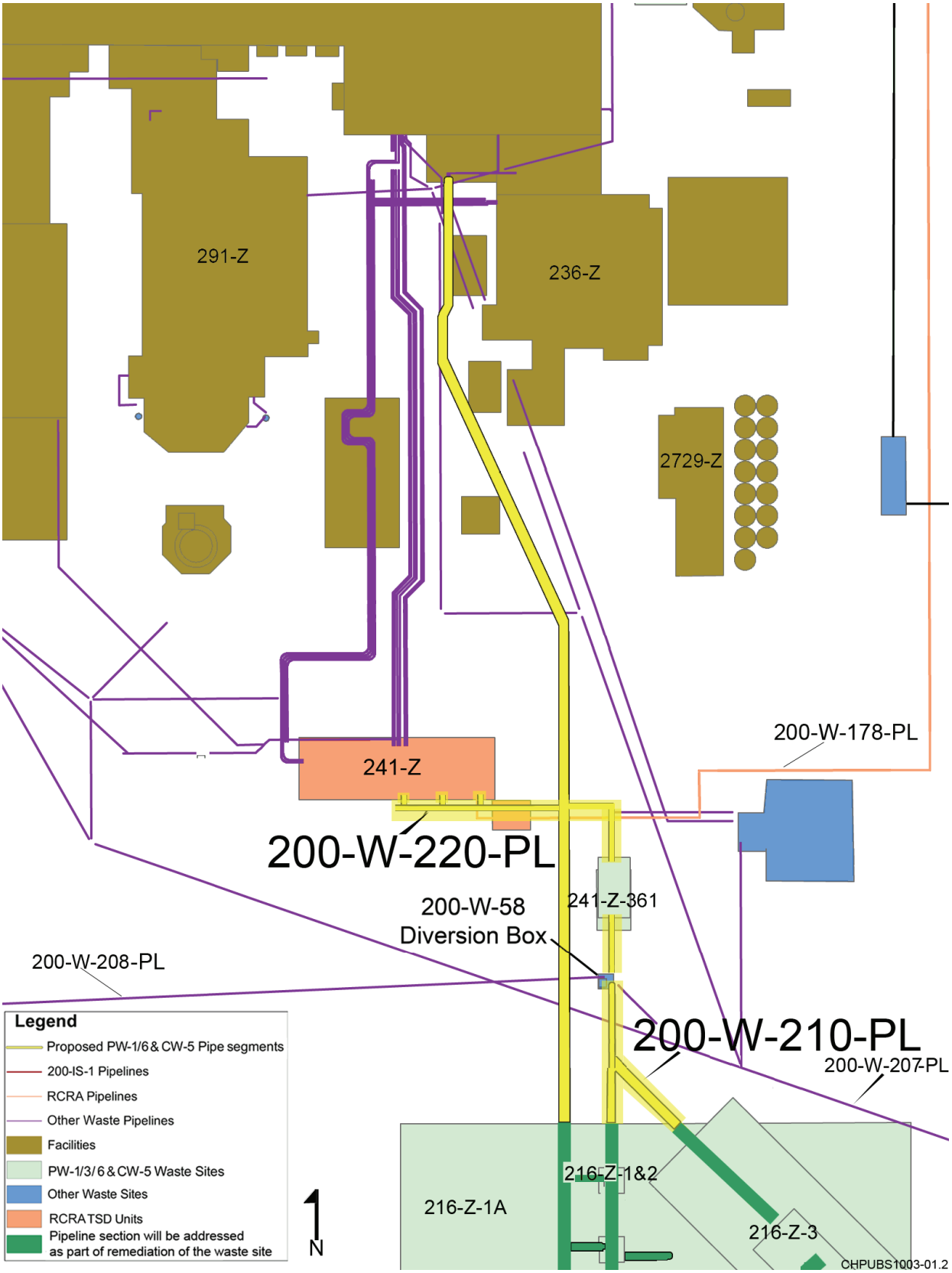

Figure H2-5. Pipeline 200-W-210 and 200-W-220-PL

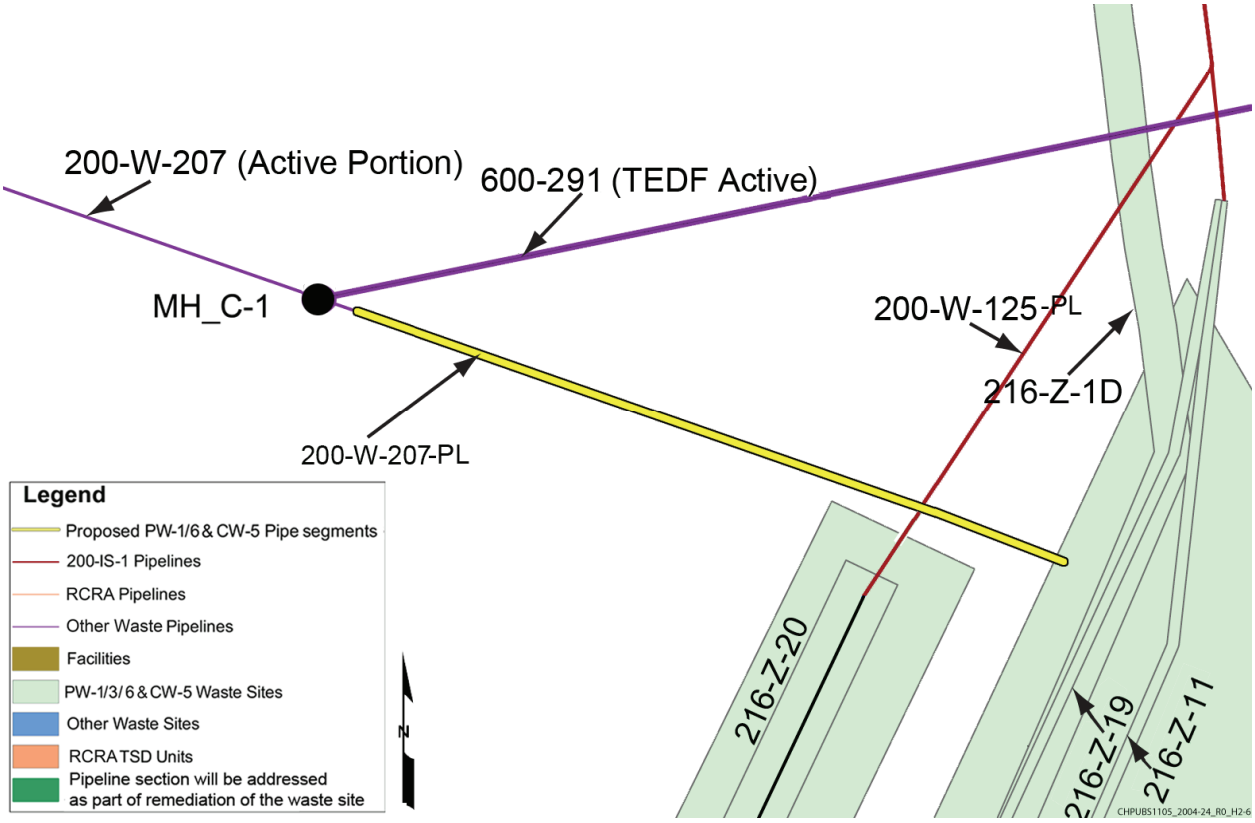

Figure H2-6. Pipeline 200-W-207-PL

Pipeline 200-W-207-PL has the following aboveground restrictions/obstructions listed in order, starting near the C-1 manhole and ending at the 216-Z-1D, 216-Z-11, 216-Z-19, and 216-Z-20 ditches:

- The pipeline begins and runs near the C-1 manhole and associated active TEDF pipeline 600-291.

Pipeline 200-W-207-PL has the following belowground restrictions/obstructions listed in order, starting near the C-1 manhole and ending at the 216-Z-1D, 216-Z-11, 216-Z-19, and 216-Z-20 ditches:

- The pipeline crosses pipeline 200-W-125-PL.

Table H2-1 summarizes the pipelines and the length, diameter, and material composition of each pipeline.

H2.2 Human and Ecological Risk Consideration

The 200-PW-1, 200-PW-6, and 200-CW-5 OU pipelines contain radioactive isotopes, heavy metals, and regulated organic compounds. The human health and ecological risks associated with the 200-PW-1, 200-PW-6, and 200-CW-5 OU pipelines have not been quantified in detail. Limited characterization data exist for contaminants remaining inside of the pipes, or for undocumented releases due to leaks. It is important to note that the potential for an undocumented release is greater for the VCP than for SS or CS pipe. For qualitative purposes, it is assumed that each pipeline contains the same contamination species and concentration levels of each of their respective destination waste sites. In general, the primary contaminant of potential concerns (COPCs) and human health risk associated with a release from the 200-PW-1, 200-PW-6, and 200-CW-5 OU pipelines is assumed to be no higher than those of the baseline risk evaluation completed for each pipeline's destination waste site (see crosswalk in Section H1).

Table H2-1. 200-PW-1, 200-PW-6, and 200-CW-5 Operable Unit Remediation Pipelines

Site	Length (ft)	Pipe Diameter/ Material	Reference Documents	Use	Maximum Depth
200-W-174-PL — Parallel pipelines to 216-Z-18 Crib and 216-Z-1A	500 x 2* 430 15	2" SS 3" SS 8" VCP	H-2-16459 Rev. 8 H-2-24923 Rev. 5 H-2-24924 Sh. 1 Rev. 3 H-2-24924 Sh. 2 Rev. 5 H-2-26093 Rev. 5 H-2-27503 Rev. 0 H-2-26094 Rev. 3	PW-1 High-Salt Drain	9 ft 15 ft
200-W-206-PL — Pipeline to 216-Z-9 Crib	690 x 2*	1-1/2" SS	H-2-15492 Rev. 5 H-2-16653 Rev. 7 H-2-31732 Rev. 3 H-2-32528 Rev. 6 H-2-71679 Rev. 1	PW-1 High-Salt Drain	6 ft
200-W-205-PL — Pipeline to 241-Z-8 Tank and 216-Z-8 French Drain	820x2* 4 33	1-1/2" SS 2" CS 4" CS	H-2-15492 Rev. 5 H-2-16653 Rev. 7 H-2-32528 Rev. 6 H-2-71679 Rev. 1	PW-6 Low-Salt Drain	6 ft
200-W-208-PL — Pipeline to 216-Z-12 Crib	115 50	6" SS 12" VCP	H-2-20986, Rev. 6 H-2-20987, Rev. 3	PW-1 Low-Salt Process Sewer	15 ft
200-W-210-PL — Pipeline to 216-Z-1&2, and 216-Z-3 Cribs, and 216-Z-1A Tile Field	36 30 46 72	*2″ SS* *8″ CS* *8″ SS* *8″ VCP*	H-2-32528 Rev. 6 H-2-16459 Rev. 8 H-2-16421 Rev. 21 H-2-24924 Sh. 2 Rev. 5 H-2-12292 Rev. 13 H-2-27503 Rev. 0 H-2-20987 Rev. 3 H-2-24923 Rev. 5	PW-1 Low-Salt Process Sewer	8 ft
200-W-220-PL — Pipeline to 241-Z-361 Settling Tank	143	6" SS	H-2-16419 Rev. 14	PW-1 Low-Salt Process Sewer	10 ft

Table H2-1. 200-PW-1, 200-PW-6, and 200-CW-5 Operable Unit Remediation Pipelines

Site	Length (ft)	Pipe Diameter/ Material	Reference Documents	Use	Maximum Depth
200-W-207-PL — Pipeline to 216-Z-1D, 216-Z-11, 216-Z-19, and 216-Z-20 Ditches (Z-Ditch system)	270	15" VCP	H-2-16421 Rev. 21 H-2-27151 Sh. 1 Rev. 1 H-2-817992 Sh. 1 Rev. 1 H-2-817992 Sh. 2 Rev. 1 M-2904-W Sh. 15 Rev. 4[x] H-2-140336 Rev. 2[u]	CW-5 Z-Ditch System Process Sewer	5 ft

Notes:

*The length represents two pipelines running parallel. For example, 200-W-174-PL is two 154 m (500 ft) stainless steel pipes. These pipelines are analyzed as side-by-side for cost estimate purposes.

H-2-12292, *Waste Effluent Disposal Facilities Plot Plan & Crib Details*, Rev. 13.

H-2-15492, *Architectural Waste Disposal Facility Details*, Rev. 5.

H-2-16419, *Waste Disposal Facilities – Waste Sumps & Storage Tank Pit Arrg't.*, Rev. 14.

H-2-16421, *Underground Services Sewer & Water*, Rev. 21.

H-2-16459, *216-Z-1A Tile Field 216-Z-1&2 Cribs*, Rev. 8.

H-2-16653, *Silica Waste Storage Tank & French Drain 216-Z-8*, Rev. 7.

H-2-20986, *Crib & Test Wells for 234-5 Building Wastes*, Rev. 6.

H-2-20987, *Crib 216-Z-12 Plan, Section & Details*, Rev. 3.

H-2-24923, *216-Z-1A Modifications – Process Waste Disposal Plan*, Rev. 5.

H-2-24924, *Plan & Profile Process Waste Disposal Facility*, Sh. 1, Rev. 3.

H-2-24924, *Plan & Profile Process Waste Disposal to 216-Z-18 Crib*, Sh. 2, Rev. 5.

H-2-26093, *Civil 216-Z-18 Crib Plot Plan & General Notes*, Rev. 5.

H-2-26094, *Civil Profile, Section & Details 216-Z-18 Crib*, Rev. 3.

H-2-27151, 1976, *Composite Drain EFD 232-Z & 291-Z & Outside Routing to 216-Z-19 Outfall*, Sh. 1, Rev. 1.

H-2-27503, *216-Z-1A File Field & Vicinity*, Rev. 0.

H-2-31732, *Civil – Outside Lines Plot Plan Fire-Sanitary Modifications Z-Plant Area*, Rev. 3.

H-2-32528, *"Z" Plant Liquid Waste Disposal Sites 216-Z Series*, Rev. 6.

H-2-71679, *Piping Plans & Elevations 241-Z-8 & 241-Z-361*, Rev. 1.

H-2-140336, *Civil Line C Sta 0-34.22 to Sta 8+52.54*, Rev. 2.

H-2-817992, *Civil PFP Effluent Stream Manhole Locations*, Sh 1, Rev. 1.

H-2-817992, *Civil PFP Effluent Stream MH Upgrades & Pipe Lining*, Sh. 2, Rev. 1.

M-2904-W, Sh. 15, Rev. 4.

Pipeline 200-W-174-PL is buried to a maximum depth of 2.7 m (9 ft) and had one known release (designated UPR-200-W-103) near the PFP Building. This release has been designated as a separate waste site and has been assigned to the 200-MG-2 OU and will be addressed under the decisions for that OU.

Segments of the pipelines do fall within the depth range of mammal burrows and plant roots (DOE/RL-2007-27, Appendix B, "Screening Level Ecological Risk Assessment"). Therefore, ecological risks associated with the pipelines may exist. In considering the subsurface extent of plant roots or animal burrows, it is important to realize that burrow and root density are not continuous from the soil surface to the maximum reported depths; biotic activity decreases with depth. It should be noted that only two segments of the pipelines (see Table H2-1) presented in this assessment reside at a depth below 4.6 m (15 ft).

The *Washington Administrative Code* (WAC) allows for a conditional point of compliance to be set at the terminus of the biologically active zone (WAC-173-340-7490[4][a], "Model Toxics Control Act--Cleanup," "Terrestrial Ecological Evaluation Procedures"). The depths to which insects, animals (burrows), and plants (roots) are likely to occur define the biologically active zone. The working hypothesis is that biological activity is limited largely to the top 3 m (10 ft).

H2.3 Evaluation of Groundwater Protection Consideration

A fate and transport evaluation of all soil contaminants at the waste sites indicated that carbon tetrachloride is the only contaminant that could potentially migrate through the soil beneath the High-Salt waste sites and affect groundwater above the drinking water level within 1,000 years (DOE/RL-2007-27, Appendix E, "Evaluation of Groundwater Protection"). The groundwater protection assessment can be extended to the pipelines, as a result of the shallower depth of the pipelines. Therefore, only carbon tetrachloride at the High-Salt pipelines would have had the potential to affect the groundwater. However, because of limited characterization data for carbon tetrachloride residing outside of the High-Salt pipelines (through a release), a data gap exists that will must be resolved during remedial activities, should previously undocumented releases be identified.

In addition, technetium-99 and nitrate are potential threats to groundwater. Technetium-99 and nitrate were detected in three wells (two at 216-Z-9 and one at 216-A-8) during routine RI sampling. However, there is some uncertainty associated with the data. The analytical results are considered to be spatially biased because the samples were collected from preferential boreholes in more contaminated areas. Therefore, the potential nature and extent of the technetium-99 and nitrate contamination needs to be confirmed. Additional sampling is proposed after the ROD has been issued for these potential non-volatile mobile contaminants.

H3 Identification and Screening of Remedial Technologies

The remedial action technologies for the 200-PW and 200-CW pipelines included in this assessment must be protective of human health and the environment and must not inhibit future implementation of remedial action operations. The potential risks to be addressed in the selection of a remedial action technology are the same as the 200-PW-1, 200-PW-6, and CW-5 OU waste sites. Radioactive and/or nonradioactive hazardous substances are contained in and potentially around the pipelines due to unidentified releases.

H3.1 General Response Actions

The general response actions (GRA) describe those actions that will satisfy the remedial action objectives (RAOs). The RAOs for the 200-PW-1, 200-PW-6, and 200-CW-5 pipelines are the same as the RAOs associated with the waste sites. Refer to the crosswalk in Section 1 of this appendix for the location of further discussion of GRAs and RAOs in each FS.

The three RAOs identified for these pipelines are:

- Prevent or mitigate unacceptable risk to human health and ecological receptors associated with radiological exposure to wastes or soil contaminated above risk-based criteria by removing the source or eliminating the pathway.
- Prevent or mitigate unacceptable risk to human and ecological receptors associated with nonradiological exposure to wastes or soil contaminated above risk-based criteria by removing the source or eliminating the pathway. Control the sources of potential groundwater contamination to support the Central Plateau groundwater goal of restoring and protecting the beneficial uses of groundwater, including protecting the Columbia River from adverse impacts.

The following four GRAs were selected to implement the RAOs:

- No action: baseline GRA required by CERCLA
- Institutional Controls/Monitored Natural Attenuation (IC/MNA): to mitigate risks by prohibiting certain activities, thereby limiting direct contact with contaminants and controlling migration of contaminants while contaminants are allowed to remediate through natural conditions
- Removal of contaminated media, treatment as necessary, and disposal: to mitigate risks by excavating contaminated media, treating it as necessary, and disposing of it in an appropriate onsite or offsite disposal facility
- In situ treatment or stabilization of contaminated media: to mitigate risks by treating contaminated media in place to reduce contaminant toxicity, mobility, or volume

H3.2 Technologies

The GRA and potential implementing technologies were first addressed in the Implementation Plan (DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan-Environmental Restoration Program*). That document provided an initial framework to guide the remedial investigations (RIs) in the 200 Areas and documented a preliminary screening of remedial technologies appropriate to the contaminants, media, and conditions found in the arid environment in the 200 Areas (Appendix D, Sections D5 to D5.6, and Table D-1 of the Implementation Plan).

The PW-1/3/6 and CW-5 OU FSs used these technologies from the Implementation Plan to develop remedial technologies, which focused more specifically on the final contaminants of potential concern (COPCs) and conditions encountered at the 200-PW-1, 200-PW-6, and 200-CW-5 OU waste sites. Because the final COPCs and RAOs are consistent between the waste site and the pipelines, the technologies that were screened in the respective FS reports would apply to the pipelines as well. For this reason, the technology screening will not be performed again. Only potential screening technologies not evaluated in the respective FS documents, will be included in the discussion.

H3.2.1 Screening of Remedial Technologies

The technologies outlined in the respective FS documents were screened based on their effectiveness, implementability, and relative cost, in accordance with CERCLA guidance and will not be repeated in this section. Two remedial options (grout fill and grout injection) were not assessed during the respective FSs. These in situ treatment and stabilization technologies are discussed below as follows.

H3.2.1.1 In Situ Treatment and Stabilization

The in situ technologies of grout filling and grout injection are viable in situ technologies that were not discussed previously, and are outlined as follows.

Grout Fill

Grout fill addresses the pipeline contamination by applying a grout flow through the pipeline with sufficient pressure to force any residual contamination that may be left in the elbows and joints of the pipeline to move through the pipeline and be flushed out of the pipe, stabilized, and disposed accordingly. The grout then hardens inside the pipeline, effectively solidifying any other contamination in the pipeline.

This methodology would entail digging to the depth of the pipeline, cutting the pipeline open at two ends (the length to be determined in the remedial action plan), and adding grout to the pipeline until grout emerges at the other end. Because this process only allows observation of two points along the pipeline, uncertainty exists as to whether or not there might be contamination that was released from the pipeline. Therefore, confirmation soil sampling may need to be accomplished along the length of the unopened pipeline to verify that contaminants have not been released from the pipeline. With filling complete, ICs will be used to prevent access to the pipeline and contaminants. Controls will include site fencing or other physical access restriction, site land use controls, and groundwater use restrictions.

Grout Isolation

Grout isolation plugs the pipeline by only injecting grout at the open ends or discharge points of the pipeline, and where else it is deemed appropriate during remedial design. The plugs prevent entrained waste from exiting the pipe and prevent water and ecology from entering the pipe from the surrounding soil. The methodology would be the same as grouting stabilization, but only grouting the openings as necessary. With plugging complete, ICs will be used to prevent access to the pipeline and contaminants. Controls will include site fencing or other physical access restriction, site land use controls, and groundwater use restrictions.

The retained remedial technologies and associated process options are listed in Table H3-1 and discussed in the following sections.

Table H3-1. Retained Remedial Technologies

General-Response Action	Technology Type	Remediation Technology	Target Contaminants
No Action	No Action	No Action	IMRO
Institutional Controls	Land Use Management	Deed Restrictions	IMRO
		Deed Notices	IMRO
		Declaration of Environmental Restrictions	IMRO
		Information Distribution	IMRO
		Restrictive Covenants	IMRO
		Federal/state/county/local registries	IMRO
		Signs/Fences	IMRO
	Warning Notices and Entry Restrictions	Entry Control	IMRO
	Monitoring	Surveillance/Monitoring	IMRO
Removal	Excavation	Conventional Excavation	IMRO
		Remote Excavation	IMRO
		Soil Vacuum Excavation	IMR
Disposal	Landfill Disposal	Onsite Landfill	IMRO
In Situ Stabilization	Chemical/ Physical Stabilization	Grout Isolation	IMRO
		Grout Fill	IMRO
Attenuation Processes	Natural Attenuation*	Monitored Natural Attenuation	RO

Notes:

*Not a treatment process

I = inorganic, nonmetallic contaminants

M = heavy metal contaminants

R = radionuclide contaminants

O = organic contaminants

H4 Remedial Action Alternatives

The alternatives presented in this chapter were developed by combining the representative process options identified in Chapter H3 into an appropriate range of remedial alternatives that will be more fully analyzed in the detailed analysis in Chapter H5. The development of remedial alternatives followed U.S. Environmental Protection Agency (EPA) guidance (EPA/540/G-89/004, *Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA*, OSWER Directive 9355.3-01) and considered the nature of contamination at each pipeline from Chapter H2 of this appendix.

H4.1 Development of Remedial Alternatives

The purpose of the overall remedy selection process is to identify remedial actions that eliminate, reduce, or control risks to human health and the environment. The pipeline remedial alternatives will be similar to each respective waste site regarding implementability and contamination history. Similar to the waste sites, the range of alternatives will reduce the toxicity, mobility, or volume of the hazardous substances, pollutants, or contaminants. One or more alternatives that involve little or no treatment, but provide protection of human health and the environment primarily by preventing or controlling exposure to hazardous substances, pollutants, or contaminants, through engineering controls, for example, containment, and, as necessary, ICs to protect human health and the environment and to ensure continued effectiveness of the response action. The No Action Alternative, which may be no further action if some removal or remedial action has already occurred at the site and pipeline, shall be developed.

The following sections outline the alternatives developed to satisfy these requirements.

H4.2 Description of Remedial Alternatives

The representative process options identified in Chapter H3 were combined to formulate a range of remedial alternatives to satisfy the RAOs for the 200-PW-1, 200-PW-6, and 200-CW-5 OUs. Preliminary technical and functional requirements for the elements of each alternative are identified based on the RAOs and potential applicable or relevant and appropriate requirements (ARARs), as well as other considerations.

Table H4-1 summarizes the remedial alternatives as well as the GRA, technology type, representative process option, and the area or volume for each option. The remedial alternatives include the following:

- No Action Alternative. The National Contingency Plan (NCP) requires consideration of a No Action Alternative. This alternative would leave a waste site "as-is" in its current state, with no additional remedial activities or access restrictions. This alternative is only acceptable if current waste site conditions are protective of human health and the environment. This alternative is not discussed further in this section; however, the alternative is carried into the detailed analysis (see Chapter H5 of this appendix).
- Alternative One – Removal, Treatment, and Disposal (RTD). For this technology, the action would be to remove the pipelines located outside the footprint of the selected remedy for the associated waste sites. Pipelines within the footprint would be excavated as part of the preferred alternative for the associated waste site. Excavations will be backfilled with clean compacted fill. Sampling to show that the selected (or appropriate) risk-based standards are met will be completed prior to backfilling.

- Alternative Two
  - In Situ Stabilization Grout Fill (ISS Grout Fill). In this technology, a pipeline will be injected with grout effectively removing and stabilizing entrained waste inside the pipe. Filling the void space inside of the pipe with grout would stabilize the pipe—the walls of the pipe would act as a physical barrier. The pipeline would be provided with institutional or administrative control to eliminate its use in the future.
  - In Situ Stabilization Grout Isolation (ISS Grout Isolation). In this technology, a pipeline will be injected with grout and plugged at the inlet and outlet to demobilize and contain the contaminants—the walls of the pipe would act as a physical barrier. The pipeline would be provided with institutional or administrative control to eliminate its use in the future.
  - This alternative may require ICs/MNA as part of the remedy.

Table H4-1. Remedial Alternatives for 200-PW-1, 200-PW-6, and 200-CW-5 Operable Unit Pipelines

Medium	General Response Action	Technology Type	Representative Process Option	Area or Volume	No Action	1 RTD	2 ISS
Soil	Institutional Controls	Land Use Management	Deed Restrictions/ Covenants/Notices	All pipelines with residual contamination above acceptable risk levels		X	X
		Warning Notices and Entry Restrictions	Signs/Fences			X	X
			Entry Control			X	X
		Monitoring	Surveillance/Monitoring			X	X
	Removal	Excavation	Conventional Excavation	Soil above risk levels		X	
	Disposal	Landfill Disposal	Onsite Landfill	All 200-PW-1, 200-PW-6, and 200-CW-5 piping		X	
	ISS	Chemical/ Physical Treatment and Stabilization	Grout Fill/Cap	All 200-PW-1, 200-PW-6, and 200-CW-5 piping			X

The details of these alternatives with regard to representative process options and specific waste sites are described as follows.

H4.2.1 Common Components of Remedial Alternatives

Several common components are included in more than one remedial alternative (see Table H4-1). To limit redundancy, they are discussed in this section and referenced in the discussion of each alternative.

H4.2.1.1 Institutional Controls

The Site-wide ICs plan (DOE/RL-2001-41, *Sitewide Institutional Controls Plan for Hanford CERCLA Response Actions*) identifies the ICs for the current Hanford Site. It also describes how ICs are implemented and maintained, and it serves as a reference for the selection of ICs in the future. ICs work in conjunction with the more active cleanup measures to protect human health and the environment during the cleanup process, as well as following the completion of cleanup for areas containing residual contamination above risk levels. Therefore, existing ICs will continue as long as risks remain that make the site unsuitable for unrestricted use. Institutional controls include the following:

- Administrative controls
  - Maintain the site listings and updates in the 200-PW-1, 200-PW-6, and 200-CW-5 OUs facility and land use plan; update changes or terminations agreed to by the agencies.
  - Provide public notices to stakeholders of changes in ICs.
  - Control the use of groundwater via use restrictions, easements for monitoring, restrictive covenants, or land withdrawal documentation that would be deemed necessary to further protect the public and the environment if land use or ownership changes.
  - Maintain work control process in accordance with the *Code of Federal Regulations* (CFR), 10 CFR 835, "Occupational Radiation Protection," and DOE G 441.1-1BC, 2008, *Radiation Protection Programs Guide for Use with Title 10, Code of Federal Regulations, Part 835, Occupational Radiation Protection*.
  - Restrict and/or control soil disturbances to eliminate the potential spread of contamination.
  - Access restrictions: Post and maintain visible access restrictions.
- Control access
  - Maintain Hanford Site access controls in accordance with DOE O 470.4A, *Safeguards and Security Program*.
  - Maintain restrictions on leasing or transferring property.
  - Maintain notification requirements in response to failed controls/corrective action.

As long as contaminants remain within the 200-PW-1, 200-PW-6, and 200-CW-5 OU pipelines at concentrations that exceed protective risk levels, a 5-year site review is required by the NCP (40 CFR 300.430(f)(4)(ii), "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*. (300.430. "Remedial Investigation/Feasibility Study and Selection of Remedy.") The 5-year reviews will be conducted to evaluate the effectiveness of the existing ICs, to evaluate the need for continued ICs, or to consider a supplemental action.

H4.2.2 Alternative 1–Removal, Treatment, and Disposal

This alternative involves removing pipeline soil, sludge, and/or debris, treating it as necessary to meet ARARs, and disposing of it in an onsite (Environmental Restoration Disposal Facility [ERDF]) disposal facility as appropriate. Refer to the waste site RTD description in the waste site FS.

The pipelines will be removed and disposed of as an extension of the respective waste site. Therefore, the same conventional excavation technologies, methods, and personnel would be used for the pipelines as they would be used for the waste site. Minimum soil volume surrounding each pipeline will be removed and disposed along with the pipe. The actual amount, excavation methods, and details will be developed during remedial design. At this time, 0.6 m (2 ft) of surrounding peripheral soil will be removed along with the pipeline for cost estimate purposes.

Conceptually, the RTD process for this alternative consists of the following five steps:

1. Remove and stockpile clean overburden for use in backfilling.
2. Remove contaminated pipelines and limited amount of soil, and place in waste containers.
3. If evidence of a leak or other release of contamination is identified, a new waste site would be investigated and assigned for possible remedial action under the appropriate geographic based operable unit. Haul waste containers to assay/screening station and then to the ERDF for disposal.
4. Backfill excavation with clean fill and compact.
5. Replant surface with native vegetation.

Each of the 200-PW-1, 200-PW-6, and 200-CW-5 pipelines contains an unspecified amount of waste inventory, or residue entrained inside the pipe. Because all the pipelines potentially contain inventories of plutonium and americium (which emit alpha radiation) special conditions apply when disturbing or handling the pipelines. Special care will be needed when removing the pipelines for further disposal, as entrained liquid could pour out of the pipeline, creating a release scenario to the surrounding soil surface. In addition, the excavation may create dust. Therefore, control of airborne contamination will require engineering controls such as water misting and appropriate personal protective equipment for remedial action workers. For the 200-PW-1, 200-PW-6, and 200-CW-5 pipelines, this assessment assumes the excavation and waste container packaging will be performed per waste site methodology. Figure H4-1 depicts the conceptual configuration of the RTD alternative at the pipelines.

H4.2.3 Alternative 2– In Situ Stabilization

This alternative consists of two potential alternatives: grout capping and grout filling.

H4.2.3.1 Grout Fill/Cap

This option utilizes grout to temporarily reduce the mobility of hazardous substances as a principal element. ISS uses strategically placed grout injection to physically fill the pipe and fill the pipe's void space. Pipelines would be filled with flowable, self-leveling, and self-compacting grout. Radionuclides and other pollutants are immobilized within the pipe. The method would involve filling the entire volume inside the pipe with grout. This operation will pressure flush the pipeline of some contaminant materials, while filling the pipeline void space to stabilize the pipeline. Any material flushed through the pipeline ideally would be observed and collected at the other open pipeline end, assuming the pipeline was not broken. The pipeline would be provided with ICs or administrative controls to eliminate its use in the future.

Institutional controls are also a component of this option at pipelines where the ISS fill process leaves residual contamination at a pipeline that will require long-term controls.

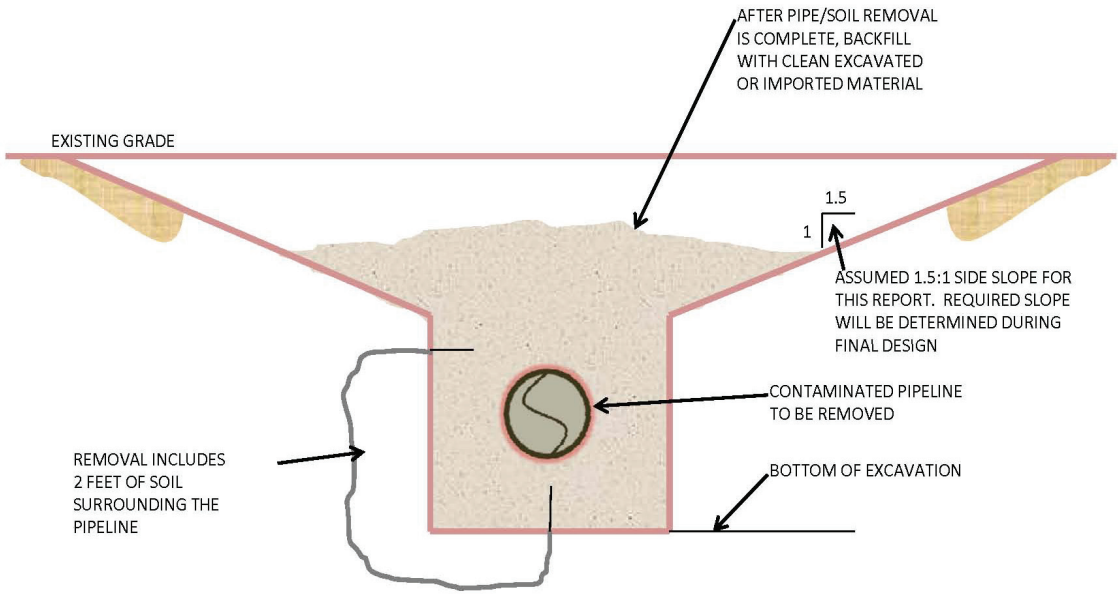

Figure H4-1. Conceptual Design of Alternative 1 - Removal, Treatment, and Disposal

Alternatively, this option utilizes grout plugs to temporarily reduce the mobility of hazardous substances as a principal element. ISS uses strategically placed grout injection to physically cap or plug the pipe at the inlet and outlet of the pipe. Pipelines would be plugged with flowable, self-leveling, and self-compacting grout. Radionuclides and other pollutants are demobilized within the pipe walls. The method would involve exposing each end of a pipeline and pouring non-shrink grout plugs or other appropriate plugs. In this technology, a pipeline will be filled with grout only at the inlet, and discharge where engineered appropriate. This operation will effectively plug or cap the pipelines at each end, trapping and containing entrained liquid residue. The pipeline would be provided with institutional or administrative controls to eliminate its use in the future. Institutional controls are also a component of this option at pipelines where the ISS process leaves residual contamination at a pipeline that will require long-term controls.

Some of the advantages of the ISS alternative include the following:

- The ISS process generates a relatively small volume of regulated waste, very little waste would require offsite disposal because most of the waste would be generated by tools and/or equipment being exposed to the contaminated pipelines and surrounding soil.
- The surrounding soil and ecology would be left undisturbed, except for strategic areas where digging is required to access and inject grout.

A disadvantage of this alternative is that the grout material used to seal the pipeline does not have an infinite lifetime. The grout material will breakdown slowly over time. In addition, the process of flushing the pipeline cannot guarantee a complete mixing/stabilization of the materials that may remain inside the pipeline.

Figure H4-2 depicts the conceptual configuration of the ISS Grout Fill/Isolation alternative at the pipelines.

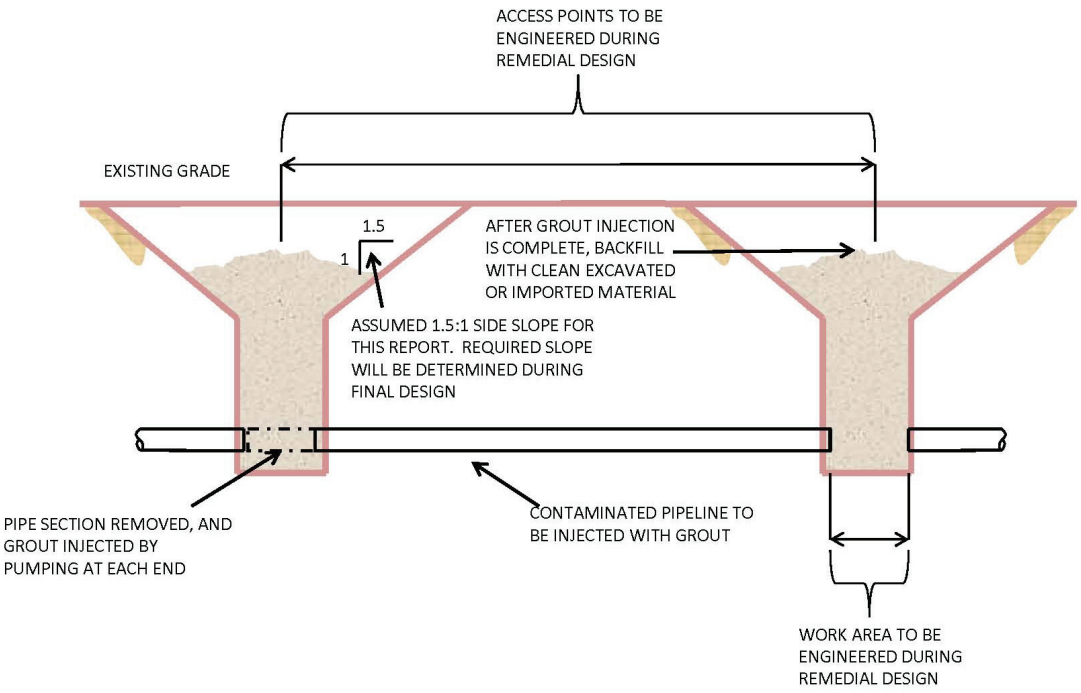

Figure H4-2. Conceptual Design of Alternative 2- In Situ Stabilization Grout Fill/Isolation

Each of these alternatives is examined in more detail in Chapters H5 and H6 of this appendix.

H5 Detailed Analysis of Alternatives

Each of the remedial alternatives described in Section H4 is evaluated in this chapter with respect to specific CERCLA evaluation criteria, as required by 40 CFR 300.430(e)(9), "National Oil and Hazardous Substances Pollution Contingency Plan," *Code of Federal Regulations*. (300.400) "Investigation/ Feasibility Study and Selection of Remedy," "Detailed Analysis of Alternatives." The CERCLA criteria are grouped into two Threshold Criteria (Overall protection of human health and the environment and Compliance with ARARs), five Balancing Criteria (Long-term effectiveness and permanence, Reduction of toxicity, mobility, or volume through treatment, Short-term effectiveness, Implementability, and Cost) and two Modifying Criteria (State acceptance and Community acceptance). These criteria have been explained extensively in Sections 6.1.1 through 6.1.9 of the PW1/3/6 FS and will not be repeated in this section.

H5.1 Detailed Analysis of No Action Alternative

The NCP requires consideration of a No Action Alternative. This alternative would leave a waste site pipeline "as-is" in its current state, with no additional remedial activities or access restrictions. This alternative is only acceptable if current waste pipeline conditions are protective of human health and the environment.

H5.1.1 Overall Protection of Human Health and the Environment

The baseline risk assessment (BRA) (Appendix A of the PW1/3/6 FS) concluded the risks from exposure to soils at the 216-Z-8 French Drain are below levels that are a health concern for all three populations evaluated (construction worker, driller, and subsistence farmer). Since the 241-Z-8 Settling Tank overflow pipeline to the 216-Z-8 French Drain would contain the same contaminant history as the soil and French drain, it is assumed that the contamination levels of this segment of pipe (200-W-205-PL) are the same. A No Action Alternative is deemed protective of human health and the environment for the soil and French drain, and therefore deemed protective for the overflow pipeline segment.

For the other six pipelines and the remaining portion of the 200-W-205-PL (similar to the respective waste sites), this alternative does not eliminate, reduce, or control potential risks; thus, it is not protective of human health and the environment and fails to meet this threshold criterion. Therefore, the discussion of the remaining evaluation criteria for this alternative is limited to its application for the overflow segment of the 200-W-205-PL pipeline to the 216-Z-8 French Drain.

H5.1.2 Compliance with ARARs

The only chemical-specific ARARs for the No Action Alternative are the requirements to protect the environment via the migration to groundwater pathway. The No Action Alternative at the 216-Z-8 French Drain and therefore the overflow segment of the 200-W-205-PL pipeline would comply with federal maximum contaminant levels (MCLs) from 40 CFR 141, "National Primary Drinking Water Regulations," because no groundwater impacts were identified in the fate and transport modeling of radionuclides in the 200 West Area (see Appendix E).

The WAC defines the soil cleanup depth (the standard point of compliance) as extending from the ground surface to 4.6 m (15 ft) bgs (WAC 173-340-7490[4][b]). However, WAC-173-340-7492(4)(a) allows for a conditional point of compliance to be used. This assessment proposes a conditional point of compliance of 3 m (10 ft). The rationale for this revised point of compliance is outlined in CHPRC-00651, "*Evaluation of Biointrusion at the Hanford Site for Protection of Ecological Receptors*, February 2010."

H5.1.3 Long-Term Effectiveness and Permanence

Although the No Action Alternative would leave untreated wastes at the overflow segment of the 200-W-205-PL pipeline, the BRA showed that these concentrations are below levels that are a health concern and the fate and transport modeling showed that these radionuclides would not affect groundwater. No controls are required to manage the untreated wastes at this pipeline to ensure long-term protection of human health and the environment. Therefore, the No Action Alternative provides long-term effectiveness and permanence at the overflow segment of 200-W-205-PL pipeline.

H5.1.4 Reduction of Toxicity, Mobility, or Volume through Treatment

The No Action Alternative does not need to employ treatment technology, or reduction in toxicity or mobility. It was determined that only the 216-Z-8 French Drain and, by extension, its pipe systems, has no risk and needs no reduction in toxicity or mobility.

H5.1.5 Short-Term Effectiveness

Because no actions are associated with this alternative, the No Action Alternative poses no additional short-term risks to human health or the environment and the response objectives are achieved immediately.

H5.1.6 Implementability

There are no technical or administrative issues that would affect the implementability of the No Action Alternative at the overflow piping leading to the 216-Z-8 French Drain.

H5.1.7 Cost

Costs associated with the No Action Alternative are estimated at $0.

H5.2 Detailed Analysis of Alternative 1–Removal, Treatment, and Disposal

Alternative 1 removes segments of pipeline, surrounding soil, residue, sludge, and/or debris, treating it as necessary to meet ARARs, and then disposing of it in an onsite (ERDF) facility as appropriate. It is expected that if the alternative leaves residual contamination above risk levels, ICs will be implemented as remedy components to protect human health and the environment. However, for the purposes of cost estimating, it has been assumed that ICs will not be needed.

H5.2.1 Overall Protection of Human Health and the Environment

Alternative 1 achieves adequate protection of human health and the environment using the soil removal criteria outlined previously for the associated pipelines. Alternative 1 poses the greatest short-term risks to remedial action workers and the environment, which can be mitigated by engineering and radiological controls but at significant costs. Compliance with this criterion, by pipeline group, is summarized as follows.

- High-salt pipelines: The potential direct contact risk to the representative industrial worker at the 200-W-174-PL, and 200-W-206-PL pipelines would be eliminated by Alternative 1, assuming the pipeline is intact because the walls of the piping act as a physical barrier, thereby encasing the residual contamination. The current direct contact risks at the 216-Z-9 Trench and the toe outlet of associated pipeline 200-W-206-PL are limited by the soil overburden and pipe encasement. However, if the piping leaks, future direct contact risks to the representative industrial worker, human health would not be eliminated by Alternative 1 unless contaminated soil around the leak was removed. There is no current direct contact risk at the 216-Z-18 Crib's associated pipeline 200-W-174-PL, and Alternative 1would further reduce this risk; however, this is based on limited data and the assumption the pipeline has not leaked. There is a potential that the pipelines have leaked, although this possibility varies greatly depending on pipeline material.

- Low-salt pipelines: Currently, there are no direct contact risks at the pipelines 200-W-208-PL and 200-W-210-PL (Cribs 216-Z-1&2, and 216-Z-3), and 200-W-220-PL due to the current depth of the pipes with soil overburden. However, it is unclear if leaks occurred in the past, thereby contaminating the surrounding soil. RTD for the pipelines would reduce risk along the reasoning explained for the respective waste sites at various depths.

- Z-Ditch pipelines: Currently, there are no known direct contact risks at the 200-W-207-PL (Z-Ditches 216-Z-1D, 216-Z-11, 216-Z-19, and 216-Z-20) pipeline due to the current depth of the pipes with soil overburden. The potential risks to a well driller, which currently are already below health-based levels, would be further reduced by Alternative 1. However, it is unclear if leaks occurred in the past, thereby contaminating surrounding soil. RTD for the pipelines would reduce risk along the reasoning explained for the respective waste sites at various depths.

- No action pipelines: Alternative 1 is not necessary for the 200-W-205-PL overflow pipe segment because a determination has already been made that this segment is protective of human health and the environment.

H5.2.2 Compliance with ARARs

The only chemical-specific ARARs for Alternative 1 include the requirements to protect the environment via the migration to groundwater pathway. Alternative 1 would comply with federal MCLs from 40 CFR 141, "National Primary Drinking Water Regulations" because the potential groundwater impacts from carbon tetrachloride underneath the High-Salt waste pipelines will be mitigated by the current soil vapor extraction (SVE) system at component of the respective High-Salt waste sites, as discussed in per the 200-PW1/3/6 OU Waste Site FS.

No archeological, historic, cultural, or Native American artifacts, or threatened or endangered species have been identified at any of the waste site areas in previous characterization activities; therefore, it is assumed the same condition applies to the pipelines and their surrounding soil. State surveys will be conducted as required prior to soil disturbance.

Designation, handling, and disposal of the excavated pipelines and associated soils will comply with WAC 173-303, "Dangerous Waste Regulations;" WAC 173-304, "Minimum Functional Standards for Solid Waste Handling;" and WAC 173-350, "Solid Waste Handling Standards." Alternative 1 will also comply with potential action-specific ARARs (WAC 173-400, "General Regulations for Air Pollution Sources" [WAC 173-400]; WAC 173-460, "Controls for New Sources of Toxic Air Pollutants" [WAC 173 -460]; WAC 173-480, "Ambient Air Quality Standards and Emission Limits for Radionuclides" [WAC 173-480]; and WAC 246-247, "Radiation Protection—Air Emissions" [WAC 246-247]), because the SVE system will treat extracted vapors for known plumes associated with the waste sites near the pipelines prior to release and engineering controls will be used to reduce and control airborne dust during the RTD process.

H5.2.3 Long-Term Effectiveness and Permanence

Compliance with this criterion, considering the magnitude of residual risk and the adequacy and reliability of controls, is discussed by pipeline group and their associated waste sites as follows.

- High-salt pipelines: The SVE component for known plumes associated with the waste sites near the pipelines would remove carbon tetrachloride from the vadose zone to prevent residual concentrations from migrating and affecting the groundwater. However, this is an interim remediation. Alternative 1 reduces the radioactive contamination at these pipelines through RTD of soil surrounding the pipelines, making this alternative a permanent remedial solution.

- Long-term monitoring, maintenance, and enforcement of ICs will not be required for contaminated soil that is removed. If ICs are required to ensure Alternative 1 remains effective and permanent, the controls will become associated with any controls required for the waste sites. Required CERCLA reviews every 5 years will reexamine and ensure this alternative remains effective and permanent in the long-term.

- Low-salt pipelines: There are no direct contact risks due to the soil overburden and physical barrier characteristic of the pipelines at the Low-Salt waste sites. Therefore, the associated pipelines (200-W-208-PL, 200-W-210-PL, and 200-W-220-PL) have no direct contact risk. The potential risks to a well driller, which currently are already below health-based levels for each waste site, and are expected as such for the associated pipelines (200-W-208-PL, 200-W-210-PL, and 200-W-220-PL), would be further reduced by the RTD Alternative 1.

- Z-Ditch pipelines–There are no direct contact risks at the Z-Ditch waste sites and it is expected that the associated pipeline 200-W-207-PL has no direct contact risk. The potential risks to a well driller, which currently are already below health-based levels for each Z-Ditch, and are expected as such for the associated pipeline 200-W-207-PL, would be further reduced by the RTD Alternative 1.

Long-term monitoring, maintenance, and enforcement of ICs will not be required for contaminated soil to be removed. If ICs are required to ensure Alternative 1 remains effective and permanent, the controls will become associated with any controls required for the waste sites. Required CERCLA reviews every 5 years will reexamine and ensure this alternative remains effective and permanent in the long-term.

H5.2.4 Reduction of Toxicity, Mobility, or Volume through Treatment

Alternative 1 reduces the radioactive contamination at the High-Salt waste sites, Low-Salt waste sites, and Z-Ditch pipelines by the physical removal of contaminated pipes and soil surrounding the pipes. However, the RTD component of Alternative 1 does not incorporate a treatment component.

H5.2.5 Short-Term Effectiveness

The remedial action workers will have risks from potential exposure to final COPCs and exposure to radionuclides during the RTD process. These risks can be reliably mitigated with standard and site-specific radiation and industrial safety practices. For example, the High-Salt and Low-Salt waste sites and pipelines RTD cases could be conducted inside a portable enclosure to mitigate the potential for airborne contamination, dust suppression controls would be used, and workers likely would use respiratory protection. All of these controls can effectively mitigate the short-term risks to workers, but they also limit RTD productivity and significantly increase costs.

Fugitive dust during RTD excavation and backfilling with clean soil will be controlled using standard dust-suppression measures. Alternative 1 disturbs an area about twice the size of the excavated pipeline and waste site because of soil stockpiles and RTD operations areas, in addition to the borrow source areas needed for backfill. However, no significant adverse environmental impacts are related to implementation of Alternative 1 (see Section H6). RTD is estimated to achieve the RAOs at the pipelines within 1 to 2 years, from the start of the remedial action.

H5.2.6 Implementability

Although the technical feasibility of RTD is proven and is a commercially available technology, several site-specific issues may affect the implementability of Alternative 1. The nature and extent of contamination is generally determined using available data. However, RTD activities may encounter previously unknown leaks, releases, or contamination. This would affect the estimated RTD excavation volumes, costs, and schedules used in the FS. Additional RTD activities could be undertaken to manage these uncertainties, similar to the methods used for the respective waste sites.

For Alternative 1, there is an additional risk due to potential drainage of entrained liquid residue from inside the pipelines as the pipelines are removed, crushed, and prepared for the ERDF. The uncertainty regarding the residual waste inventory is high, but drainage is expected as an occurrence that could be controlled and isolated to the ground surface, or onsite collection. Any discharge to the soil or collection would be followed by immediate soil removal or disposal to the ERDF.

The technical and administrative feasibility of Alternative 1 is the result of the proximity of several pipelines and respective waste sites to facilities and infrastructure. The High-Salt and Low-Salt pipelines are located adjacent to the PFP and associated structures. Decontamination and decommissioning (D&D) of the PFP is currently ongoing and coordination of Alternative 1 with that project will be necessary. Some of these pipelines overlap and affect other pipelines and utilities. The 216-Z-1&2, 216-Z-3, and 216-Z-1A waste sites' pipelines (200-W-174-PL, 200-W-210-PL, and 200-W-220-PL) are co-located and near the RCRA 241-Z Building, the inactive RCRA pipeline 200-W-178-PL, the active portion of pipeline 200-W-207-PL, and the 241-Z-361 Settling Tank. Therefore, the selection and implementation of the remedies for these pipelines will require careful planning and coordination. The same careful planning would be needed for the remainder of the pipelines because most of the pipelines have aboveground and belowground obstructions that may hinder accessibility during RTD.

The conventional excavation technology considered as part of Alternative 1 is readily available through many contractors. Alternative 1 will require onsite disposal services and capacity at the ERDF. All of these services and disposal capacities are assumed to be available.

H5.2.7 Cost

Table H5-1 summarizes the estimated costs for Alternative 1 at the High-Salt, Low-Salt, and Z-Ditch waste sites' associated piping. The period of analysis for the present value cost is 1 year for the High-Salt, Low-Salt, and Z-Ditch pipelines.

H5.3 Detailed Analysis of Alternative 2– In Situ Stabilization Grout Fill/Capping

Alternative 2, ISS Grout Fill provides no treatment, but prevents and controls exposure to hazardous substances through injection grouting, engineering controls, and ICs to protect human health and the environment. This alternative consists of a grout injection (either cap or fill). The grout injection would consist of excavating access points along each pipeline (such as the inlet and outlet or where dictated from the remedial design), and injecting grout at the ends of the pipe to successfully isolate and plug the pipe. Grout can also be injected to fill the pipeline void space, leaving the pipelines in the ground. Contaminated material generated as part of this technology would be disposed of to the ERDF.

In addition, Alternative 2 includes common components already provided by the respective waste sites. These components include ICs for sites with residual risks above acceptable levels (1,000 years for sites with long-lived radionuclides).

H5.3.1 Overall Protection of Human Health and the Environment

Alternative 2 has the potential to achieve adequate protection of human health and the environment by eliminating, reducing, or controlling potential risks. Compliance with this criterion, by waste site and pipeline group, is summarized as follows:

- High-Salt pipelines: Given that the walls of the piping act as a physical barrier encasing residual contamination, there is no direct contact risk assuming the pipeline has not leaked. If the pipeline has leaked, Alternative 2 does not eliminate a potential direct contact risk to the representative industrial worker at any of the waste sites' associated pipelines. Lastly, the ICs component will help control potential risks by controlling site access and preventing land use that is not compatible with this alternative.

- Low-Salt pipelines: Compliance is the same as for the High-Salt pipelines, except there are no direct contact risks at these waste sites due to the physical barrier characteristic of the pipelines unless the pipeline has been leaking. There is no carbon tetrachloride characterized for the Low-Salt waste sites and expected for the pipelines so the SVE system is not part of Alternative 2 for these sites.

- Z-Ditch pipeline: There are no direct contact risks at the Z-Ditch waste sites and it is expected that the proposed segment of pipeline 200-W-207-PL has no direct contact risks. The potential risks to a well driller, which currently are already below health-based levels for each Z-Ditch, and expected as such for the associated pipeline 200-W-207-PL, would be further reduced by the RTD Alternative 2.

- 216-Z-8 French Drain's associated overflow pipe segment from the 241-Z-8 Settling Tank: Alternative 2 is not applicable to this pipeline.

Although the pipe contents can be filled/remediated using this methodology, any releases from the pipelines would not be protective of human health or the environment. Because there is limited characterization data for the pipelines and collecting soil samples to attempt to characterize pipeline releases cannot be performed without a substantial soil sampling effort, this alternative does not meet this overall protection of human health and the environment criterion and will not be evaluated further. Table H5-1summarizes the alternative assessment for the High-Salt, Low-Salt, and Z-Ditch pipelines, including costs.

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Table H5-1. Summary of Detailed Analysis of Alternatives

Criteria	No Action Alternative	Alternative 1– Removal, Treatment, and Disposal	Alternative 2–ISS Grout Injection
Overall Protection of Human Health and the Environment	The No Action Alternative is only evaluated for the pipelines where this alternative meets both threshold criteria.	Alternative 1 is evaluated for all of the pipelines except the pipelines evaluated under the No Action Alternative.	Alternative 2 is evaluated for all of the pipelines except the pipelines evaluated under the No Action Alternative.
Representative Industrial Worker	Final COPCs are below risk levels at the 216-Z-8 French Drain overflow pipeline so this alternative is protective and the remaining criteria are only evaluated for this pipeline.	RTD eliminates potential direct contact risk at pipelines.	Grout injection eliminates potential direct contact risk at pipelines. However, any releases present from the pipelines would not be protective of human health and the environment. Therefore, this alternative has not been retained for further evaluation.
Well Driller	At the other pipelines, there is no elimination, reduction, or control of potential risks, so this alternative fails this threshold criterion.	Current risks below health concerns – RTD further reduces these risks.	
Future Subsistence Farmer		None.	
Protection of Groundwater		SVE component of waste sites removes impact from carbon tetrachloride underneath High-Salt pipelines.	
Environmental Protection		Ecological risks at pipelines unknown – RTD reduces risk.	
Compliance with ARARs			
Chemical-specific ARARs	Would comply with MCLs to protect groundwater.	Would comply with MCLs to protect groundwater.	
Location-specific ARARs	There are no location-specific ARARs.	Excavation activities would comply with archeological, historic, cultural, Native American, and threatened and endangered species ARARs. After excavation, waste soil and debris would be handled and disposed of to comply with ARARs regarding dangerous waste, solid waste, and disposal criteria at ERDF.	
Action-specific ARARs	There are no action-specific ARARs.	Would comply with air pollution ARARs.	
Long-term Effectiveness and Permanence			
Magnitude of Residual Risk	Residual risks are below health concerns with no groundwater impacts.	RTD reduces risk at High-Salt, and Low-Salt pipelines as described previously for the overall protection criterion.	
Adequacy and Reliability of Controls	Not needed.	Not needed.	
Need for 5-Year Reviews	Not needed.	Required at High-Salt, and Low-Salt pipelines to ensure alternative remains protective as long as risks exceed acceptable levels.	
Reduction of Toxicity, Mobility, or Volume Through Treatment			
Treatment Process Used	None.	None.	
Amount Destroyed or Treated	None.	None.	
Expected Reduction in Toxicity, Mobility, or Volume	None.	None.	
Irreversible Treatment	None.	None.	

Table H5-1. Summary of Detailed Analysis of Alternatives

Criteria	No Action Alternative	Alternative 1– Removal, Treatment, and Disposal	Alternative 2–ISS Grout Injection
Type and Quantity of Residuals Following Treatment	None.	None.	
Statutory Preference for Treatment	Does not satisfy.	Does not satisfy.	
Short-term Effectiveness			
Community Protection	No risk to community. Pending confirmatory sampling.	No risk to community for onsite disposal to ERDF.	
Worker Protection	No significant risk to workers.	Protection required from dermal contact, and dust during RTD construction. Engineering and radiological controls needed for worker protection at significant cost.	
Environmental Impacts	No environmental impacts.	Dust emissions will meet air pollution ARARs.	
Time Until Action is Complete	None.	One year.	
Implementability			
Technical Feasibility	No technical issues.	Excavation may have technical difficulties caused by proximity of several pipelines to facilities and infrastructure (roads and utilities).	
Administrative Feasibility	No administrative issues.	Coordinate RTD of High-Salt and Low-Salt pipelines with PFP D&D.	
Availability of Services and Materials	No availability issues.	No availability issues.	
Cost*			
Capital Cost	$0 for 216-Z-8 French Drain.	High-salt $2,620,000 Low-salt $2,260,000	
Total Non-Discounted Costs	$0	High-salt $2,620,000 Low-salt $2,260,000	
Total Present Value Cost	$0	High-salt $2,620,000 Low-salt $2,260,000	

* These cost estimates are based on the best available information for the site-specific anticipated remedial actions. The actual costs are expected to range from -30 percent to +50 percent of these estimated values. Major changes to assumed remedial action scope can result in remedial action costs outside of this range. Net present worth calculations are based on 1,000 years.

H6 Comparative Analysis of Alternatives

The remedial action alternatives for the 200-PW-1, 200-PW-6, and 200-CW-5 OU pipelines that were developed in Chapter H4 and analyzed in detail in Chapter H5 resulted in retention of only Alternative 1. The comparative analysis can only be conducted against the No Action Alternative as follows.

- No Action Alternative
- Alternative 1—RTD
  - Remove contaminated soils and pipelines that could be a direct-contact risk to representative industrial workers. For the pipelines, removal to include soil within 0.6 m (2 ft) of the pipe. The observational approach will be used to make decisions about the remedy to be applied to those sections of the pipeline that are 3 to 4.6 m (10 to15 ft) bgs.

H6.1 Overall Protection of Human Health

Alternative 1 will provide better overall protection for human health and the environment than the No Action Alternative. The No Action Alternative provides adequate protection of human health and the environment only at the 216-Z-8 French Drain's overflow segment of pipeline 200-W-205-PL because current risk levels at this site are within or below the CERCLA risk range of 10^{-4} to 10^{-6} based on the FS discussion. For the remaining CW-5 OU sites, the No Action Alternative is not protective of human health and the environment. Alternative 1 will utilize the SVE component of the waste sites' FS to eliminate groundwater impacts from carbon tetrachloride at the High-Salt waste sites and pipelines.

H6.2 Compliance with ARARs

The evaluation of the ability of the alternatives to comply with ARARs included a review of chemical-specific, location-specific, and action-specific ARARs that was presented for each alternative in Chapter H5. Alternative 1 will meet the respective ARARs, whereas the No Action Alternative will not meet ARARs.

H6.3 Long-Term Effectiveness and Permanence

Alternative 1 provides better long-term effectiveness at the High-Salt waste pipelines because it will remove contaminants to the ecological exposure depth and eliminate the need for long-term ICs. The No Action Alternative provides long-term effectiveness and permanence at the 216-Z-8 French Drain's overflow segment of pipeline 200-W-205-PL because, similar to the waste site assessment, current risk levels at this site's associated pipeline are anticipated to be within or below the CERCLA risk range of 10^{-4} to 10^{-6}.

H6.4 Reduction of Toxicity, Mobility, or Volume through Treatment

There is no treatment component for the pipelines.

H6.5 Short-Term Effectiveness

Alternative 1 is expected to present short-term risks to the community, remedial action workers, and the environment. However, all these risks can be readily addressed. The potential land area impacts, wastes generated, and soil and rock quantities needed for backfill are summarized for the RTD alternative. The RTD alternative at the High-Salt, Low-Salt, and Z-Ditch waste pipelines would result in approximately 4,650 m^3 (6,079 yd^3) of waste transported to the ERDF. These potential risks to the community are mitigated by costly shipping requirements. Workers must be protected from dermal contact, dust, and vapors during SVE and RTD construction and SVE operation. Protecting workers from airborne radiological contamination during excavation at the High-Salt, Low-Salt, and Z-Ditch pipelines will require engineering and radiological controls at significant cost. Alternative 1 will also have the greatest environmental impacts at the pipelines being excavated and will disturb significant land areas. The time required to achieve short-term effectiveness for the pipelines is anticipated to be approximately 1 year from the start of the remedial action. The sequencing and duration of remedy components will be refined during the remedial design.

H6.6 Implementability

Alternative 1 would be less implementable than the No Action Alternative. Alternative 1 is readily implementable using current technology. Coordination will be required to handle any entrained liquid residue, and the known proximity of active RCRA and TEDF facilities, equipment, and pipelines near the excavation zone. The RTD excavations will require significant contaminated material handling requirements for worker safety and environmental protection due to the entrained residual (although perceived to be negligible) material within the pipes. Because the High-Salt and Low-Salt sites' pipelines contain plutonium and americium (which emit alpha radiation) special conditions apply when disturbing, handling, and transporting these contaminated pipelines. Control of airborne contamination will require engineering controls such as water misting and appropriate personal protective equipment for remedial action workers. For the High-Salt, Low-Salt, and Z-Ditch pipelines, the excavation, and waste container packaging could be performed inside a portable enclosure. All contaminated pipelines, soil, and debris are expected to meet the criteria for disposal onsite at the ERDF. In addition, radiation dose rates to workers from the contaminated pipelines and soils in the excavation and from the full waste containers will limit the excavation rate and the amount of contaminated soil that can be placed in each waste container.

Because of the land area required for pipeline excavation, remedial operations, and clean soil stockpiling, Alternative 1 at the High-Salt, Low-Salt, and Z-Ditches must be administratively coordinated with the PFP D&D project. Because the 216-Z-1&2, 216-Z-3, and 216-Z-1A pipelines are co-located and near the 241-Z Building and inactive RCRA pipeline 200-W-178-PL, and 241-Z-361 Settling Tank, the selection and implementation of the remedy(s) for these pipelines will require careful planning and coordination.

A key uncertainty that affects the cost and duration of Alternative 1 is the estimated quantity of contaminated soil at the High-Salt and Low-Salt pipelines that will require disposal at the ERDF. To address this uncertainty, if contaminated soil is found below the pipelines because of leaks, those contaminated areas will be investigated and assigned, as needed, to an appropriate geographic based operable unit. More information will be presented during the remedial design stage of the project.

H6.7 Cost

The No Action Alternative has no costs for the High-Salt and Low-Salt pipelines. It should be noted that the CW-5-related pipeline has been incorporated into the Low-Salt costs. Alternative 1 has a capital cost, non-discounted cost, and net present value cost of $2,260,000 for the Low-Salt pipeline cost and $2,620,000 for the High-Salt pipeline cost. No operations and maintenance (O&M) costs are associated with Alternative 1, as the soil removal will not require O&M.

H6.8 State Acceptance

State acceptance will be addressed in the ROD.

H6.9 Community Acceptance

Community acceptance will be addressed in the ROD.

H7 Uncertainties Related to Decision Making

The purpose of this chapter is to describe the key uncertainties inherent to the analyses performed as part of this assessment. Uncertainties are propagated throughout any evaluation of technical processes that have a scope as complex as environmental restoration. The uncertainty is a reflection of limited knowledge, engineering, and technical assumptions made during the evaluation. The pipelines analyses will follow the areas of cost, performance, technology, policy, future land use, and human health and ecological risk. This section will focus on the uncertainty related to the inventory and residual contamination, and physicality (size, configuration and integrity) of the pipelines. The following summary presents these uncertainties and their associated potential impacts.

H7.1 Uncertainties in Estimating Pipeline Inventory

Pipeline residual volumes and concentration are important in understanding the risk associated with remediating the pipelines. Because there is no characterization or surveys of the contents of the pipelines, there is uncertainty related to the residual volumes and concentrations of processed waste. The residual concentration cannot be estimated to a confident degree because sample data are not available.

Moving and/or disturbing the pipelines will certainly cause any residual volume entrained in the pipeline to move or flow. The residual volume would most likely flow to the low point of the pipeline during movement or disturbance, resulting in a potential encounter with a worker during construction, and/or a ground surface spill at the outlet of a low-point leak.

Based on previous information, the residual volume associated with pipelines with histories of plugging is a concern. Pipeline 200-W-208-PL is the only pipeline that has shown a history of plugging. This is why a bypass line was installed in 1968. The plugged VCP portion is only 12.2 to 15.2 m (40 to 50 ft long), with only 4.6 m (15 ft) vertical in orientation, and resides near the footprint of the 216-Z-12 Crib. The residual waste volume for 200-W-208-PL could most likely be removed within the scope of work for the 216-Z-12 Crib.

Residual volumes can be estimated per the methodologies developed in RPP-RPT-42323, *Hanford C-Farm Tank and Ancillary Equipment Residual Waste Inventory Estimates*. It is assumed that there is minimal waste inventory entrained in several pipelines (200-W-174-PL, 200-W-205-PL, 200-W-206-PL, 200-W-207-PL, and 200-W-210-PL) as per the basis set forth in RPP-25113, *Residual Waste Inventories in the Plugged and Abandoned Pipelines at the Hanford Site*. That is, the pipelines were typically flushed or drained to a diversion box, before, during, and after being taken out of service. Therefore, the risk is relatively low for this uncertainty. This poses an upper-bound risk and is conservative, given the operational history provided in HNF-30862, *Engineering Evaluation/ Cost Analysis for the Plutonium Finishing Plant Sub-grade Structures and Installations*. HNF-30862 describes the process records, showing that the 200-PW-1 and 200-PW-6 pipelines were flushed and rinsed after each waste discharge and during the shutdown of the facility. It is assumed that these flushes effectively diluted and removed the contents of the pipelines and that the pipelines contain some impregnated residue inside the walls of the pipelines. The concentrations of the residue impregnated in the walls would probably be similar to those concentrations found at the respective waste sites, but would be far less mobile than if it were free flowing, posing a far less risk than the wastes found at each respective pipeline's waste site.

H7.1.1 Potential Impacts

Every aspect of the risk assessment contains multiple sources of uncertainty. Because the exact amount of uncertainty cannot be quantified, the risk assessment is intended to overestimate rather than underestimate probable risk. The pipeline inventory uncertainty impacts will be less than the impacts associated with the waste sites due to the increased dilution (and, therefore, decreased residence time) from the operational flushes. The pipeline inventory uncertainty impacts will be less because the sampling strategies for contaminants in the waste site assessment were, in general, designed to prevent underestimation of media concentrations, thus avoiding an underestimation of the risks to public health. The results of the pipeline assessment, therefore, are likely to be protective of health despite the inherent uncertainties in the process, similar to the waste site evaluation.

H7.2 Uncertainties in Estimating Pipeline Physicality (Size, Configuration, and Integrity)

Although there is quite a bit of information about pipeline locations (maps, surveys, and historical drawings), knowledge is limited concerning the pipelines' current size, configuration, and structural integrity. Some drawings are unclear regarding vertical and horizontal changes in perceived straight sections of pipe. It is unknown how much the pipelines have moved or changed due to soil settling immediately after construction, and to natural shifts in the geology of the soil where they lie. Any settlement of soil underneath the pipelines could naturally affect the slope of the pipelines to some degree.

There are uncertainties as to the structural integrity of each pipeline, i.e., have the pipelines underlying roads and access ways been affected (deformed or broken) by the weight of passing vehicles and heavy equipment aboveground. There is uncertainty as to whether welds in stainless steel and carbon steel have held up and are still intact. Although it is known that VCP is generally prone to cracks, leaks, and split joints, it is uncertain if the piping has significant damage or wear. Most of this type of piping is a part of the 200-W-207-PL pipeline, which conveyed very low-contaminated cooling water to the Z-Ditches (see DOE/RL-2004-24 for Z-Ditch waste characteristics). Pipeline 200-W-207-PL is a larger-diameter pipe, making it prone to collapse and resulting in the potential for infiltration and leaks. Other shorter lengths and portions of VCP are located at the pipeline outlets near or in the waste sites' (cribs and tile field) footprint. For all cases, it is assumed the pipelines were built per the construction drawings in location, size, and configuration, and the pipe structural integrity is still intact as initially designed and constructed.

H7.2.1 Potential Impacts

The uncertainty in estimating the extent of contamination at various pipelines potentially affects the extent of a remedial alternative. This would affect the estimated cost and duration of the remedial alternatives. For example, if a pipe were found to be broken (split-joint), then sampling could be conducted at the target area, and a decision made concerning the path forward. The uncertainty in contamination extent and the potential impacts will be mitigated by pre-remedial design confirmatory investigations.

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