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Office of River Protection
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JUN 21 2005

05-TPD-062

Mr. Michael A. Wilson, Program Manager
Nuclear Waste Program
State of Washington
Department of Ecology
3100 Port of Benton Blvd.
Richland, Washington 99352

Dear Mr. Wilson:

SUBMITTAL OF WASTE MANAGEMENT AREA (WMA) INTEGRATION STUDIES IN PARTIAL FULFILLMENT OF HANFORD FEDERAL FACILITY AGREEMENT AND CONSENT ORDER (HFFACO) MILESTONE M-45-00B

The U.S. Department of Energy, Office of River Protection (ORP) is hereby submitting to the State of Washington Department of Ecology (Ecology) two WMA integration plans in partial fulfillment of HFFACO Milestone M-45-00B, which states:

Work under this milestone includes:

- Submittal of WMA integration plans for WMA-C and one additional WMA by June 30, 2005.

These two plans, RPP-PLAN-26062, Rev. 0, "Waste Management Area Integration Study – Waste Management Area C" (Attachment 1), and RPP-PLAN-25942, Rev. 0, "Waste Management Area Integration Study – Waste Management Area T" (Attachment 2), have been previously briefed to Ecology staff. Because these are not primary documents, Ecology review and comment is not required. However, if there are any comments, please provide them to ORP to allow incorporation into the documents.

JUN 2 1 2005

If you have any questions, you may contact me, or your staff may contact Roger Quintero, Tank Farms Operations Division, (509) 373-0421.

Sincerely,

Roy J. Schepens
Manager

TOD:RAQ

Attachments
1. WMA-C Integration Study
2. WMA-T Integration Study

cc w/attachs:
J. J. Lyon, Ecology

cc w/o attach:
M. N. Jaraysi, CH2M HILL
P. S. Schaus, CH2M HILL
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CH2M Correspondence Control

Attachment 1
05-TPD-062

RPP-PLAN-26062, Rev. 0
Waste Management Area Integration Study – Waste Management Area C

(Consisting of 110 pages,
including coversheet)

RPP-PLAN-26062, Rev. 0

WASTE MANAGEMENT AREA INTEGRATION STUDY

WASTE MANAGEMENT AREA C

6/1/2005

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SUMMARY

S1.0 INTRODUCTION

This document is being prepared to partially satisfy the *Hanford Federal Facility Agreement and Consent Order* (HFFACO)[1] Interim Milestone M-45-00B for "Submittal of WMA Integration Plans for WMA C and One Additional WMA by June 30, 2005." This WMA C Integration Study along with the WMA T Integration Study (RPP-PLAN-25942) meets the requirements for M-45-00B. The U.S. Department of Energy (DOE) is in the process of preparing the *Draft Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, Washington* (DOE/EIS-0356) under the *National Environmental Policy Act of 1969* (NEPA)[2]. It is anticipated that the TC-EIS will evaluate various closure alternatives, including but not limited to, clean and landfill closure. After completion of the NEPA process, the TC-EIS will form the basis for DOE decision-making regarding closure and will be confirmed in a Record of Decision (ROD). Although this WMA C Integration Study assumes that the waste management areas (WMAs) would be landfill closed, it does not represent a DOE decision to landfill close in advance of completing the NEPA process, but is only intended to provide additional information regarding potential closure approaches.

The need for integration studies is identified in HFFACO Appendix I, which states:

> "For each SST tank farm (or WMA), DOE shall submit a WMA Integration Study. This study shall look at the entire WMA from a systems perspective and describe the inter-relationships between the various components. The study shall describe a logical sequence of events that would lead to efficient and effective waste retrieval and closure of the WMA, including field sampling and characterization activities of the ancillary equipment (piping, valve pits, vaults, Miscellaneous Underground Storage Tanks, diversion boxes, etc.) This study will be used in the development of the WMA Closure Plan. The document will propose a regulatory path for all ancillary equipment in that WMA and all the activities to achieve efficient and effective closure of that WMA, including all:
>
> - Single Shell Tanks
> - SST system ancillary equipment
> - Soil remediation per WMA corrective actions and proposed plans for WMA soils
> - Groundwater remediation activities and activities necessary for integration with Central Plateau groundwater remediation."

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[1] Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

[2] *National Environmental Policy Act of 1969*, 42 USC 4321 et seq.

S1.1 OVERVIEW OF THE WMA C INTEGRATION STUDY

This WMA C Integration Study describes a systematic and holistic approach for remediating and closing WMA C. Consistent with the stated intent of the HFFACO Appendix I and Milestone M-45-00B, this study considers the full range of components that comprise WMA C including 16 single-shell tanks (SSTs), their associated ancillary equipment, abovegrade facilities (e.g., the 241-C-801 Load-Out Facility), as well as contaminated soils and groundwater. To understand the full breadth and complexity of WMA C, the first step of this study was to perform a detailed and rigorous examination of approximately 800 engineering drawings associated with WMA C. In addition to the 16 tanks that are the current focus of remediation activities in WMA C, this study identified and verified 790 additional components within WMA C including 7 diversion boxes; 19 external pipelines; and numerous pits, risers, and internal pipelines that supported past C tank farm waste transfer operations.

These component data were entered into a Microsoft® Access database. To further an understanding of the complexities of the geo-spatial relationship of the 806 components, the as-built engineering drawings were converted into a three-dimensional drawing using AutoCAD® 3D. In turn, the three-dimensional drawing formed the foundation for the development of a three-dimensional visualization tool, or model, of WMA C.

The WMA C three-dimensional model enabled the WMA Integration Study team to more effectively identify integration issues and physical limitations of proposed closure and corrective actions for WMA C through a better understanding of how the 806 components within the C tank farm functioned and were related within the overall WMA C system. The model also provides a means to determine how the WMA C components with similar attributes could be optimally grouped to better evaluate the range of closure and corrective actions that may need to be performed as progress is made toward final closure of WMA C. These actions may include:

- Waste retrieval
- Characterization
- Isolation of pipelines and other components that could provide a future pathway for migration of contamination
- Grout filling tanks and other components that have significant void space
- Corrective measures for unplanned releases (UPRs)
- Closing drywells.

The model further enabled the evaluation of components in close proximity to, but not necessarily residing within, the C tank farm fenceline that could be considered for remediation as part of WMA C. The types of components that require consideration as part of WMA C closure include:

- External pipelines (i.e., pipelines that traverse the C tank farm fenceline)
- UPRs in close proximity to WMA C and in some cases were the result of activities associated with operations at C tank farm
- Groundwater monitoring wells outside of the C tank farm fenceline but that may be covered by the final closure barrier
- Other components (e.g., French drains, septic systems) that serviced C tank farm operations but are outside of the C farm fenceline.

Closure actions for the majority of the components within WMA C are the responsibility of the DOE, Office of River Protection (ORP), while closure actions for components outside of the WMA are the responsibility of the DOE, Richland Operations Office (RL). Close coordination and cooperation between these two DOE field offices and their respective contractors, in concert with the regulatory agencies, would be required to determine the optimal integration of closure actions within and in close proximity to WMA C, as well as the timing of their execution and the appropriate regulatory pathway.

S1.2 INTEGRATION PLANNING ASSUMPTIONS AND SEQUENCING BASES

Initial closure actions have already begun within WMA C. Using risk analyses and closure information collected to date, this WMA C Integration Study includes a set of broad-based assumptions for closure of the SST system components that have been used to guide the sequencing of activities. These assumptions are consistent with the current DOE closure baseline. While final closure decisions have not been made, the assumption for this study is that WMA C would be closed as a landfill and that the risk to human health and the environment would be greatly reduced upon completion of waste retrieval from the C farm SSTs, grout placement in the tanks, and barrier placement over WMA C. Related assumptions include the following:

- All components in the WMA would comply with landfill closure performance standards.
- No additional waste residuals from transfer piping and smaller ancillary equipment would be removed (i.e., no flushing would occur) because of unknown component integrity and the predicted low, long-term risk potential.
- Additional waste residuals may be removed for larger ancillary equipment (e.g., vaults, catch tanks) with significant inventories of residual waste in accordance with approved closure plans
- Some removal of soil at UPR sites may be required to a yet-to-be determined depth in highly contaminated areas. Any remaining contaminated soil would be left in-place and covered by an engineered barrier. An alternatives analysis would define specific corrective actions within WMA C as required under HFFACO Milestone M-45-60.

- Existing groundwater remediation projects for the Central Plateau, which are managed by the RL contractor, would be sufficient for contaminated groundwater, and groundwater projects would interface with the ORP Vadose Zone Project.

The closure sequence of a WMA would ideally follow a logical progression that allows multiple actions to occur within the WMA without creating conflicts between ongoing, concurrent activities. In developing a general closure/remediation sequencing approach, there are several planning assumptions that should be regularly reviewed and validated during the closure process. Those bases include the following:

- The WMA would be isolated from external components to prevent inadvertent introduction of liquids into the WMA during waste retrieval and closure actions.

- Waste retrieval from inactive miscellaneous underground storage tanks, including vaults and catch tanks within the WMA, would be integrated with waste retrieval activities for the 100- and 200-series tanks.

- The WMA would be subdivided into sub-areas referred to as sectors. Sectors would be established based on consideration for the geographic proximity of components, hydraulics, and regulatory pathway to closure considerations.

- Isolation of components within the WMA would be conducted such that the decontamination of pits and vaults would be completed before any down-gradient receiving tank has been isolated (i.e., to prevent reintroduction of liquids).

- The sequence for conducting closure activities would be defined to minimize interference and rework.

- Pipelines that have not already been flushed would not be flushed because of integrity concerns.

- SSTs would be retrieved to the limits of the selected retrieval technology(ies), consistent with the criteria defined in HFFACO Milestone M-45-00.

- SSTs and other large ancillary equipment, as appropriate, would be grouted to stabilize residual wastes and to provide structural stability to the tank and barrier.

- Other ancillary equipment with significant void spaces would be grouted as necessary to provide structural stability to the barrier.

- Pipelines would not be void-space filled.

- Above-grade buildings and temporary structures/facilities would be removed or leveled to meet the site preparation requirements for the final engineered barrier.

- UPR sites would typically not be excavated.

S1.3 WMA C SECTORS

During the development of the assumptions for this study, it became apparent that the closure actions associated with WMA C could be better accomplished by subdividing WMA C. Seven sectors were defined based on geographical, hydraulic, and operational characteristics of the components in each sector, with the major WMA C components grouped as follows (see Figure S-1):

- **Sector 1** – The twelve 100-series SSTs with their associated pits, risers and internal pipes, and four UPRs (200-E-16, 200-E-107, 200-E-118 and 200-E-136)
- **Sector 2** – The four 200-series SSTs with their associated pits, risers and internal pipes; one diversion box; external piping; and one UPR (200-E-137)
- **Sector 3** – The Cesium Load-Out Facility, two associated French drains, and two UPRs (200-E-115, and 200-E-91)
- **Sector 4** – Three diversion boxes, external piping, and one UPR (200-E-81)
- **Sector 5** – The 244-CR process vault, which includes four process tanks, internal piping, and a ventilation system
- **Sector 6** – The C tank farm control room buildings, the cold chemical make-up building, French drain C-8, septic tank/leach field 2607-EG, and two UPRs (200-E-72 and 200-E-27)
- **Sector 7** – Three diversion boxes; external piping; a catch tank; and three UPRs (200-E-68, 200-E-82, and 200-E-86).

Subdividing WMA C into sectors may also afford common regulatory decision processes to occur. While it is well recognized and accepted that the SSTs and most ancillary equipment would be closed under the *Resource Conservation and Recovery Act of 1976* (RCRA)[3] Site-Wide Permit[4] as treatment, storage, and/or disposal facilities, there are opportunities to consider other regulatory pathways to closure for specific sectors within WMA C. In particular, the major components requiring remediation and closure in Sectors 3 and 6 are non-treatment, storage, and/or disposal facilities that do not require closure under RCRA. Therefore, the regulatory processes that are currently being developed for many of the 200 Area Plateau facilities as part of the Central Plateau Closure Plan[5] (i.e., RCRA past-practice, *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* [CERCLA],[6] or decontamination and decommissioning processes) can also be applied to the remediation and closure of components in these two sectors.

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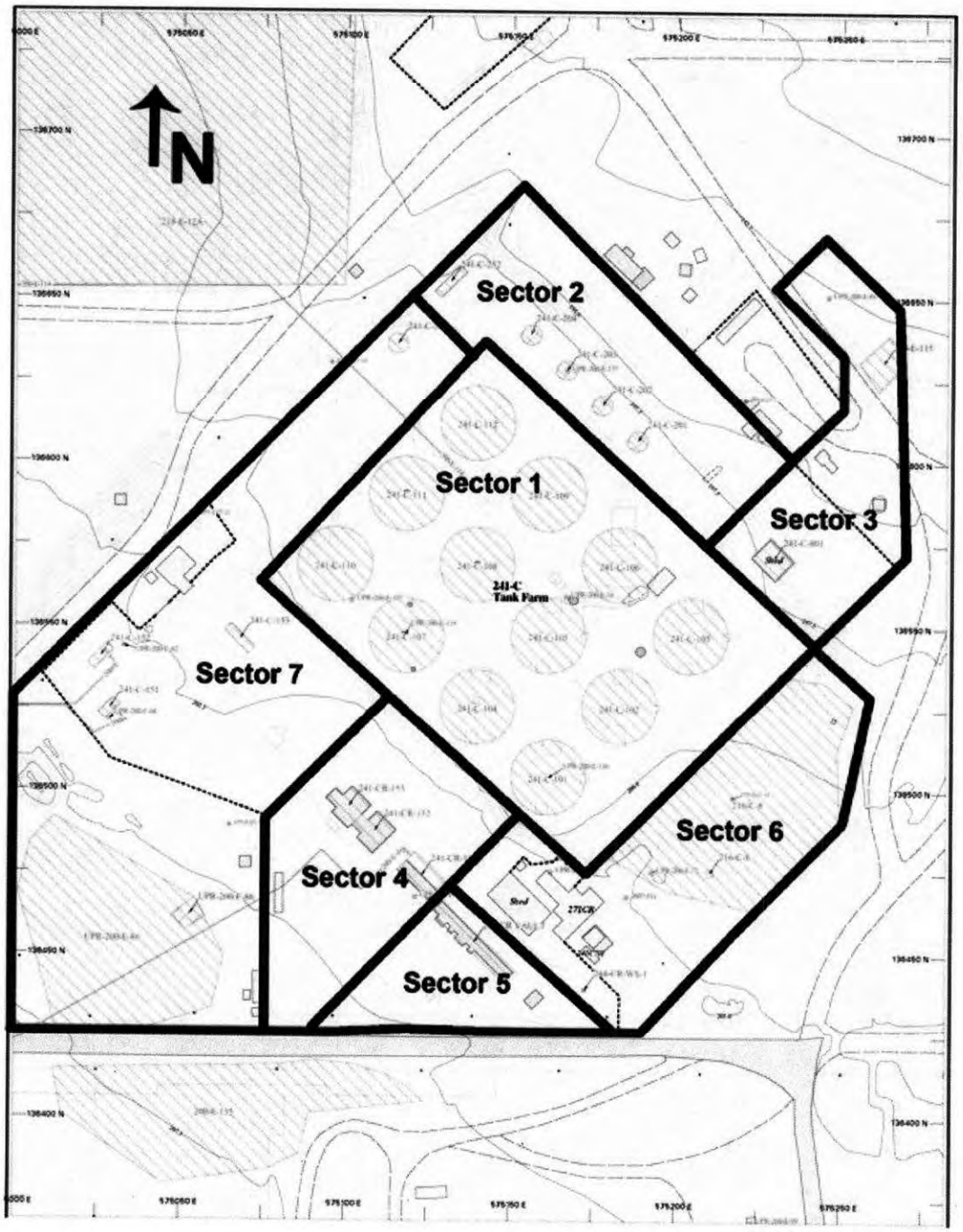
[3] *Resource Conservation and Recovery Act of 1976*, Public Law 94-580, 90 Stat. 2795, 42 USC 901 et seq.

[4] Ecology, 2001, *Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*, Rev. 7, Permit 7890008967, Washington State Department of Ecology, Olympic, Washington.

[5] CP-22319-DEL, 2004, *Plan for Central Plateau Closure*, Rev. 0, Fluor Hanford Inc., Richland, Washington.

[6] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, Public Law 96-150, 94 Stat. 2767, Title 26, 42 USC 9601 et seq.

Figure S-1. WMA C Sector Map.



S2.0 INTEGRATION WITH CENTRAL PLATEAU CLOSURE

In addition to integrating activities within WMA C, it is important that there is an integration of the closure of WMA C (an ORP responsibility) with the closure of the Central Plateau (an RL responsibility). An understanding of these integration issues includes waste sites, pipelines, and groundwater. A process has been developed within this study that promotes WMA C closure being closely coordinated with other actions on the Central Plateau and leads to consistency in the actions taken, clarity in the responsibilities for these actions, and completeness in the coverage of actions that must be taken. Fundamental to the integration between WMA C and the Central Plateau is a strategy that allows ORP and RL to understand their respective processes to ensure that decisions and strategies would accommodate structures and facilities at the interface areas and that they be complementary.

S2.1 PHYSICAL BOUNDARIES AND INTERFACES

Because there are Central Plateau waste sites and SST components that exist within and adjacent to WMA C, there is a need to clarify the WMA boundary in the context of efficient WMA C and Central Plateau closure planning. Inclusion of a waste site within the WMA C closure planning scope that is outside the WMA fenceline would depend upon whether it is cost-effective to include that waste site within the footprint of the WMA C barrier. Waste sites that are outside of the barrier footprint would be closed under other regulatory processes but may require coordination with WMA C closure planning (e.g., timing of physical activities). Non-SST components within the WMA C fenceline would be closed under other regulatory processes, but in close coordination with WMA C closure planning. In some cases, the currently defined program for these waste sites may require revision to optimally coordinate closure actions among programs.

S2.2 PIPELINE INTERFACE AND DISPOSITION STRATEGY

An important interface between scope of the Central Plateau and the WMA C closure is the point at which pipelines cross the boundary of the WMA C barrier footprint. To define this interface, a pipeline interface strategy was developed for this WMA C Integration Study and includes the following key elements.

- The regulatory responsibility for pipeline disposition should be established at the boundary of the final closure barrier for WMA C:
  - The portion of each pipeline not covered by the WMA C final closure barrier should be addressed through the assessment and decision process within the applicable operable unit remedial investigation/feasibility study process.

  - The portion of each pipeline covered by the WMA C final closure barrier should be addressed through the WMA corrective action and closure decision processes.

- The pipeline isolation and regulatory strategy should not alter the existing RL or ORP ownership and responsibility for pipelines within or outside of the WMA.

- The locations and approaches for isolating pipelines (e.g., cutting, capping, grouting) should be coordinated between the remedial investigation/feasibility study process and the WMA closure process to ensure the integrity and hydraulic isolation of the final barrier system as well as closure sequencing.

- The additional pipelines that have been identified during this study should be included in the WIDS (waste information data system) database to ensure that they can be incorporated into the operable unit decision logic through a 'plug-in' approach.

The waste transfer pipelines that traverse the WMA C boundary are shown in Figure S-2.

S2.3 INTERFACE WITH 200 AREA GROUNDWATER DECISIONS AND REMEDIATION

The *Hanford Site Groundwater Strategy*[7] calls for the CERCLA process to integrate all groundwater protection and remediation actions. Therefore, CERCLA RODs for the 200 Areas groundwater operable units would need to address the potential groundwater impacts from tank farm sources, including WMA C. A critical connection exists between the RCRA WMA C performance assessment[8] and corrective action process documents, and the CERCLA 200-PO-1 and 200-BP-5 operable unit feasibility studies. To insure that the tank farm sources are accounted for in the 200 Areas groundwater operable units will require their integration by determining the relationship between a WMA C performance assessment, SST performance assessment, the RCRA facility investigation report and corrective measures study, and the 200-PO-1 and 200-BP-5 groundwater operable unit feasibility studies. ORP and RL have initiated a process to integrate risk assessments across the Hanford Site which will better define these relationships.

The timing of the RODs for groundwater operable units 200-PO-1 and 200-BP-5 need to be coordinated with the completion of the Phase I RCRA corrective measures study for tank farms, currently scheduled for mid-fiscal year 2007. WMA C closure should be an important factor in reaching final RODs for groundwater operable units 200-PO-1 and 200-BP-5.

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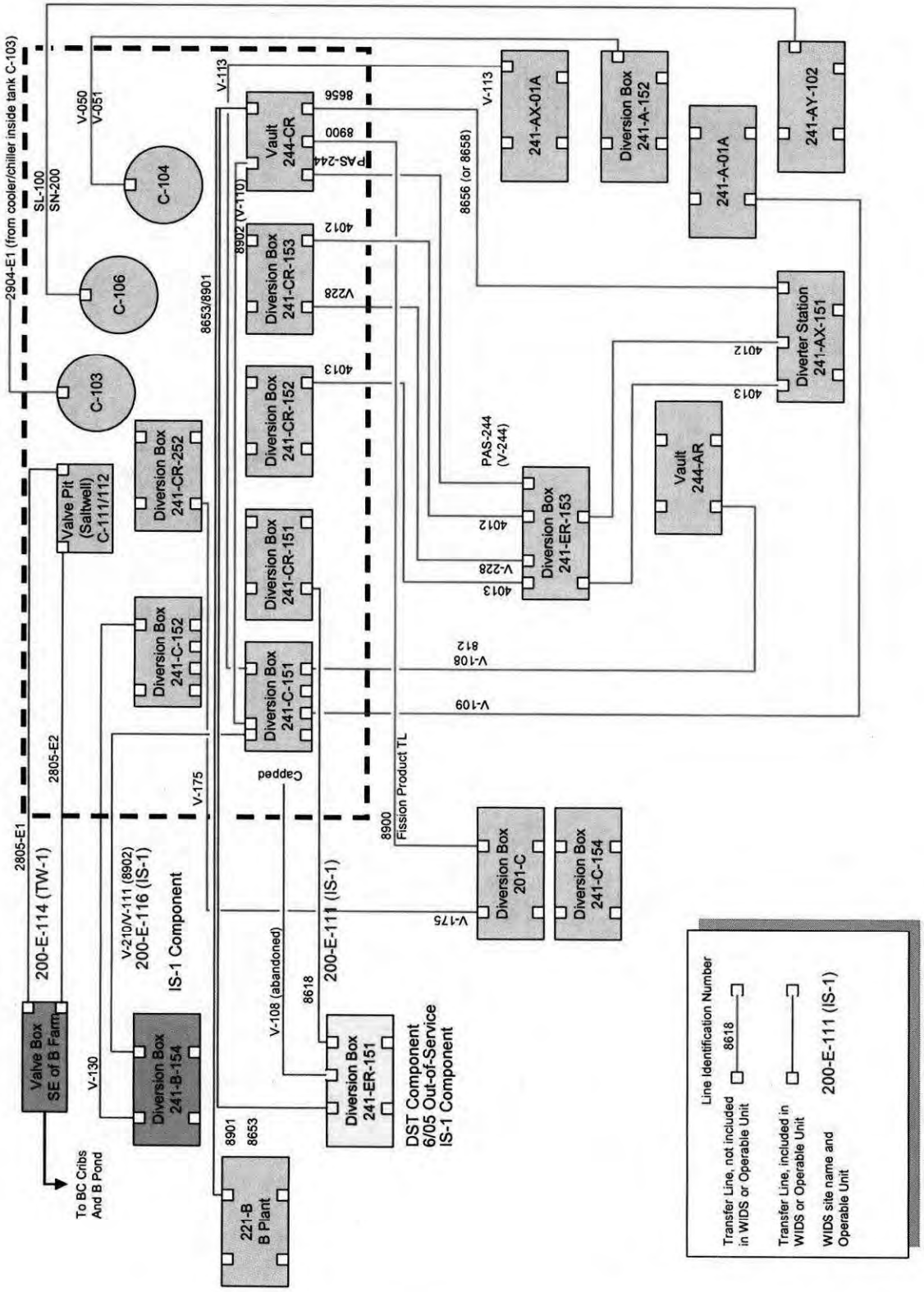
[7] DOE/RL-2002-59, 2003, *Hanford Site Groundwater Strategy*, Draft, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

[8] DOE/ORP-2003-11, 2003, *Preliminary Performance Assessment for Waste Management Area C at the Hanford Site, Washington,* Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Figure S-2. Pipeline Interfaces.



S3.0 WMA C BARRIER CONFIGURATION

As part of the final closure process, a surface barrier would be constructed over WMA C and, if appropriate, adjacent contaminated waste sites that are beyond the existing fenceline. The final barrier configuration would be dependent upon an analysis that would properly size and orient the barrier given a variety of factors such as those presented in the RCRA corrective action documents that may conclude capping is the preferred corrective measure in lieu of removal of contaminated soil. There may be large portions of the WMA that do not require a barrier, or there may be adjacent external waste sites that would benefit from a larger barrier.
The cost-effectiveness of the barrier is expected to be one of the factors in establishing the final footprint of the cover. Figure S-3 presents a conceptual barrier for WMA C based upon the integrating assumptions in this report. As shown in Figure S-3, the footprint of the barrier could reasonably be expected to extend outside of the existing WMA boundary.

S4.0 WMA C INTEGRATED CLOSURE TIMELINE

Figure S-4 presents a preliminary closure timeline that integrates the time-phased schedule for WMA C sectors with associated corrective action and Central Plateau closure activities.
All dates other than those directly associated with HFFACO milestones are estimated, but provide the best current planning basis. As indicated on the time line, HFFACO Milestone M-45-06-T04 requires closure of the first WMA (assumed to be WMA C) by March 31, 2014. By this date, all soil corrective actions and tank and ancillary remedial actions are expected to be completed. However, groundwater remedial actions may still be ongoing beyond that date.

Figure S-3. Conceptual Barrier Footprint Based Upon Integrated Closure of Sectors.

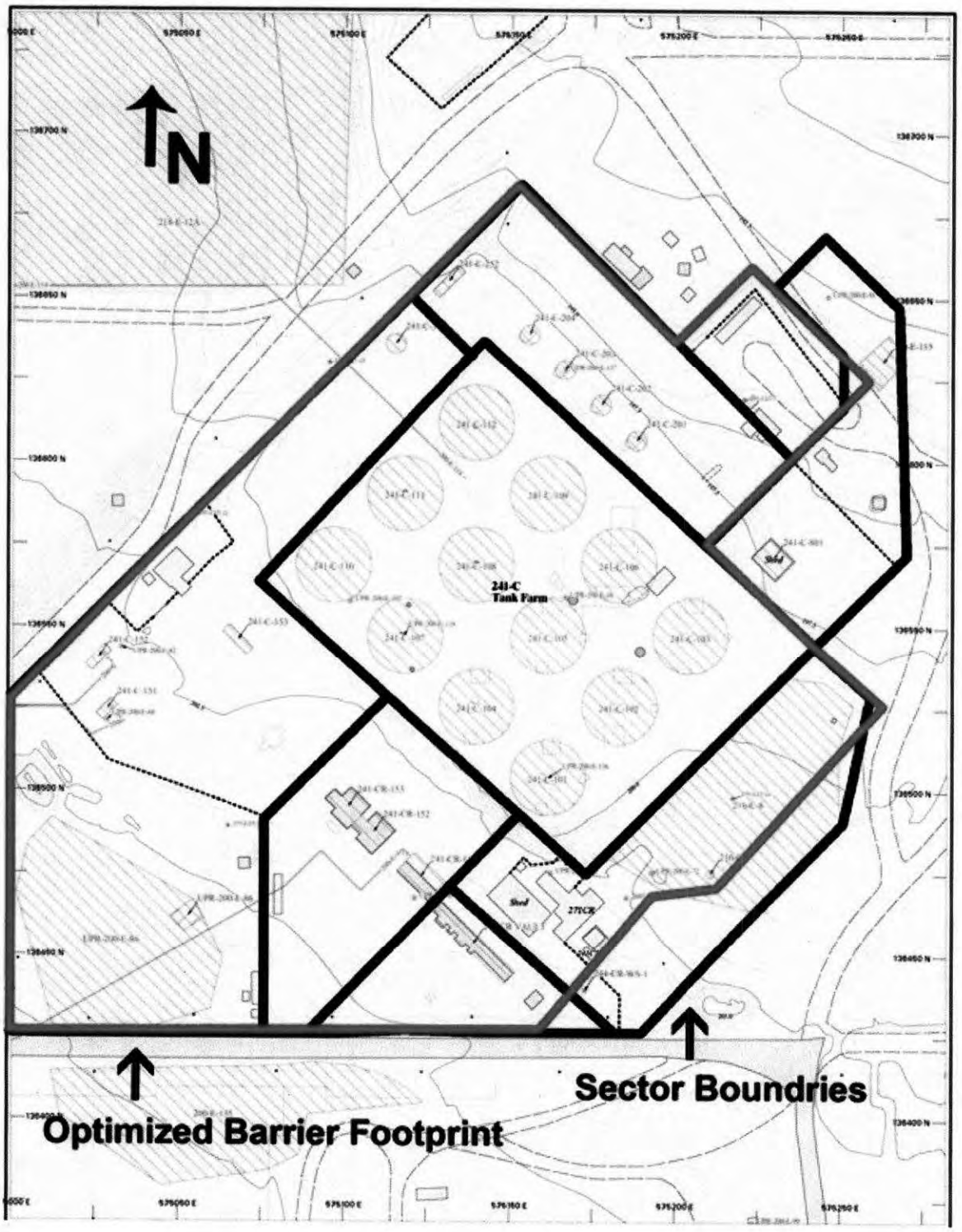


Figure S-4. Time-Phased Integration for WMA Closure Activities.

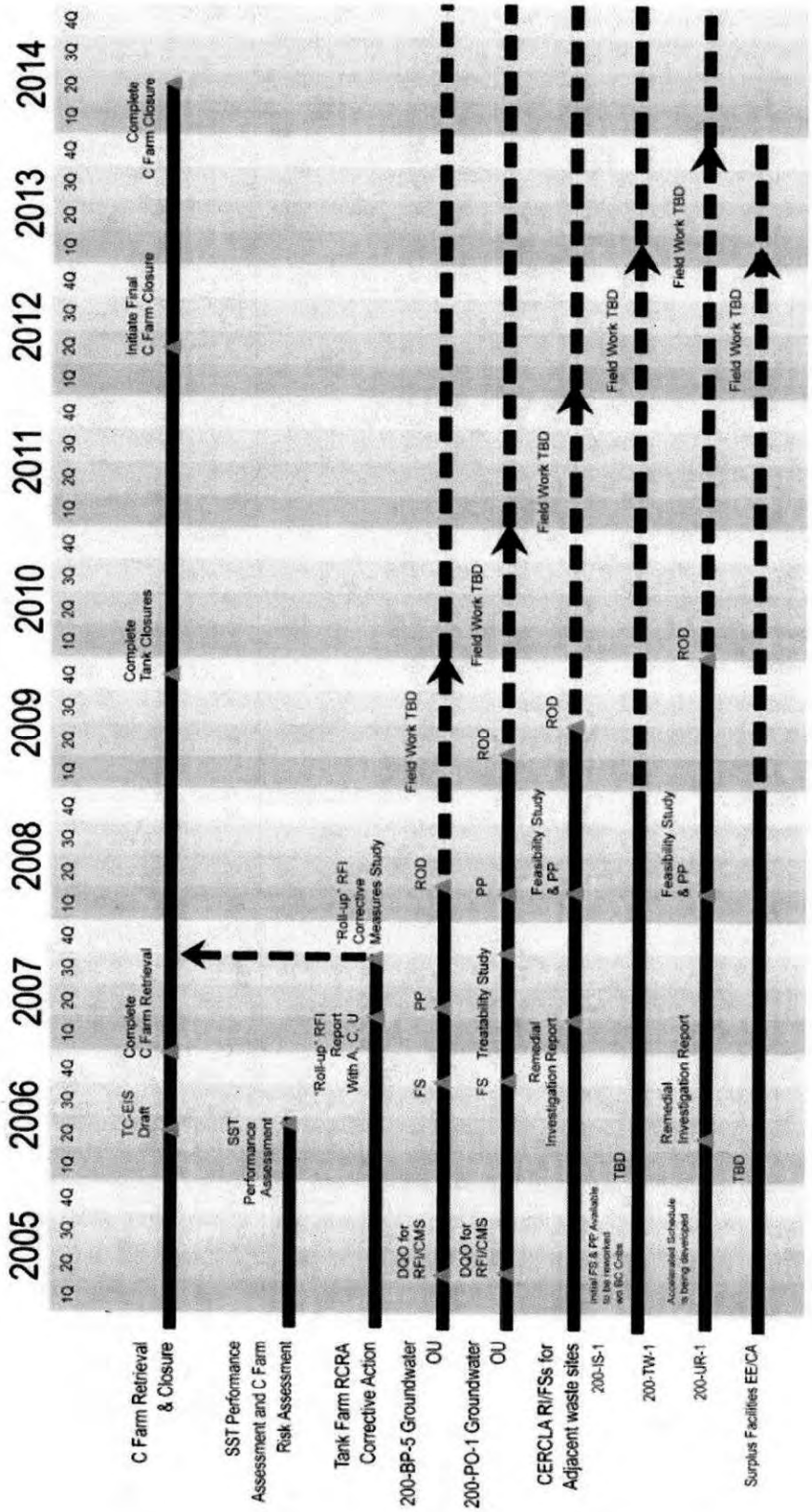


TABLE OF CONTENTS

1.0 INTRODUCTION 1
- 1.1 PURPOSE AND SCOPE 1
- 1.2 WMA C BACKGROUND 2

2.0 WMA STUDY AREA AND CLOSURE SECTORS 7
- 2.1 COMPONENT INTEGRATION LOGIC 9
  - 2.1.1 WMA C Database 9
  - 2.1.2 WMA C Waste Characterization 12
- 2.2 WMA C CLOSURE SECTORS 12

3.0 REGULATORY SETTING 16
- 3.1 DRIVERS FOR CLOSURE 16
  - 3.1.1 HFFACO Milestones 16
  - 3.1.2 RCRA 17
  - 3.1.3 RCRA Corrective Action Requirements 18
  - 3.1.4 CERCLA Remedial Action Requirements 19
  - 3.1.5 NEPA and SEPA 19
- 3.2 TANK CLOSURES AND WASTE DETERMINATIONS 21

4.0 CLOSURE/REMEDIATION SEQUENCING 22
- 4.1 REGULATORY ASSUMPTIONS 22
- 4.2 COMPLIANCE WITH GENERAL CLOSURE PERFORMANCE STANDARDS BASED ON CLOSURE/REMEDIATION ASSUMPTIONS 24
  - 4.2.I General Performance Standard #1 24
  - 4.2.2 General Performance Standard #2 24
  - 4.2.3 General Performance Standard #3 25
- 4.3 WMA C INTEGRATED CLOSURE SECTOR SEQUENCE APPROACH 26
- 4.4 ISOLATION OF COMPONENTS 29
- 4.5 TANK WASTE RETRIEVAL RISK ASSESSMENTS AND WMA PERFORMANCE ASSESSMENTS 30
- 4.6 UNPLANNED RELEASE SITES 30
- 4.7 DECOMMISSIONING, DECONTAMINATION AND DISMANTLEMENT 33
- 4.8 WMA C COMPONENT REGULATORY PATHWAYS TO CLOSURE 34
- 4.9 SECTOR 1 SEQUENCING 34
  - 4.9.1 Approach 34
  - 4.9.2 Waste Retrieval 37
  - 4.9.3 Waste Characterization 39
  - 4.9.4 Post-Retrieval Isolation and Activities 39
  - 4.9.5 Vadose Zone Monitoring/Drywell Decommissioning 41
  - 4.9.6 Integration 41
  - 4.9.7 Status 41

4.10 SECTOR 2 SEQUENCING 42
4.10.1 Approach 42
4.10.2 Characterization 43
4.10.3 Integration 44
4.10.4 Status 44
4.11 SECTOR 3 SEQUENCING 44
4.11.1 Approach 46
4.11.2 Waste Removal and Characterization 46
4.11.3 Integration 47
4.11.4 Status 47
4.12 SECTOR 4 SEQUENCING 47
4.12.1 Approach 48
4.12.2 Characterization 49
4.12.3 Isolation 49
4.12.4 Integration 49
4.12.5 Status 49
4.13 SECTOR 5 SEQUENCING 49
4.13.1 Approach 50
4.13.2 Characterization 51
4.13.3 Isolation 51
4.13.4 Integration 51
4.13.5 Status 51
4.14 SECTOR 6 SEQUENCING 52
4.14.1 Approach 54
4.14.2 Characterization 54
4.14.3 Isolation 54
4.14.4 Status 54
4.15 SECTOR 7 SEQUENCING 54
4.15.1 Approach 55
4.15.2 Characterization 55
4.15.3 Isolation 55
4.15.4 Integration 57
4.15.5 Status 57

5.0 INTEGRATION WITH VADOSE ZONE/SOIL 58
5.1 INTEGRATION OF THE WMA C SOIL COMPONENT CLOSURE PROCESS 58
5.1.1 Status of Current Soil Component Closure Activities 58
5.1.2 Approach to Remaining Soil Component Closure Activities 59

6.0 INTEGRATION WITH CENTRAL PLATEAU 60
6.1 PHYSICAL BOUNDARIES AND INTERFACES 60
6.2 PIPELINE INTERFACE AND DISPOSITION STRATEGY 63
6.3 INTERFACE WITH 200 AREA GROUNDWATER DECISIONS AND REMEDIATION 65

7.0 CLOSURE CONFIGURATION AND DESIGN ISSUES 67
7.1 FINAL WMA C STATUS FOR BARRIER PLACEMENT 67
7.2 FINAL BARRIER DESIGN CRITERIA 69

8.0 POST-CLOSURE 73

9.0 REFERENCES 74

LIST OF APPENDICES

APPENDIX A – SUMMARY OF WMA C DATABASE ..... A-i
APPENDIX B – SUMMARY OF WMA C PROCESS HISTORY ..... B-i
APPENDIX C – SUMMARY OF WMA C Three-Dimensional MODEL ..... C-i

LIST OF FIGURES

Figure 1-1. Location Map of WMA C in the 200 East Area of the DOE Hanford Site. 3
Figure 1-2. Location Map of WMA C and Surrounding Area. 4
Figure 2-1. WMA C Integration Study Area. 8
Figure 2-2. WMA C Sectors. 14
Figure 2-3. WMA C Sectors and Major Components. 15
Figure 3-1. RFI/CMS Process. 20
Figure 4-1. Time-Phased Sequence of Sector Closure and Barrier Design Construction. 28
Figure 4-2. Location of Unplanned Release Sites In and Around WMA C. 33
Figure 4-3. Sector 1 Components. 36
Figure 4-4. Waste Retrieval Facilities for WMA C. 38
Figure 4-5. Sector 2 Components. 42
Figure 4-6. Sector 3 Components. 46
Figure 4-7. Sector 4 Components. 48
Figure 4-8. Sector 5 Components. 50
Figure 4-9. Sector 6 Components. 53
Figure 4-10. Photograph of Sector 6 Components. 53
Figure 4-11. Sector 7 Components. 56
Figure 6-1. Pipeline Interfaces. 64
Figure 6-2. Time-Phased Sequence for Central Plateau Closure Activities. 66
Figure 7-1. Conceptual Barrier Footprint Based Upon Integrated Closure of Sectors. 68
Figure 7-2. Modified RCRA Subtitle C Barrier Design. 71

LIST OF TABLES

Table 2-1. Component Groupings. 10
Table 2-2. Component Type Closure Plans Required for WMA C Sector Closure. 13
Table 3-1. HFFACO Milestones Applicable to the WMA C Integration Study. 17
Table 4-1. WMA C Component Closure Pathways. 35
Table 4-2. Planned Isolation Actions. 40
Table 6-I. Disposition Pathway for Waste Sites and Structures Outside of C Farm. 61
Table 7-1. Summary of Surface Barrier Design Criteria. 70

LIST OF TERMS

CERCLA	*Comprehensive Environmental Response Compensation and Liability Act of 1980*
CMS	corrective measures study
DOE	U.S. Department of Energy
DQO	Data Quality Objectives
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
HWMA	Hazardous Waste Management Act
IMUST	inactive miscellaneous underground storage tank
NEPA	*National Environmental Policy Act of 1969*
ORP	Office of River Protection
OU	operable unit
PA	performance assessment
PUREX	plutonium uranium extraction
RCRA	*Resource Conservation and Recovery Act of 1976*
RFI	RCRA facility investigation
ROD	Record of Decision
RL	Richland Operations Office
SEPA	State Environmental Policy Act
SST	single-shell tank
TC-EIS	Tank Retrieval and Closure Environmental Impact Statement
TWRWP	Tank Waste Retrieval Work Plan
UPR	unplanned release
WIDS	waste information data system
WMA	waste management area

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This document is being prepared to partially satisfy *Hanford Federal Facility Agreement and Consent Order* (HFFACO; Ecology et al. 1989) Interim Milestone M-45-00B for "Submittal of WMA Integration Plans for WMA C and One Additional WMA by June 30, 2005." This WMA C Integration Study along with the WMA T Integration Study (RPP-PLAN-25942) meets the requirements for M-45-00B. The U.S. Department of Energy (DOE) is in the process of preparing the *Draft Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, Washington* (DOE/EIS-0356) under the *National Environmental Policy Act of 1969* (NEPA). DOE/EIS-0356 is commonly referred to as the Tank Retrieval and Closure Environmental Impact Statement (TC-EIS). It is anticipated that the TC-EIS will evaluate various closure alternatives including clean and landfill closure. After completion of the NEPA process, the TC-EIS will form the basis for DOE decision-making regarding closure and will be confirmed in a Record of Decision (ROD). Although this Waste Management Area (WMA) C Integration Study assumes that the WMAs would be landfill closed, it does not represent a DOE decision to landfill close in advance of completing the NEPA process. This study is only intended to provide additional information regarding potential closure approaches.

The DOE, Office of River Protection (ORP) has prepared the *Single-Shell Tank System Closure Plan* (RPP-13774), which lays out a plan to clean up and close the single-shell tank (SST) system in the 200 Areas of the Hanford Site Central Plateau. RPP-13774 is consistent with the HFFACO milestones. The WMA integration studies will support the closure plan by proposing a sequence of actions and activities within each of the seven WMAs (A/AX, B/BX/BY, C, S/SX, T, TX/TY, and U) that will allow for an effective and efficient approach to cleanup and closure.

Where information regarding treatment, management, and disposal of the radioactive component of mixed waste (as defined by the *Atomic Energy Act of 1954*) has been provided in this document, it is not intended for the purpose of regulating the radiation hazards of such components under the authority of the "Hazardous Waste Management Act" and its implementing regulations but is provided for informational purposes only

HFFACO Milestone M-45-00B establishes that there will be two initial WMA integration studies, both of which will be completed by June 30, 2005. Subsequent WMA integration studies will follow the preparation of these first two studies on a schedule that is yet to be determined.

During renegotiation of the second phase of the SST waste retrieval activities (Milestone M-45-00C), the negotiation team concluded that additional supporting information and plans were necessary to aid in defining an integrated closure process to support closure decisions for all SST

components or groups of components within a WMA. This decision is reflected in the revised Milestone M-45-00B. The Milestone M-45-00C negotiation team recognized that the issues of closure of ancillary equipment and other components within a WMA, as well as contaminated soil sites and facilities both within and outside a WMA, are inter-related with tank waste retrieval and tank closure. The team also recognized that there were instances where system components, sites, and facilities could be grouped and closure actions sequenced for more effective and efficient closure and remediation activities.

The WMA integration studies will be an integral part of the overall process for closure of the tank farm system and the Central Plateau. An overview of this process is described in the draft HFFACO Appendix I, which states:

> "For each SST tank farm (or WMA), DOE shall submit a WMA Integration Study. This study shall look at the entire WMA from a systems perspective and describe the inter-relationships between the various components. The study shall describe a logical sequence of events that would lead to efficient and effective waste retrieval and closure of the WMA, including field sampling and characterization activities of the ancillary equipment (piping, valve pits, vaults, Miscellaneous Underground Storage Tanks, diversion boxes, etc.) This study will be used in the development of the WMA Closure Plan. The document will propose a regulatory path for all ancillary equipment in that WMA and all the activities to achieve efficient and effective closure of that WMA, including all:
>
> - Single Shell Tanks
> - SST system ancillary equipment
> - Soil remediation per WMA corrective actions and proposed plans for WMA soils
> - Groundwater remediation activities and activities necessary for integration with Central Plateau groundwater remediation."

1.2 WMA C BACKGROUND

WMA C encompasses the C tank farm, including soil and groundwater contaminated by C tank farm operations. WMA C is located in the east-central portion of the 200 East Area (Figures 1-1 and 1-2). In general, the WMA C boundary is represented by the fenceline surrounding the C tank farm. The C tank farm 100-series tanks are 23 m (75 ft) in diameter, have a 5-m (15-ft) operating depth, and an operating capacity of 1.89 million L (530,000 gal) each. The 200-series tanks are 6 m (20 ft) in diameter with a 5-m (17-ft) operating depth and an operating capacity of 208,000 L (55,000 gal) each. The tanks sit below grade with at least 2 m (7 ft) of soil cover to provide shielding from radiation exposure to operating personnel. Tank pits are located on top of six of the 100-series tanks and all four of the 200-series tanks and provide access to the tanks and their operating equipment (e.g., pumps and monitoring equipment).

Figure 1-1. Location Map of WMA C in the 200 East Area of the DOE Hanford Site.

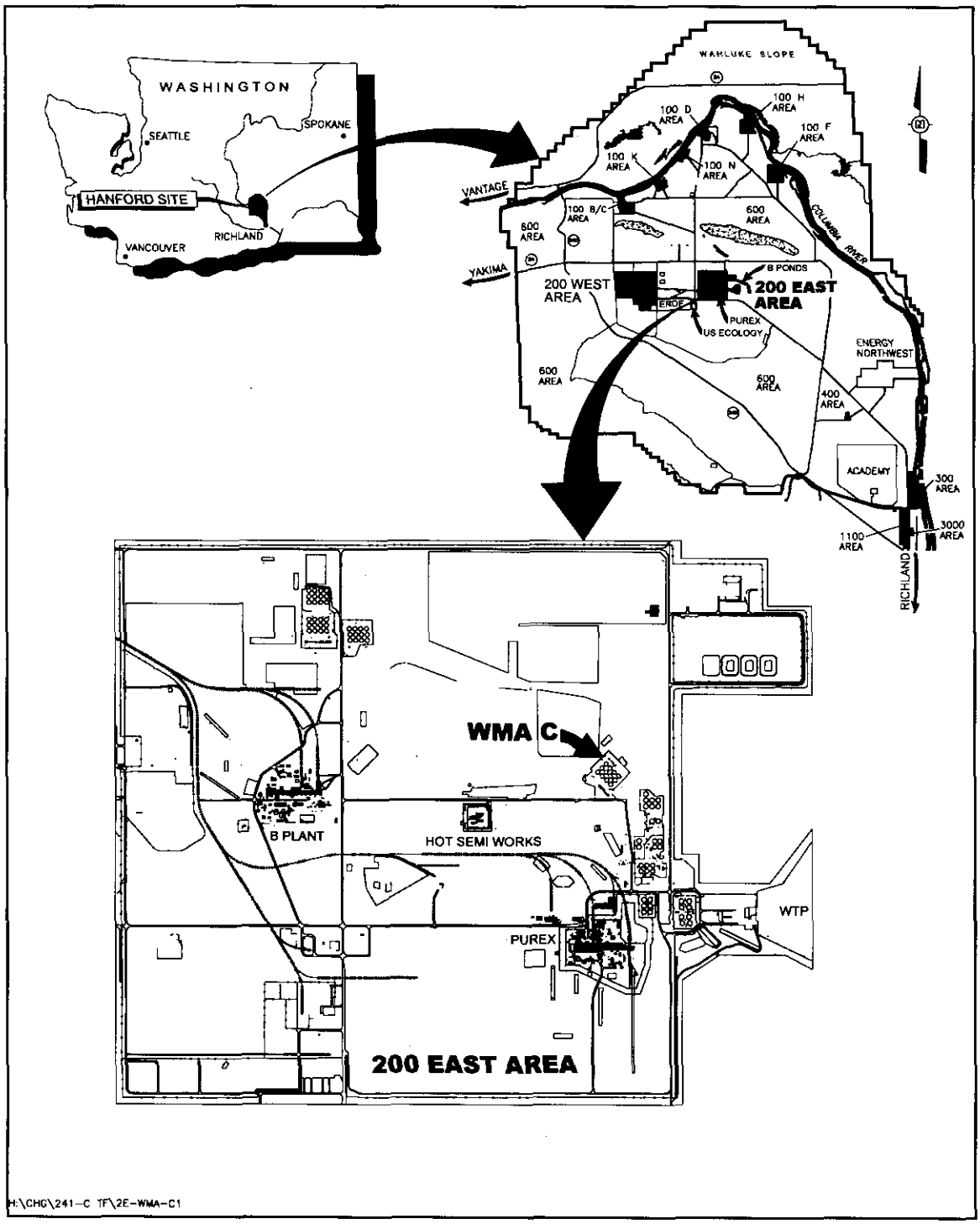
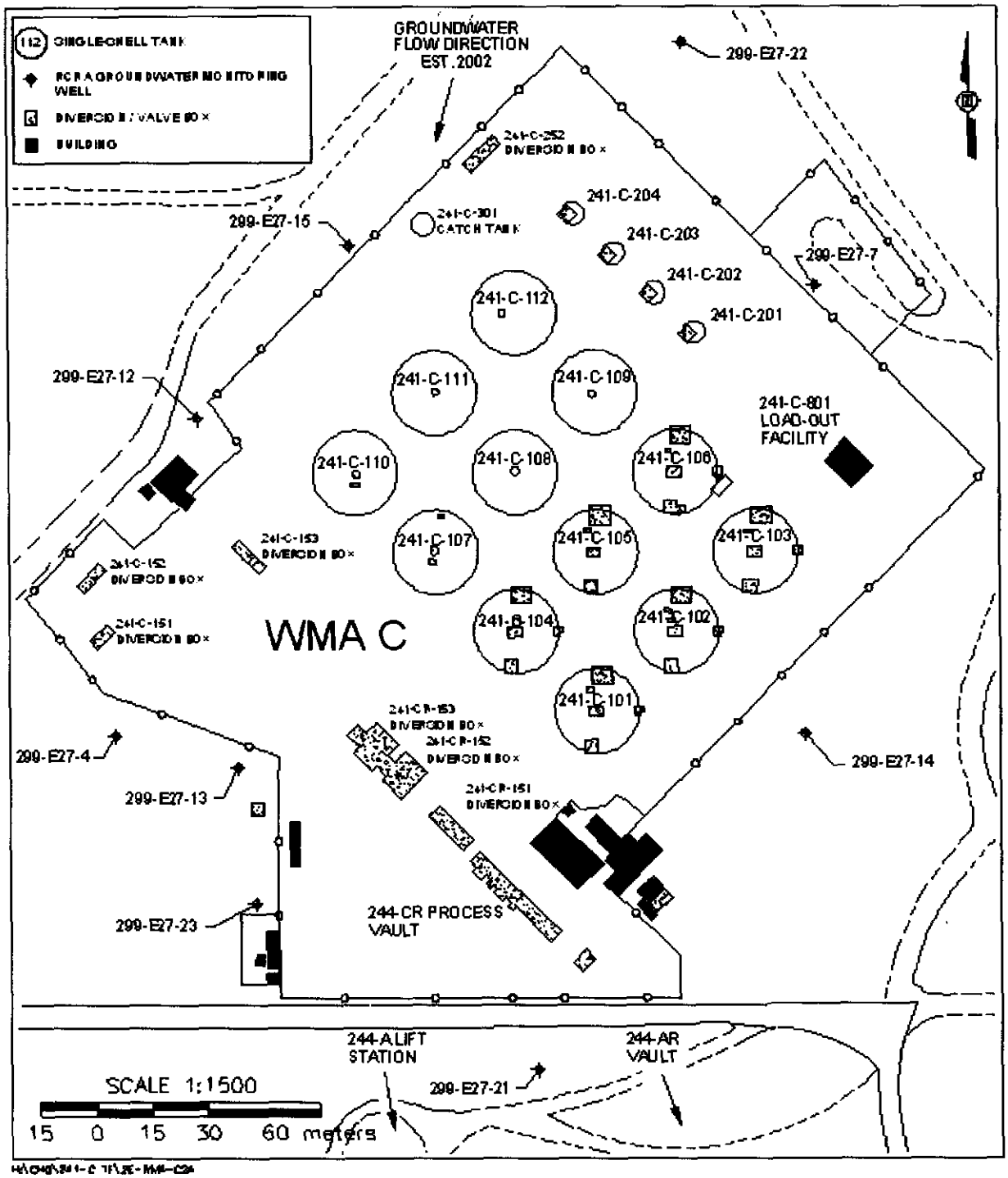


Figure 1-2. Location Map of WMA C and Surrounding Area.



The SSTs were constructed in place with carbon steel (ASTM A 283 Grade C) lining the bottom and sides of the interior of a reinforced-concrete shell. The tanks have concave bottoms (i.e., the center of each tank is lower than the perimeter) and a curving intersection of the sides and bottom. The inlet and outlet lines are located near the top of the liners. The twelve 100-series tanks are grouped into four sets of three tanks. Each tank in the three-tank grouping is connected to the next tank via a buried pipeline. These lines are also referred to as 'cascade' lines because they allowed the transfer of fluids between tanks using gravity flow. The SSTs in WMA C were used to store waste primarily from the bismuth phosphate, plutonium-uranium extraction (PUREX), and uranium extraction processes as well as the semi-works pilot tests.

A waste transfer system of pipelines (transfer lines), diversion boxes, vaults, valve pits, pump pits, sluice pits, heel pits, and other miscellaneous structures support the transfer and storage of waste within the WMA C SSTs. Collectively, these are referred to as ancillary equipment. Another major component of significance is the 244-CR vault, located south of the tanks. The vault is a two-level, multi-cell, reinforced-concrete structure constructed below grade (*PUREX Source Aggregate Area Management Study Report* [DOE/RL-92-04]) and containing four underground tanks along with overhead piping and equipment. Two of the tanks have a capacity of 170,300 L (45,000 gal) each. The other two tanks have capacities of 55,500 L (14,700 gal) each. This vault was constructed in 1951 to support uranium recovery from metal waste; it ceased operating in 1988. It was last used to transfer waste solutions from processing and decontamination operations (DOE/RL-92-04).

The routing of liquid waste from the operations buildings to the tank farms was accomplished using underground transfer lines, diversion boxes, and valve pits. The diversion boxes housed the switching facilities where waste could be routed from one transfer line to another. The diversion boxes are belowground, reinforced-concrete boxes that were designed to contain any waste that escaped the high-level waste transfer line connections. These losses typically occurred during the reconfiguration of waste routings when jumpers were disconnected. Diversion boxes generally were drained by gravity to nearby catch tanks where any spilled waste was stored and then pumped to the SSTs (DOE/RL-92-04).

Valve pits are belowground, reinforced-concrete structures that contain valve and jumper assemblies that were used for routing the liquid waste through the transfer lines. Liquid waste was routed to valve pits when several tanks were undergoing simultaneous pumping to a single receiver tank. Each valve pit has a flush line connected to a flush pit or drain line connected to an underground tank.

Thirteen unplanned releases (UPRs) are thought to have occurred within or adjacent to WMA C. There exists uncertainty in the volume and content of UPRs from components within WMA C. Estimates of contaminant release volumes, inventories, and locations for some UPRs are included in the Hanford Site waste information data system (WIDS).

This WMA C Integration Study is the first such study to be produced in fulfillment of HFFACO Appendix I and Milestone M-45-00B requirements. It is an initial approach to defining the inter-relationships among the WMA components and is expected to mature as more information is gathered and lessons are learned during the closure process. New information will include the following:

- Verification of chemical and radiological inventories through characterization activities
- Verification of physical attributes of SST components
- Implementation of closure actions in highly radioactive environments
- Completion of regulatory approvals and conditions associated with closure actions.

As closure of the SST system progresses, the WMA integration studies may be updated to reflect new information

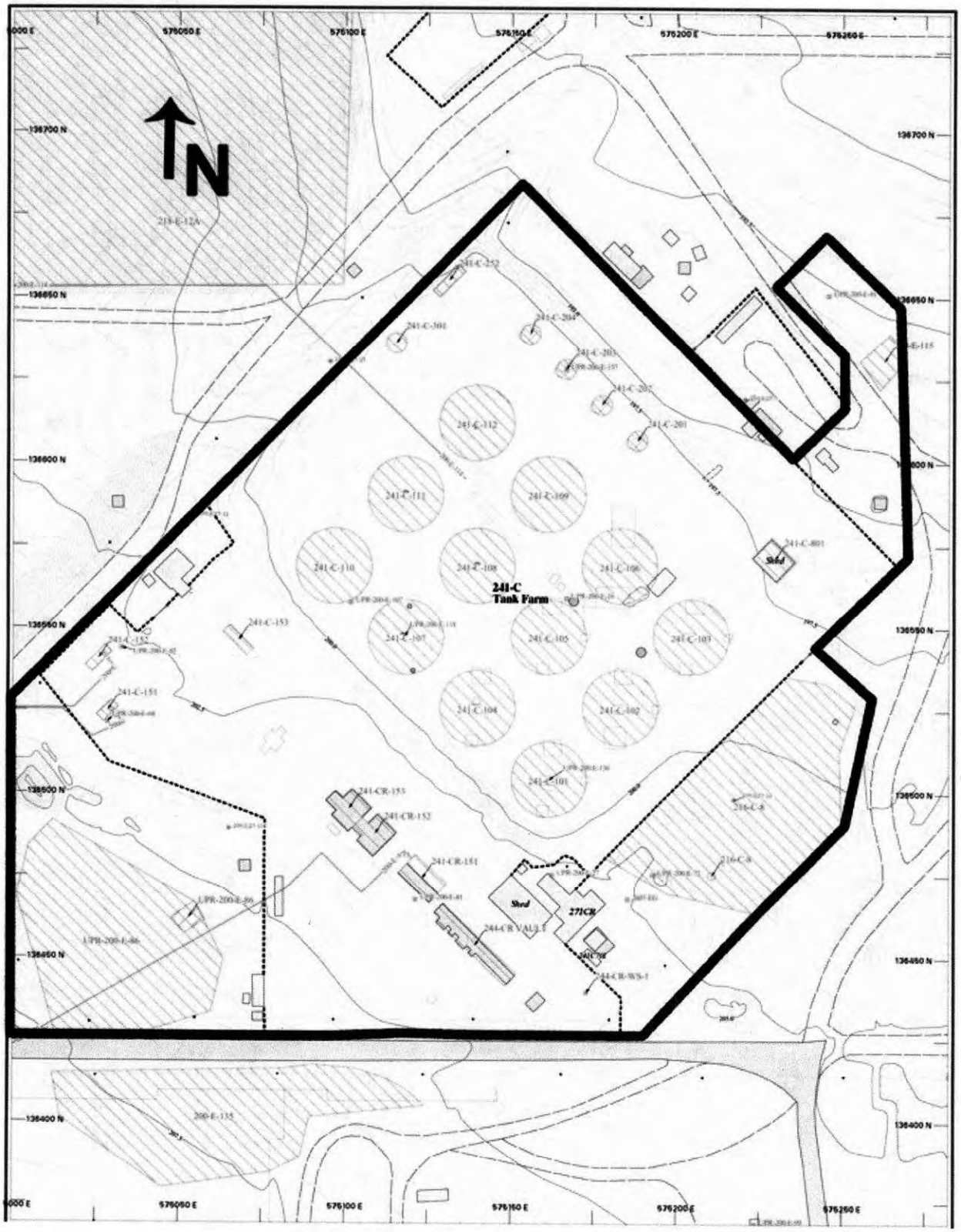
2.0 WMA STUDY AREA AND CLOSURE SECTORS

The concept of WMAs was originally based upon the grouping of the 12 SST farms into 7 WMAs for purposes of the "Hazardous Waste Management Act" (HWMA) ("Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities" [40 CFR 265]) groundwater assessment and monitoring program as implemented by the Washington State Department of Ecology (Ecology) under "Interim Status Facility Standards" (WAC 173-303-400). This program was established in response to the HFFACO requirement for periodic groundwater monitoring at the SSTs to detect potential releases. WMA boundaries are depicted in *40 CFR 265 Interim-Status Ground-Water Monitoring Plan for the Single-Shell Tanks* (WHC-SD-EN-AP-012). The boundary of the seven WMAs for the purposes of defining the point of compliance for groundwater protection is considered to be the tank farm fenceline.

The scope of this WMA C Integration Study goes beyond the limits set for the groundwater assessment and monitoring program. This study includes a compilation of tank farm system components, buildings and supporting infrastructure, and waste sites that exist within and in close proximity to the C tank farm. The WMA C Integration study area is illustrated in Figure 2-1. The study area includes the contiguous area that contains both aboveground and belowgrade physical structures and sites associated with the C tank farm system that must be closed, remediated, or otherwise dispositioned to support the long-term land use of the area. It is inclusive of the area within the tank farm fenceline, as well as that area outside the fenceline that contains SST related components.

The WMA C Integration Study Area encompasses components that may be dispositioned under different regulatory authorities. This integration study identifies and defines the interface points of these regulatory authorities, such that each waste site/component that is part of the WMA C closure activity has an associated closure decision process identified for it, if known. Where undefined, the need for defining a closure decision process is captured as a future action. While ORP maintains ownership for the majority of waste sites and components within the WMA fenceline, the DOE, Richland Operations Office (RL) maintains ownership for the majority of those outside the fenceline. The two DOE offices are continuing to develop integrated closure planning between their respective areas of responsibility to ensure consistent, efficient closure options for all sites within geographic closure zones (as defined in *Plan for Central Plateau Closure* [CP-22319]).

Figure 2-1. WMA C Integration Study Area.



2.1 COMPONENT INTEGRATION LOGIC

Major emphasis has been placed on accelerating the retrieval of waste and closure of SSTs. In WMA C, 241-C-106 (hereafter tank C-106) is the first SST to be retrieved to the limits of the selected technologies (i.e., acid dissolution and sluicing). The remaining tank wastes in WMA C are planned to be retrieved by September 30, 2006. However, the closure of WMA C goes well beyond retrieval of waste from the remaining 15 tanks in C tank farm. Closure must also address ancillary equipment (including pipelines, vaults, pits, diversion boxes, tank risers, and pumps) as well as buildings and supporting infrastructure and waste sites.

Much of the in-tank equipment is expected to be dispositioned as in-tank debris during the tank closure activity. Disposition of tank ancillary equipment (e.g., in-tank measuring equipment, tank risers) will be described in the respective tank component closure activity plans.

Disposition of ex-tank ancillary equipment (e.g., pipelines, diversion boxes, cascade lines) will be described in either an ancillary equipment component closure activity plan, a tank component closure activity plan, or other alternate decision documentation (e.g., corrective measures study (CMS)/permit modification, feasibility study/ROD) upon approval through incorporation into the SST system chapter of the *Resource Conservation and Recovery Act of 1976* (RCRA) Site-Wide Permit (*Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste* [Ecology 2004]).

2.1.1 WMA C Database

The WMA C database inventories 806 components structures, waste sites, and buildings that will require dispositioning as part of WMA C closure. A summary of this database is presented in Appendix A.

There are limited or no data available for many of the 806 components that have been inventoried into the configuration controlled database. Knowledge of the physical features is important to determine a component's status with regard to other components. For example, knowing a pipeline has been cut and capped and isolated from a diversion box would indicate that this line would not be a potential conduit for liquids into the diversion box. Similarly, understanding the potential for a component to contain waste inventory could affect decisions as to whether it should be cleaned or removed before final WMA closure.

The components have been characterized to describe their known or suspected physical states based upon the current information. To more efficiently manage and organize these components for evaluation in this WMA C Integration Study, these components have been organized into groups based upon their common associations (e.g., functionality, geography, configuration). The grouping of waste transfer components and ancillary equipment in the database provides the foundation for closure integration that considers the physical characteristics associated with the components and equipment so that closure decisions can be made. The current state of knowledge for the components and ancillary equipment is available in the WMA C database. These groupings are presented in Table 2-1.

Table 2-1. Component Groupings. (2 Sheets)

Components	Descriptions	Comments
Waste Conveyance and Storage Facilities		
Exterior pipelines	Pipeline segments that extend beyond the WMA fenceline and are not within the exclusive control of the tank farm closure contractor.	Closure and final disposition of these pipeline segments would require close coordination with RL and the Central Plateau Closure contractor.
Diversion boxes	Diversion boxes and nozzles.	—
Internal pipelines	Pipeline segments that fully reside within the WMA fenceline and are under the exclusive control of ORP.	This is inclusive of pipeline encasements and trenches.
Pits	Pits including nozzles, risers located within the pit, and abandoned equipment in the pit.	This will include equipment requiring removal in the pit (i.e., pump motor) but not equipment abandoned in the pit (i.e., AMS mast)
Risers	Stand-alone risers not in a pit.	—
Tanks and cascade lines	100- and 200-series SSTs. 100-series tank sloping cascade lines and 200-series connecting lines (level).	—
IMUSTs	IMUSTs including 241-C-301, and tanks within buildings such as the CR vault (244-TK-CR-001, -002, -003, and -011).	—
Infrastructure		
Water system	Water pipelines and associated components.	—
Electric distribution and lighting systems	Power distribution system including lines, poles, transformers, and lighting.	—
Steam lines	All steam lines and associated components.	Steam lines were typically insulated with asbestos and any removal may require an Asbestos Abatement Program.
Ventilation system	Active or passive (breather filter) in pit or out of pit equipment, abovegrade skids or integration with rest of C tank farm ventilation system (portable exhauster or hooked into C tank farm acceleration ventilation system).	—

Table 2-1. Component Groupings. (2 Sheets)

Components	Descriptions	Comments
Miscellaneous Components and Features		
CR vault	Components other than the tanks that are inside the CR vault including the building itself.	—
Cesium Load-Out Facility, 241-216-C-801	Components inside the Cesium Load-Out Facility including the building itself.	—
Control Building, 271-C	Components that are inside the Control Building including the building itself.	—
Sanitary drain field	Sewer line from the building to the drain field including soil.	—
Chemical sewer French drain	Sewer line from the building to the drain field including soil.	—
Retrieval facilities	This includes a variety of temporary structures and facilities used during waste retrieval.	As part of the preparation for initiating closure and before commencement of closure of the SSTs, these facilities must be removed and disposed of.
UPR sites		
UPRs	13 identified sites including soil and vadose zone.	—

AMS = articulated mast system.
DOE = U.S. Department of Energy.
IMUST = inactive miscellaneous underground storage tank.
ORP = Office of River Protection.
RL = Richland Operations Office.
SST = single-shell tank.
UPR = unplanned release.
WMA = waste management area.

2.1.2 WMA C Waste Characterization

Characterization of the nature and extent of residual waste contaminants will be performed for the four major WMA component groupings (tanks, ancillary equipment, contaminated soil, and groundwater) to develop a technical basis for decision making to ensure that closure actions are effective in protecting human health and the environment. As tank retrieval efforts proceed, samples of the residual waste will be collected in accordance with a Sampling and Analysis Plan (SAP). Tank waste characterization data are maintained in the Best Basis Inventory (BBI). Characterization data are also being collected for contaminated soil as part of the RCRA Facility Investigation/Corrective Measures Study (RFI/CMS) process underway at WMA C. Groundwater characterization data will need to be assembled and evaluated from RCRA groundwater monitoring, WMA C RFI/CMS, 200-PO-1 and 200-BP-5 groundwater operable unit Remedial Investigation/Feasibility study (RI/FS) activities. To date, characterization information for ancillary equipment is limited.

Efforts are underway to organize and evaluate process knowledge with respect to the conditions in pipelines. A similar compilation and evaluation of process knowledge will be necessary for the remaining ancillary equipment types. A summary of the process history for WMA C is presented in Appendix B. Upon evaluation of process knowledge, it may be determined that some further data collection and analysis efforts are needed to confirm process knowledge or better define the residual contaminant inventories in ancillary equipment. To accomplish this, a DQO process will likely be undertaken. It is expected that a graded approach to characterization will be pursued. A graded approach involves balancing characterization data needs with worker exposure that results from increasingly intrusive characterization activities. It is anticipated that analogs for equipment types can be developed and applied. In addition, opportunistic sampling and characterization could be achieved through close coordination with ongoing operations, maintenance, and closure activities.

2.2 WMA C CLOSURE SECTORS

The WMA C Integration Study area has been subdivided into seven sectors. A sector is a contiguous collection of one or more of the component and ancillary equipment groupings listed in Table 2-1. A sector is defined based upon specific physical, waste inventory, and regulatory characteristics of the components that exist within the sector. Table 2-2 shows the component groupings that have been proposed for each of the seven closure planning sectors in the study area.

Table 2-2. Component Type Closure Plans Required for WMA C Sector Closure.

Component Group	Sector 1	Sector 2	Sector 3	Sector 4	Sector 5	Sector 6	Sector 7
Tanks/pits	X	X					
Diversion boxes		X		X			X
Internal piping	X	X	X	X			X
External piping	X	X		X	X		X
Miscellaneous underground storage tanks					X		X
Dry wells	X	X					
Unplanned release sites	X	X	X	X			X
Vaults					X		
Cesium Load-Out Facility			X				
Miscellaneous components					X	X	

The major components within each sector are identified in the following list. Selection is based on current tank farm system knowledge of physical waste characteristics (including the UPRs) in and adjacent to WMA C, as well as the regulatory drivers for each of the component groupings (Table 2-2) that make up the WMA C closure sectors.

- **Sector 1** – Twelve 100-series SSTs with their associated pits, risers, and internal pipes; and four UPRs (200-E-16, 200-E-107, 200-E-118 and 200-E-136).
- **Sector 2** – Four 200-series SSTs with their associated pits, risers and internal pipes; one diversion box; external piping; and one UPR (200-E-137).
- **Sector 3** – Cesium Load-Out Facility, two associated French drains, and two UPRs (200-E-115, and 200-E-91).
- **Sector 4** – Three diversion boxes, external piping, and one UPR (200-E-81).
- **Sector 5** –244-CR process vault, which includes four process tanks, internal piping, and a ventilation system.
- **Sector 6** – C tank farm control room buildings, cold chemical make-up building, French drain C-8, septic tank/leach field 2607-EG, and two UPRs (200-E-72 and 200-E-27).
- **Sector 7** – Three diversion boxes, external piping, a catch tank, and three UPRs (200-E-68, 200-E-82 and 200-E-86).

The general boundaries of the WMA C sectors are shown in Figures 2-2 and 2-3.

Figure 2-2. WMA C Sectors.

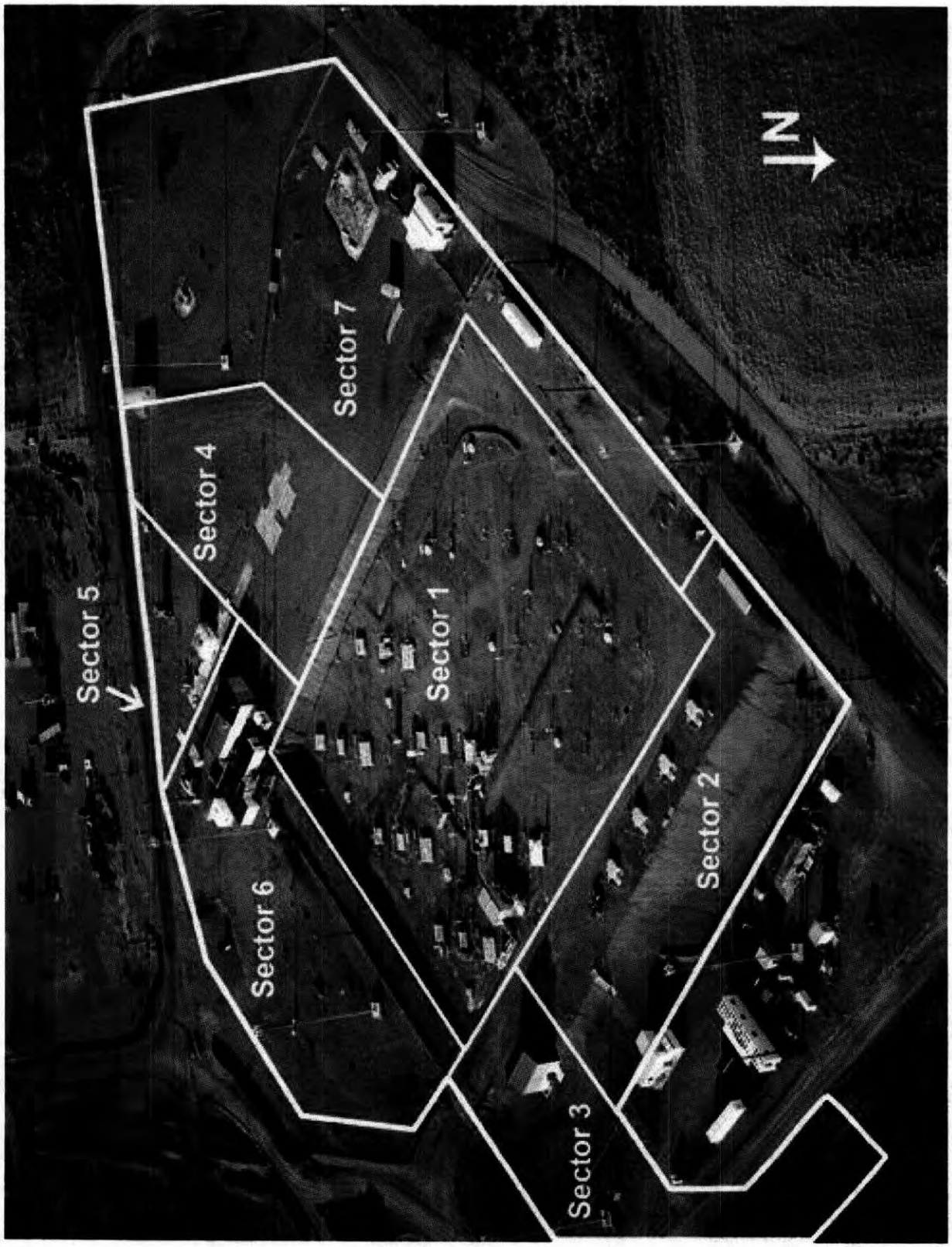
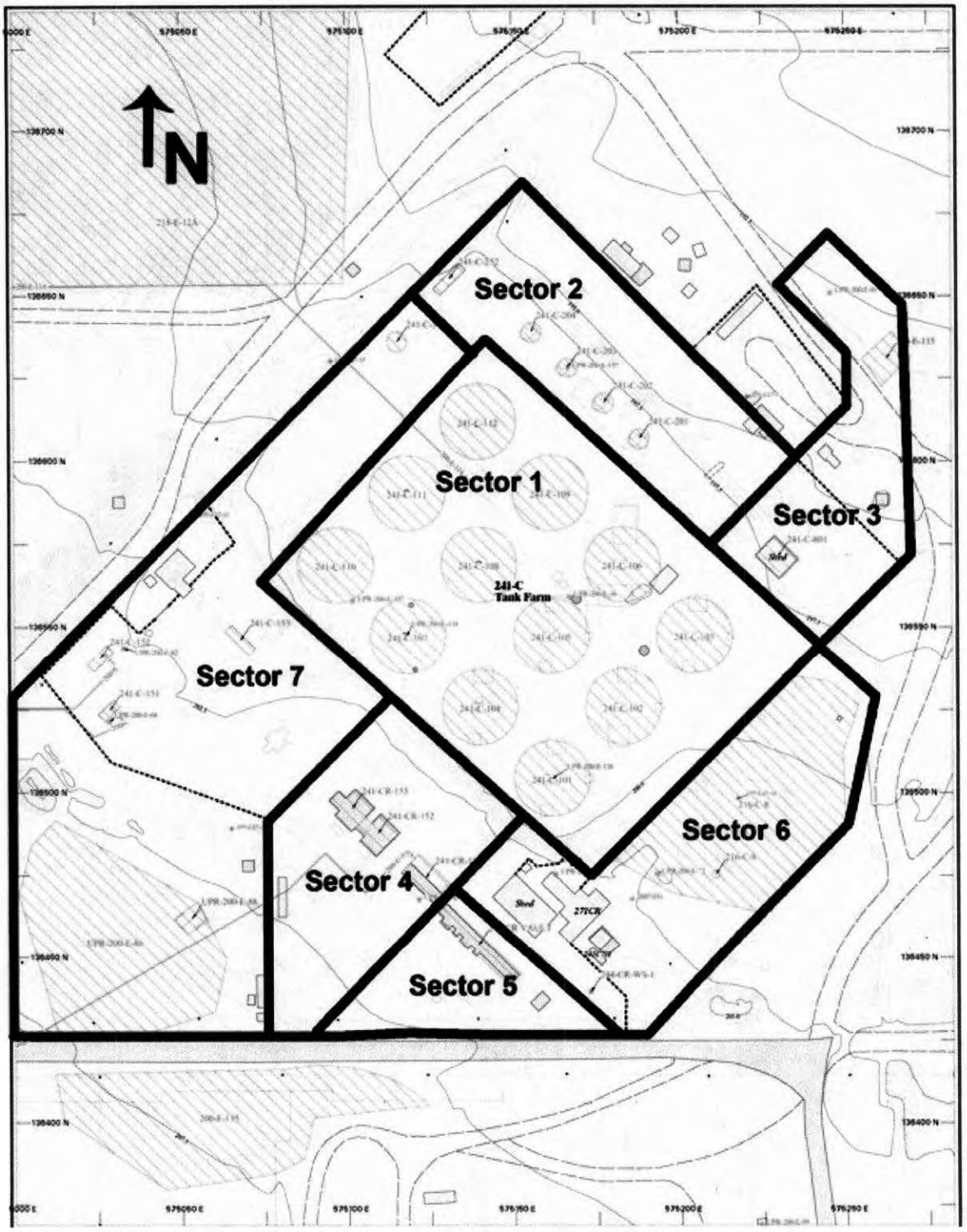


Figure 2-3. WMA C Sectors and Major Components.



3.0 REGULATORY SETTING

This section identifies the regulatory background and requirements that are relevant to the closure of WMA C and how compliance with these requirements is expected to be achieved based on current knowledge of site conditions. Although characterization has not been completed, residual waste data from tank 241-C-106 along with information contained in the best-basis inventory for WMA C tanks provides a solid basis from which to proceed with closure planning. Refinements to this basis will be ongoing as more information is gathered during closure.

3.1 DRIVERS FOR CLOSURE

There are several drivers that directly influence and guide closure activities at the Hanford Site. The primary drivers include the following

- HFFACO
- RCRA
- *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA)
- NEPA
- "Washington State Environmental Policy Act (SEPA)"
- *Atomic Energy Act of 1954* as implemented through *Radioactive Waste Management* (DOE O 435.1).

3.1.1 HFFACO Milestones

The HFFACO establishes a high-level schedule for overall SST system closure activities. The milestones that have been negotiated in the HFFACO provide a structure for developing detailed plans that specify activities and requirements for SST system closure. Key HFFACO milestones pertinent to the planning approach presented in this WMA C Integration Study are presented in Table 3-1.

Table 3-1. HFFACO Milestones Applicable to the WMA C Integration Study.

Milestone	Summary of Milestone	Completion Date
M-45-00	Complete closure of all SSTs and requirement that all SST retrieval and closure actions be conducted in compliance with the HFFACO Appendix I process	9/30/2024
M-045-00B	Complete retrieval of all WMA C SSTs	9/30/2006
	Submittal of the WMA C Integration Study	6/30/2005
M-045-06-T03	Initiate closure actions of one WMA	3/31/2012
M-045-06-T04	Complete closure actions of one WMA	3/31/2014
M-045-55	Submittal to Ecology of Phase 1 RFI Report for all WMAs	1/31/2007
M-045-58	Submittal to Ecology of CMS for interim corrective measures for all WMAs	6/30/2007
M-045-60	Submittal to Ecology of RFI/CMS Work Plan for interim corrective measures for all WMAs	9/30/2007

CMS = corrective measures study.
HFFACO = *Hanford Federal Facility Agreement and Consent Order.*
RCRA = *Resource Conservation and Recovery Act of 1976.*
RFI = RCRA facility investigation.
SST = single-shell tank.
WMA = waste management area.

The specification in the HFFACO that retrieval of all WMA C tanks be completed by the year 2006 is unique to WMA C and therefore distinguishes it from planning assumptions to be developed for other WMAs. This requirement will be a key driver for the sequencing of WMA C closure actions. For other WMAs, sequencing of work may result in a different order of component closure actions in the absence of a schedule driver for SST waste retrieval and closure.

3.1.2 RCRA

The certified SST system closure plan, RPP-13774, was submitted to Ecology on January 19, 2004 under the provisions of RCRA and the HWMA and in fulfillment of HFFACO Milestone M-45-05H. The SST system closure process consists of three tiers:

- **Tier 1** – The framework plan for SST system closure, which provides a general description of the system closure process.

- **Tier 2** – The WMA closure action plans (one for each of the seven WMAs), which describe actions that will be taken to support remediation and closure of an entire WMA. These include risk assessments, groundwater monitoring, planning for design of a final cover, and integration of the WMA-wide actions with adjacent or site-wide remediation and closure strategies.

- **Tier 3** – Component closure activity plans that document descriptions of the activities leading to closure of the components that comprise a WMA (tanks, ancillary equipment, contaminated soil, and groundwater). These plans may address individual structures or similar structures within a component grouping.

The SST system closure process emphasizes closure at the WMA level. Input from this WMA C Integration Study can be used to support modification of RPP-13774 and subsequently the RCRA Site-Wide Permit (Ecology 2004). Modifications are expected to bring more information into the closure plan and permit actions for groups of components within the WMA by way of common and systematic implementation of retrieval, characterization, and closure.

RCRA requirements, as implemented through "Dangerous Waste Regulations" (WAC 173-303) will be specified in the SST system portion of the RCRA Site-Wide Permit upon its modification. The permit will specify closure actions that must be performed to comply with RCRA requirements, whether the closure action is defined in association with tanks or ancillary equipment under a RCRA closure plan, or with contaminated soil and associated components under a RCRA corrective measures study (CMS). These specifications may impact the assumptions that form the basis for this WMA C Integration Study. If such an impact should occur, the planning identified in this study would need to be re-examined.

The RCRA closure requirements call for meeting both the general closure performance standards of WAC 173-303-610 and the landfill closure performance standards of WAC 173-303-665(6) (as specified in WAC 173-303-640[8][b]). In planning integrated closure actions within the WMA, these standards will determine how closure is achieved under RCRA requirements.

The general closure performance standards of WAC 173-303-610(2) and the planning assumptions used to meet these requirements are discussed in detail in Section 4.0. General performance standards require that the facility be closed in a manner that:

- Minimizes the need for further maintenance;
- Controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of dangerous waste, dangerous constituents, leachate, contaminated runoff, or dangerous waste decomposition products to the ground, surface water, groundwater, or the atmosphere;
- Returns the land to the appearance and use of surrounding land areas to the degree possible, given the nature of the previous dangerous waste activity.

3.1.3 RCRA Corrective Action Requirements

Contaminated soil and the Cesium Load-Out Facility within WMA C would undergo an alternatives analysis within a RCRA facility investigation(RFI)/CMS in accordance with the requirements of the HFFACO. Decisions concerning appropriate soil cleanup or corrective actions would be determined through the RFI/CMS process defined in condition II.Y of the

RCRA Site-Wide Permit (Ecology 2004), WAC 173-303-645, WAC 173-303-646, HFFACO Milestone M-45-55, and the RCRA corrective action process, as described in the HFFACO.

There are two primary steps in the WMA C soil component closure activities: (1) characterizing the nature, extent, and mobility of the contamination in the soil column, and (2) performing necessary cleanup in accordance with WAC 173-303-610 and WAC 173-303-645. Characterization of soils involves an assessment of known and suspected contamination. Characterization information is then used to prepare a risk assessment that evaluates the relative risk from the contaminated soil. A RCRA past-practices CMS, based on the risk assessment, is then conducted to identify any appropriate remediation methodologies. Finally, the corrective measures alternative(s) are implemented. The RFI/CMS process is depicted in Figure 3-1.

3.1.4 CERCLA Remedial Action Requirements

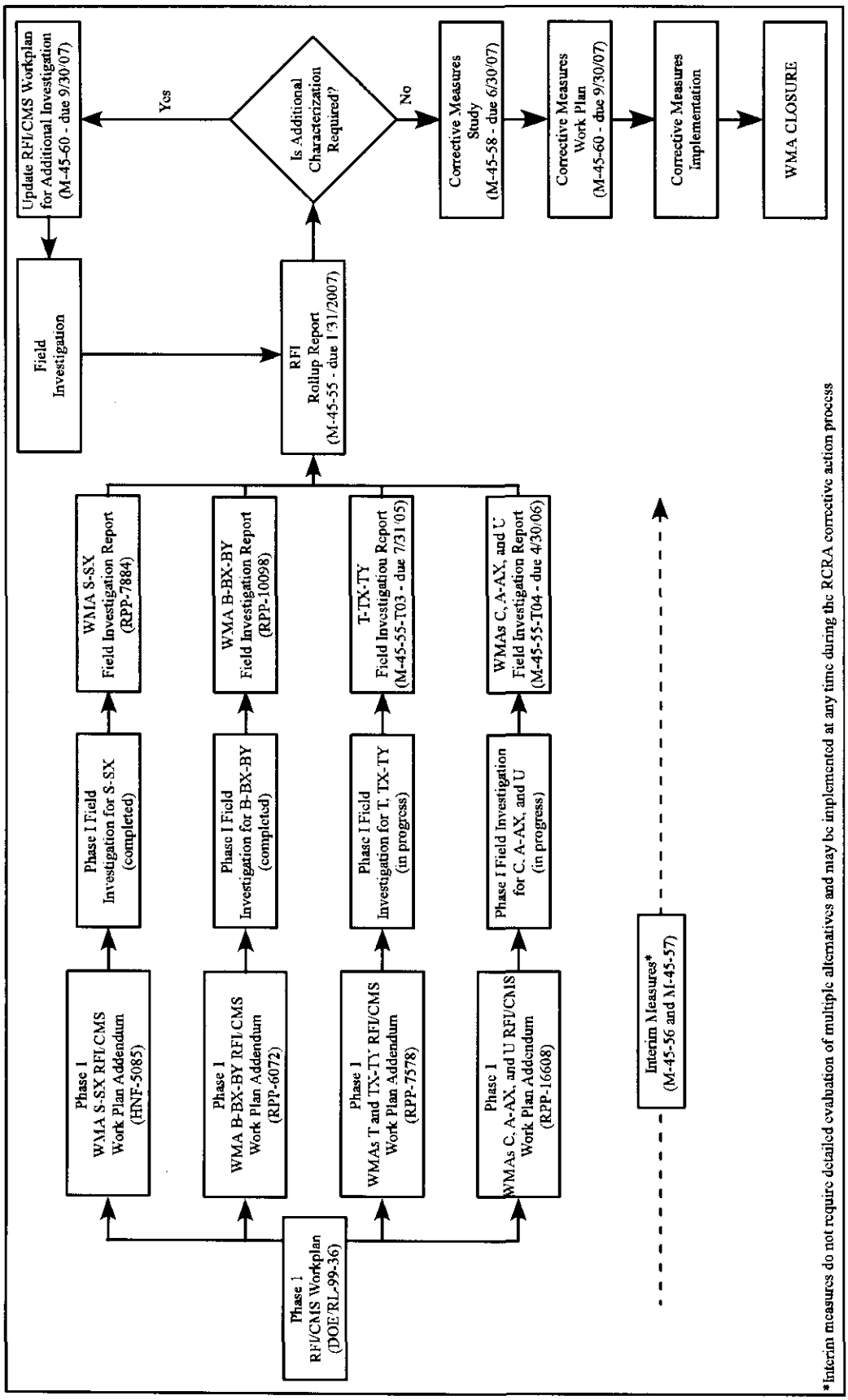
If it is determined that groundwater corrective actions associated with WMA C are necessary, groundwater remediation may be performed pursuant to a CERCLA ROD (interim and final) developed for the associated groundwater operable unit (OU) (200-BP-5 or 200-PO-1). Groundwater monitoring and response actions are integrated within the context of HFFACO Milestones M-24 and M-45 and, as feasible, would be integrated with, but separate from, the WMA C and Central Plateau regional closure strategy.

3.1.5 NEPA and SEPA

In addition to RCRA closure requirements, other regulatory programs would drive closure planning within WMA C. NEPA was created to integrate environmental awareness and environmental factors early in the planning process of all federal actions. Compliance with NEPA provisions calls for federal agency planning and analysis that fully considers and documents, on a timely basis, the environmental considerations and alternatives to the proposed action.

NEPA requires federal agencies to consider environmental impacts when proposing federal actions that may significantly affect the quality of the human environment. An environmental review is conducted early in the planning and decision-making process to determine whether significant environmental impacts are anticipated. This review is used to determine if the proposed action can be modified or redesigned to lessen or eliminate environmental impacts and to determine if further investigation is required before proceeding with the action.
An environmental assessment may be prepared for use as a screening document to determine if an EIS must be prepared or if a finding of no significant impact (FONSI) can be made. An EIS, which is a much more comprehensive analysis of the impacts of the proposed action and alternatives, may also be prepared directly, without the use of an environmental assessment.

Figure 3-1. RFI/CMS Process.



The draft TC-EIS being developed under NEPA will analyze SST system-wide closure issues. The TC-EIS will evaluate various closure alternatives including clean and landfill closure. After completion of the NEPA process, the TC-EIS will form the basis for DOE decision-making regarding closure, as set forth in a ROD. This WMA T Integration Study does not represent a DOE decision to landfill close in advance of completing the NEPA process, but is only intended to provide additional information regarding potential closure approaches.

SEPA is intended to ensure that environmental values are considered during decision-making by state and local agencies. SEPA requires decision-making agencies, such as Ecology, to conduct an evaluation of proposals in accordance with "SEPA Rules" (WAC 197-11) to determine the potential significance of impacts to the environment and public health. In lieu of preparing a separate SEPA EIS, Washington State has the option to adopt a NEPA EIS if certain requirements in WAC 197-11-610(3) are met, or if they cooperated with a federal agency that is preparing an EIS. As a cooperating agency, Ecology may participate in a range of activities associated with the preparation of an EIS, including co-authoring a document, providing input to development of alternatives, or similar actions. The decisions that result from both the Final TC-EIS and subsequent SEPA determinations could impact closure planning at WMA C. Assumptions used in this WMA C Integration Study are consistent with those used to support certain alternatives as currently defined in the draft TC-EIS. However, these may need to be revisited upon issuance of the TC-EIS ROD.

3.2 TANK CLOSURES AND WASTE DETERMINATIONS

Chapter IV of *Radioactive Waste Management Manual* (DOE M 435.1-1) specifies criteria and processes for ensuring that low-level radioactive wastes are disposed of in a manner that is protective of human health and the environment. HFFACO Milestone M-45 sets forth waste retrieval objectives for SSTs that provide for the retrieval of at least 99% of the wastes in those tanks.[9] HFFACO Appendix I sets forth an integrated closure process for SSTs with residues following HFFACO-compliant waste retrieval that also results in the closures being compliant with relevant requirements set forth in DOE M 435.1-1, Chapter IV. The HFFACO integrated closure process obviates the need to also conduct a DOE M 435.1-1 closure process, which would be largely duplicative. Relative to the residues in SSTs following waste retrieval, DOE M 435.1-1, Chapter II specifies criteria and processes that enable DOE to determine that the residues meeting those criteria can be managed as low-level waste, even though they may have been in some fashion derived from wastes associated with the reprocessing of spent nuclear fuel. Those processes and criteria provide assurance that, once solidified, the residues will not contain fission products (or other radionuclides) in sufficient concentrations to require disposal in a geologic repository and, therefore, no longer need to be managed as high-level radioactive waste. Waste residues remaining in tanks at closure will be managed as mixed wastes under RCRA.

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[9] The 99% objective was used to establish a maximum volume of residue in tanks following retrieval. The large 100-series tanks can contain no more than 360 ft^3 of residue following retrieval and the smaller 200-series tanks can contain no more than 30 ft^3 of residues following retrieval. HFFACO Appendix H provides a means for Ecology to approve a greater residue volume than stated above on a case-by-case basis if it is not technically practical to reach the HFFACO objective for any given tank. Appendix H also requires DOE to consult with the U.S. Nuclear Regulatory Commission.

4.0 CLOSURE/REMEDIATION SEQUENCING

To develop a sequencing approach for an integrated closure strategy, it is necessary to establish a set of closure and remediation assumptions. Specifically, what are the regulatory assumptions and how do the closure and remediation planning assumption used in this integration study comply with the general closure performance standards of WAC 173-303-610(2).

4.1 REGULATORY ASSUMPTIONS

Closure/remediation assumptions provide the basis for planning WMA C closure in lieu of final regulatory decision making. These assumptions would require reexamination once the TC-EIS ROD is issued, as closure progresses and final regulatory decisions are made for WMA C.

Initial closure actions have already begun within WMA C, and the information collected during these actions has been used to develop these assumptions. Retrieval of tank C-106 waste has been achieved to the limits of the selected technologies. Waste retrieval activities have also begun in the four C farm 200-series tanks. In addition, RPP-13774 has been completed, including the risk assessment for WMA C in fulfillment of HFFACO Milestone M-45-05H. The initial risk assessment was performed based on current information, such as tank C-106 residual analytical data, the best-basis inventory for tank waste, geophysical vadose zone data, and groundwater monitoring data. Assumptions were drawn from this progress and are summarized as follows:

- Because residuals were left in tank 241-C-106 (i.e., clean closure was not achieved), it is assumed that landfill closure would be pursued in accordance with WAC 173-303-640(8)(b) and WAC 173-303-665(6).
- Similarly, it is assumed that the remaining WMA C tanks would contain waste residuals that meet HFFACO Milestone M-45-00C waste retrieval volume goals (below 360 ft^3 for 100-series tanks and below 30 ft^3 for 200-series tanks).
- Tanks would be filled with a cement-based grout after all appropriate regulatory approvals are obtained.
- An engineered surface barrier 4.57 m (15 ft) in thickness would be placed over the entire or the majority of the footprint of WMA C, thereby greatly reducing recharge through the vadose zone.
- Upon completion of waste retrieval from the C farm SSTs, grout fill of those tanks, and placement of a barrier over WMA C, the risk to human health and the environment would be greatly reduced because:

- Primary contributors to groundwater contamination are contaminants resulting from past leaks from tanks and ancillary equipment

- Cumulative dose from residuals left in all WMA C SSTs is below the drinking water value of 4 mrem in a year at the perimeter of WMA C.

- Cumulative incidental lifetime cancer risk exceeds the 1.0×10^{-5} target value at the WMA C perimeter for tank and ancillary waste residuals but not at the core zone boundary or the Columbia River for both the *Hanford Site Baseline Risk Assessment Methodology* (DOE/RL-91-45) Industrial and Residential receptors with technetium-99 responsible for the majority of the estimated risk.

- The Hazard Index does not exceed the target value for residual waste, past leaks, or hypothetical retrieval leaks for nonradiological constituents.

- No nonradiological contaminants in WMA C contribute to groundwater contamination above drinking water standards at the fenceline.

- Under a conservative assumption that 25% of the capacity of all ancillary equipment is filled with waste and left in place, risk levels are protective to human health and the environment. (Note that the pipelines in WMA C were typically drained and flushed after use; therefore, the amount of residual remaining in the pipelines is expected to be much smaller than the 25% used in this estimate).

Compliance with landfill closure performance standards is assumed for components in WMA C. As such, removal of waste from large, belowgrade ancillary equipment (e.g., inactive miscellaneous underground storage tanks [IMUSTs]) to the limits of technology and void space filling is assumed for planning purposes where waste inventories exist and they are practicable to remove. Given the low, long-term risk potential associated with smaller ancillary equipment (e.g., transfer piping), it is assumed that no additional waste residuals would be removed from ancillary equipment (i.e., no flushing would occur). Historically, transfer piping was typically flushed with water following transfer of waste through the piping. Failed piping was not flushed. The low, long-term risk associated with leaving these components in place under a surface barrier balanced with concerns associated with the removal and disposal of ancillary equipment, including higher worker exposure, questionable integrity of the ancillary equipment, and the necessity for disposal of removed waste within the Central Plateau, are the primary rationales for this assumption in closure planning.

For contaminated soil, WMA C closure planning assumes that some removal of soil may be required in highly contaminated areas. An alternatives analysis would define specific corrective actions within WMA C as required under HFFACO Milestone M-45-60.

4.2 COMPLIANCE WITH GENERAL CLOSURE PERFORMANCE STANDARDS BASED ON CLOSURE/REMEDIATION ASSUMPTIONS

The following sections discuss how the planning assumptions for this WMA C Integration Study comply with the general closure performance standards of WAC 173-303-610(2).

4.2.1 General Performance Standard #1

General Performance Standard #1 minimizes the need for further maintenance.

Planning Assumptions: Removal of waste from tanks and other components that may contain a significant waste inventory, in accordance with HFFACO Milestone M-45-00, will serve to meet this performance standard. Low-maintenance approaches to directly enhance containment of any residual (those left in the tank after having met the limits of waste retrieval technology) will be accomplished by grouting tanks and large belowgrade ancillary structures such as catch tanks and vaults. A secondary aspect to the filling of the tank is to help shed water around the tank and any residual waste. The third aspect is to maintain a basic environment that minimizes corrosion as well as leaching of the residuals. Abovegrade buildings and temporary structures/facilities will be removed or leveled to near ground level to meet the site preparation requirements for the final engineered barrier. Finally, the construction of the barrier (see Section 7.0) will greatly reduce contaminant infiltration of and intrusion into the vadose zone, thus minimizing the need for future maintenance.

4.2.2 General Performance Standard #2

General Performance Standard #2 controls, minimizes, or eliminates – to the extent necessary to protect human health and the environment – post-closure escape of dangerous waste, dangerous constituents, leachate, contaminated runoff, or dangerous waste decomposition products to the ground, surface water, groundwater, or the atmosphere.

Planning Assumptions: Many of the measures described in Section 4.2.1 will also have the consequence of ensuring compliance with this general performance standard. Waste retrieval from SSTs will result in the greatest reduction of risk to human health and the environment from WMA C contaminants. A risk assessment has been performed on remaining residuals to confirm earlier PA results from the WMA C Closure Plan (Appendix C of RPP-13774) that shows their contribution to risks to human health and the environment is minimal. Characterization of non-SST components (as identified through the DQO process), will ensure that residual inventory is protective of human health and the environment by validating that closure performance standards are being achieved. Closure actions that will contribute to further mitigation of risk will include stabilization of SSTs and certain large belowgrade ancillary equipment. Isolation of components will ensure that remaining contaminated structures do not become pathways for the mobilization of remaining constituents of concern.

As stated under the first general performance standard, it is not expected that smaller WMA C components (e.g., transfer piping) will require removal or decontamination before placement of the barrier. However, certain exceptions to this may be made on a case-by-case basis where:

- Inventory may be found to be significant or is readily removable;
- Removal of combined or adjacent soil or components is already occurring;
- Components may create a preferential pathway for contaminant transport to groundwater;
- The WMA footprint could be further optimized through component removal;
- Component removal is more cost-effective than characterization or treatment.

The removal/decontamination, treatment, or containment of contaminated soil as needed to achieve protection of human health and the environment will also require integrated planning to meet this general performance standard.

The installation of engineered barriers that meet RCRA criteria will effectively eliminate direct exposure concerns for both human and ecological receptors as specified under the requirements of "Model Toxics Control Act Cleanup Regulation" (WAC 173-340). The installation of groundwater monitoring systems to meet the post-closure monitoring goals, and the inspection and maintenance procedures to ensure the effectiveness of these protective measures, will also contribute towards meeting this performance standard consistent with post-closure groundwater monitoring for the Central Plateau.

4.2.3 General Performance Standard #3

General Performance Standard #3 returns the land to the appearance and use of surrounding land areas to the degree possible, given the nature of the previous dangerous waste activity.

Planning Assumptions: Closure planning must evaluate administrative, engineering, and regulatory measures that are necessary to protect public health and the environment in the future. After closure of the SST system, other than surface barriers that will rise above ground level, the ground surface will be returned to the approximate appearance and use of the surrounding land areas. This is consistent with obligations under WAC 173-303-610 to return the land to the appearance and use of surrounding areas. Institutional controls that are robust and layered and that rely heavily on passive measures will reduce the potential for future adverse impacts on the environment and diminish public exposure to residual SST waste contaminants through the air, soil, and groundwater. These controls will need to be factored into planning during the post-closure phase of WMA C.

The closure sequence of a WMA would ideally follow a logical progression that transitions from one sector of the WMA to another in such a manner that multiple actions can be optimized without creating conflicts between ongoing, concurrent activities. In developing a general closure/remediation sequencing approach, there are several assumptions that should be regularly reviewed and validated during the process. These assumptions are supported in part by the experience gained from the retrieval of waste from tank 241-C-106. These assumptions include:

- The WMA will be isolated from external components to prevent inadvertent infiltration into the WMA during waste retrieval and closure actions.
- Waste retrieval will generally be prioritized to first retrieve from the 100- and 200-series tanks followed by the retrieval from any IMUSTS, catch tanks, and other large volume components as required; however, as opportunities arise, retrieval from these latter components may be undertaken to optimize closure progress.
- Sectors within the WMA will be defined based on their internal similarities and distinctness from other sectors.
- Isolation of sectors within the WMA will be conducted such that the decontamination of pits and vaults will be completed before any down-gradient receiving tank has been isolated (i.e., to provide a pathway for decontamination liquids to a collection low point for future removal).
- The sequence for conducting closure activities within sectors will be defined to minimize interference and minimize rework.

4.3 WMA C INTEGRATED CLOSURE SECTOR SEQUENCE APPROACH

The concept of the sector sequence approach is to isolate the C tank farm and its components to prevent any further waste or liquids from entering WMA C from outside sources. Isolation of WMA C from external connections is accomplished by cutting and capping the transfer pipelines that feed into and out of the tank farm. WMA C should be isolated from external waste and liquid sources early in the sequencing of closure activities and should be coordinated with the Central Plateau to define the location of the isolation points. This external isolation is expected to occur at or very near the perimeter of the barrier footprint. Equally important is the isolation of the sectors inside of the WMA from each other. This includes that multitude of pipelines within the boundary of the WMA and includes the junction points at diversions boxes of the external transfer pipelines. This will ensure that waste and liquids do not enter a sector in which retrieval and closure activities have commenced or are completed. Isolation within a sector is further discussed in Section 4.4.

The next major activity is completion of waste retrieval operations. The sector waste retrieval strategy will involve isolation of each sector and continuance of waste retrieval operations in Sectors 1 and 2. Waste retrieval operations in WMA C have established a lay out of waste retrieval equipment and facilities that creates a general corridor that runs north-south through WMA C. It will be necessary to ensure that other activities within WMA C do not create a conflict or interfere with the equipment and facilities in this waste retrieval corridor. However, while SST wastes are being retrieved, the opportunity exists to close the 241-C-801 Cesium Load-Out Facility in Sector 3, and not interfere with ongoing waste retrievals in Sectors 1 and 2. This assumes resources are available and this activity does not interfere with activities in the waste retrieval corridor.

In addition, the potential exists that during the SST waste retrievals, an independent waste removal campaign could also be conducted on the four tanks located in the CR vault (Sector 5) and preparation could be initiated to prepare this building and its associated ventilation system for removal. Again, this parallel activity assumes resources are available and the conduct of this activity would not interfere with activities in the retrieval corridor for the SSTs.

Following waste retrieval within Sectors 1 and 2, any retrieval activities determined necessary in Sectors 4 and 7 (diversion boxes 241-CR-151, -152, -153 and 241-C-151, -152, -153) would be conducted. Following these activities, the last retrieval would occur in Sector 7 with the removal of waste from catch tank 241-C-301, if necessary. This catch tank has been determined to be the last retrieval point within WMA C because it represents the lowest down-gradient point of the waste transfer system within the WMA. At the completion of the catch tank retrieval, the waste retrieval campaign would be complete and activities would transition to closure operations in Sectors 1, 2, 4, and 7.

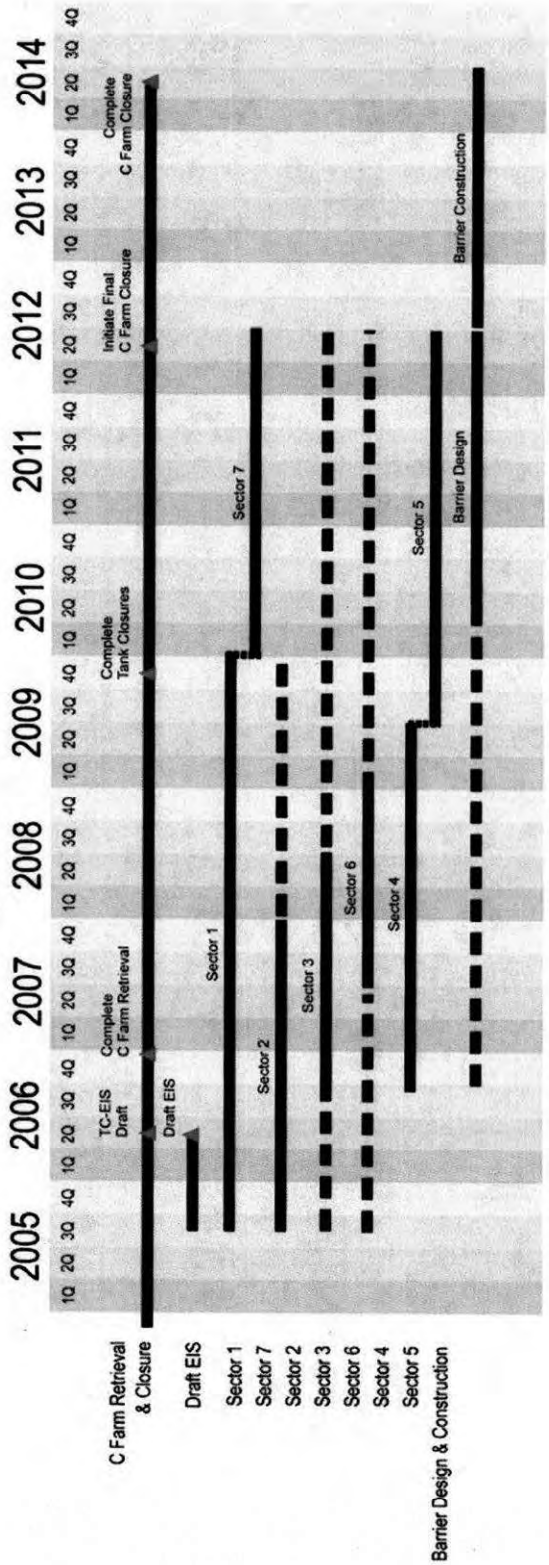
During the course of waste retrieval, it is necessary to conduct flushing and removal of temporary waste transfer lines and hose-in-hose transfer lines. Flushing of these lines needs to be considered in association with retrievals (i.e., where will flushed liquids be collected). The initial field activities for closure would commence with site preparation (removal of retrieval equipment and facilities) and installation of grouting equipment and facilities.

Grouting activities are predicated upon several regulatory decisions: (1) the ROD for the TC-EIS being published documenting the DOE-selected approach to closure of the SST system, (2) the Component Closure Plan being accepted and the Site-Wide Permit modified accordingly by Ecology, and (3) the determination that any residual waste in the SSTs is low-level waste and non-TRU.

Once waste retrieval has been completed, remediation of the south end retrieval corridor (Sector 6) could be started. This would involve removal of the Control Building and Chemical Make-Up Building along with supporting infrastructure. Concurrent with this would be closure of the CR vault. Grouting of the SSTs would be completed as well as any grouting determined necessary of the diversion boxes and catch tank 241-C-301. Depending upon the timeframe required to complete grouting operations, site preparation could commence for barrier construction in the other sectors.

It is anticipated that the vadose monitoring using the drywells will continue through retrieval of waste from SSTs and the post-retrieval monitoring period established in the Tank Waste Retrieval Work Plan (TWRWP). Drywell vadose monitoring may need to be extended to support implementation of some corrective measures until it is determined that the data or subsurface access they provide is no longer necessary. As part of the site preparation for placement of the barrier, the vadose monitoring wells will be decommissioned in accordance with "Minimum Standards for the Construction and Maintenance of Wells" (WAC 173-160) as well as to meet any additional barrier design requirements. Additional monitoring wells may be installed beyond the barrier footprint if necessary to support groundwater OU remedial actions and to satisfy long-term Hanford Site monitoring requirements. A time-phased sequence of WMA C closure and placement of a final barrier or engineered cap is shown in Figure 4-1.

Figure 4-1. Time-Phased Sequence of Sector Closure and Barrier Design Construction.



Note: Dashed lines associated with sectors indicate that sector closure actions may occur anywhere within the span of the timeline.

The information that follows focuses on the integration of closure activities and approaches within the WMA closure sectors and sites immediately adjacent to the WMA. To further aid in visualizing the complexity of WMA C and understand the aspects of the approaches that could be applied to closing the different sectors in WMA C, a three-dimensional model was developed. A summary of this model is presented in Appendix C. Section 5.0 discusses the integration approach for the vadose zone and soil components of WMA C and Section 6.0 describes the integration of WMA C closure actions with those of the Central Plateau.

4.4 ISOLATION OF COMPONENTS

A key element in closing the WMA C sectors is to develop an isolation strategy to eliminate the potential for waste or liquid entering that sector or major components within the sector. The SSTs within the C tank farm have been partially isolated; however, the other components and groupings within the tank farm have been isolated only to a very limited degree.

Isolation can occur 'externally,' applying to the boundaries of the sector, or 'internally,' applying to components within the sector. An initial assessment of the hydraulics of the external transfer pipeline system will be performed to determine through a pipeline assessment which lines have been cut and capped, which have been previously flushed, and which are assumed to be plugged or otherwise failed in service. This assessment will identify low points in the system and then will trace them up-gradient. The objective is to track the possible down-gradient systems that an up-gradient component may affect if it is flushed and to locate where it would be possible to isolate a transfer line system from the WMA.

The basic strategy for isolating components and groupings internally is to generally follow hydraulic gradients. The strategy may require working from an up-gradient high point down, from a low point up-gradient, or from both ends toward the middle. The objective of isolation is two-fold: (1) to minimize the potential of waste inadvertently being released to the environment within a sector by activities being conducted within the sector such as retrieval of wastes and (2) to prevent additional waste from entering from outside the sector once waste has been removed.

This strategy is applied in WMA C with catch tank 241-C-301 as the low point and last component to be retrieved. Alternatively, to prevent any waste from entering a low point component (i.e., SST) that would complicate waste retrieval, it may be advantageous to isolate that component from the up-gradient components. Isolation not only includes the physical separation of one component from another, but also the stabilization and post-isolation monitoring of components.

Post-isolation monitoring is typically performed only at the hydraulic low point of the system. Because it can reduce the number of monitoring points, it is often advantageous to isolate pipelines by installing blanks in diversion boxes and pits rather than cutting and capping the connecting pipelines. Additionally, the blanking of a pipeline can be performed inside the diversion box or pit and does not involve excavation to the line outside the pit/diversion box.

4.5 TANK WASTE RETRIEVAL RISK ASSESSMENTS AND WMA PERFORMANCE ASSESSMENTS

For making final retrieval or closure decisions, a PA will be developed for the SST system and will be continually updated to include the latest characterization information. WMA PAs will be generated within the SST system PA. Lastly, individual tank component risk assessments will be developed using actual post-retrieval sampling information. These PAs and risk assessments will be approved by Ecology and DOE pursuant to their respective authorities and will be incorporated into the Site-Wide Permit through the closure plans.

As individual components are retrieved or characterized, or other component closure activities are completed, the resulting component characterization information will be incorporated into the WMA PA to determine its relative risk compared to the entire WMA performance. As each WMA proceeds toward closure, its respective PA will be updated to address pertinent results and findings. Final WMA closure decisions will be made after components are retrieved and/or characterized, other component closure activities have been completed, and a final WMA PA is issued.

4.6 UNPLANNED RELEASE SITES

UPRs will be addressed as potentially contributing sources to the soil component of the WMA as well as part of the investigation and cleanup of soil. The proposed approach to integrating soil remediation is discussed in Section 5.0. In addition to the UPRs that exist within the WMA boundary, there are UPRs that are either adjacent to the boundary but outside the fenceline or are in close enough proximity to the WMA and therefore warrant integration in the WMA closure planning. Consolidated UPRs (i.e., sites within the WMA boundary) and associated UPRs (i.e., sites outside the WMA boundary but within close proximity) are described as follows:

Consolidated UPRs (UPRs within the WMA C fenceline and collectively managed under WIDS site 200-E-133) include:

- **UPR-200-E-16** – A surface spill that resulted from a leak in an overground transfer pipeline between SSTs 241-C-105 and 241-C-108. The surface spill associated with this release is located approximately 18 m (60 ft) northeast of SST 241-C-105 and occurred in 1959. The spilled liquid was classified as coating waste from the PUREX process.

- **UPR-200-E-27** – Located just east of the 244-CR vault and extends east beyond the tank farm fenceline. The release originated from the 244-CR vault and spread eastward, contaminating the inside of the tank farm and also several hundred feet beyond the tank farm perimeter fence. This site was consolidated with UPR 200-E-133.

- **UPR-200-E-68** – Wind-borne surface contamination spread from diversion box 241-C-151. The release occurred in 1985 and was subsequently decontaminated to background radiation levels or covered with clean soil for later decontamination (the source document is inconclusive). Sometime after the release, diversion box 241-C-151

was opened, flushed, and sprayed with a fixative to physically fix contamination to the interior of the structure surface.

- **UPR-200-E-81** – Located northeast of the 244 CR vault, near diversion box 241-CR-151. This release occurred as a result of a leak in an underground transfer pipeline in October 1969. The waste that leaked from the pipeline consisted of PUREX coating waste. The site is covered with 0.5 m (18 in.) of backfill and clean gravel.

- **UPR-200-E-82** – Occurred in December 1969, with the source determined to be the feed line running between SST 241-C-105 and the 221-B Building. The leak was discovered near diversion box 241-C-152. The liquid release flowed from the vicinity of diversion box 241-C-152 to the northeast, downgrade, until it pooled into an area measuring approximately 0.46 m^2 (5 ft^2) outside the WMA C fence. The leak volume is unknown. The contaminated site was covered with clean gravel in 1969. The depth of the clean gravel applied in 1969 was not provided in the WIDS report; however, it states that additional decontamination of the area occurred in 1985.

- **UPR-200-E-107** – Thought to be located at tank 241-C-110. Process waste was being directed to the first tank in the series. Waste failed to cascade to the second tank, indicating the overflow line was plugged. An overground transfer was attempted. During this transfer, the pump operation was checked under the assumption that it had not yet been submerged into the waste. Unfortunately this assumption was incorrect and, when tested, the pump discharged approximately 19 L (5 gal) of waste with enough velocity to propel it 6 m (20 ft).

- **UPR-200-E-118** – Located in the northeast portion of the tank farm and extends north up to about 300 m (1,000 ft) beyond the fenceline. It was the result of an airborne release from SST 241-C-107 that occurred in April 1957. The highest exposure rate was estimated to be 50 mrem/hr at the ground surface (DOE/RL-92-04).

- **UPR-200-E-136** – A release of 64,345 to 90,840 L (17,000 to 24,000 gal) of waste from SST 241-C-101. This tank was designated as a confirmed leaker in January 1970. This site includes the soil around and underneath tank 241-C-101. Between 1946 and 1970, 2,000 Ci were released (DOE/RL-92-04).

- **UPR-200-E-137** – Occurred when water entered SST 241-C-203, migrated through the saltcake, and either became entrained in the saltcake or leaked out of the tank. The leak was 1,500 L (400 gal) of PUREX high-level waste.

Associated UPRs (outside of the WMA C fenceline) include:

- **UPR-200-E-72** – Occurred in 1985 and is located south of WMA C near crib 216-C-8. The source of the contamination resulted from contaminated waste that was buried. The waste posed little release potential because the contamination was fixed in place with Turco Fabri-Film. The source of the contamination was determined to be from the burial of previously undocumented contamination material. The area was surrounded with a chain and posted as a surface contamination area; however, the site is no longer marked or posted. No information regarding the buried material is presented in the WIDS report;

it is assumed that the contamination extends to the depth of the buried material, but the aerial extent and depth are unknown. The volume of the contamination is also unknown.

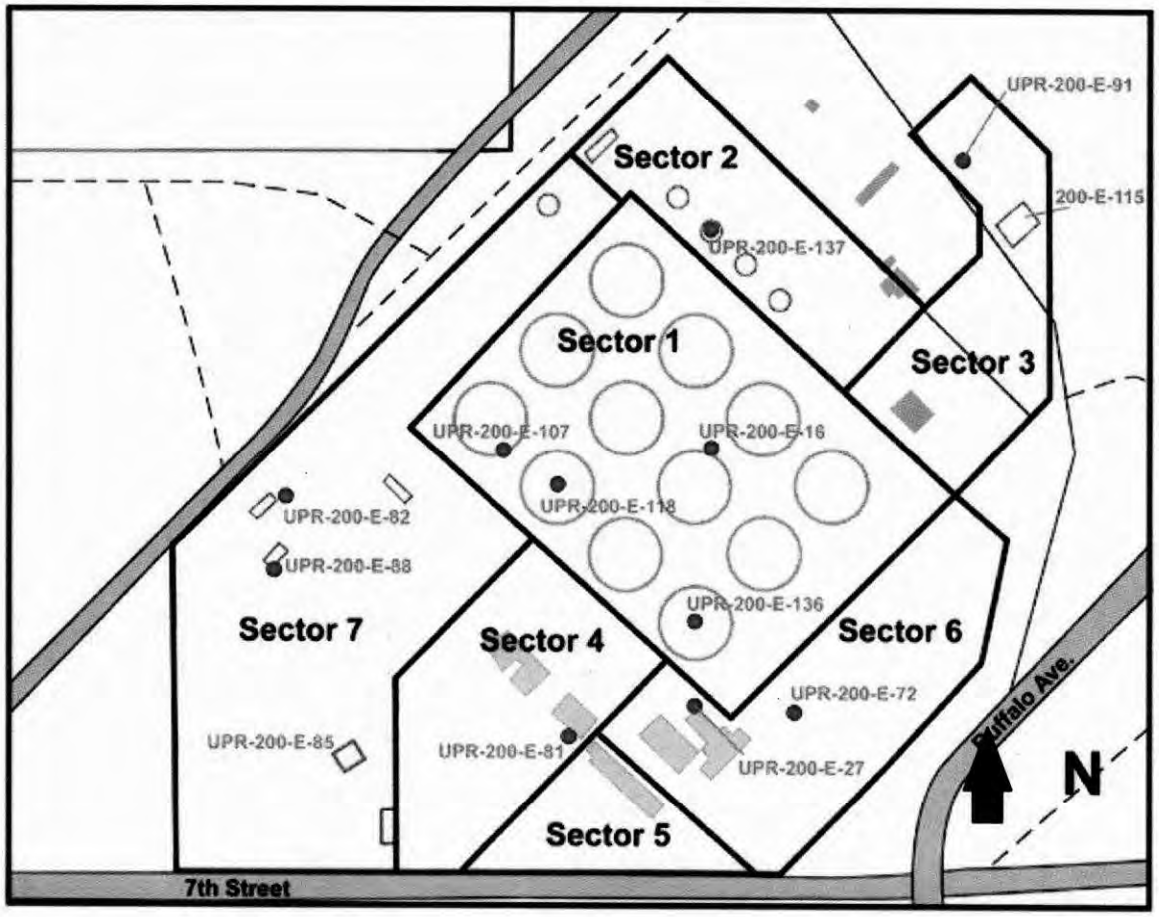
- **UPR-200-E-86** – A spill that resulted from a leak in a pipeline used to transfer waste from vault 244-AR to WMA C. The depth of the leaking pipeline was approximately 2 m (8 ft) below ground surface. The release occurred in March 1971 near the southwest corner of WMA C, outside the fence. The spill consisted of 25,000 Ci of cesium-137. The soils surrounding the pipeline were sampled, and it was determined the contamination had not penetrated below 6 m (20 ft). The contamination plume volume was estimated at 37 m^3 (1,300 ft^3). The surface of the release site has been stabilized with 'shotcrete.' The release site is demarcated with concrete AC-540 marker posts and signs indicating "Underground Radioactive Material."

- **UPR-200-E-91** – Located approximately 30 m (100 ft) from the northeast side of the tank farm. It resulted from surface contamination that migrated from WMA C. The date of the occurrence, its aereal extent, and the nature of the contamination are not known. DOE/RL-92-04 states that the contaminated soil was removed and the area was released from radiological controls.

- **200-E-115** – Located east of C tank farm, south of 8th Street, across an unnamed gravel road. As a result of routine radiological surveys confirming radiological contamination in this area, the Dyncorp Integrated Soil, Vegetation and Animal Control group submitted a Waste Site Information Form to WIDS in 2000. The site was classified as Discovery until programmatic responsibility and ownership were determined in March 2001. No radiological surveys can be found to provide information about the radiological conditions inside the posted area. Very little is known about this posted area. During an interview with the Dyncorp Radiological Group in October 2000, an assumption was made that the area was posted by the CH2M HILL Hanford Group, Inc. East Tank Farm Radiological Control Group. A review of underground pipeline locations did not indicate a pipeline at this location. In 1980, a larger area of posted contamination (see UPR-200-E-91) had been located in the same vicinity. The contaminated soil from UPR-200-E-91 was removed in 1981. Because so much time has passed, it is difficult to determine if the two sites are related. In June 2004, 200-E-115 was stabilized with gravel and posted as an Underground Radioactive Material Area.

Figure 4-2 shows the location of the UPRs in and adjacent to WMA C.

Figure 4-2. Location of Unplanned Release Sites In and Around WMA C.



4.7 DECOMMISSIONING, DECONTAMINATION AND DISMANTLEMENT

During the planning phase for closure activities within a sector, aboveground structures in WMA C could become candidates for decommissioning, decontamination, and dismantlement under DOE O 430.1 before final closure of the WMA. DOE has developed a framework to accomplish decommissioning, decontamination, and dismantlement activities. Once DOE facilities complete mission operations and are declared excess, they pass into a transition phase that ultimately prepares them for final disposition. The disposition phase of a facility's life cycle includes deactivation, decommissioning, and surveillance and maintenance activities, decontamination, and dismantlement.

In 1995, DOE issued *Policy on Decommissioning of Department of Energy Facilities Under the Comprehensive Environmental Response, Compensation, and Liability Act(CERCLA)* (DOE 1995). The policy is consistent with, and builds upon, the 1994 multi-agency *Guidance on Accelerating CERCLA Environmental Restoration at Federal Facilities* (DOE 1994).

The policy establishes that decommissioning activities will generally be conducted as non-time-critical removal actions under CERCLA, unless the circumstances at the facility make

it inappropriate (e.g., for generally clean structures or complex, high hazard structures). Use of non-time-critical removal actions for conducting decommissioning activities effectively integrates U.S. Environmental Protection Agency oversight responsibility, DOE lead agency responsibility, and state and stakeholder participation. Non-time critical removal actions are defined and explained in "National Oil and Hazardous Substances Pollution Contingency Plan" (40 CFR 300). In brief, non-time critical removals are response actions initiated under CERCLA removal authority that are conducted under DOE lead-agency authority and that typically have a planning horizon of six months or more. For any non-treatment, storage, and/or disposal buildings within a WMA, it is assumed that those buildings would be dispositioned as non-time-critical removals under CERCLA.

4.8 WMA C COMPONENT REGULATORY PATHWAYS TO CLOSURE

RCRA and CERCLA provide the primary pathways to closure for the components, structures, and waste sites associated with WMA C. The closure pathways for the major components are identified in Table 4-1.

The following sections describe the approach to sequencing closure within the seven sectors of WMA C. Sectors with UPRs are shown in Figure 4-2.

4.9 SECTOR 1 SEQUENCING

Sector 1 includes the twelve 100-series SSTs including their associated ancillary equipment (pits, risers, and pipelines) and four UPRs (200-E-16, 200-E-107, 200-E-118, and 200-E-136). Figure 4-3 shows the components in this sector.

4.9.1 Approach

The major remediation and closure activities that would be conducted within Sector 1 include:

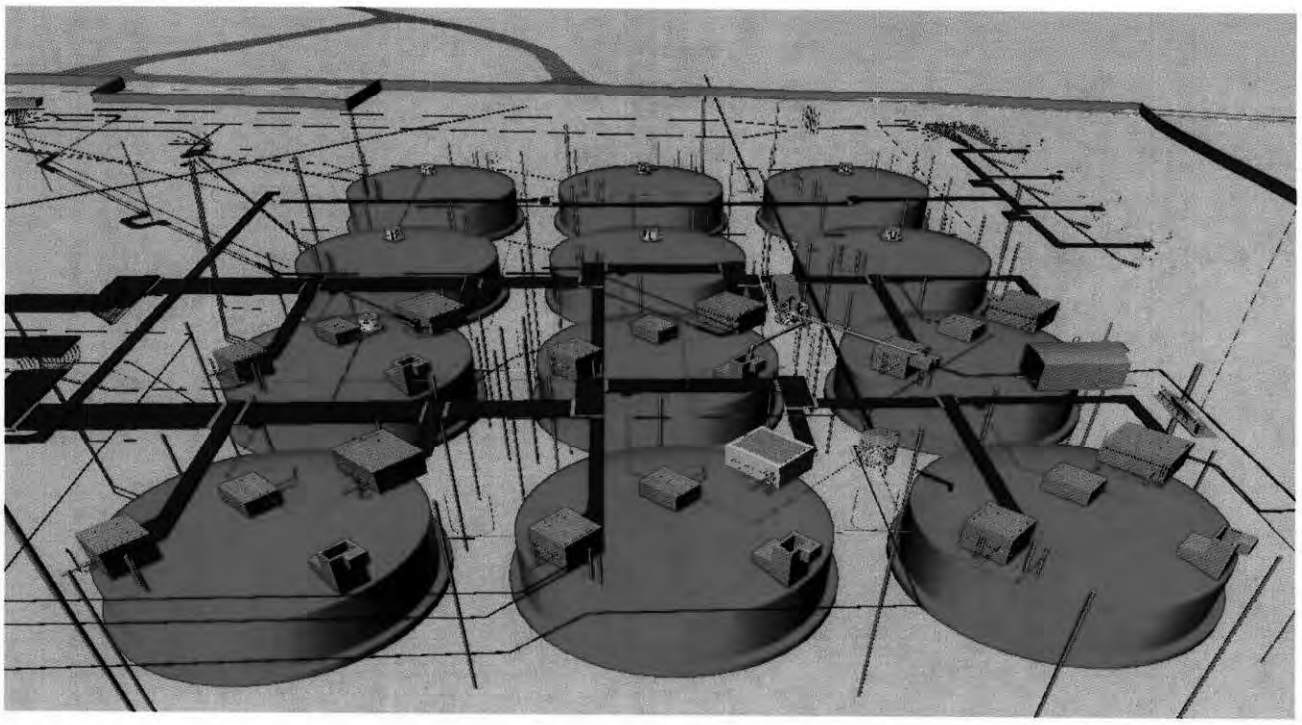
- Isolate sector (external isolation from other sectors)
- Isolate sector components (internal isolation, as appropriate)
- Retrieve tank waste
- Characterize sector components (including UPR sites)
- Prepare site for closure
- Fill tanks/pits with grout
- Implement corrective actions for UPR sites, as required
- Close drywells.

Once a tank or other component within the sector has been identified for waste retrieval and closure, the following activities would be undertaken: (1) planning and engineering design for retrieval or remediation actions, as appropriate; and (2) preparing the component closure plan that directs the closure of ancillary equipment. In addition, a TWRWP would be prepared to provide the technical basis of the waste retrieval and the evaluation of the retrieval actions.

Table 4-1. WMA C Component Closure Pathways.

WMA C Component	Regulatory Path	Comments
SST Ancillary Equipment within WMA C Barrier Footprint	RCRA Closure Plan/Site-Wide Permit	Isolated exceptions to this regulatory path could occur if ancillary equipment is remediated as part of corrective actions for soil (e.g., removed)
SST Ancillary Equipment outside of WMA C Barrier Footprint	CERCLA Record of Decision/ Site-Wide Permit • 200-IS-1 • 200-TS-1	CERCLA decisions will be integrated into RCRA closure actions through the Site-Wide Permit
241-C-801 Cesium Load Out Facility	RCRA /CERCLA Past Practice Integration	Integration of activities to dispose of this building is currently anticipated to occur under a CERCLA EE/CA process. However, this building is defined as a RCRA past practice unit and closure decisions may be integrated with the RCRA Site-Wide Permit.
241-C-701 Compressor Building	RCRA /CERCLA Past Practice Integration	Integration of activities to dispose of this building is currently anticipated to occur under a CERCLA EE/CA process. However, this building is defined as a RCRA past practice unit and closure decisions may be integrated with the RCRA Site-Wide Permit.
271-CR Air Compressor Building	RCRA /CERCLA Past Practice Integration	Integration of activities to dispose of this building is currently anticipated to occur under a CERCLA EE/CA process. However, this building is defined as a RCRA past practice unit and closure decisions may be integrated with the RCRA Site-Wide Permit.
Unplanned Releases to Soil	RCRA Corrective Measures Study/Site-Wide Permit	
241-CR-271 Cold Chemical Make-up Building	RCRA /CERCLA Past Practice Integration	Integration of activities to dispose of this building is currently anticipated to occur under a CERCLA EE/CA process. However, this building is defined as a RCRA past practice unit and closure decisions may be integrated with the RCRA Site-Wide Permit.
Groundwater	CERCLA Remedial Action/Site-Wide Permit • 200-PO-1 • 200-BP-5	CERCLA decisions will be integrated into RCRA closure actions through the Site-Wide Permit

Figure 4-3. Sector 1 Components.



A DQO was developed for all post-retrieval sampling of SSTs. Ancillary equipment and soil characterization are also expected to follow a DQO process. The DQO process serves as the basis for ensuring sampling and analysis efforts result in information sufficient to support closure decisions. The collected data are then used as part of the evaluation process to guide closure decisions and to evaluate the risk from any residuals that may remain. Other actions include the design, procurement, and installation of the waste retrieval system(s) followed by the conduct of waste retrieval. Post-retrieval evaluations using the DQO process include measurement of the residual waste volume and characterization of the residual waste. Upon determination that retrieval is complete, per HFFACO criteria and approval of closure conditions in the RCRA Site-Wide Permit, the tank can be filled with grout to immobilize any residual waste and to provide structural stability to the tank.

The majority of the pipelines, as indicated in the assumptions, would be closed in place; the primary activities for closure of pipelines would focus on isolation. An initial assessment of the hydraulics of the pipeline system will be performed to determine which lines have been cut and capped, which have been previously flushed, and which are assumed to be plugged.
This assessment will define low points, and then trace back up-gradient to high points.
This assessment process is considered fundamental to effectively isolating the interior pipeline system (i.e., pipelines within the sector) in preparation for closure. Interior pipelines, including cascade lines, typically would not be flushed, retrieved, or grouted because of structural integrity concerns.

Before the determination that the four Sector 1 UPR sites (UPR 200-E-16, UPR 200-E-107, UPR 200-E-118 and UPR 200-E-136) will require remediation, a RCRA site assessment will be completed. Based upon the findings of the site assessment, it will be determined if any of these

UPRs are a candidate for corrective measure. The approach to UPRs is further discussed in Sections 3.1.3 and 5.0.

4.9.2 Waste Retrieval

The sequence of tank waste retrieval follows a specific process set forth in HFFACO Milestone M-45-02M. The goal of the tank waste retrieval activity, as stated in Milestone M-45-00, is:

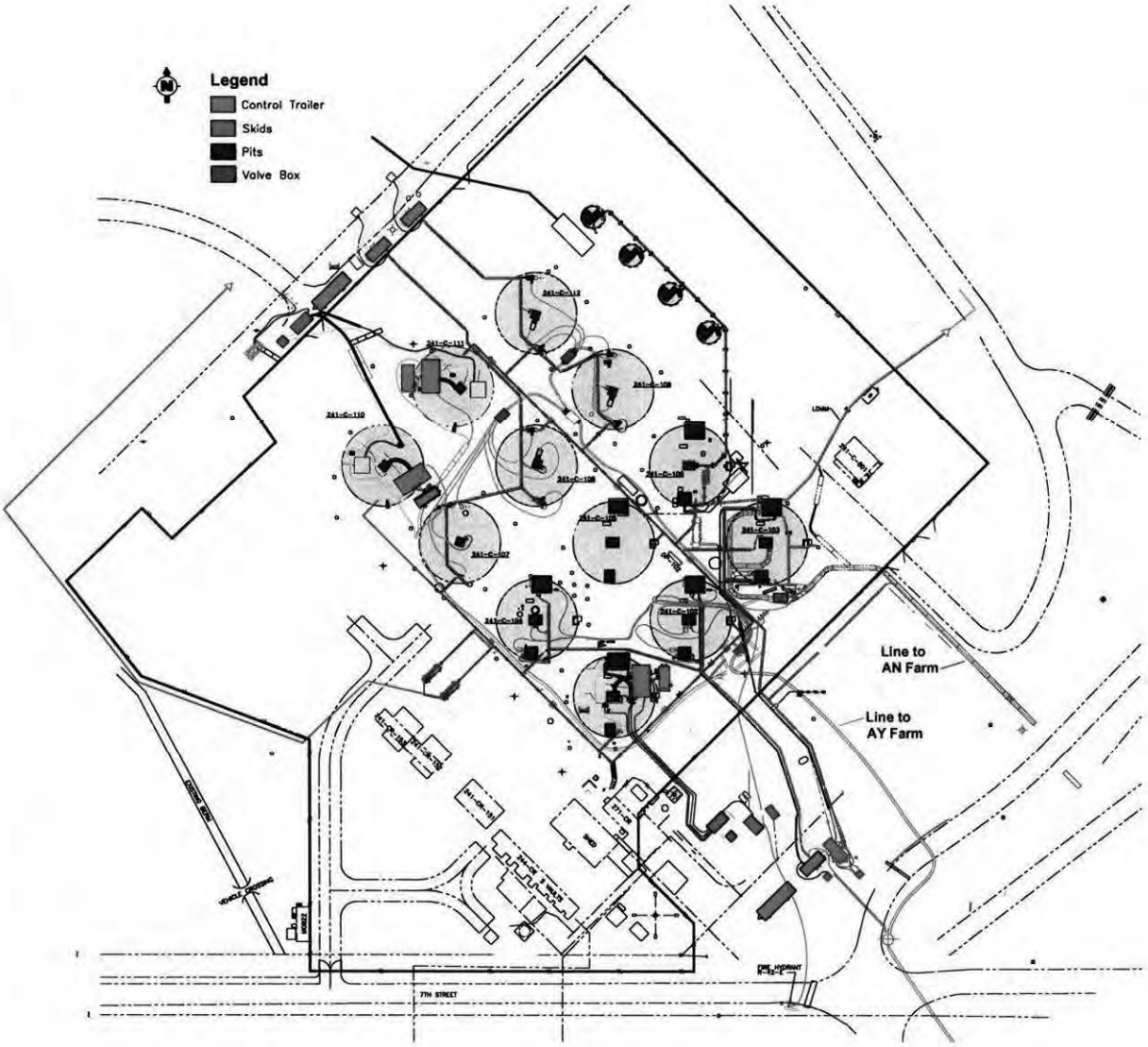
> ...retrieval of as much waste as technically possible, with tank residues not to exceed 360 cubic feet (cu. ft.) in each of the 100 series tanks, 30 cu. ft. in each of the 200 series tanks, or the limit of waste retrieval technology capability, whichever is less.

If the waste retrieval goal is not met for a specific tank, DOE will follow the HFFACO Appendix H process to seek an exception to the criteria or develop sufficient data over the course of multiple retrievals to establish a basis for revising the waste retrieval performance objective. A risk assessment will be performed on the remaining residuals to ascertain their contribution to risks to human health and the environment using methods described in RPP-13774.

Waste retrieval alternatives consider waste types and tank conditions on a tank-by-tank basis (e.g., whether a tank is a suspected leaker or not) including the presence of sludge. Other tank farms may also consider the presence of salt-cake or a hard heel as part of the waste matrix. Leak detection, mitigation, and monitoring plans and decisions required during waste retrieval are also specified on a tank-by-tank basis and documented in a TWRWP. The conduct of waste retrieval operations within the WMA will involve the design and construction of complex systems that will extend beyond the boundaries of Sector 1. Figure 4-4 shows the design layout of the WMA C retrieval systems. During waste retrieval, these facilities can not be compromised and will create a limitation on other remediation and closure actions that may be able to be conducted simultaneously.

Tank waste liquids and any sludge/solids will be removed in accordance with HFFACO Appendix H. The waste retrieval process will be conducted in compliance with field operation procedures that include environmental criteria and appropriate reporting requirements. Following waste retrieval, the residuals will be characterized, including a determination of residual waste volume. The characterization data and remaining waste volume will be used to evaluate the tank's contribution to the total risk associated with the waste by incorporation into the PA for WMA closure. Following the determination of residual volumes and the tanks' contribution to the PA, a retrieval data report will be prepared and submitted to Ecology. If the waste retrieval effort has not achieved the retrieval performance goals, the data report will include an exception request prepared pursuant to HFFACO Appendix H.

Figure 4-4. Waste Retrieval Facilities for WMA C.



The pits are associated with each individual tank and are considered part of the tank's ancillary equipment. Caps have been placed on many of the pits to isolate them from water infiltrating the tank. Certain pits have been designated for use during waste retrieval and closure operations and will be modified to support specific waste retrieval/closure equipment. Pits that have been isolated and are not expected to be used in retrieval are not expected to be opened to fill the void space because the void space is small and is not expected to cause subsidence problems with barrier performance. Pits used to support waste retrieval would be grouted as part of the final grouting sequence of the specific tank and then a waterproof cap would be installed. Retrieval and closure activities for the pits will be closely integrated with those of the 100-series SSTs. Integration of pit closure with tank closure sequencing would typically occur during the initial closure planning process.

4.9.3 Waste Characterization

Tanks and UPR sites will be characterized to (1) determine residual waste volume and amount of contaminants in the soil, (2) analyze composition of chemical and radiological constituents, and (3) assist in the management of waste residuals. The DQO process will guide the sampling and analysis efforts that support the characterization effort for hazardous waste and will incorporate the requirements of DOE O 435.1, which guides radiological characterization.

Sampling and analysis results will be summarized and made available to regulatory agencies. Sampling and analysis results pertinent to closure actions will be summarized in response to closure plans and interim corrective measures. Characterization will provide data that:

- Support decisions to ensure measures are in place to protect workers, the general public, and the environment
- Determine the volume of waste remaining at completion of retrieval or existing in the soil
- Allow a determination of a defensible estimate of constituents remaining at closure
- Allow determinations that reduce uncertainty in contaminant inventories used in risk assessments
- Provide samples and analysis to refine conceptual models for PA
- Increase the accuracy and utility of best-basis inventory information.

4.9.4 Post-Retrieval Isolation and Activities

Isolation of tanks, pits, and diversion boxes following waste retrieval prevents intrusion of wastes or inadvertent infiltration of water. The desired physical end state for these components is for penetrations/pathways into the tank and associated at-tank pits (excluding those associated with passive ventilation) to be capped, sealed, plugged, administratively closed, or otherwise

obstructed such that liquids cannot enter the tank. Interim isolation actions would typically be reversible. Table 4-2 summarizes isolation actions planned for specific pathways.

Table 4-2. Planned Isolation Actions.

Pathway	Isolation Actions
Cascade lines	Administrative controls until placement of tank fill
Waste transfer lines including concrete encasements into pits or risers	Capped at the high hydraulic end at the edge of the engineered barrier or cap
Utility lines into at-tank pits and tank risers	Severed from active lines and blocked
Temporary waste transfer lines	Disconnected and removed
Pit drains	Plug drain (grout or foam) or leave open since external lines and cover will be isolated
Pit covers	Weather-proofing with a sealant
Weep holes	Left open if pit drains are left open; blocked if pit drains are blocked

Following completion of waste retrieval, a significant amount of disposable and expendable equipment is expected to remain in WMA C. As part of the transitioning between the completion of waste retrieval and the commencement of closure, this equipment will be removed and disposed of as part of the site preparation phase of closure. The waste retrieval equipment to be dispositioned as part of the site preparation includes cross-site transfer lines, ventilation systems, skids, and disposal boxes that housed equipment in support of waste retrieval.

Much of the in-tank equipment (e.g., articulated mast system mast, retrieval pumps/sluicers, level detectors, and thermocouple trees) will be dispositioned as in-tank debris during the tank closure activity. The disposition of in-tank ancillary equipment (e.g., in-tank measuring equipment and tank risers) will be described in the respective tank component closure activity plans.

Closure of a tank will include assessing compliance with the RCRA Site-Wide Permit (Ecology 2004), "Land Disposal Restriction" (40 CFR 268) requirements, DOE orders, and engineering requirements. Closure will include stabilizing the tank and immobilizing residual waste with placement of a fill material. Grout will be used in WMA C to fill significant void spaces (e.g., tanks, large belowgrade ancillary equipment), thereby avoiding subsidence, providing structural stability to prevent settlement of the tank dome, promoting barrier stability, and increasing protection against inadvertent intrusion. Similarly, grout or other stabilization media may be used on larger, belowgrade ancillary equipment, if filling in void spaces is required for structural stability purposes. The fill will be formulated to provide a relatively impermeable and impenetrable monolith, which will provide structural stabilization of void space in the tank and physical/chemical immobilization of residuals in the tank.

A multi-phase approach to filling SSTs will be used. Phase I fill will consist of a 30- to 90-cm (12- to 36-in.) base layer of free-flowing grout that will cover waste residuals and debris on a tank bottom and support subsequent fills. Phase II fill will enhance stability for the tank

structure and fill the majority of tank volume. Phase III fill will be a high-compressive-strength grout placed in the remaining void space (between the Phase II grout and the tank dome and fill tank risers) to discourage intruder access.

Void space filling and tank stabilization is based upon the assumption that any residual waste is not classified as transuranic or high-level waste.

4.9.5 Vadose Zone Monitoring/Drywell Decommissioning

It is anticipated that vadose zone monitoring using the drywells will continue through retrieval of waste from SSTs and that the post-retrieval monitoring period will be established in the TWRWP. Drywell vadose zone monitoring might be extended to support implementation of some corrective measures, until it is determined that the data or subsurface access they provide is no longer necessary. Before placement of the barrier, the vadose zone monitoring wells in all sectors will be decommissioned to be in accordance with WAC 173-160 and to meet any additional barrier design requirements.

4.9.6 Integration

Both waste retrieval and closure activities on each tank have been integrated with planned activities for other components in this sector, as well as with any soil investigation or remediation activities occurring in the area (see Section 4.1). Integration includes coordination of isolation activities before tank closure. Such activities will not preclude the subsequent removal or closure needs of another tank in a series, connecting pipeline(s), or any associated ancillary components. The DQO and sampling and analysis plan process for SST waste characterization can proceed independent of that for UPR characterization because the data collection efforts are supporting different closure activities and decisions.

The currently identified approach is to integrate closure of Sector 1 with Sector 7 in a series, with Sector 1 being closed before Sector 7. This sequencing would allow closure in Sector 1 to proceed and maintain operations to complete waste retrieval from the tanks in the C tank farm (Figure 4-1 depicts the time-phased sequence).

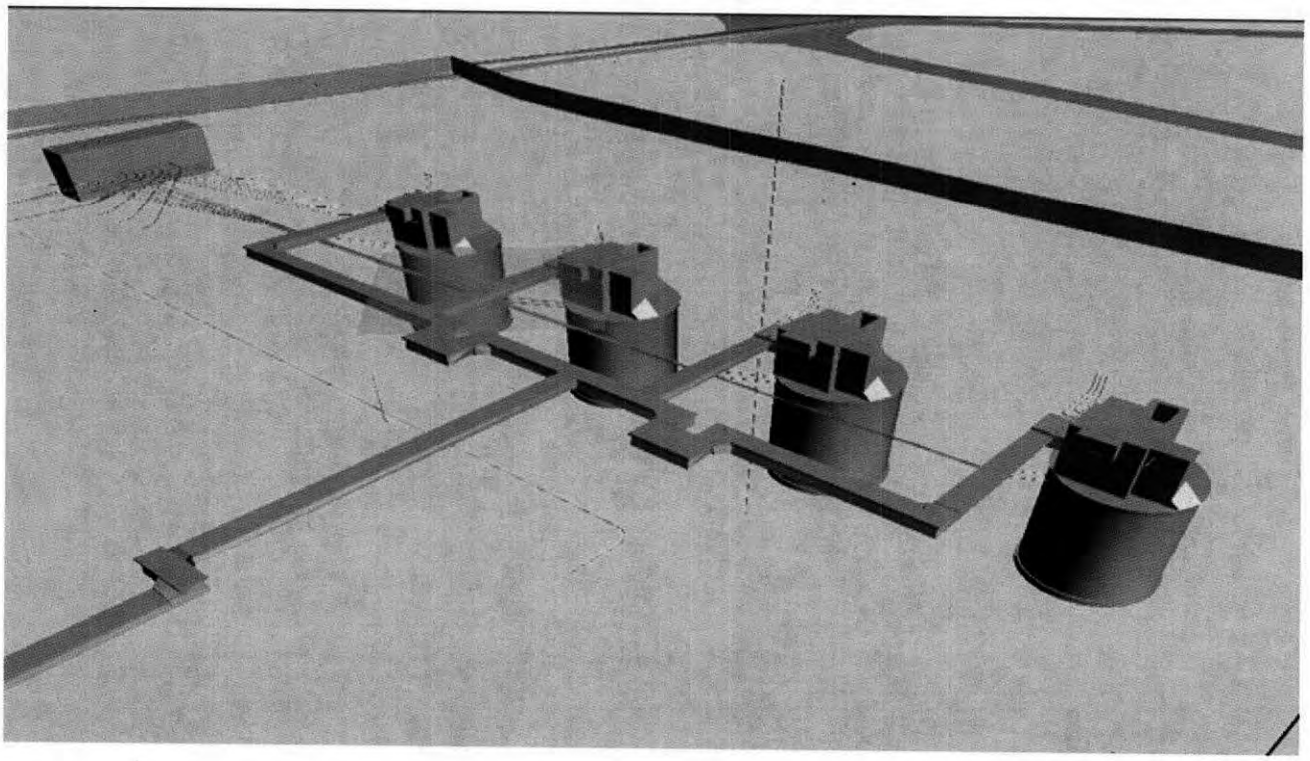
4.9.7 Status

Retrieval of waste from tank C-106 has been completed to the limits of technologies for modified sluicing and oxalic acid dissolution. Post-retrieval sampling has also been completed. A request for an exception to the HFFACO waste retrieval criteria has been submitted to Ecology and the U.S. Environmental Protection Agency for review and approval. Retrieval equipment is currently being designed, procured, and installed in support of additional waste retrieval from C farm 100-series tanks.

4.10 SECTOR 2 SEQUENCING

The four 200-series tanks and associated ancillary equipment (pits, risers, and pipelines) including diversion box 241-C-252 will be waste retrieved and closed with a similar approach as the 100-series tanks and ancillary equipment described in Section 4.9. Figure 4-5 shows the components in this sector.

Figure 4-5. Sector 2 Components.



4.10.1 Approach

The approach to the 200-series tanks and diversion box 241-C-252 will be consistent with that described for the 100-series tanks and associated ancillary equipment. The diversion box and associated piping are defined as ancillary equipment. The major activities associated with Sector 2 waste retrieval and closure include:

- Retrieve tank waste
- Characterize sector components (including UPR sites)
- Isolate sector (external isolation)
  - External piping
  - From CR-151 diversion box
  - From 241-C-301 catch tank
- Isolate sector components (internal)
- Prepare site before closure

- Fill tanks/pits/diversion box with grout
- Implement corrective actions for UPR sites, as required
- Close drywells.

The closure of ancillary equipment that is part of a RCRA-regulated tank system slated for closure will be described in attachments to RPP-13774 unless it is in close association with corrective actions taken for UPR sites, in which case closure actions may be identified in a CMS.

Closure of external transfer pipelines outside of the WMA are defined within a CERCLA OU and are subject to that documentation and review process. Strategies and priorities for closing ancillary equipment are now emerging that address inter-relationships outside the SST system and may be subject to different closure actions or remedies.

The primary documents and actions that will direct the conduct of activities to close ancillary equipment are:

- DOE completes NEPA review (ROD is issued for the TC-EIS).
- DOE submits Closure Activity Plan along with supporting SEPA Checklist to Ecology.
- Ecology issues permit modification along with SEPA determination of no significance.
- DOE requests and the state issues the appropriate Notices of Construction for radioactive and non-radioactive emissions, if necessary.

Tank farms typically have multiple external transfer pipelines coming into the system (see Section 6.2, Figure 6-1). To affect the closure of a WMA, it is necessary to isolate those segments of pipeline to be placed under the final closure barrier from those that will be closed under OU 200-IS-1. The segmentation between OU 200-IS-1 and the WMA will be established at or near the perimeter of the final barrier with consideration given to hydraulic isolation. This partitioning will place segments of the pipeline associated with the WMA under a barrier and allow remedial actions to be implemented on the OU 200-IS-1 segments without being constrained by the barrier. These external transfer pipelines interface with the closure sector at the diversion box. For Sector 2, the interface point is diversion box 241-C-252.

4.10.2 Characterization

The WMA C database presents information on the configuration, location, and inter-relationships of diversions boxes. This database also provides process history information about ancillary equipment that will aid in the characterization process. The general approach to characterization is discussed in Section 2.1.2.

While the waste volume in the diversion boxes is expected to be small in comparison to the SST waste residue inventory, the inventory may prove difficult to define. Substantial mechanical and worker safety issues are associated with accessing the interior of the boxes. In the event it is determined that it is necessary to perform intrusive sampling of any diversion box, the sampling

and analysis requirements will be developed pursuant to a DQO/sampling and analysis plan process in recognition of the challenges of accessing the interior of the diversion box and safety issues.

4.10.3 Integration

Both waste retrieval and closure activities on each tank can be integrated with planned activities for diversion box 241-C-252. Integration includes coordination of isolation activities before a given tank closure so as not to preclude the subsequent removal or closure needs of another tank in a series, connecting pipeline, or an associated ancillary structure.

Depending upon available resources, Sector 2 closure could be conducted in parallel with all of the sectors. All waste retrieval would be completed before Sectors 7 and 5 could start closure. This is to avoid interference within the retrieval equipment and facilities that cross through these two sectors (Figure 4-1 depicts the time-phased sequence).

4.10.4 Status

Waste retrieval is currently in progress for the C farm 200-series tanks. SST 241-C-203 waste retrieval has been completed. Post-retrieval sampling is planned for fiscal year 2005 for the C farm 200-series tanks, as retrievals are completed.

4.11 SECTOR 3 SEQUENCING

Facility 241-C-801 is the Cesium Load-Out Facility, which was built in 1962. When the facility was in operation, cesium-rich waste from tank 241-C-103 was pumped to an ion exchanger on a trailer. The cesium-depleted waste was returned to tank 241-C-102. The purpose was to provide load-out capability of cesium, which was independent of the PUREX Plant, thus freeing fission-product equipment in PUREX to be devoted to other programs. The building has a total area of 77 m^2 (832 ft^2) and consists of three parts: the load-out room, the operating room, and the valve pit room. The building is reinforced-concrete, partially below grade, with a metal upper section and roof. There are two French drains associated with this facility: one for steam condensate from space heaters in the building and one for floor drains in the truck bay and valve pit (*Control Decision Record for the 241-AX-IX, ITS-1, 241-SX-401, 241-SX-402, 241-A-431 and 241-C-801 Facilities* [RPP-6925]). The top of the drywell is a concrete plugged riser that is visible above ground level. The facility ceased operation in 1976. It is an inactive, mixed-waste site. Other than the waste in the piping or that was spilled, no waste was retained in this facility.

The cesium load-out process included modifications to (1) tank 241-C-103 for storage of cesium feed solution, (2) tank 241-C-102 to receive the waste after it had gone through the cask loaded with the ion exchange resin bed material, and (3) building the Cesium Load-Out Facility. The facility included process piping, valves and controls, and a truck load-out station.

The Cesium Load-Out Facility (7 by 11 m [24 by 32 ft]) has a concrete ground floor with a metal structure installed over it as a second floor. The valve pit (3 by 5 m [9 by 16 ft]) and operating control (3 by 5 m [9 by 15 ft]) areas are installed on the upper level and the load-out ramp (4 by 10 m [12 by 32 ft]) is on the lower level. The building includes a bridge crane, impact wrench station, and other general use equipment. There are waste transfer lines from the facility to tanks 241-C-102 and 241-C-103. In addition, there are instrumentation lines that run from the facility to the equipment installed in the 241-C-103 pump pit. The weight factor instrument lines running between the facility and the pump pit were plastic and had been direct buried approximately 1 m (3 ft) below grade. The 5.1-cm (2-in.)-diameter pipe from the floor drain in the valve pit runs approximately 31 m (100 ft) north to the 1.2-m (4-ft) drywell. The 5.1-cm (2-in.)-diameter pipe from the floor drain in the cask load-out area also runs approximately 100 ft north to the 1.2-m (4–ft) drywell. The 1.2-m (4-ft) drywell located approximately 5 m (15 ft) away from the building (northeast side) was for the 2.5-cm (1-in.) steam condensate line from the steam used for the two unit heaters in the building. The safety shower is located outside the building on the south and was supplied from the raw water source to the building. The control area has electrical and instrument panels, controls, and a bottle storage rack (helium gas). The building had raw water, compressed air, and electrical power supplied to it from the existing C tank farm utilities.

As per *RPP Administration* (HNF-IP-0842), Volume 18, "Inactive Waste Sites" (Section 1.1, Rev. 1), the Cesium Load-Out Facility is inactive and isolated. As of September 2002, all process lines connected to the building were determined to be isolated and no liquid could be discharged from or into the building.

The actions associated with closure activities within this sector include:

- Characterize sector components (including UPR sites)
- Remove any radioactive source terms from the facility
- Decontaminate and decommission the facility
- Remediate French drains (process and sanitary sewer)
- Implement corrective actions for UPR sites, as required.

Figure 4-6 shows the components in this sector.

Figure 4-6. Sector 3 Components.

4.11.1 Approach

Currently the Cesium Load-Out Facility is assumed to be closed under CERCLA. The two UPR sites are outside of the WMA C boundary. Figure 4-2 lists details of these UPR sites, including their status and disposition pathways. While not within the WMA, the two UPR sites have been included in the WMA C Integration Study area and should be evaluated and corrective measures selected to address remediation of these sites in a manner consistent with the approach previously described. The closure process for UPRs is discussed further in Sections 3.1.3 and 5.0.

4.11.2 Waste Removal and Characterization

As inspection of the Cesium Load-Out Facility was performed in late October 2000. This inspection made the following findings (*Hazard Evaluation for 241-AX-IX, ITS1, 241-SX-401, 241-SX-402, 241-216-C-801, 241-A-431* [RPP-6637]):

> The plug in the drywell was removed and was found to have contamination on the bottom, as expected. Radiation readings taken over the drywell when the plug was removed were essentially background radiation. The control room had no unexpected findings, and radiation levels and contamination levels throughout the building were essentially background level. The shield block over the valve pit was not removed. A portable exhauster is stored in the truck bay. A number of drums, most of which appeared to be empty resin drums, are also stored in the truck bay. However, not all of the drums were inspected to verify that they were empty. There was no flammable gas or toxic material detected in the inspection. This is an inactive facility whose condition is deteriorating. There are no immediate plans for maintaining or transitioning to decontamination and decommissioning.

This facility is classified as a nuclear facility. It is assumed that the facility is cleaned up and there is no significant combustible loading and no chemicals present.

4.11.3 Integration

Integration within Sector 3 occurs with the inclusion of UPR 200-E-91 and UPR 200-E-115. Although both of these sites are outside the WMA C boundary, integration of these two UPR sites with this sector is logical for planning and remediation with WMA C because of their close proximity to the Cesium Load-Out Facility. Closure of this sector can occur when resources are available and is independent of closure activities in other sectors.

4.11.4 Status

There are currently no closure activities under way for the Cesium Load-Out Facility. The opportunity exists for this work to be initiated and completed concurrently with other activities in other WMA C sectors.

4.12 SECTOR 4 SEQUENCING

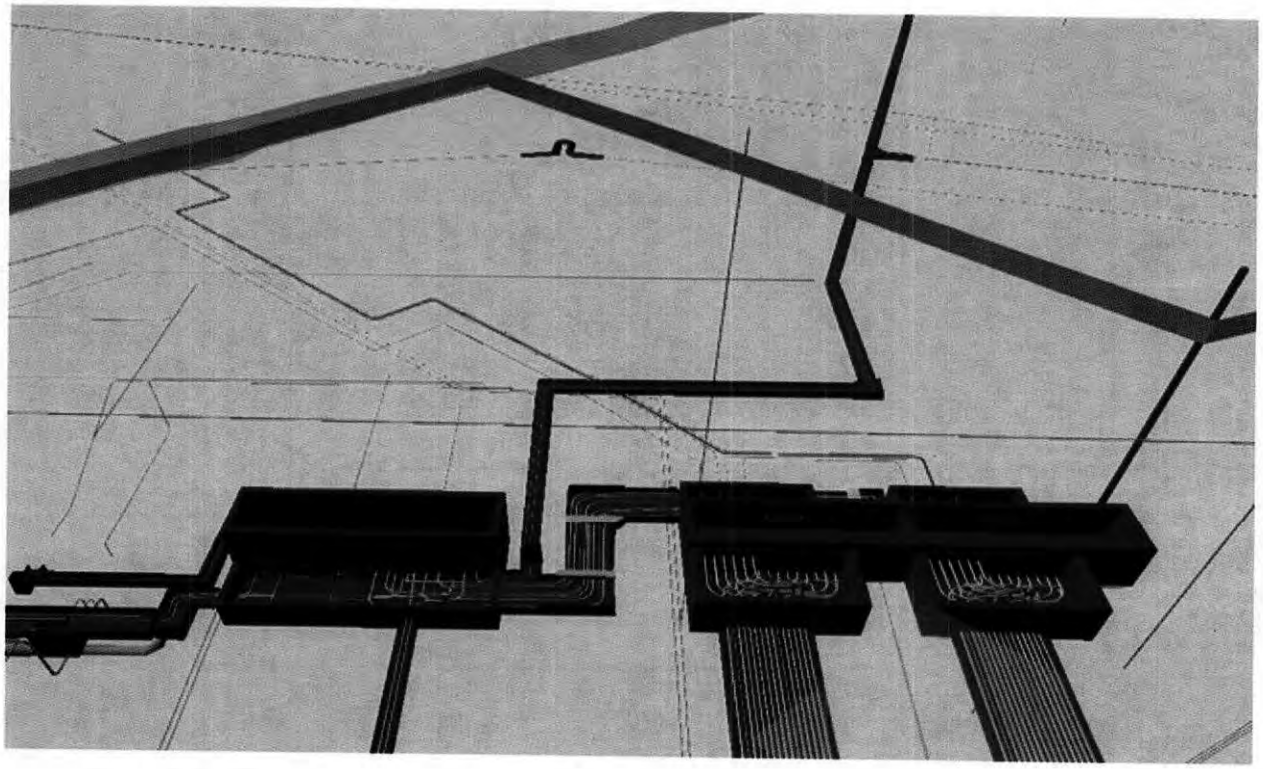
The major waste transfer components located in Sector 4 are diversion boxes and associated piping. WMA C diversion boxes located in Sector 4 include 241-CR-151, 241-CR-152, 241-CR-153. The major closure activities include:

- Characterize sector components (including UPR sites)
- Isolate sector (external isolation)
  - External piping including encasements
  - From 244-CR vault
  - From C farm 200-series tanks (if needed)
- Isolate sector components (internal isolation)
- Prepare site before closure

- Fill diversion boxes with grout
- Implement corrective actions for UPR sites, as required.

Diversion boxes exist in varying sizes and configurations, reflecting the range of functions for which they were designed. Grouping of diversion boxes for closure according to proximity and similarity promotes efficient, coordinated closure actions, and will facilitate integration of regulatory processes. The components in Sector 4 are shown in Figure 4-7.

Figure 4-7. Sector 4 Components.



4.12.1 Approach

The regulatory approach for the retrieval and closure of diversion boxes and other ancillary equipment is consistent with that described for the SSTs and diversion box 241-C-252 in Sector 2.

UPR 200-E-81 is located adjacent to diversion box 241-CR-151. As noted in Section 4.10.1, the closure of ancillary equipment that is part of a RCRA-regulated tank system slated for closure will be described in attachments to RPP-13774 unless it is in close association with corrective actions taken for UPR sites, in which case closure actions may be identified in a CMS (see Sections 3.1.3 and 5.0 for more discussion on the closure of UPR sites).

The soil remediation strategy for UPR sites is carried out under RCRA past-practice investigations and is discussed in Section 5.0.

4.12.2 Characterization

The same approach to characterization described for diversion box 241-C-252 in Sections 4.10.2 and 2.1.2 would be applied to these diversion boxes and ancillary equipment.

4.12.3 Isolation

Diversion boxes will be isolated to prevent intrusion of wastes or inadvertent infiltration of other liquids (e.g., rain water, snow melt). Additionally, pipelines (including external transfer lines) connected to diversion boxes undergoing closure will be isolated to eliminate pathways that would allow inadvertent introduction of waste or other liquids into a diversion box. In some cases, isolation actions may be reversible to ensure that future closure activities are not precluded. Isolation may be accomplished through physical and/or administrative actions.

RPP-13774 will be revised to incorporate decisions concerning the design and anticipated timing of construction of the final closure action(s).

4.12.4 Integration

The currently identified approach is to integrate closure of ancillary equipment within a WMA. A RCRA corrective action process for components other than tanks (e.g., transfer lines, valve pits, diversion boxes, contaminated soils) and either a RCRA component closure process or a CERCLA decontamination and decommissioning process for surplus facilities could be applied.

The currently identified approach is to integrate closure of Sector 4 with Sector 5 in a series with Sector 4 being closed before Sector 5. This sequencing would allow closure in Sector 4 to proceed without interfering with the waste retrieval corridor and would support the completion of all waste retrieval from the tanks in C farm.

4.12.5 Status

There are currently no closure activities under way in Sector 4.

4.13 SECTOR 5 SEQUENCING

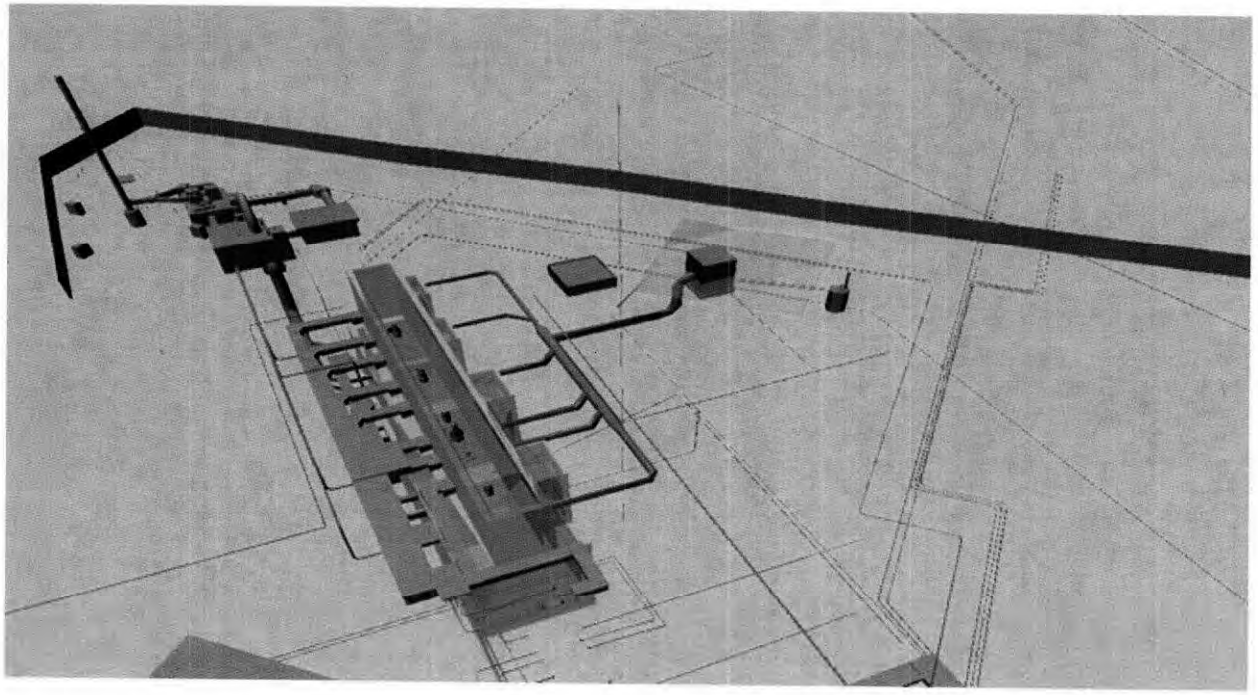
Sector 5 encompasses the 244-CR vault, four IMUSTs, internal piping, and a ventilation complex. Closure of the components within this sector will include the following major activities:

- Retrieve waste
- Characterize sector components

- Isolate sector components (internal isolation)
- Fill IMUSTs and vault with grout, as required
- Decontaminate and decommission ventilation complex.

The components included in Sector 5 are shown in Figure 4-8.

Figure 4-8. Sector 5 Components.



4.13.1 Approach

The 244-CR vault and associated tanks, piping, and ventilation system are considered ancillary equipment and the closure of ancillary equipment that is part of a RCRA-regulated tank system slated for closure will be described in attachments to RPP-13774.

Any wastes remaining in the IMUSTs would be retrieved before isolation. Liquid buildup (pumpable liquids, potentially including sludge) in the tanks and the vault sumps would need to be transferred to the double-shell tank system. This process would involve removing cover plates and, potentially, cover blocks or to 'core-bore' the existing cover blocks to gain access to the tanks/vaults to remove the liquids. In addition, this process may include removal and disposal of old jumpers, instruments, tools, and miscellaneous debris/items. Old equipment occupying risers that are required to gain access to the tanks for new pumps, level instrumentation, etc., would need to be removed and disposed of. There is a potential for having to cut new holes into the tanks to insert pumps and/or instrumentation. A temporary ventilation system would be required to support the removal of liquids from the tanks/vaults. All of the temporary systems/equipment used to support the removal of liquids from the tanks/vaults should be removed before or during the final isolation activities. Additional instrumentation

(e.g., liquid level monitoring for detection of future intrusions) may also be required until final closure of the facility occurs.

4.13.2 Characterization

The approach to characterization described in Section 2.1.2 would be applied to the components in Sector 5.

4.13.3 Isolation

Three major isolation activities must be accomplished:

- Isolate the 244-CR vault from the waste transfer system, including the waste transfer lines, drain lines, raw water lines and any similar lines, to prevent any potential pathways for liquids to enter the isolated facility.
- Isolate the ventilation systems intake and exhaust lines and to install a passive breather filter for the facility until final closure of the facility occurs.
- Isolate the 244-CR vault with the application of intrusion protection coatings to all cover plates and cover blocks to prevent surface moisture intrusion into the facility.

4.13.4 Integration

The currently identified approach is to integrate closure of Sector 5 with Sector 4 in a series with Sector 4 being closed before Sector 5. This sequencing would allow closure in Sector 4 to proceed without interfering with the waste retrieval corridor and would support the completion of all waste retrieval from the tanks in C farm.

4.13.5 Status

Two activities are under way in Sector 5. A liquid level assessment is to be performed on the IMUSTs in the CR vault in accordance with HFFACO Milestone M-23-27. The second activity is the isolation of the stack exhauster in accordance with the HFFACO. The opportunity exists for other work to be initiated and completed concurrently with other activities in other WMA C sectors.

4.14 SECTOR 6 SEQUENCING

Sector 6 encompasses Control Building 271-CR, the Cold Chemical Makeup Building (241-CR-271), French drain 216-C-8, septic tank/leach field 2607-EG, and two UPRs (200-E-72 and 200-E-27). Control Building 271-CR has (1) a mechanical equipment room that houses an air compressor, receiver vessel, air dryer and filters, and a water heater; (2) a control room that houses the electrical distribution equipment (panel boards and motor control center) and the control/alarm panels; and (3) an operator area that houses a lunch room, shower, locker room, and toilet. The operator area is no longer used by operations personnel. The equipment in Control Building 271-CR is non-operational except for the control/alarm panel and the electrical distribution equipment. The control/alarm panels have operational instruments that monitor the tank waste temperatures and liquid levels. The two funnel drains and the two floor drains in the mechanical equipment room drained to the French drain located adjacent to the structure (approximately 7 m [22 ft] away from the building). The drains from the shower area, toilet, and lunch room are routed to the sanitary sewer septic (holding) tank and tile (drain) field. The old septic tank and tile field that were previously connected to the sanitary sewer line were isolated and abandoned in 1972. The electrical substation (254-CR) is located adjacent to the 271-CR building. The 254-CR substation is comprised of three single-phase 75 kVA pole-mounted transformers. The 271-CR structure has ventilation for the control room provided by a heat pump. The old evaporative cooler (used to provide cooling air for the control room) adjacent to the 271-CR building is non-operational.

The 241-C-701 (also known as 241-C-90) building houses a more recently installed compressed air system that is operational.

The 241-CR-271 building is located adjacent to the 271-CR building. The building has an office, an electrical room, a laboratory, a cell, and a tank room. The tank room houses tank 5-1 (previously TK-CR-004) used for adding chemicals for the processing of waste. The tank was removed in approximately 1968. The structure has been used as a storage shed since the late 1960s. The floor and sink drains located in the structure drain to crib 216-C-8, except for a sink drain in the laboratory area that is routed to the French drain. The 216-C-8 concrete crib is located on the southeast side of the C tank farm and is 1.8 m (6 ft) in diameter and 2.4 m (8 ft) deep. The crib is filled with 5.1- to 7.6-cm (2- to 3-in.) size gravel and is covered with 5.1-cm (2-in.) planking and approximately 9 m (30 ft) of backfill.

The gas filters and the 291-CR exhaust fans and stack are used for exhaust air from the 244-CR vault (see Section 4.13). The exhaust system is non-operational.

The UPR-200-E-72 Site is in the vicinity of the three 61-cm (24-in.) drywells installed for condensate and drains associated with the 241-C-601 building (see Section 4.13) and for a sink drain from the 241-CR-271 building.

Figures 4-9 and 4-10 show the components and their location within this sector, respectively. Closure of this sector involves conducting the following major activities:

- Characterize sector components (including UPR sites)
- Disconnect/isolate energy sources

- Decontaminate and decommission control buildings and chemical make-up building
- Remediate French drain and leach field
- Implement corrective actions for UPR sites, as required.

Figure 4-9. Sector 6 Components.

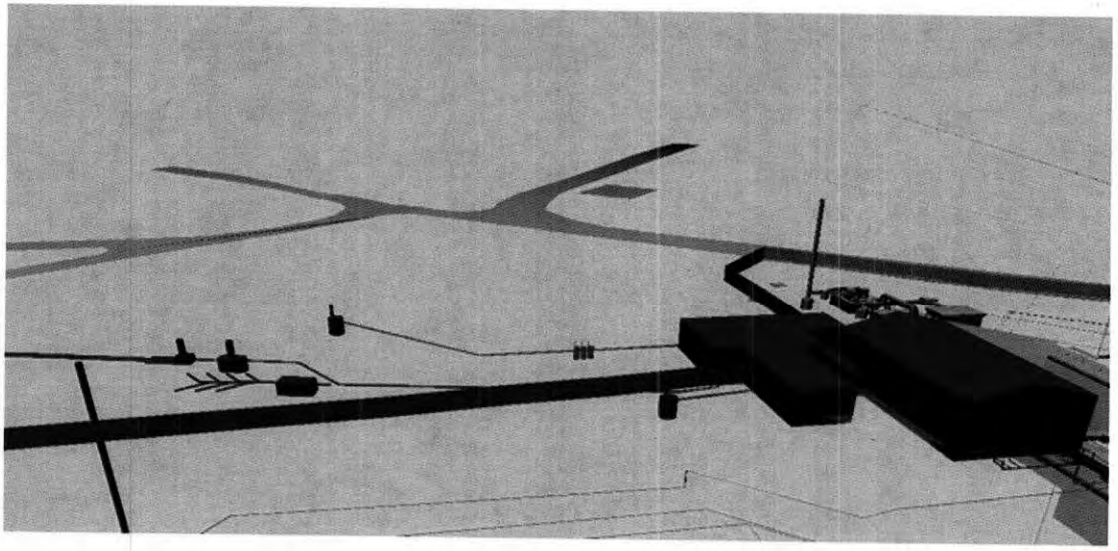


Figure 4-10. Photograph of Sector 6 Components.

4.14.1 Approach

These structures are regulated as RCRA components; however, it is expected that closure will occur through a CERCLA process RPP-13774. The UPR will be addressed under RCRA past practices (see Sections 3.1.3 and 5.0 for more discussion on closure of UPR sites).

4.14.2 Characterization

Currently it is not expected that any further characterization of the buildings would be required. The approach to characterization of the 216-C-8 crib, French drain, and septic leach field would follow the approach described in Section 2.1.2. The characterization of the two UPR sites would be included as part of the RFI/CMS process for UPR sites in C tank farm, which is discussed in Section 5.0.

4.14.3 Isolation

Based upon current information, Sector 6 is considered isolated. This would be confirmed during closure planning.

4.14.4 Status

The Control Building still provides operational monitoring support to the tank farm, but the other components in this sector are no longer functional. There are currently no closure activities under way in Sector 6.

4.15 SECTOR 7 SEQUENCING

This sector includes the piping, diversion boxes, and a catch tank on the northern side of WMA C. Catch tank 241-C-301 has a working volume of approximately 133,000 L (35,200 gal) and has an inside diameter of approximately 6.1 m (20 ft). Its maximum operating liquid level is about 4.6 m (15 ft) above the floor (due to the sidewall inlet lines from the diversion boxes). The catch tank is vertical, has eight risers, and is the lowest hydraulic point in the drain system. There is little history or information known about these structures. The UPR sites are associated with leaks from the piping and diversion boxes. Figure 4-11 shows the components and their location in this sector. The major activities associated with closure of the components in Sector 7 include:

- Retrieve waste (if required) from catch tank 241-C-301
- Characterize sector components (including UPR sites)

- Isolate external piping (isolation of external piping [i.e., waste transfer components that transverse the WMA C boundary] may be performed as a focused remediation activity that is separate from sector closure)
- Isolate sector components (internal isolation)
- Fill diversion boxes and catch tank with grout
- Implement corrective actions for UPR sites, as required.

4.15.1 Approach

The approach to diversion boxes and associated external transfer lines has been previously discussed. Sector 7 includes three UPR sites that are located both inside and outside of the WMA C fenceline. Ongoing site investigations are attempting to define the nature and extent of these sites. In some instances RCRA interim corrective measures have been implemented (or are planned) to either remove or isolate and stabilize the contamination resulting from these UPR sites. Within WMA C it has been assumed that most UPR sites within the WMA boundary will be isolated as part of the final closure barrier. Removal of soil as the corrective action or as part of remediation under CERCLA will be determined based upon the cost benefit of the removal of the waste and consideration of risk reduction through either the CMS or the CERCLA ROD. In the event that soil removal is determined to be the preferred remedial action, the evaluation will also determine the viability of removing any components that may be associated with the UPR sites. This may involve removing a segment of a pipeline or other structure such as a diversion box associated with the release site. The sequence of pipeline removal will be factored into the overall system evaluation to ensure that up-gradient actions do not anticipate subsequent use of that line for waste conveyance to a low point.

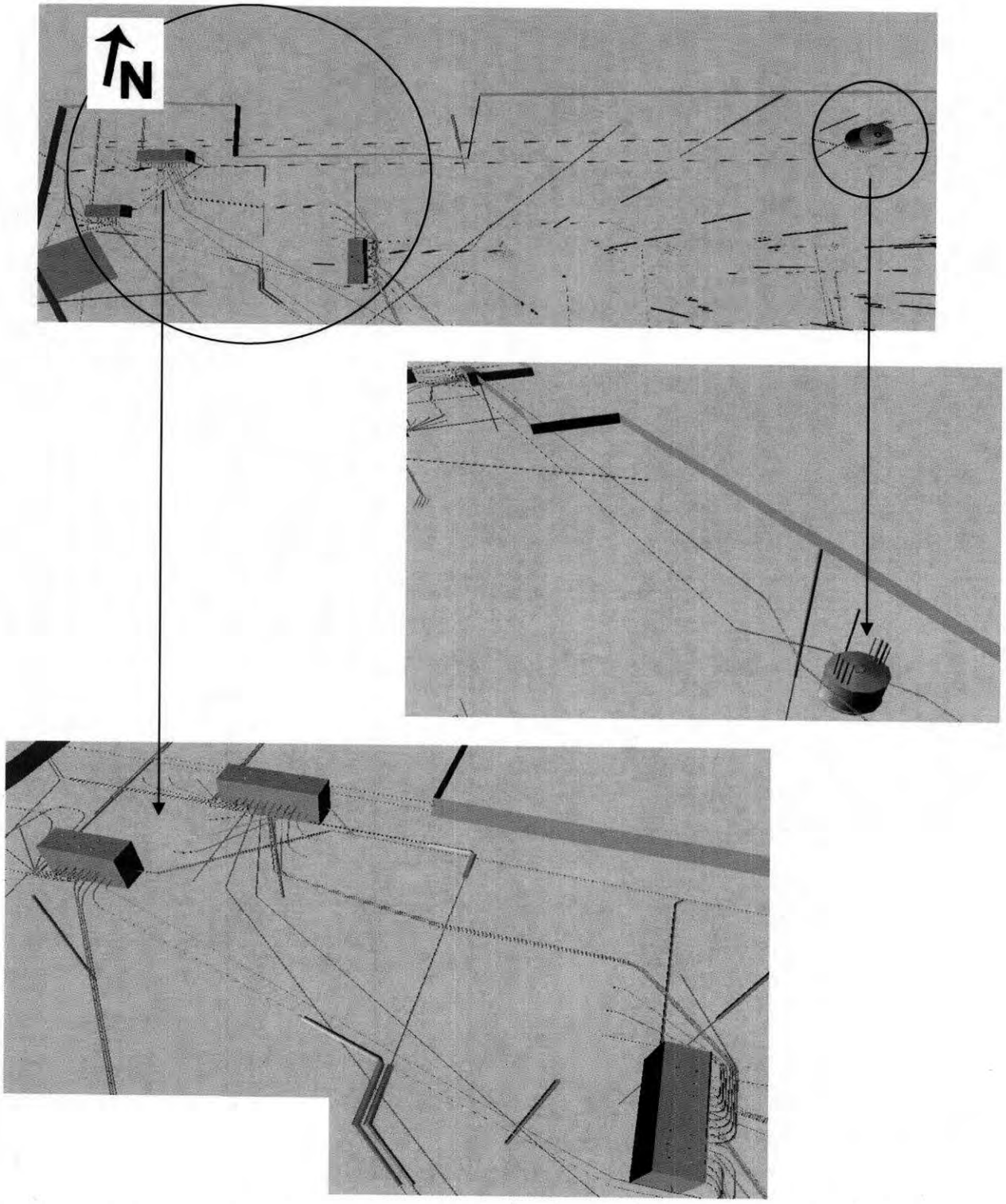
4.15.2 Characterization

The approach to characterization described in Section 2.1.2 would be applied to the components in Sector 7.

4.15.3 Isolation

The same approach to characterization described for diversion box 241-C-252 in Sections 4.10.2 and 2.1.2 would be applied to these diversion boxes and ancillary equipment.

Figure 4-11. Sector 7 Components.



4.15.4 Integration

The currently identified approach is to integrate closure of Sector 7 in series with Sector 1, with Sector 1 being closed before Sector 7. This sequencing would allow closure in Sector 1 to proceed and maintain the retrieval operations to complete all waste retrieval from the tanks in C farm (Figure 4-1 depicts the time-phased sequence).

4.15.5 Status

There are currently no closure activities under way in Sector 7.

5.0 INTEGRATION WITH VADOSE ZONE/SOIL

This section provides an overview of the closure process associated with the vadose zone/soil and UPRs associated with WMA C. The information is based on the WMA C Closure Action Plan (Appendix C of RPP-13774), and recent changes to the HFFACO including the addition of Appendix I, and milestone modifications. The section also describes the status of current closure activities and proposes approaches to closure activities.

5.1 INTEGRATION OF THE WMA C SOIL COMPONENT CLOSURE PROCESS

There are 13 UPR sites in or adjacent to WMA C that are being addressed through the RFI/CMS process summarized in Section 3.1.3. Soil characterization and corrective measures activities associated with these UPR sites will need to be integrated as appropriate with ancillary equipment and groundwater component closure activities and with the Ecology, the U.S. Environmental Protection Agency, and DOE Central Plateau regional closure strategies currently under development.

It is expected that the Phase I corrective action process required by the specified HFFACO milestones will result in adequate characterization to make final closure decisions. Additional characterization either through a Phase II corrective action process or through the development of a component closure activity plan may also be required at a later date. It is expected that in some cases, the RCRA corrective action process will be used to investigate and analyze alternatives for remediation of selected soils and associated ancillary equipment.

After regional closure strategies are finalized, the WMA C closure plan will be revised and the Site-Wide Permit modified in accordance with WAC 173-303-830. The coordination between WMA C closure activities and adjacent Central Plateau closure activities is described in Section 6.0.

5.1.1 Status of Current Soil Component Closure Activities

Groundwater monitoring has not identified any contamination that is directly attributable to UPRs or other releases in WMA C. However, the presence of contaminants in the vadose zone requires both characterization and a determination of the potential for resultant environmental impacts, which may provide a basis for remediation or closure. The *Site-Specific Single-Shell Tank Phase 1 RCRA Facility Investigation/ Corrective Measures Study Work Plan Addendum for Waste Management Areas C, A-AX, and U* (RPP-16608) describes planned vadose zone characterization for WMA C. Phase I field investigations for WMA C were initiated in 2003 and the field investigation report is to be completed by January 31, 2006. The investigation will include drilling two boreholes to establish the distribution of contaminants at depth, in the vicinity of tank 241-C-105, and adjacent to the UPR-200-E-82 site just northeast of diversion

box 241-C-152. In addition, 2 transects of 10 sampling sites using direct-push technology are planned in the vicinity of the UPR-200-E-82 site to establish the shallow, lateral distribution of contaminants.

An evaluation of the adequacy of Phase I field investigations for all WMAs will be documented in a Phase I RFI rollup report due on January 31, 2007. If it is determined that additional characterization is necessary, then a work plan to direct Phase II field investigations will be issued on September 30, 2007.

5.1.2 Approach to Remaining Soil Component Closure Activities

A CMS is scheduled to be released by June 30, 2007 and a corrective measures work plan will be issued by September 30, 2007. To date, a schedule for implementation of corrective measures has not been established. However, it is recognized that corrective measures associated with soil remediation must be completed according to the HFFACO milestones for the closure of the tank farm. In the event that a Phase II field investigation for WMA C is determined necessary, the release of the CMS would likely be delayed accordingly unless there are corrective measures that could be implemented concurrent with the additional characterization efforts.

6.0 INTEGRATION WITH CENTRAL PLATEAU

In addition to integrating activities within WMA C, it is important to understand the issues involved in WMA C closure integration with the closure of the Central Plateau. The interfaces between the Central Plateau and WMA C must be clearly accounted for in the closure planning. The interactions and interfaces between WMA C closure and other Central Plateau remediation and closure actions include waste sites, pipelines, and groundwater. Proposed integration strategies for waste site remediation, pipeline interface definition and remediation, and groundwater decision making and remediation are presented in the following sections.
The intent of these strategies would be to ensure that the WMA C closure is closely coordinated with other actions on the Central Plateau and leads to consistency in the actions taken, clarity in the responsibilities for these actions, and completeness in the coverage of all actions that must be taken. Fundamental to the integration between WMA C and the Central Plateau would be a strategy that allows ORP and RL to understand their respective processes to ensure that decisions and strategies will accommodate structures and facilities at the interface areas and be complementary.

6.1 PHYSICAL BOUNDARIES AND INTERFACES

The boundaries for WMAs have been defined for purposes of groundwater monitoring (see Section 2.0). Because there are waste sites and other tank farm system components that exist in both WMA C and the Central Plateau, there is a need to clarify the boundaries in the context of WMA/Central Plateau closure that go beyond the requirements for groundwater monitoring. The interface between WMA C and the C tank farm closure zone includes waste sites that require a determination of the program overseeing closure.

Table 6-1 lists waste sites or structures that currently lie outside of WMA C but reside within the C tank farm closure zone and which are considered part of the WMA C Integration Study area. Table 6-1 also presents a proposed rationale for the disposition of each site or structure (i.e., whether it is to be integrated with WMA C closure actions or whether a non-WMA process will address its closure). This proposed rationale has not been adopted by DOE and will require further coordination and development between ORP and RL.

The integrating rationale for a site to be considered for inclusion in the WMA C closure study area that is outside the fenceline is that their physical proximity to WMA C may make it cost-effective for the final closure barrier to cover/close these sites.

RL is currently developing a Central Plateau-wide disposition strategy for surplus facilities (e.g., buildings and structures) that will establish logical categories of facilities and decision pathways for each category. ORP is participating in the development of the RL process to ensure that the decision strategy will accommodate structures and facilities within WMA C (241-C-801, 241-C-701, and 271-CR building).

Table 6-1. Disposition Pathway for Waste Sites and Structures Outside of C Farm. (2 Sheets)

Site Name	Description	Current Operable Unit	Recommended Disposition Pathway	
			Decision Pathway	Remediation or Closure
200-E-115	UPR, northeast of C farm. Currently shown outside of the C tank farm closure zone boundary.	200-UR-1	Retain with 200-UR-1 for regulatory decision-making. Recommend redrawing the C farm boundary to include this site.	Coordinate final remedy with WMA C closure, Sector 3.
216-216-C-8	French drain, southeast of C farm.	200-PO-3	Assign to 200-MW-1 for regulatory decision making.	Coordinate final remedy with WMA C closure, Sector 6.
241-C-701	Facility/structure, next to 271-CR Building, outside of C farm fence, southeast of C farm.	Facility	Include with Central Plateau D&D EE/CA process.	Coordinate final remedy with WMA C closure, Sector 6.
2607-EG	Septic tank, between 241-C-701 building and 216-216-C-8 French drain, southeast of C farm.	200-PO-3	Assign to 200-ST-1 for regulatory decision making.	Coordinate final remedy with WMA C closure, Sector 6.
UPR-200-E-72	UPR, between 241-C-701 building and 216-216-C-8 French drain, southeast of C farm.	200-PO-3	Assign to 200-UR-1 for regulatory decision making.	Coordinate final remedy with WMA C closure, Sector 6.
UPR-200-E-86	UPR, southwest of C farm. This is a very significant pipeline leak.	200-PO-3	Assign to 200-E-133, consolidated UPR for C farm, and address through RCRA corrective action along with UPRs within the fenceline.	Include with the RCRA corrective action process inside of C farm for interim action or corrective measures. Include with Sector 7.
UPR-200-E-91	UPR, northeast of C farm, previously removed.	200-PO-3	The waste from this site has been removed. No further action required.	The waste from this site has been removed. No further action required.
200-E-135	RL waste site, UPR, south of 7th Street.	200-UR-1 (RL)	Retain within RL scope and responsibility.	Retain within RL scope and responsibility.

Table 6-1. Disposition Pathway for Waste Sites and Structures Outside of C Farm. (2 Sheets)

Site Name	Description	Current Operable Unit	Recommended Disposition Pathway	
			Decision Pathway	Remediation or Closure
UPR-200-E-99	ORP waste site, UPR, south of 7th Street.	200-PO-3	Assign to 200-UR-1 for regulatory decision making. Consider removing from C farm as this site is closer to the 244-DCRT and 244-A lift station.	Retain as ORP scope and responsibility.

D&D = decontamination and decommissioning.
DCRT = double-contained receiver tank.
EE/CA = engineering evaluation/cost analysis
ORP = Office of River Protection.
RCRA = *Resource Conservation and Recovery Act of 1976.*
RL = Richland Operations Office.
UPR = unplanned release.
WMA = waste management area.

6.2 PIPELINE INTERFACE AND DISPOSITION STRATEGY

The WIDS currently identifies 3 sets of pipelines entering WMA C: 200-E-111, 200-E-114, and 200-E-116. In addition, this WMA C Integration Study has identified 16 distinct pipelines that connect the WMA C waste transfer system to locations outside of WMA C (e.g., B Plant, 244-AR vault). These pipelines are shown in Figure 6-1 along with their line identifiers and junction points both within and external to WMA C. In some cases (e.g., 200-E-114) these lines extend a mile before reaching a junction point (or access location) outside WMA C. The extent of this network of transfer lines and access points creates significant challenges for the isolation of WMA C.

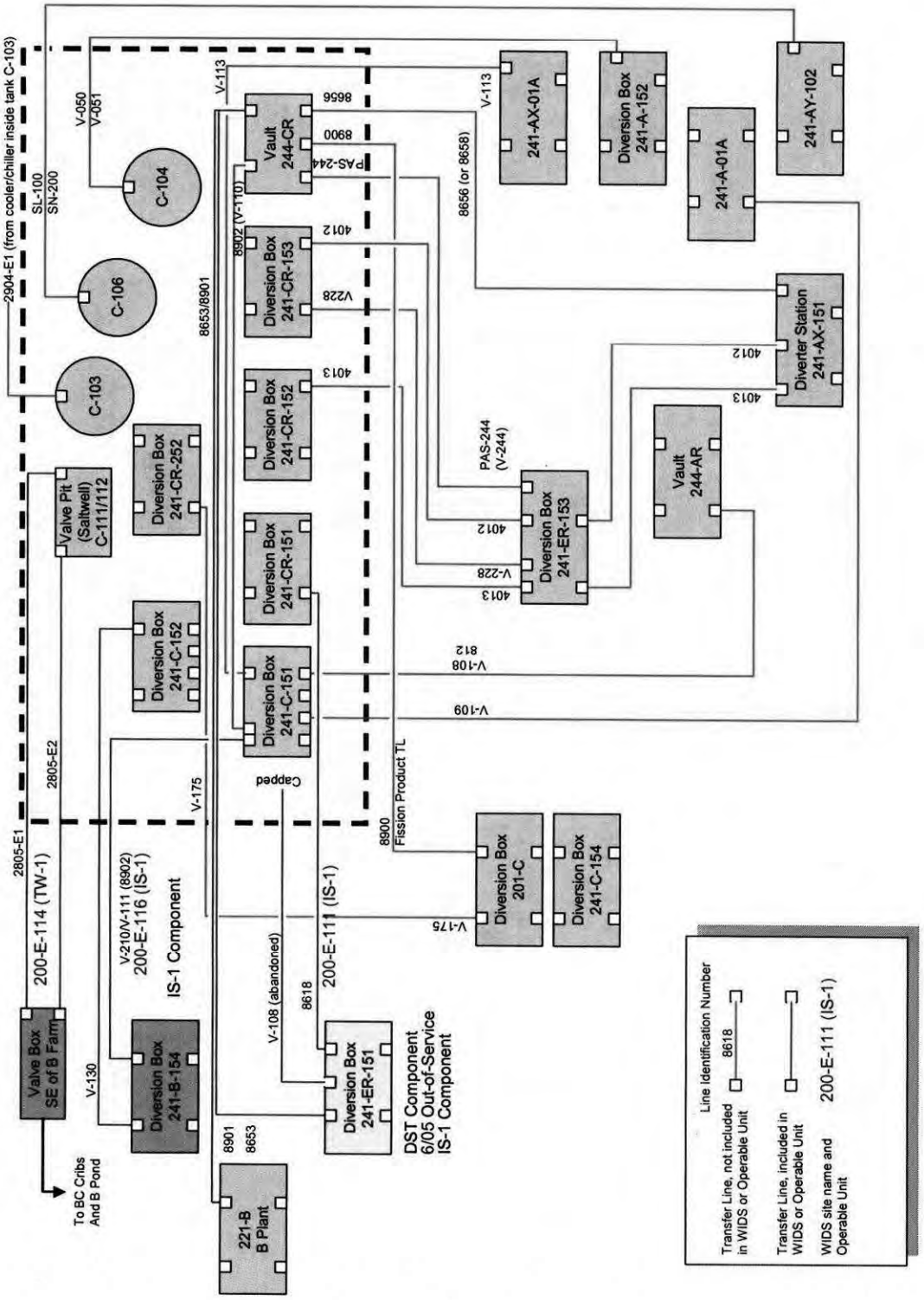
The framework for a pipeline interface strategy is outlined below and needs to be further developed in conjunction with the 200-IS-1 OU. Key aspects of this strategy are the needs to define boundary conditions for the WMA C and OU responsibilities including an integrated isolation strategy (cutting and capping pipelines at boundary of the surface barrier).

The framework for a pipeline interface strategy includes the following key elements:

- The regulatory responsibility for pipeline disposition should be established at the boundary of the final closure barrier for WMA C.
  - The portion of each pipeline not covered by the WMA C final closure barrier should be addressed through the assessment and decision process within the 200-IS-1 OU RI/FS process.
  - The portion of each pipeline covered by the WMA C final closure barrier should be addressed through the WMA corrective action and closure decision processes.
- The pipeline isolation and regulatory strategy should not alter the existing RL or ORP ownership and responsibility for pipelines within or outside of the WMA.
- The locations and approaches for isolating pipelines (e.g., cutting, capping, grouting) should be coordinated between the 200-IS-1 OU process and the WMA closure process to ensure the integrity and hydraulic isolation of the final barrier system as well as closure sequencing.

The additional pipelines identified above should be included in the WIDS database to ensure that they can be incorporated into the 200-IS-1 OU decision logic.

Figure 6-1. Pipeline Interfaces.



6.3 INTERFACE WITH 200 AREA GROUNDWATER DECISIONS AND REMEDIATION

The most challenging interface between WMA C closure and the surrounding areas will be focused on groundwater. There are two groundwater OUs defined in the 200 East Area: 200-PO-1 (tritium and iodine-129 plume) and 200-BP-5 (technetium and uranium plume). There is no active remediation under way for these plumes, but they are monitored and CERCLA RI/FS processes are planned.

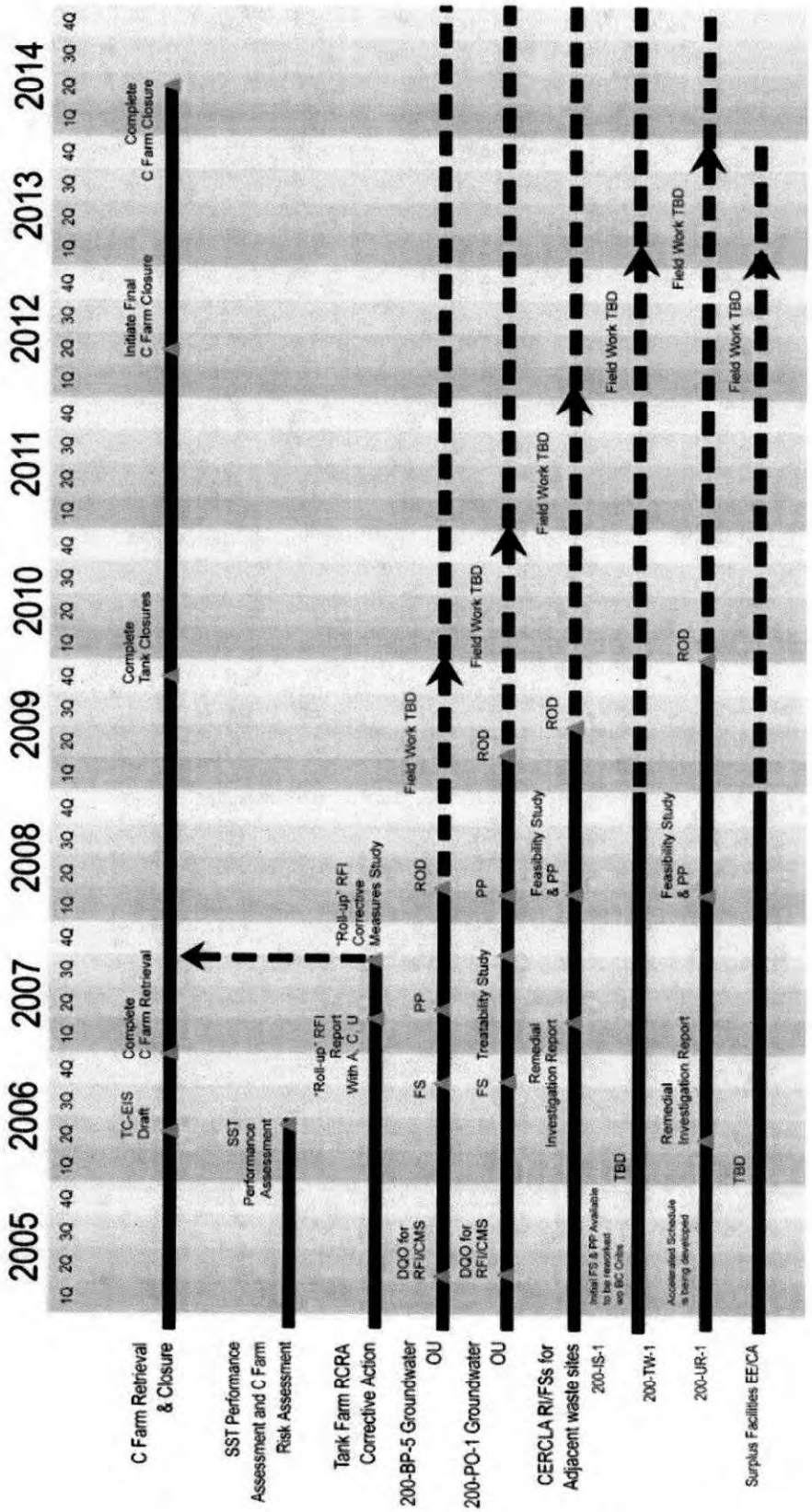
The *Hanford Site Groundwater Strategy* (DOE/RL-2002-59) calls for the CERCLA process to integrate all groundwater protection and remediation actions. Therefore, CERCLA RODs for the 200-PO-1 and 200-BP-5 OUs will need to address the potential groundwater impacts from tank farm sources, including WMA C. A critical connection exists between WMA C risk assessment (SST PA), the RFI/CMS, and the 200-PO-1 and 200-BP-5 OU feasibility studies. The latter feasibility studies will need to integrate the potential contributions from all waste sites and sources on the 200 East Area groundwater. ORP and RL have initiated a process to integrate risk assessments across the Hanford Site which will better define these relationships.

The timing of the ROD for the 200-PO-1 OU (iodine-129 plume) needs to be coordinated with the completion of the Phase 1 RCRA corrective action CMS for tank farms, currently scheduled for mid-fiscal year 2007. WMA C (and WMA A-AX) should be an important factor in reaching a final ROD for the 200-PO-1 OU.

Integration of groundwater issues will not be resolved on an individual WMA basis. A separate study is currently underway that will identify opportunities for integration of groundwater risk assessments across the entire Hanford Site. WMA C PAs as well as 200-PO-1 and 200-BP-5 OU feasibility studies are elements of this larger integration. However, to provide an integration of technical information between the 200-PO-1 OU feasibility study and the 200-BP-5 OU feasibility study that could benefit from the output of the tank farm CMS, the schedules for the feasibility studies would need to be advanced to coincide with, or follow, the 'roll-up' CMS report for WMA C as well as all of the tank farms.

A time-phased sequence of Central Plateau closure activities is shown in Figure 6-2.

Figure 6-2. Time-Phased Sequence for Central Plateau Closure Activities.



7.0 CLOSURE CONFIGURATION AND DESIGN ISSUES

As part of the final closure process, a surface barrier or final cover would be constructed over WMA C and, if appropriate, adjacent contaminated waste sites that are beyond the existing fenceline. The final barrier design and configuration would be approved by Ecology, and the configuration would be dependent upon an analysis that would properly size and orient the barrier given a variety of factors (e.g., RFI/CMS) that may conclude capping is the preferred corrective measure in lieu of removal of contaminated soil. There may be portions of the WMA that do not require a barrier, or there may be adjacent external waste sites that would benefit from a larger barrier. The cost-effectiveness of the barrier is expected to be one of the factors in establishing the final footprint of the cover. Figure 7-1 shows a conceptual footprint for the WMA C barrier based upon the integrating assumption in this report. As shown in Figure 7-1, the footprint of the barrier could reasonably be expected to extend outside of the existing WMA boundary.

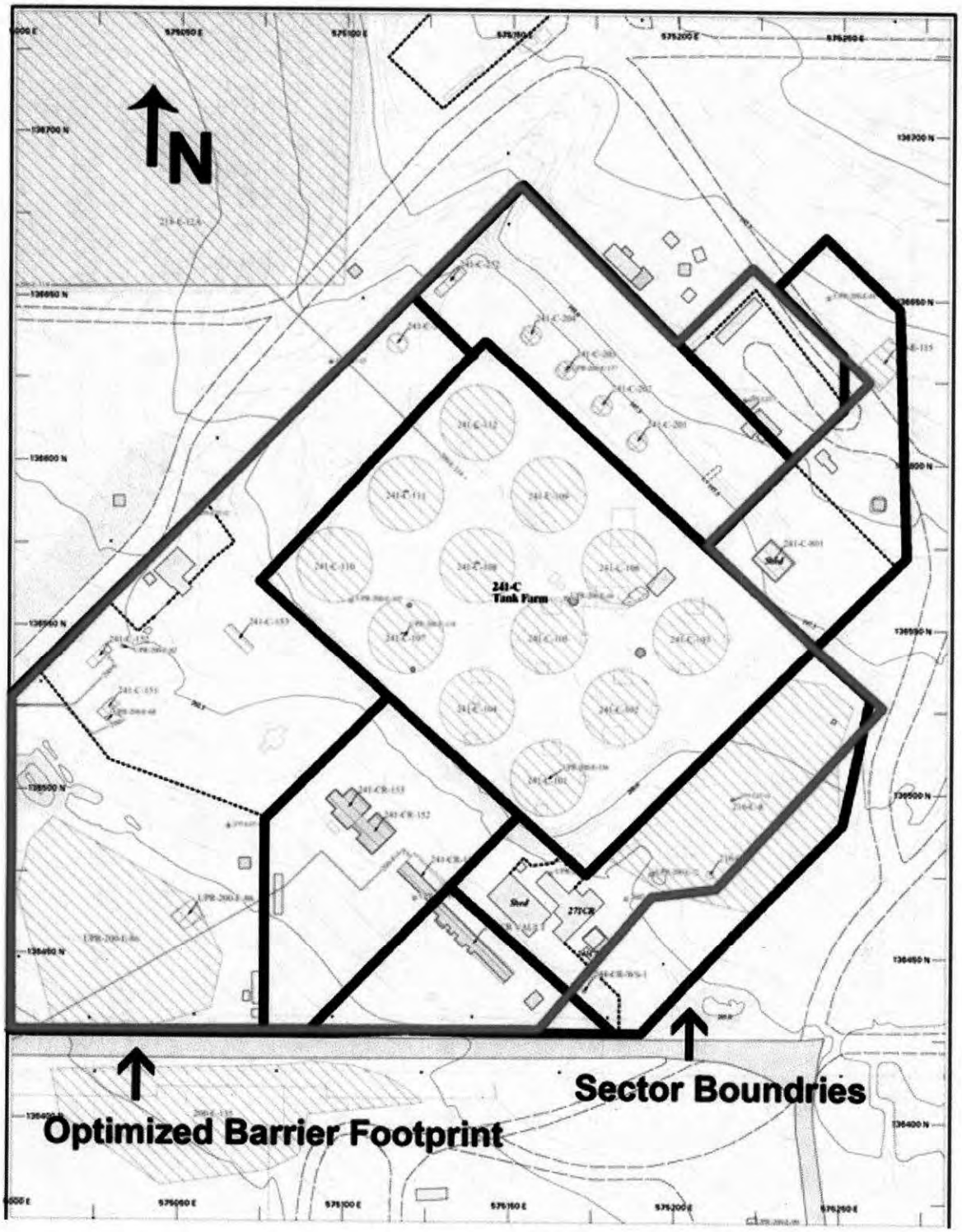
7.1 FINAL WMA C STATUS FOR BARRIER PLACEMENT

This barrier is intended to control the amount of precipitation that may infiltrate into any remaining contaminated media. This will reduce or eliminate the potential leaching of contamination to groundwater. In addition to their hydrological function, barriers may also serve to prevent human and ecological intrusion, limit wind and water erosion, prevent the run-on of surface water, and attenuate radiation.

The construction of the final WMA C closure barrier would require the surface area to be covered and prepared so that the performance design criteria can be met. The barrier design criteria, which are under development, for the U Plant facilities have provided the basis for the design criteria being developed for the WMAs and the proposed barrier described in the IDF closure plan. As these design criteria are further developed and finalized it is expected that some modifications will be made to accommodate specific applications. Site preparation activities would be required to provide a clean and stable foundation for the surface barrier. During the sector closure process, structures (e.g., buildings, equipment, risers, utilities, wells) that obstruct the placement of a surface barrier would generally require removal, realignment, or stabilization in place. Underground pipelines that extend outside the surface barrier footprint would have been evaluated for stabilization in place or removal depending on site-specific conditions during sector closure activities. Existing groundwater monitoring wells that are within the proposed footprint of the surface barrier will be decommissioned.

A site-specific assessment of the geometry of the areas to be included under the barrier would be needed to properly size the barrier footprint to ensure that the appropriate areas are contained. Some degree of over-sizing of the barrier (referred to as overlap) is expected, depending upon the depth of contamination and unsaturated flow properties. It is currently assumed that an overlap of 6.1 m (20 ft) is appropriate.

Figure 7-1. Conceptual Barrier Footprint Based Upon Integrated Closure of Sectors.



7.2 FINAL BARRIER DESIGN CRITERIA

The Modified RCRA Subtitle C Barrier design has been identified as a baseline design for sites containing dangerous waste, Category 3 low-level waste and/or Category 3 mixed low-level waste, and Category 1 mixed low-level waste (*Focused Feasibility Study of Engineered Barriers for Waste Management Units in the 200 Areas* [DOE/RL-93-33]) consistent with the WMA C inventory. This barrier design provides long-term containment and hydrologic protection for a performance period of 500 years. This design incorporates RCRA "minimum technology guidance" (*Technology Guidance Document – Final Covers on Hazardous Waste Landfills and Surface Impoundments* [EPA/530-SW-89-047]), with modifications for extended performance. One major change is the elimination of the clay layer, which may desiccate and crack over time in an arid environment. The geomembrane component has also been eliminated because of its uncertain long-term durability. This design also incorporates provisions to control ecological and human intrusion (DOE/RL-93-33).

Closure and post-closure requirements for landfills under WAC 173-303-665(6) require that the final cover be designed and constructed to:

- Provide long-term minimization of the migration of liquids through the closed landfill;
- Function with minimum maintenance;
- Promote drainage and minimize erosion or abrasion of the (final) cover;
- Accommodate settling and subsidence so that the cover's integrity is maintained;
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present;
- Prevent run-on and runoff from eroding or otherwise damaging the (final) cover.

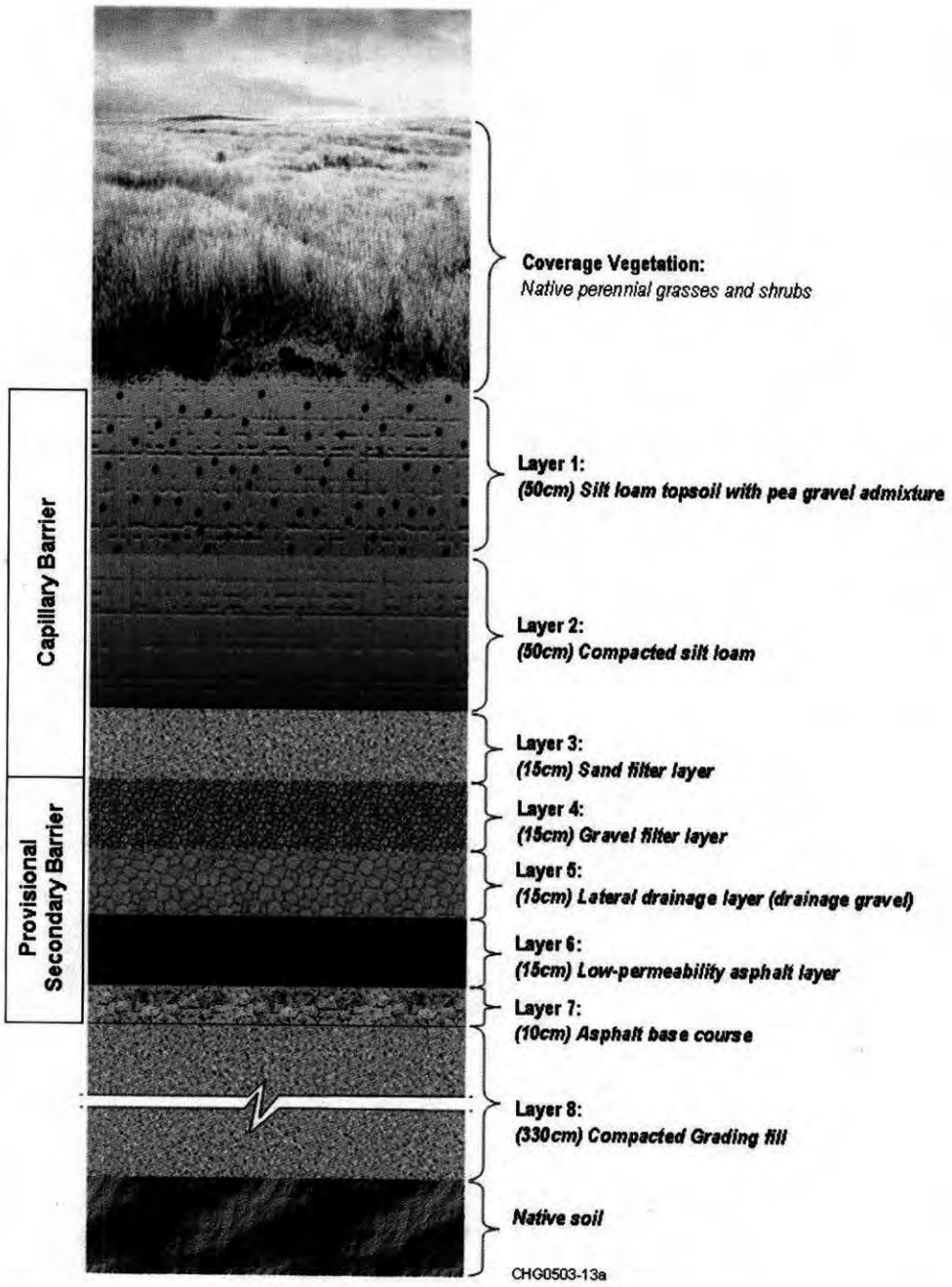
The Modified RCRA Subtitle C Barrier is composed of 8 layers of durable material with a combined thickness of 170 cm (5.5 ft) (Figure 7-2). The design includes evapotranspiration features of 100 cm (40 in.) of silt loam and 15 cm (6 in.) of sand filter layers overlying a secondary barrier system utilizing a low-permeability layer. The secondary barrier layers are provisional, depending on the site-specific need for redundancy in hydrologic protection, a vapor barrier and/or a more robust bio-intrusion layer. The overall thickness of the proposed barrier assumed in the WMA C risk assessment is 5 m, which includes 170 cm (67 in.) for the 8-layered Modified RCRA Subtitle C Barrier and 330 cm (130 in.) of grading fill.

A summary of design criteria for the surface barrier based on regulatory requirements is provided in Table 7-1. These design criteria have been reviewed and it has been determined that the barrier designed to these requirements will satisfy regulatory requirements for closure of a disposal facility for dangerous and low-level waste as required under WAC 173-303-610, WAC 173-303-665, and 10 CFR 61.52(a)(2).

Table 7-1. Summary of Surface Barrier Design Criteria.

Design Criteria
Minimize moisture infiltration through the cover.
Design a multi-layer cover of materials that are resistant to natural degradation processes.
Design a durable cover that needs minimal maintenance during its design life.
Design a cover with a functional life of 500 years.
Prevent plants from accessing and mobilizing contamination (i.e., prevent root penetration into the waste zone).
Prevent burrowing animals from accessing and mobilizing contamination.
Ensure that the top of the waste is at least 5 m (16.4 ft) below final grade or include appropriate design provisions to limit inadvertent human intrusion.
Facilitate drainage and minimize surface erosion by wind and water.
Design the low-permeability layer of the cover to have a permeability less than or equal to any natural subsoils present.

Figure 7-2. Modified RCRA Subtitle C Barrier Design.



Source: DOE/RL-98-28, 1999, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan, Environmental Restoration Program*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

Site-specific requirements and criteria, as well as tailoring the performance standards and technical guidance to site-specific conditions, will be considered during the site-specific evaluation and subsequent definitive design of barriers for individual waste sites. Site-specific requirements and criteria may include the following items:

- Results of site characterization studies, including chemical, radiological, and physical characteristics and contamination geometry;
- Adaptation and detailing of conceptual designs to address side-slope design, crown slope geometry, drainage, the size and shape of the cover footprint, and edge effects;
- Design optimization using numerical modeling;
- Settlement and subsidence issues and control measures, including void reduction and subgrade compaction specifications;
- Gas control;
- Evaluations of seismic susceptibility;
- Thickness of barrier layers and materials with respect to shielding needs;
- Availability and properties testing of construction materials;
- Safety and construction quality assurance plans;
- Specification of suitable cover vegetation;
- Monitoring and maintenance plans;
- Grading plans to control runon and runoff;
- Barrier performance monitoring plan.

8.0 POST-CLOSURE

Following completion of waste retrieval, stabilization activities, and construction of a surface barrier compliant with the approved closure plan, each WMA will enter a post-closure care period during which surface barrier inspection, barrier maintenance and performance monitoring, administrative controls, and groundwater monitoring will be implemented. These activities may be integrated with the Hanford Site long-term stewardship program and Central Plateau closure strategies. DOE has authorized programs to develop a site-wide institutional controls plan to provide for the implementation and maintenance of institutional controls including the placing of markings, signs, and/or monuments at the Hanford Site to protect human health and the environment. DOE will specifically integrate the planning, development, and implementation of institutional controls for SST system closure with appropriate elements of the site-wide institutional controls plan. In addition, post-closure groundwater monitoring will be integrated with the Central Plateau regional groundwater monitoring system. New groundwater monitoring wells may be installed, if necessary, to support post-closure groundwater monitoring following construction of the surface barrier.

During closure planning, post-closure actions that might be impacted by WMA closure activities would likely be those activities associated with groundwater characterization or remediation such as ensuring that locations remain available for sampling points or treatment systems. All other post-closure activities are not expected to be impacted by WMA C closure actions.

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APPENDIX A

SUMMARY OF WMA C DATABASE

APPENDIX A
SUMMARY OF WMA C DATABASE

The waste management area (WMA) C database was developed in an effort to collect detailed component-level information of the 241-C tank farm (C tank farm). The information contained within the database provides an up-to-date inventory for the purpose of establishing the technical basis of this WMA C Integration Study, which is the first step towards the eventual closure of that WMA. It also forms the foundation of the three-dimensional visualization model of WMA C.

The component-level information was collected by a team of field investigators who had previously assembled similar information for the double-shell tank system in support of Project E-525. Team members reviewed routing board drawings, as well as other relevant Hanford Site drawings, engineering change notices, pertinent reports related to C tank farm activities, etc. The database fields were populated as investigative activities took place with cross-checking and peer reviews occurring both as part of the initial investigations, as well as during the finalization of inputs to the database.

The investigations revealed that there were a minimal number of released AutoCad® drawings for C tank farm. Therefore, the team members were required to identify X, Y coordinate data from the information they had available. Z dimension coordinates were subsequently calculated by the three-dimensional modelers, using an AutoCad® subroutine. This information was then provided as input to the WMA C database.

The database for WMA C contains approximately 1400 records. Data utilized by the three-dimensional modelers resulted in approximately 800 records. The difference in the total number of records between the database and the model was because in many cases a single transfer line contained such a large number of coordinates, it had to be entered into the database in multiple segments.

APPENDIX B

SUMMARY OF WMA C PROCESS HISTORY

APPENDIX B
SUMMARY OF WMA C PROCESS HISTORY

Table B-1 tabulates information gathered on C tank farm history. The following process was used to develop the C Tank Farm History File.

1. Search retrievable document files to find documents that meet the criteria of:

    a. Location – C tank farm
    b. Time frame
    c. Type of document – weekly reports, monthly reports, incident reports, radiation reports, summary reports, etc.

2. Review the retrieved documents to find incidences of interest in a history. These include:

    a. Surface contamination
    b. Underground contamination
    c. Failed equipment with chemical/radiological consequences
    d. Newly installed or retired equipment or structures
    e. Failed and abandoned pipelines (leaks, plugs, etc.)

3. Create a spreadsheet with salient facts and retrieval information. The spreadsheet is designed to allow someone else to find the information in the same documents the information was gleaned from.

Perspective for Future Research

1. Tank farm operations during the time that fuel was actually being processed were seen in a much different light than now.

    a. The entire farm system was used as an integrated whole. This means that the individual farms were not individually reported on or managed as they are now. Each time someone goes through the process of retrieving history from old documents, they should make a point of getting history for all farms rather than just focusing on a single farm.

    b. The farm system was used to support fuel processing. Consequently, tank space was always an issue and efforts were constantly being made to dump the least hazardous materials to cribs, trenches, and other ground effluent disposal facilities. Pressures from the war effort and cold war effort drove tank farm operations to do things that would be unacceptable in today's environment.

    c. Balance that last statement with the fact that the Hanford Site was actively working with state (Washington and Oregon) and federal environmental and pollution prevention organizations as far back as the late 1940s. Also throw into the mix the fact that many of the problems they faced were simply new because nobody had ever worked with the amounts of radioactive materials being worked with at Hanford, either in curie loading or in volume. New materials and material

protection strategies had to be developed, and they could not be developed until a problem was identified by a system or material failure.

2. Future researchers must always view the tank farm from a chemical point of view, keeping in mind what separations strategies were in effect at different times, the wastes these different processes created, and the strategies that had to be developed to mitigate hazardous effects of the waste while still working to make room for more waste in the tanks. Waste characteristics drove the migration of the separations processes from the bismuth phosphate process to the REDOX (reduction-oxidation) process to the PUREX (plutonium-uranium extraction) process.

With these things in mind, the following points should be made:

1. Researched drawings should be categorized by project number, and the reason for the project should be understood. This approach provides a framework for the otherwise seemingly random data found in weekly reports or summaries.

2. Projects should also be evaluated based on the political climate of the time, further providing illuminating perspective. For example, the second round of saltwell pumping took place in the late 1970s. The projects for this round of saltwell pumping (B-171A, B-171B, B-171C, and B-180) were broken into small projects rather than left as a single large project probably to enable milestone progress to be shown to the Congress, which was taking more interest in Hanford Site activities and funding at the time.

3. When gathering tank farm information, collect information on all farms and let the software sort out the information after it is captured. This approach allows the researcher to collect the simplest items to fix and maximize the benefit for their cost.

Table B-1. Summary of C Tank Farm History. (7 Sheets)

RMIS #	Document #	Page	Event Type	Event	Date (M/Yr)	Location	Comments
D0512392	HW-37331		Line Plug	"The cross country line between the 153 ER diversion station and Tank 108-C plugged with waste on 1-27-53. Maintenance cleared the line and returned it to service on 1-28-53. While filling the line with waste, it either plugged again or was not completely cleared. Attempts are now being made to free the line.	30-Jan-1953	Cross country transfer line	
D0512392	HW-37331		Line Plug	"Some rocks and concrete were removed from the 103-C to 101-C transfer line."	27-Feb-1953	241-CR	
D0509267	HW-28043	4	Plugged Line	"Overflow to 108-C Plugged"	30-Apr-1953		
D0509267	HW-28043	4	Plugged Line	"Overflow to 111-C Plugged"	30-Apr-1953		
D0523630	HW-37301	134	Plugged Line	"On the first attempt to sluice tank 204-C after the equipment was installed, it was found that the line to the sluice nozzle and sludge jet was plugged. All attempts to unplug this line have failed."	12-Feb-1954		
D3082572	HW-44024-RD	40	Crib Waste	"On July 30th permission was received from Radiological Sciences to crib the sixth batch (6-112C-105C) of in-farm scavenged waste. The transfer from the 112-C tank to the BC-3 crib was started on July 31st and is progressing satisfactorily."	3-Aug-1956	BC-3 crib	

Table B-1. Summary of C Tank Farm History. (7 Sheets)

RMIS #	Document #	Page	Event Type	Event	Date (M/Yr)	Location	Comments
D3082572	HW-44024-RD	48	Crib Waste	"Transfer of the sixth batch of in-farm scavenged waste (6-112C-105C) to the BC-3 crib was completed on August 7th. The transfer was interrupted for a day when the 112C pump lost its prime."	8-Aug-1956	BC-3 crib	
D3082572	HW-44024-RD	63	Ditch Waste	"Transfer of the 5-111C-108-C-105C tank of in-farm scavenged waste to the Ditch was started on August 18th and completed on August 23rd. 475,750 gallons of waste was transferred into the first three sections of the ditch."	24-Aug-1956	C-farm ditch	The ditch mentioned was likely the BC-7 ditch.
D3082572	HW-44024-RD	70	Ditch Waste	"Transfer of the 8-112C-111C tank of in-farm scavenged waste (stored in 108C) to the BC-7 ditch was started on August 29th. Approximately 290,000 gallons of this material will be needed to complete filling of this ditch."	31-Aug-1956	BC-7 Ditch	
D3082572	HW-44024-RD	70	Plugged Line	"Since the overflow from the 104C to 105C tank is plugged it was necessary to pump the Purex coating waste overground to fill the 105C tank."	31-Aug-1956	C-104 to C-105 cascade line	

Table B-1. Summary of C Tank Farm History. (7 Sheets)

RMIS #	Document #	Page	Event Type	Event	Date (M/Yr)	Location	Comments
D198128641	HW-28471	25	Surface Contamination	"102-C Tank While installing equipment in the tank during the summer of 1951 contamination of low activity was spread to the surrounding excavation. The area was subsequently backfilled with approximately five feet of clean earth. The area is not delimited in any way."	?/?/1951	241-C-102	
D198128641	HW-28471	25	Surface Contamination	"105-C Tank Removal of a "thermal" element from the tank in the summer of 1951 resulted in the spread of metal waste contamination to the excavated area and surrounding ground surfaces. The majority of the contamination was removed to the Industrial Burial Ground and the remainder, which had dose rates up to 100 mrem/hr at two inches, was covered with approximately six feet of clean earth. The area is not delimited in any way."	?/?/1951	241-C-105	Radiological unit reported as "mrep/hr" should probably be "mrem/hr"

Table B-1. Summary of C Tank Farm History. (7 Sheets)

RMIS #	Document #	Page	Event Type	Event	Date (M/Yr)	Location	Comments
D199155779	HW-41535	13	Surface Contamination	"Diversion Boxes 241-C-151, 152, and 153 The area surrounding these three diversion boxes is contaminated due to a general buildup of contamination over a long period of time caused by work in the diversion boxes. An area approximately 100 feet square was chained off and posted with "Underground Contamination" signs in the spring of 1955."	?/?/1955	241-C-151, 152, and 153 Diversion Boxes	
D199155779	HW-41535	13	Surface Contamination	"241-CR Steam Cleaning Pit A pit for steam cleaning heavy equipment was dug during 1954 northeast of the 103-CR tank. The approximate center coordinated are N-42,800 and W-48,200. The pit has been covered but is not delimited above ground in any way other than being within the 241-C tank farm fence."	?/?/1955	241-CR Steam Cleaning Pit	
D8517123	HW-60807	14	Surface Contamination	"Diversion Boxes 241-C-151, 152, and 153 The area surrounding these three diversion boxes is contaminated due to a general buildup of contamination over a long period of time caused by work in the diversion boxes. An area approximately 100 feet square was chained off and posted with "Underground Contamination" signs in the spring of 1955."	?/?/1955	241-C-151, 152, and 153 Diversion Boxes	This event was reported in an earlier document.

Table B-1. Summary of C Tank Farm History. (7 Sheets)

RMIS #	Document #	Page	Event Type	Event	Date (M/Yr)	Location	Comments
D8517123	HW-60807	14	Surface Contamination	"241-CR Steam Cleaning Pit A pit for steam cleaning heavy equipment was dug during 1954 northeast of the 103-CR tank. The approximate center coordinated are N-42,800 and W-48,200. The pit has been covered but is not delimited above ground in any way other than being within the 241-C tank farm fence."	?/?/1955	241-CR Steam Cleaning Pit	This event was reported in an earlier document.
D8517123	HW-60807	20	Surface Contamination	"241-C Tank Farm (105-C to 108-C Overground Transfer) About 50 gallons of Purex coating waste leaked from an overground transfer line contaminating the soil. The area bout 20 feet wide and about 50 feet long is located 60 feet NE of the 105-C tank pit. Coordinates are approximately N-4200, W48310. The remaining contaminated pipe was buried in a trench near the 241-C fence due north of original site of the contamination spread at coordinates N-4300, W-48200. The original site was marked with stake, chain and underground radiation zone signs."		C-farm	No date given

Table B-1. Summary of C Tank Farm History. (7 Sheets)

RMIS #	Document #	Page	Event Type	Event	Date (M/Yr)	Location	Comments
D8402408	HW-27627	2, 3	Surface Contamination	"Contamination spread to ground and equipment during a transfer pump installation in the 110-CR tank farm on November 26, 1952."	26-Nov-1952	C-farm	This document is an investigation of the incident.
D8604174	ARH-2757 4	13	Underground Leak & Contamination	"A leak in the line from Purex Plant to 102-C tank was found October 19, 1969. Volume which leaked to ground has been estimated at 36,000 gallons. Contamination was covered with clean gravel."	19-Oct-1969	C-farm. Est N-42600, W-48460, H-2-44500 sheet 7	
D8604174	ARH-2757 4	13	Underground Leak & Contamination	"A leak in the line from tank 105-C to B Plant was found December 19, 1969. Volume which leaked to ground has been estimated at 2,600 gallons. The contaminated soil was covered with clean gravel."	19-Dec-1969	C-farm. Est N-42570, W-48685, H-2-44500 sheet 7	
D8604174	ARH-2757 4	14	Underground Leak & Contamination	"Process transfer line #812 from AR Vault to 241-C Tank Farm was found leaking near southwest corner of that farm. At that location the line is eight feet deep. Contaminated soil zone was estimated at 1,300 cubic feet. Test wells driven into the ground indicated the contamination did not extend below a depth of 20 feet."	3/?/1971	Est N-42725, W-48745, H-2-44500 sheet 7.	

Table B-1. Summary of C Tank Farm History. (7 Sheets)

RMIS #	Document #	Page	Event Type	Event	Date (M/Yr)	Location	Comments
D8565181	HW-84619	9	Surface Contamination	"5. 241-CR Vault On November 1, 1960 during work in the 241-CR vault, winds spread contaminated particles from the vault generally east and out to several hundred feet beyond the limited area fence. Contamination levels around the vault were on the order of 50 to 100 mrad/hr. Particles outside the fence read as high as 40,000 c/m on a GM meter. No private vehicles were involved."	1-Nov-1960	241-CR vault	
D8638169	ARH-780	5	Flooded Vault	"Document RL-SEP-332, 3-22-65. On 2-18 the 244-CR Vault was flooded to the level of the tank tops. Source of the flood was found to be a failed coating waste line in a diversion box which drains to the vault sump."	18-Feb-1965	244-CR Vault	

APPENDIX C

SUMMARY OF WMA C THREE-DIMENSIONAL MODEL

APPENDIX C
SUMMARY OF WMA C THREE-DIMENSIONAL MODEL

In support of the waste management area (WMA) C database component identification and remediation sequencing activities for this WMA C Integration Study, a three-dimensional model of the waste management area was created, based on a component catalog of more than 1400 components and derived from approximately 800 engineering drawings.

These data were imported into AutoCAD® 3D, an industry-standard computer-aided drafting software program. Developing the model in three dimensions allowed for all components (e.g., entire pipe runs) to be reviewed and verified. Through is rigorous process, inconsistencies in drawing and as-built configuration of the components could be identified and corrected in the new three-dimensional drawing.

Once all components were verified as accurately placed and modeled, the information from the AutoCad® 3D file was transferred into the Quest 3D™ computer program, which provides the platform for visualization of the three-dimensional model of WMA C on any computer or network. This three-dimensional visualization tool provides many advantages in developing this WMA C Integration Study including:

- Allowing one to digitally 'fly' through WMA C and view all of the components from any perspective. It also allows for up-close access to objects that were otherwise below ground and/or highly radioactive.
- Embedded in the three-dimensional visualization model are links to the WMA C database as well as available information on WMA C unplanned releases (UPRs). This information can be easily retrieved from the component database as well as waste and plume data from the Grand Junction database.[10]
- The user has the capability to create custom groupings of objects that could be removed from the rest of the group, made transparent, or placed into a color-coded selection of similar objects. This capability will aid in assessing 'what if' scenarios for closure planning.
- Save the current configuration of the world to a shareable file, giving additional users the ability to load and easily view the saved configuration.
- Save screen shots of custom configurations.

Beyond the uses of the Integration study, the AutoCad® 3D drawing has dramatically reduced the number of engineering drawing under configuration control from over 800 to 1.
The three-dimensional visualization model also has applications beyond this study, including use as a training tool; for presentation purposes in a variety of forums including public meetings, media briefings, presentation and workshops with stakeholder and regulators. The model can

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[10] GJO-HAN-18, 1998, *Hanford Tank Farms Vadose Zone: C Tank Farm Report*, U.S. Department of Energy, Grand Junction Project Office, Grand Junction, Colorado.

also provide detailed visuals for reports and papers. It is expected that the application and use of the AutoCad® 3D drawing and the three-dimensional visualization model will continue to expand.

Attachment 2
05-TPD-062

RPP-PLAN-25942, Rev. 0
Waste Management Area Integration Study – Waste Management Area T

(Consisting of 115 pages,
including coversheet)

RPP-PLAN-25942
Revision 0

WASTE MANAGEMENT AREA INTEGRATION STUDY

WASTE MANAGEMENT AREA T

6/01/2005

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SUMMARY

S1.0 INTRODUCTION

This document is being prepared to partially satisfy the *Hanford Federal Facility Agreement and Consent Order* (HFFACO)[1] Interim Milestone M-45-00B for the submittal of two waste management area (WMA) integration plans by June 30, 2005. This WMA T Integration Study along with the WMA C Integration Study[2] meets the requirements of Milestone M-45-00B. The U.S. Department of Energy (DOE) is in the process of preparing the *Draft Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, Washington* (DOE/EIS-0356) under the *National Environmental Policy Act of 1969* (NEPA).[3] It is anticipated that the TC-EIS will evaluate various closure alternatives, including but not limited to, clean and landfill closure. After completion of the NEPA process, the TC-EIS will form the basis for DOE decision-making regarding closure, and will be confirmed in a Record of Decision. Although the WMA T Integration Study assumes that the WMAs will be landfill closed, it does not represent a DOE decision to landfill close in advance of completing the NEPA process, but is only intended to provide additional information regarding potential closure approaches.

The need for integration studies is identified in Appendix I of the HFFACO, which states:

> "For each SST tank farm (or WMA), DOE shall submit a WMA Integration Study. This study shall look at the entire WMA from a systems perspective and describe the inter-relationships between the various components. The study shall describe a logical sequence of events that would lead to efficient and effective waste retrieval and closure of the WMA, including field sampling and characterization activities of the ancillary equipment (piping, valve pits, vaults, Miscellaneous Underground Storage Tanks, diversion boxes, etc.) This study will be used in the development of the WMA Closure Plan. The document will propose a regulatory path for all ancillary equipment in that WMA and all the activities to achieve efficient and effective closure of that WMA, including all:
>
> - Single Shell Tanks
> - SST system ancillary equipment
> - Soil remediation per WMA corrective actions and proposed plans for WMA soils

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[1] Ecology, EPA, and DOE, 1989, *Hanford Federal Facility Agreement and Consent Order*, as amended, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

[2] RPP-PLAN-26062, 2005, *Waste Management Area Integration Study Waste Management Area C*, Rev. 0, CH2M HILL Hanford Group, Inc., and Cenibark International, Inc., Richland, Washington.

[3] *National Environmental Policy Act of 1969*, 42 USC 4321 et seq.

- Groundwater remediation activities and activities necessary for integration with Central Plateau groundwater remediation."

S1.1 OVERVIEW OF THE WASTE MANAGEMENT AREA T INTEGRATION STUDY

This WMA T Integration Study describes a systematic and holistic approach for remediating and closing WMA T. Consistent with the stated intent of the HFFACO Appendix I and Milestone M-45-00B, this study considers the full range of components that comprise WMA T, including 16 single-shell tanks (SSTs), their associated ancillary equipment, two cribs and one trench, the contact-handled `transuranic packaging facility, as well as contaminated soils and groundwater. To understand the full breadth and complexity of WMA T, the first step of this study was to perform a detailed and rigorous examination of approximately 450 engineering drawings associated with WMA T. This study identified and verified 597 components within WMA T including 6 diversions boxes (including the 241-TR-153 pump pit), 16 external pipelines, and numerous pits, risers and internal pipelines that supported past T tank farm waste transfer operations.

These component data were entered into a Microsoft® Access database. To further an understanding of the complexities of the geo-spatial relationship of the 597 components, the as-built engineering drawings were converted into a three-dimensional drawing using AutoCAD® 3D.

This WMA T Integration Study identifies integration issues and physical limitations of proposed closure and corrective actions for WMA T through an understanding of how the 597 components within the T tank farm functioned and were related within the overall WMA T system.
The study team also assessed how the WMA T components with similar attributes could be optimally grouped to better evaluate the range of closure and corrective actions that may need to be performed as progress is made toward final closure of WMA T. These actions may include:

- Waste retrieval
- Characterization
- Isolation of pipelines and other components that could provide a future pathway for migration of contamination
- Grout filling tanks and other components that have significant void space
- Corrective measures for unplanned releases (UPRs)
- Closing drywells.

The WMA Integration Study team also evaluated components in close proximity to, but not necessarily residing within, the T tank farm fenceline that could be considered for remediation as

part of WMA T. The types of components that require consideration as part of WMA T closure include:

- External pipelines (i.e., pipelines that traverse the T tank farm fence line)
- UPRs that are in close proximity to WMA T and in some cases were the result of activities associated with operations at T tank farm
- Groundwater monitoring wells outside of the T tank farm fence line, but that may be covered by the final closure barrier
- Other components (e.g., cribs and trenches) that serviced T tank farm operations but are outside of the T farm fence line.

Closure actions for the majority of the components within WMA T are the responsibility of the DOE, Office of River Protection (ORP), while closure actions for components outside of the WMA are currently the responsibility of the DOE, Richland Operations Office (RL). Close coordination and cooperation between these two U.S. Department of Energy field offices and their respective contractors in concert with the regulatory agencies will be required to determine the optimal integration of closure actions within and in close proximity to WMA T, as well as the timing of their execution and the appropriate regulatory pathway.

S1.2 INTEGRATION PLANNING ASSUMPTIONS AND SEQUENCING BASES

Initial closure planning has already begun within WMA T. Using closure information collected to date, this WMA T Integration Study includes a set of broad-based assumptions for closure of the SST system components that have been used to guide the sequencing of activities leading to closure. These assumptions are consistent with the current DOE closure baseline. While final closure decisions have not been made, the assumption for this study is that with the exception of the contact-handled transuranic mixed waste packaging system, WMA T would be closed as a landfill and that risk to human health and the environment will be greatly reduced upon completion of waste retrieval from the T farm SSTs, grout placement in the tanks, and barrier placement over WMA T. Based upon the closure plan submitted to the Washington State Department of Ecology, this study assumes that the contact-handled transuranic mixed waste packaging system will be clean closed.[4] The landfill closure assumptions include the following:

- All components in the WMA will comply with landfill closure performance standards.
- No additional waste residuals from transfer piping and smaller ancillary equipment will be removed (i.e., no flushing will occur) because of unknown component integrity and the predicted low, long-term risk potential.

---

[4] DOE/ORP-2003-22, 2004, *Hanford Facility Dangerous Waste Permit Application, Contact-Handled Transuranic Mixed Waste Treatment, Packaging, and Storage Facility*, Rev. 0A, U.S. Department of Energy, Office of River Protection, Richland, Washington.

- Additional waste residuals may be removed for larger ancillary equipment (e.g., vaults, catch tank) with significant inventories of residual waste in accordance with approved closure plans.

- Some removal of soil at UPR sites may be required to a yet-to-be determined depth in highly contaminated areas. Any remaining contaminated soil would be left in place and covered by an engineered barrier. An alternatives analysis will define specific corrective actions within WMA T as required under HFFACO Milestone M-45-60.

- Existing groundwater remediation projects for the Central Plateau, which are managed by the RL contractor, will be sufficient for contaminated groundwater, and groundwater projects will interface with the ORP Vadose Zone Project.

The closure sequence of a WMA would ideally follow a logical progression that allows multiple actions to occur within the WMA without creating conflicts between ongoing, concurrent activities. In developing a general closure/remediation sequencing approach, there are several planning assumptions that should be regularly reviewed and validated during the closure process. Those bases include the following:

- The WMA will be isolated from external components to prevent inadvertent introduction of liquids into the WMA during waste retrieval and closure actions.

- Waste retrieval from the 241-T-301B catch tank, if required, will be integrated with waste retrieval activities for the 100- and 200-series tanks.

- The WMA will be subdivided into sub-areas referred to as sectors. Sectors will be established based on consideration for the geographic proximity of components, hydraulics, and regulatory pathway to closure considerations.

- Isolation of components within the WMA will be conducted such that the decontamination of pits and vaults will be completed before any down-gradient receiving tank has been isolated (i.e., to prevent reintroduction of liquids).

- The sequence for conducting closure activities will be defined to minimize interference and rework.

- Pipelines that have not already been flushed will not be flushed because of integrity concerns.

- SSTs will be retrieved to the limits of the selected retrieval technology(ies), consistent with the criteria defined in HFFACO Milestone M-45-00.

- SSTs and other large ancillary equipment, as appropriate, will be grouted to stabilize residual wastes and to provide structural stability to the tank and barrier.

- Other ancillary equipment with significant void spaces will be grouted as necessary to provide structural stability to the barrier.

- Pipelines will not be void-space filled.

- Above-grade buildings and temporary structures/facilities will be removed or leveled to meet the site preparation requirements for the final engineered barrier.
- UPR sites will typically not be excavated.

S1.3 WASTE MANAGEMENT AREA T SECTORS

During the development of the assumptions for this study, it became apparent that the closure actions associated with WMA T could be better accomplished by subdividing WMA T. Four sectors were defined based on geographical, hydraulic and operational characteristics of the components in each sector, with the major WMA T components grouped as follows (see Figure S-1):

- **Sector 1** – The twelve 100-series SSTs with their associated pits, risers and internal pipes, and two UPRs (UPR-200-W-147, and UPR-200-W-148).
- **Sector 2** – The four 200-series SSTs with their associated pits, risers and internal pipes; one diversion box (241-T-252); catch tank 241-T-301B; CH-TRUM packaging equipment, and external piping.
- **Sector 3** – Four diversion boxes (241-T-151, 241-T-152, 241-T-153, and 241-TR-152) including one pump pit (241-TR-153) with associated French drain and booster pump; external piping; and six UPRs (UPR-200-W-7, 200-W-78, 200-W-79, UPR-200-W-29, UPR-200-W-64, and UPR-200-W-97.
- **Sector 4** – Three cribs (216-T-32, 216-T-36, and 200-W-52); crib 216-T-7; trench 216-T-5; and file field 216-T-7; internal piping; and two UPRs (200-W-79 and 200-W-90).

Subdividing WMA T into sectors may also afford common regulatory decision processes to occur. The CH-TRUM packaging system would be closed as a *Resource Conservation and Recovery Act of 1976* (RCRA)[5] treatment, storage, and/or disposal facility. While it is well recognized and accepted that the SSTs and most ancillary equipment will be closed under the RCRA Site-Wide Permit as treatment, storage, and/or disposal facilities, there are opportunities to consider other regulatory pathways to closure for specific sectors within WMA T. In particular, the major components requiring remediation and closure in Sector 4 are non-treatment, storage, and/or disposal facilities that do not require closure under the RCRA. Therefore, the regulatory processes that are currently being developed for many of the 200 Areas Plateau facilities as part of the Central Plateau Closure Plan[6] (i.e., RCRA past-practice, *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* [CERCLA][7]) can also be applied to the remediation and closure of components in this sector.

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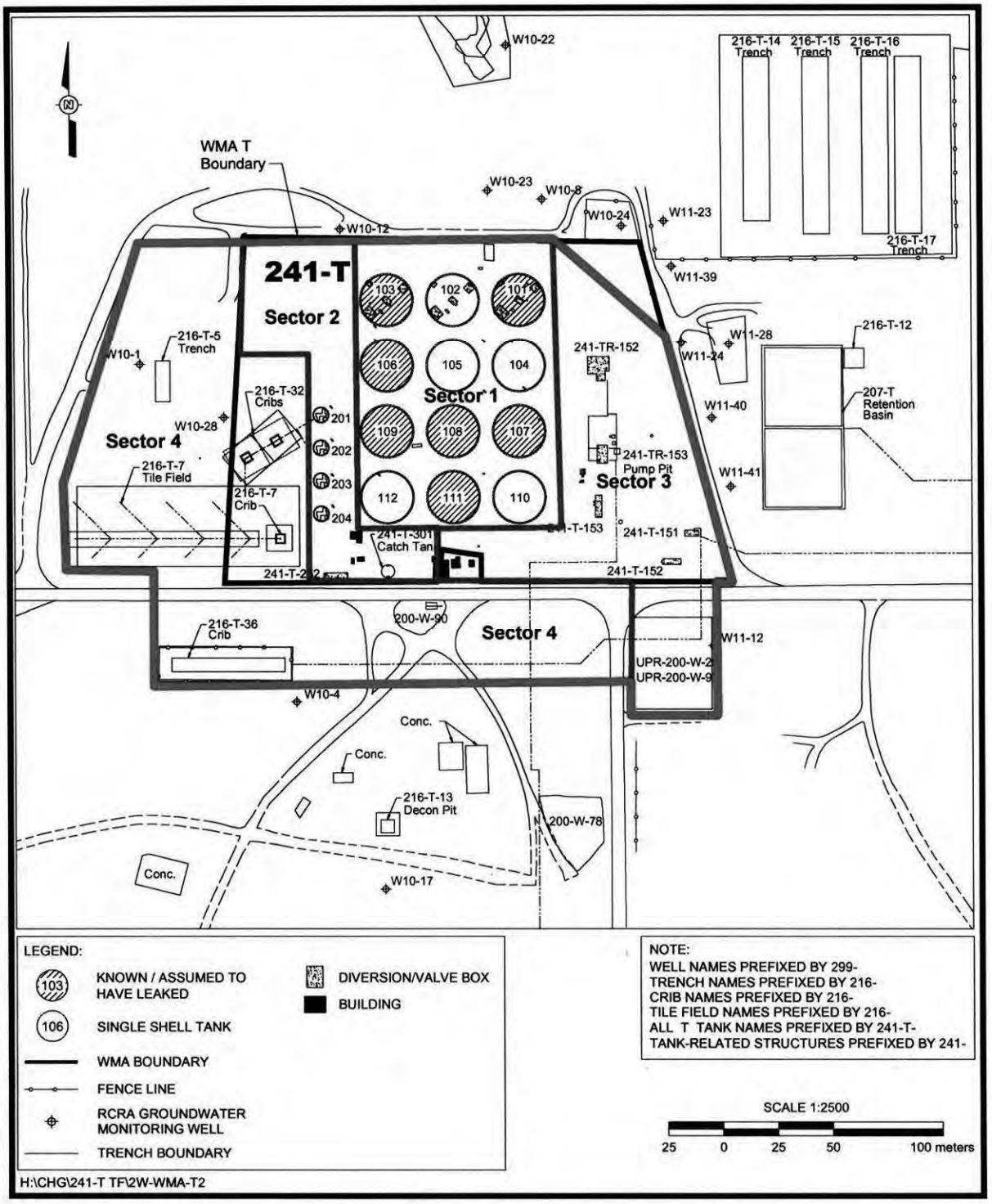
[5] *Resource Conservation and Recovery Act of 1976*, Public Law 94-580, 90 Stat. 2795, 42 USC 901 et seq.

[6] CP-22319-DEL, 2004, *Plan for Central Plateau Closure*, Rev. 0, Fluor Hanford Inc., Richland, Washington.

[7] *Comprehensive Environmental Response, Compensation, and Liability Act of 1980*, Public Law 96-150, 94 Stat. 2767, Title 26, 42 USC 9601 et seq.

Figure S-1. Waste Management Area T Sector Map.



S2.0 INTEGRATION WITH CENTRAL PLATEAU CLOSURE

In addition to integrating activities within WMA T, it is important that there is an integration of the closure of WMA T (an ORP responsibility) with the closure of the Central Plateau (an RL responsibility). An understanding of these integration issues includes waste sites, pipelines, and groundwater. A process has been developed within the study that promotes WMA T closure being closely coordinated with other actions on the Central Plateau and leads to consistency in the actions taken, clarity in the responsibilities for these actions, and completeness in the coverage of actions that must be taken. Fundamental to the integration between WMA T and the Central Plateau is a strategy that allows the ORP and RL to understand their respective regulatory processes to ensure that decisions and strategies will accommodate structures and facilities at the interface areas and that they be complementary.

S2.1 PHYSICAL BOUNDARIES AND INTERFACES

Because there are Central Plateau waste sites and SST components that exist within and adjacent to WMA T, there is a need to clarify the WMA boundary in the context of efficient WMA T and Central Plateau closure planning. Inclusion of a waste site within the WMA T closure planning scope that is outside the WMA fenceline would depend upon whether it is cost-effective to include that waste site within the footprint of the WMA T barrier. Waste sites that are outside of the barrier footprint would be closed under other regulatory processes but may require coordination with WMA T closure planning (e.g., timing of physical activities). Non-SST components within the WMA T fenceline would be closed under other regulatory processes, but in close coordination with WMA T closure planning. In some cases, the currently defined program for these waste sites may require revision to optimally coordinate closure actions among programs.

S2.2 PIPELINE INTERFACE AND DISPOSITION STRATEGY

An important interface between scope of the Central Plateau and WMA T closure is the point at which pipelines cross the boundary of the WMA T barrier footprint. To define this interface, a pipeline interface strategy was developed for this WMA T Integration Study and includes the following key elements:

- The regulatory responsibility for pipeline disposition should be established at the boundary of the final closure barrier for WMA T:
  - The portion of each pipeline not covered by the WMA T final closure barrier should be addressed through the assessment and decision process within the applicable operable unit remedial investigation/feasibility study process.

- The portion of each pipeline covered by the WMA T final closure barrier should be addressed through the WMA corrective action and closure decision processes.

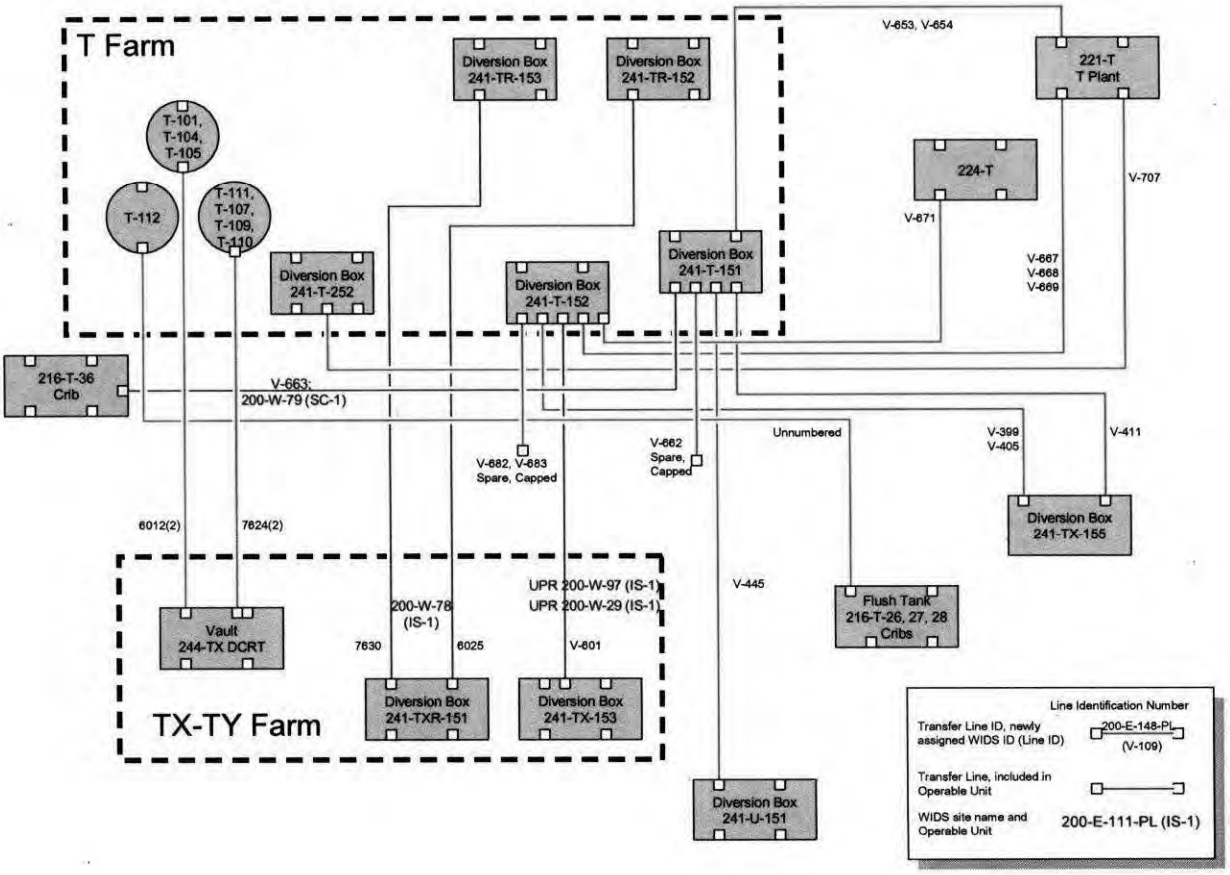
- The pipeline isolation and regulatory strategy should not alter the existing RL or ORP ownership and responsibility for pipelines within or outside of the WMA.

- The locations and approaches for isolating pipelines (e.g., cutting, capping, grouting) should be coordinated between the remedial investigation/feasibility study process and the WMA closure process to ensure the integrity and hydraulic isolation of the final barrier system as well as closure sequencing.

- The additional pipelines that have been identified during this study should be included in the WIDS (waste information data system) database to ensure that they can be incorporated into the operable unit decision logic through a 'plug-in' approach.

The waste transfer pipelines that traverse the WMA T boundary are shown in Figure S-2.

Figure S-2. Pipeline Interfaces.



S2.3 INTERFACE WITH 200 AREA GROUNDWATER DECISIONS AND REMEDIATION

The *Hanford Site Groundwater Strategy*[8] calls for the CERCLA process to integrate all groundwater protection and remediation actions. Therefore, CERCLA RODs for the 200 Areas groundwater operable units would need to address the potential groundwater impacts from tank farm sources, including WMA T. To insure that the tank farm sources are accounted for in the 200 Areas groundwater operable units will require their integration by determining the relationship between a WMA T performance assessment, SST performance assessment, the RCRA facility investigation report and corrective measures study, and the 200-ZP-1 groundwater operable unit feasibility study. ORP and RL have initiated a process to integrate risk assessments across the Hanford Site which will better define these relationships.

The timing of the ROD for the 200-ZP-1 groundwater operable unit needs to be coordinated with completion of the Phase I RCRA corrective action corrective measures study for tank farms, currently scheduled for mid-fiscal year 2007. WMA T closure should be a factor in reaching a final ROD for the 200-ZP-1 groundwater operable unit.

[8] DOE/RL-2002-59, 2003, *Hanford Site Groundwater Strategy*, Draft, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

S3.0 WASTE MANAGEMENT AREA T BARRIER CONFIGURATION

As part of the final closure process, a surface barrier would be constructed over WMA T and, if appropriate, adjacent contaminated waste sites that are beyond the existing fenceline. The final barrier configuration would be dependent upon an analysis that would properly size and orient the barrier given a variety of factors such as those presented in the RCRA corrective action documents that may conclude capping is the preferred corrective measure in lieu of removal of contaminated soil. There may be large portions of the WMA that do not require a barrier, or there may be adjacent external waste sites that would benefit from a larger barrier.
The cost-effectiveness of the barrier is expected to be one of the factors in establishing the final footprint of the cover. Figure S-3 presents a conceptual barrier configuration for WMA T based upon the integrating assumptions in this report. As shown in Figure S-3, the footprint of the barrier could reasonably be expected to extend outside of the existing WMA boundary.

S4.0 WASTE MANAGEMENT AREA T INTEGRATED CLOSURE TIMELINE

Figure S-4 presents a preliminary closure timeline that integrates the time-phased schedule for WMA T sectors with associated corrective action and Central Plateau closure activities.
All dates other than those directly associated with HFFACO milestones are estimated, but provide the best current planning basis. For purposes of this integration study, it has been assumed that WMA T would be the second tank farm closed and will occur within two years of completing WMA C closure. Based upon this assumption, WMA T would be closed by March 31, 2016.

Figure S-3. Conceptual Barrier Footprint Based Upon Integrated Closure of Sectors.

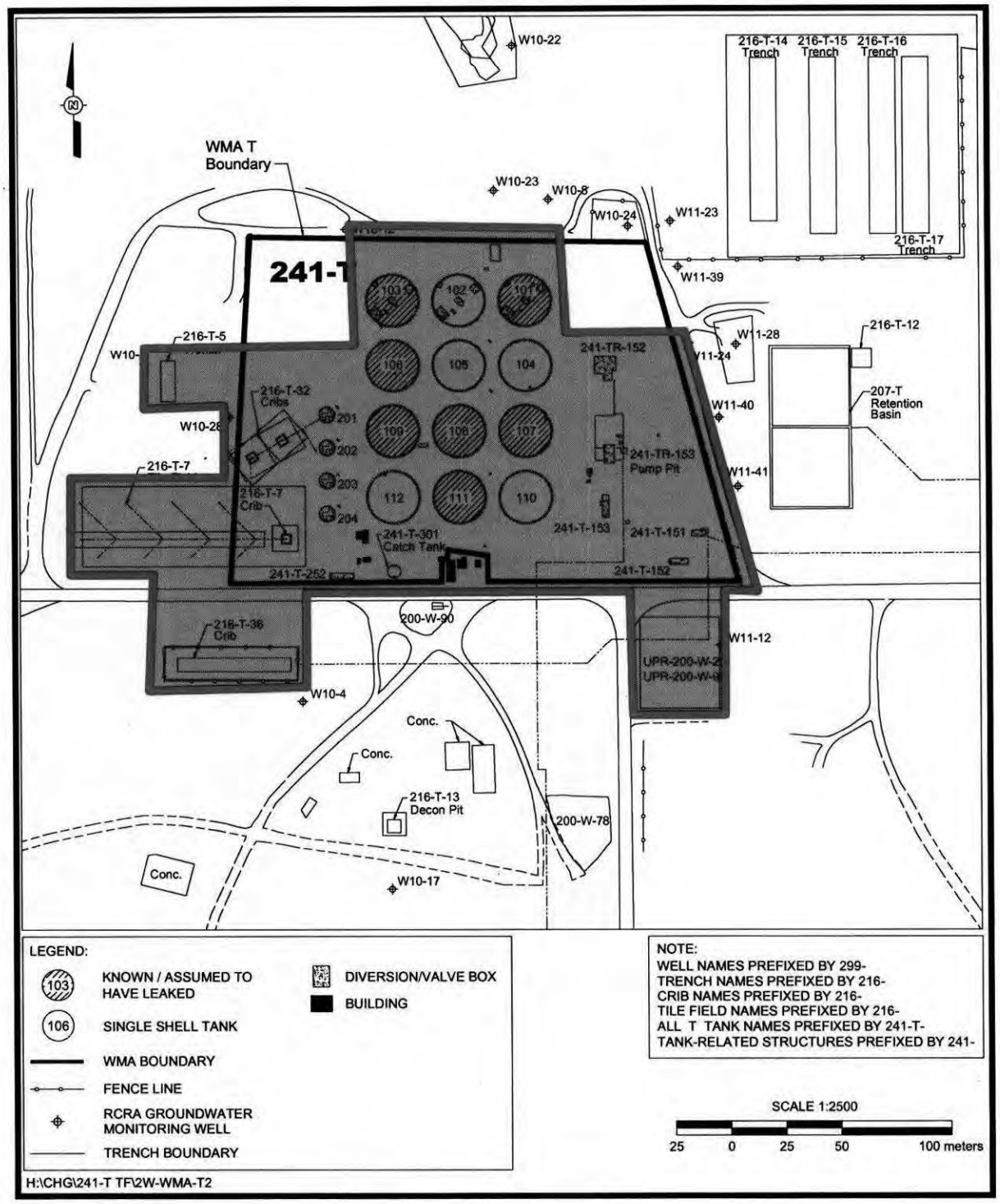


Figure S-4. Integrated Time-Phased Schedule for Waste Management Area T Sector Closure.

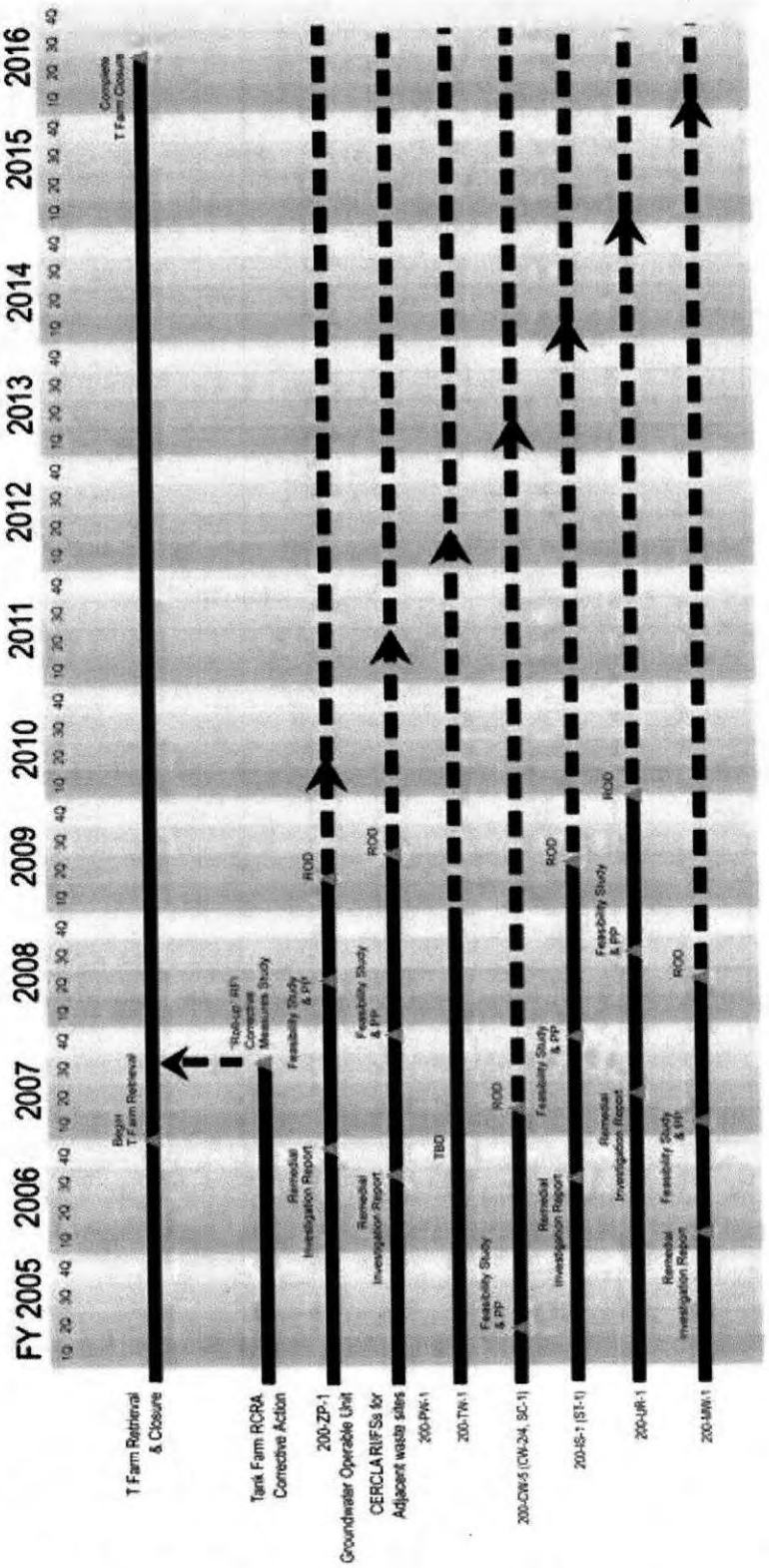


TABLE OF CONTENTS

1.0 INTRODUCTION 1
- 1.1 PURPOSE AND SCOPE 1
- 1.2 WASTE MANAGEMENT AREA T BACKGROUND 2

2.0 WASTE MANAGEMENT AREA STUDY AREA AND CLOSURE SECTORS 7
- 2.1 COMPONENT INTEGRATION LOGIC 9
  - 2.1.1 Waste Management Area T Database 9
  - 2.1.2 Waste Management Area T Waste Characterization 11
- 2.2 WASTE MANAGEMENT AREA T CLOSURE SECTORS 11

3.0 REGULATORY SETTING 14
- 3.1 DRIVERS FOR CLOSURE 14
  - 3.1.1 HFFACO Milestones 14
  - 3.1.2 RCRA 15
  - 3.1.3 RCRA Corrective Action Requirements 16
  - 3.1.4 CERCLA Remedial Action Requirements 17
  - 3.1.5 NEPA and SEPA 17
- 3.2 TANK CLOSURES AND WASTE DETERMINATIONS 19

4.0 CLOSURE/REMEDIATION SEQUENCING 20
- 4.1 REGULATORY ASSUMPTIONS 20
- 4.2 COMPLIANCE WITH GENERAL CLOSURE PERFORMANCE STANDARDS BASED ON CLOSURE/REMEDIATION ASSUMPTIONS 21
  - 4.2.1 General Performance Standard #1 22
  - 4.2.2 General Performance Standard #2 22
  - 4.2.3 General Performance Standard #3 23
- 4.3 WASTE MANAGEMENT AREA T INTEGRATED CLOSURE SECTOR SEQUENCE APPROACH 24
- 4.4 ISOLATION OF COMPONENTS 27
- 4.5 WASTE MANAGEMENT AREA PERFORMANCE ASSESSMENTS 27
- 4.6 WASTE SITES AND UNPLANNED RELEASE SITES 28
  - 4.6.1 Waste Sites and Unplanned Releases in Waste Management Area T 29
  - 4.6.2 Waste Sites and Unplanned Releases near Waste Management Area T 30
  - 4.6.3 Other Waste Sites and Unplanned Releases near Waste Management Area T 32
- 4.7 DECOMMISSIONING, DECONTAMINATION AND DISMANTLEMENT 34
- 4.8 WASTE MANAGEMENT AREA T COMPONENT REGULATORY PATHWAYS TO CLOSURE 34

4.9 SECTOR 1 SEQUENCING 36
4.9.1 Approach 36
4.9.2 Waste Retrieval 37
4.9.3 Waste Characterization 38
4.9.4 Post-Retrieval Isolation and Activities 39
4.9.5 Vadose Zone Monitoring/Drywell Decommissioning 40
4.9.6 Integration 41
4.9.7 Status 41
4.10 SECTOR 2 SEQUENCING 41
4.10.1 Approach 43
4.10.2 Characterization 47
4.10.3 Integration 48
4.10.4 Status 48
4.11 SECTOR 3 SEQUENCING 48
4.11.1 Approach 51
4.11.2 Characterization 51
4.11.3 Isolation 51
4.11.4 Integration 51
4.11.5 Status 53
4.12 SECTOR 4 SEQUENCING 53
4.12.1 Approach 55
4.12.2 Characterization 56
4.12.3 Isolation 57
4.12.4 Integration 57
4.12.5 Status 57

5.0 INTEGRATION WITH VADOSE ZONE/SOIL 58
5.1 INTEGRATION OF THE WASTE MANAGEMENT AREA T SOIL COMPONENT CLOSURE PROCESS 58
5.1.1 Status of Current Soil Component Closure Activities 58
5.1.2 Approach to Remaining Soil Component Closure Activities 59

6.0 INTEGRATION WITH CENTRAL PLATEAU 60
6.1 PHYSICAL BOUNDARIES AND INTERFACES 60
6.2 PIPELINE INTERFACE AND DISPOSITION STRATEGY 63
6.3 INTERFACE WITH 200 AREA GROUNDWATER DECISIONS AND REMEDIATION 64

7.0 CLOSURE CONFIGURATION AND DESIGN ISSUES 67
7.1 FINAL WASTE MANAGEMENT AREA T STATUS FOR BARRIER PLACEMENT 67
7.2 FINAL BARRIER DESIGN CRITERIA 69

8.0 POST-CLOSURE 73

9.0 REFERENCES 74

LIST OF APPENDICES

APPENDIX A – SUMMARY OF WASTE MANAGEMENT AREA T DATABASE ..... A-i

APPENDIX B – SUMMARY OF WASTE MANAGEMENT AREA T PROCESS HISTORY ..... B-i

APPENDIX C – STATUS OF EXTERNAL TRANSFER LINE ISOLATION ..... C-i

LIST OF FIGURES

Figure 1-1. Location Map of Waste Management Area T in the 200 West Area of the U.S. Department of Energy Hanford Site. 3

Figure 1-2. Location Map of Waste Management Area T and Surrounding Area. 4

Figure 2-1. Waste Management Area T Integration Study Area. 8

Figure 2-2. Waste Management Area T Integration Study Sectors. 13

Figure 3-1. RCRA Facility Investigation/Corrective Measures Study Process. 18

Figure 4-1. Time-Phased Sequence of Sector Closure and Barrier Design Construction. 26

Figure 4-2. Location of Waste Sites in and Around Waste Management Area T. 28

Figure 4-3. Sector 1 Components. 36

Figure 4-4. Sector 2 Waste System Components. 42

Figure 4-5. Contact-Handled Transuranic Mixed Waste Packaging System. 44

Figure 4-6. Contact-Handled Transuranic Mixed Waste Temporary Storage Facility Layout. 45

Figure 4-7. Sector 3 Components. 49

Figure 4-8. Waste Management Area T Proposed Boundary Re-alignment. 52

Figure 4-9. Sector 4 Components. 54

Figure 6-1. Waste Management Area T Pipeline External Interfaces. 63

Figure 6-2. Time-Phased Sequence for Central Plateau Closure Activities. 66

Figure 7-1. Conceptual Barrier Footprint Based Upon Integrated Closure of Sectors. 68

Figure 7-2. Modified RCRA C Barrier Design. 70

LIST OF TABLES

Table 2-1. Waste Management Area T Component and Infrastructure Groupings. 10

Table 2-2. Component Type Closure Plans Required for Waste Management Area T Component Group Closure. 12

Table 3-1. HFFACO Milestones Applicable to Waste Management Area T Integration Study. 15

Table 4-1. Waste Management Area T Regulatory Path for Component Closure. 35

Table 4-2. Planned Isolation Actions. 39

Table 6.1. Disposition Pathway for Waste Sites and Structures Outside of T Farm. 61

Table 7-1. Summary of Surface Barrier Design Criteria. 71

LIST OF TERMS

CERCLA	*Comprehensive Environmental Response, Compensation, and Liability Act of 1980*
CH-TRUM	contact-handled transuranic mixed waste
CMS	corrective measures study
DCRT	double-contained receiver tank
DOE	U.S. Department of Energy
DST	double-shell tank
DQO	data quality objectives
Ecology	Washington State Department of Ecology
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
HFFACO	*Hanford Federal Facility Agreement and Consent Order*
LLW	low-level waste
NEPA	*National Environmental Policy Act of 1969*
ORP	Office of River Protection
OU	operable unit
PA	performance assessment
RA	risk assessment
RCRA	*Resource Conservation and Recovery Act of 1976*
RFI	RCRA facility investigation
RI/FS	remedial investigation/feasibility study
ROD	Record of Decision
SEPA	Washington State Environmental Policy Act
SST	single-shell tank
TC-EIS	Tank Retrieval and Closure Environmental Impact Statement
TRU	transuranic
UPR	unplanned release
URM	underground radioactive material
WIDS	waste information data system
WMA	waste management area

1.0 INTRODUCTION

1.1 PURPOSE AND SCOPE

This document is being prepared to partially satisfy *Hanford Federal Facility Agreement and Consent Order* (HFFACO; Ecology et al. 1989) Interim Milestone M-45-00B for "Submittal of WMA Integration Plans for WMA C and One Additional WMA by June 30, 2005." This waste management area (WMA) T Integration Study, along with *Waste Management Area Integration Study: Waste Management Area C* (RPP-PLAN-26062), meets the requirements of HFFACO Milestone M-45-00B. The U.S. Department of Energy (DOE) is in the process of preparing the *Draft Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, Washington* (DOE/EIS-0356) under the *National Environmental Policy Act of 1969* (NEPA). DOE/EIS-0356 is commonly referred to as the Tank Retrieval and Closure Environmental Impact Statement (TC-EIS). It is anticipated that the TC-EIS will evaluate various closure alternatives, including clean and landfill closure. After completion of the NEPA process, the TC-EIS will form the basis for DOE decision-making regarding closure and will be confirmed in a Record of Decision (ROD). Although this WMA T Integration Study assumes that the WMAs will be landfill closed, it does not represent a DOE decision to landfill close in advance of completing the NEPA process. This study is only intended to provide additional information regarding potential closure approaches.

The DOE, Office of River Protection (ORP) has prepared the *Single-Shell Tank System Closure Plan* (RPP-13774), which lays out a plan to clean up and close the single-shell tank (SST) system in the 200 Areas of the Hanford Site Central Plateau. RPP-13774 is consistent with the HFFACO milestones. The WMA integration studies will support the closure plan by proposing a sequence of actions and activities within each of the seven WMAs (A/AX, B/BX/BY, C, S/SX, T, TX/TY, and U) that will allow for an effective and efficient approach to cleanup and closure.

Where information regarding treatment, management, and disposal of the radioactive component of mixed waste (as defined by the *Atomic Energy Act of 1954*) has been provided in this document, it is not intended for the purpose of regulating the radiation hazards of such components under the authority of the "Hazardous Waste Management Act" and its implementing regulations but is provided for informational purposes only

HFFACO Milestone M-45-00B establishes that there will be two initial WMA integration studies, both of which will be completed by June 30, 2005. Subsequent WMA integration studies will follow the preparation of these first two studies on a schedule that is yet to be determined.

During renegotiation of the second phase of the SST waste retrieval activities (Milestone M-45-00C), the negotiation team concluded that additional supporting information and plans were necessary to aid in defining an integrated closure process to support closure

decisions for all SST components or groups of components within a WMA as reflected in the revised Milestone M45-00B. The Milestone M-45-00C negotiation team recognized that the issues of closure of ancillary equipment and other components within a WMA, as well as contaminated soil sites and facilities both within and outside a WMA, are inter-related with tank waste retrieval and tank closure. The team also recognized that there were instances where system components, sites, and facilities could be grouped and closure actions sequenced for more effective and efficient closure and remediation activities.

The WMA integration studies will be an integral part of the overall process for closure of the tank farm system and the Central Plateau. An overview of this process is described in the draft HFFACO Appendix I, which states:

> "For each SST tank farm (or WMA), DOE shall submit a WMA Integration Study. This study shall look at the entire WMA from a systems perspective and describe the inter-relationships between the various components. The study shall describe a logical sequence of events that would lead to efficient and effective waste retrieval and closure of the WMA, including field sampling and characterization activities of the ancillary equipment (piping, valve pits, vaults, Miscellaneous Underground Storage Tanks, diversion boxes, etc.) This study will be used in the development of the WMA Closure Plan. The document will propose a regulatory path for all ancillary equipment in that WMA and all the activities to achieve efficient and effective closure of that WMA, including all:
>
> - Single Shell Tanks
> - SST system ancillary equipment
> - Soil remediation per WMA corrective actions and proposed plans for WMA soils
> - Groundwater remediation activities and activities necessary for integration with Central Plateau groundwater remediation."

1.2 WASTE MANAGEMENT AREA T BACKGROUND

WMA T encompasses the T tank farm, including soil and groundwater contaminated by T tank farm operations. WMA T is located in the north-central portion of the 200 West Area (Figures 1-1 and 1-2). In general, the WMA T boundary is represented by the fenceline surrounding the T tank farm. The 100-series tanks are 23 m (75 ft) in diameter, have a 5-m (15-ft) operating depth, and an operating capacity of 1.89 million L (530,000 gal) each. The 200-series tanks are 6 m (20 ft) in diameter with a 5-m (17-ft) operating depth and an operating capacity of 208,000 L (55,000 gal) each. The tanks sit below grade with at least 2 m (7 ft) of soil cover to provide shielding from radiation exposure to operating personnel. Tank pits are located on top of six of the 100-series tanks and all four of the 200-series tanks and provide access to the tanks and their operating equipment (e.g., pumps and monitoring equipment).

Figure 1-1. Location Map of Waste Management Area T in the 200 West Area of the U.S. Department of Energy Hanford Site.

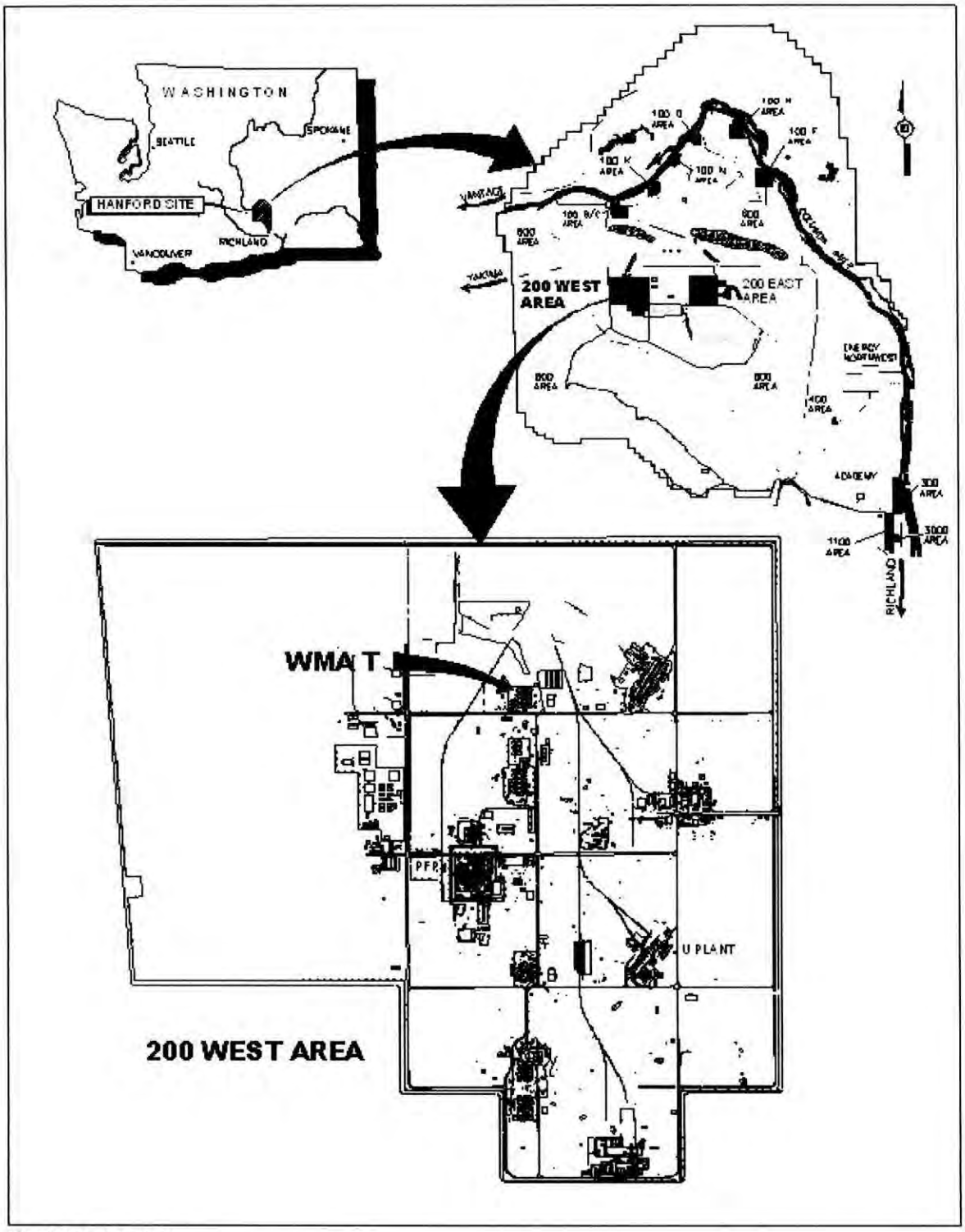


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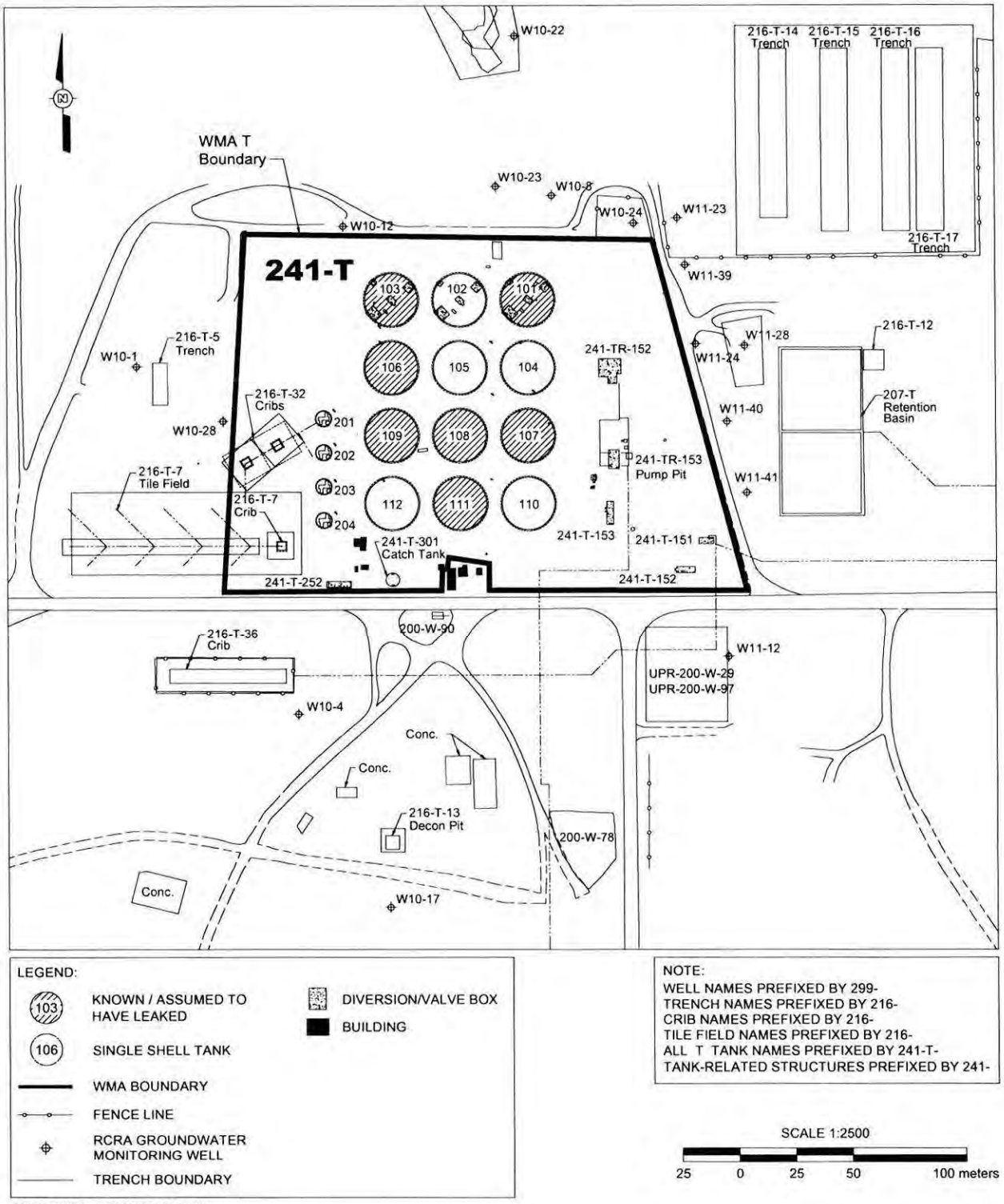
Figure 1-2. Location Map of Waste Management Area T and Surrounding Area.



The SSTs were constructed in place with carbon steel (ASTM A283 Grade C) lining the bottom and sides of the interior of a reinforced-concrete shell. The tanks have concave bottoms (i.e., the center of each tank is lower than the perimeter) and a curving intersection of the sides and bottom. The inlet and outlet lines are located near the top of the liners. The twelve 100-series tanks are grouped into four sets of three tanks. Each tank in the three-tank grouping is connected to the next tank via a buried pipeline. These lines are also referred to as 'cascade' lines because they allowed the transfer of fluids between tanks using gravity flow. Between 1943 and 1956, the SSTs in WMA T were used to store waste primarily from the bismuth phosphate plutonium separations operations in T Plant. Between 1952 and 1958, these tank wastes were sent to U Plant for uranium recovery and fission product scavenging. The scavenged wastes and process condensates were discharged to the T complex cribs. From 1958 to 1969, decontamination wastes from T Plant operations, as well as 300 Area waste, were discharged to these cribs. Using the 242-T evaporator, the waste volume in the T farm tanks was reduced with the condensate again being discharged to the cribs.

A waste transfer system of pipelines (transfer lines), diversion boxes, vaults, valve pits, pump pits, sluice pits, and other miscellaneous structures support the transfer and storage of waste within the WMA T SSTs. Collectively, these are referred to as ancillary equipment.

The routing of liquid waste from the operations buildings to the tank farms was accomplished using underground transfer lines, diversion boxes, and valve pits. The diversion boxes housed the switching facilities where waste could be routed from one transfer line to another. The diversion boxes are belowground, reinforced-concrete boxes that were designed to contain any waste that escaped the high-level waste transfer line connections. These losses typically occurred during the reconfiguration of waste routings when jumpers were disconnected. Diversion boxes generally were drained by gravity to nearby catch tanks where any spilled waste was stored and then pumped to the SSTs (*PUREX Source Aggregate Area Management Study Report* [DOE/RL-92-04]).

Valve pits are belowground, reinforced-concrete structures that contain valve and jumper assemblies that were used for routing the liquid waste through the transfer lines. Liquid waste was routed to valve pits when several tanks were undergoing simultaneous pumping to a single receiver tank. Each valve pit has a flush line connected to a flush pit or drain line connected to an underground tank.

Three unplanned releases (UPRs) are thought to have occurred within, and six in close proximity to, WMA T (total UPRs is believed to be nine). While there is considerable uncertainty regarding the volume and content of most of these UPRs, the most severe tank leak was a leak of an estimated 435,000 L (115,000 gal) of bismuth phosphate process wastes from SST T-106 (UPR-200-W-148), which occurred in May 1973. Estimates of contaminant release volumes, inventories, and locations for some UPRs are included in the Hanford Site waste information data system (WIDS).

This WMA T Integration Study is the second of two such studies to be produced in fulfillment of HFFACO Appendix I and Milestone M-45-00B requirements. It is an initial approach to defining the inter-relationships among the WMA components and is expected to mature as more

information is gathered and lessons are learned during the closure process. New information will include the following:

- Verification of chemical and radiological inventories through characterization activities
- Verification of physical attributes of SST components
- Implementation of closure actions in highly radioactive environments
- Completion of regulatory approvals and conditions associated with closure actions.

As closure of the SST system progresses, these integration studies may be updated to reflect new information.

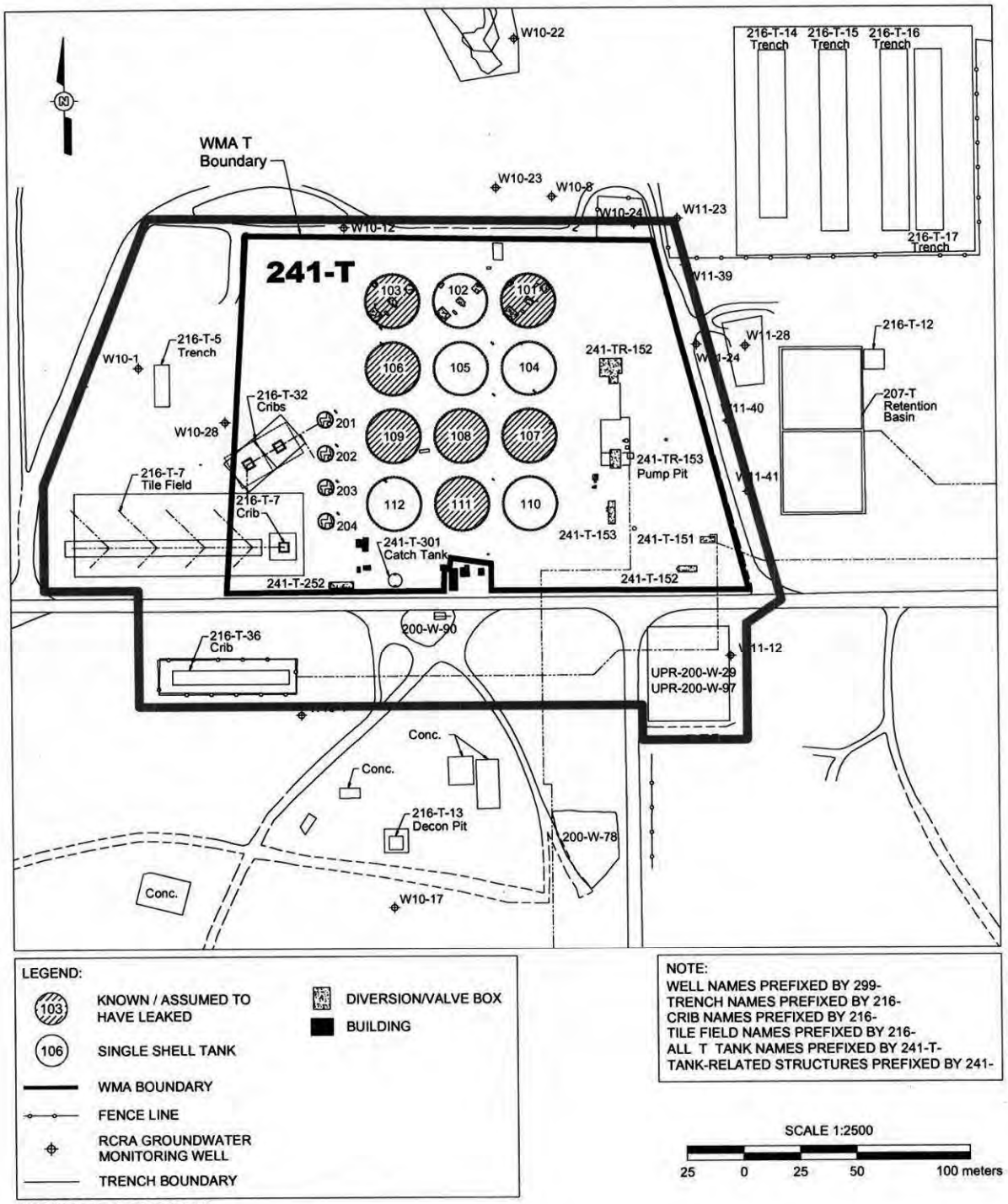
2.0 WASTE MANAGEMENT AREA STUDY AREA AND CLOSURE SECTORS

The concept of WMAs was originally based upon the grouping of the 12 SST farms into 7 WMAs for purposes of the "Hazardous Waste Management Act" ("Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities" [40 CFR 265]) groundwater assessment and monitoring program as implemented by the Washington State Department of Ecology (Ecology) under "Interim Status Facility Standards" (WAC 173-303-400). This program was established in response to the HFFACO requirement for periodic groundwater monitoring at the SSTs to detect potential releases. WMA boundaries are depicted in *40 CFR 265 Interim-Status Ground-Water Monitoring Plan for the Single-Shell Tanks* (WHC-SD-EN-AP-012). The boundary of the seven WMAs for the purposes of defining the point of compliance for groundwater protection is considered to be the tank farm fenceline.

The scope of this WMA T Integration Study goes beyond the limits set for the groundwater assessment and monitoring program. This study includes a compilation of tank farm system components, structures and supporting infrastructure, and waste sites that exist within and in close proximity to the T tank farm. The WMA T Integration Study area is illustrated as Figure 2-1. The study area includes the contiguous area that contains both aboveground and belowgrade physical structures and sites associated with the T farm system that must be closed, remediated, or otherwise dispositioned to support the long-term land use of the area. It is inclusive of the area within the tank farm fenceline, as well as that area outside the fenceline that contains SST-related components.

The WMA T Integration Study area encompasses components that may be dispositioned under different regulatory authorities. This integration study identifies and defines the interface points of these regulatory authorities, such that each waste site/component that is part of the WMA T closure activity has an associated closure decision process identified for it, if known. Where undefined, the need for defining a closure decision process is captured as a future action. While ORP maintains ownership for the majority of waste sites and components within the WMA fenceline, RL maintains ownership for the majority of those outside the fenceline. The two DOE offices are continuing to develop integrated closure planning between their respective areas of responsibility to ensure consistent, efficient closure options for all sites within geographic closure zones (as defined in *Plan for Central Plateau Closure* [CP-22319]).

Figure 2-1. Waste Management Area T Integration Study Area.



2.1 COMPONENT INTEGRATION LOGIC

Major emphasis has been placed on accelerating the retrieval of waste and closure of SSTs. In accordance with the HFFACO, tank wastes in WMA T must be retrieved no later than September 30, 2018 and WMA T closed by September 30, 2024. For purposes of this WMA T Integration Study, it was assumed that the WMA T tank wastes would be retrieved by September 30, 2012 to allow sufficient time for final closure of WMA T as the second tank farm by March 31, 2016. However, the closure of WMA T goes well beyond retrieval of waste from the 16 tanks in T tank farm. Closure must also address ancillary equipment (including pipelines, vaults, pits, diversion boxes, tank risers, and pumps) as well as the contact-handled transuranic mixed waste (CH-TRUM) packaging system and supporting infrastructure and waste sites.

Much of the in-tank equipment is expected to be dispositioned as in-tank debris during the tank closure activity. Disposition of tank ancillary equipment (e.g., in-tank measuring equipment, tank risers) will be described in the respective tank component closure activity plans.

Disposition of ex-tank ancillary equipment (e.g., pipelines, diversion boxes, cascade lines) will be described in either an ancillary equipment component closure activity plan, a tank component closure activity plan, or other alternate decision documentation (e.g., corrective measures study [CMS]/permit modification, feasibility study/ROD) upon approval through incorporation into the SST system chapter of the *Resource Conservation and Recovery Act of 1976* (RCRA) Site-Wide Permit (*Dangerous Waste Portion of the Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste* [Ecology 2004]).

2.1.1 Waste Management Area T Database

The WMA T database inventories 597 components that will require dispositioning as part of WMA T closure. A summary of this database is presented in Appendix A.

There are limited or no data available for many of the 597 components that have been inventoried into the configuration-controlled database. Knowledge of the physical features is important to determine a component's status with regard to other components. For example, knowing a pipeline has been cut and capped and isolated from a diversion box would indicate that this line would not be a potential conduit for liquids into the diversion box. Similarly, understanding the potential for a component to contain waste inventory could affect decisions as to whether it should be cleaned or removed before final WMA closure.

The components have been characterized to describe their known or suspected physical states based upon the current information. To more efficiently manage and organize these components for evaluation in the WMA T Integration Study, these components have been organized into groups based upon their common associations (e.g., functionality, geography, configuration). The grouping of waste transfer components and ancillary equipment in the database provides the foundation for closure integration that considers the physical characteristics associated with the components and equipment so that closure decisions can be made. The current state of knowledge for the components and ancillary equipment is available in the WMA T database. These groupings are presented in Table 2-1.

Table 2-1. Waste Management Area T Component and Infrastructure Groupings.

Components	Descriptions	Comments
Waste Conveyance and Storage Facilities		
External pipelines	Pipeline segments that extend beyond the WMA fenceline and are not within the exclusive control of the tank farm closure contractor.	Closure and final disposition of these pipeline segments would require close coordination with RL and the Central Plateau Closure contractor.
Diversion boxes	Diversion boxes and nozzles.	—
Internal pipelines	Pipeline segments that fully reside within the WMA fenceline and are under the exclusive control of ORP.	This is inclusive of pipeline encasements and trenches.
Pits	Pits including nozzles, risers located within the pit, and abandoned equipment in the pit.	This will include equipment requiring removal in the pit (i.e., pump motor) but not equipment abandoned in the pit (i.e., AMS mast)
Risers	Standalone risers not in a pit.	—
Tanks and cascade lines	100- and 200-series SSTs. 100-series tank sloping cascade lines and 200-series connecting lines (level).	—
Infrastructure		
Water system	Water pipelines and associated components.	—
Electric distribution and lighting systems	Power distribution system including lines, poles, transformers, and lighting.	—
Steam lines	All steam lines and associated components.	Steam lines were typically insulated with asbestos and any removal may require an Asbestos Abatement Program.
Miscellaneous Components and Features		
CH-TRUM Packaging Equipment	The CH-TRUM packaging and storage facility will be supported by its own retrieval system and consists of a slurry tank, CH-TRUM packaging system and container storage area.	Based upon the CH-TRUM packaging system closure plan* these facilities will be clean closed.
Retrieval facilities	This includes a variety of temporary structures and facilities used during waste retrieval.	As part of the preparation for initiating closure and prior to commencement of closure of the SSTs these facilities must be removed and disposed of.
UPRs/waste sites	9 UPRs identified sites including soil and vadose zone.	—

* DOE/ORP-2003-22.

AMS = articulated mast system.
CH-TRUM = contact-handled transuranic mixed waste.
DOE = U.S. Department of Energy.
ORP = Office of River Protection.
SST = single-shell tank.
UPR = unplanned release.
WMA = waste management system.

2.1.2 Waste Management Area T Waste Characterization

Characterization of the nature and extent of residual waste contaminants will be performed for the four major WMA component groupings (tanks, ancillary equipment, contaminated soil, and groundwater) to develop a technical basis for decision making to ensure that closure actions are effective in protecting human health and the environment. As tank retrieval efforts proceed, samples of the residual waste will be collected in accordance with a sampling and analysis plan. Tank waste characterization data are maintained in the best-basis inventory. Characterization data are also being collected for contaminated soil as part of the RCRA facility investigation (RFI)/CMS process underway at WMA T. Groundwater characterization data will need to be assembled and evaluated from RCRA groundwater monitoring, WMA T RFI/CMS, and 200-ZP-1 groundwater operable unit (OU) remedial investigation/feasibility study (RI/FS) activities. To date, characterization information for ancillary equipment is limited.

Efforts are underway to organize and evaluate process knowledge with respect to the conditions in pipelines. A similar compilation and evaluation of process knowledge will be necessary for the remaining ancillary equipment types. A summary of the process history for WMA T is presented in Appendix B. Upon evaluation of process knowledge, it may be determined that some further data collection and analysis efforts are needed to confirm process knowledge or better define the residual contaminant inventories in ancillary equipment. To accomplish this, a data quality objectives (DQO) process will likely be undertaken. It is expected that a graded approach to characterization will be pursued. A graded approach involves balancing characterization data needs with worker exposure that results from increasingly intrusive characterization activities. It is anticipated that analogs for equipment types can be developed and applied. In addition, opportunistic sampling and characterization could be achieved through close coordination with ongoing operations, maintenance, and closure activities.

2.2 WASTE MANAGEMENT AREA T CLOSURE SECTORS

The WMA T Integration Study area has been subdivided into four sectors. A sector is a contiguous collection of one or more of the component and ancillary equipment groupings listed in Table 2-1. A sector is defined based upon specific physical, waste inventory, and regulatory characteristics of the components that exist within the sector. Table 2-2 shows the component groupings that have been proposed for each of the four closure planning sectors in the study area.

Table 2-2. Component Type Closure Plans Required for Waste Management Area T Component Group Closure.

Component Group	Sector #1	Sector #2	Sector #3	Sector #4
Tanks/pits	X	X		
Diversion boxes		X	X	
Internal piping	X	X	X	
External piping		X	X	
Miscellaneous underground storage tanks		X		
Dry wells	X	X		
Unplanned release sites	X		X	X
Cribs/tile fields/trenches				X
Miscellaneous components	X	X	X	
CH-TRUM packaging system		X		

CH-TRUM = contact-handled transuranic mixed waste.

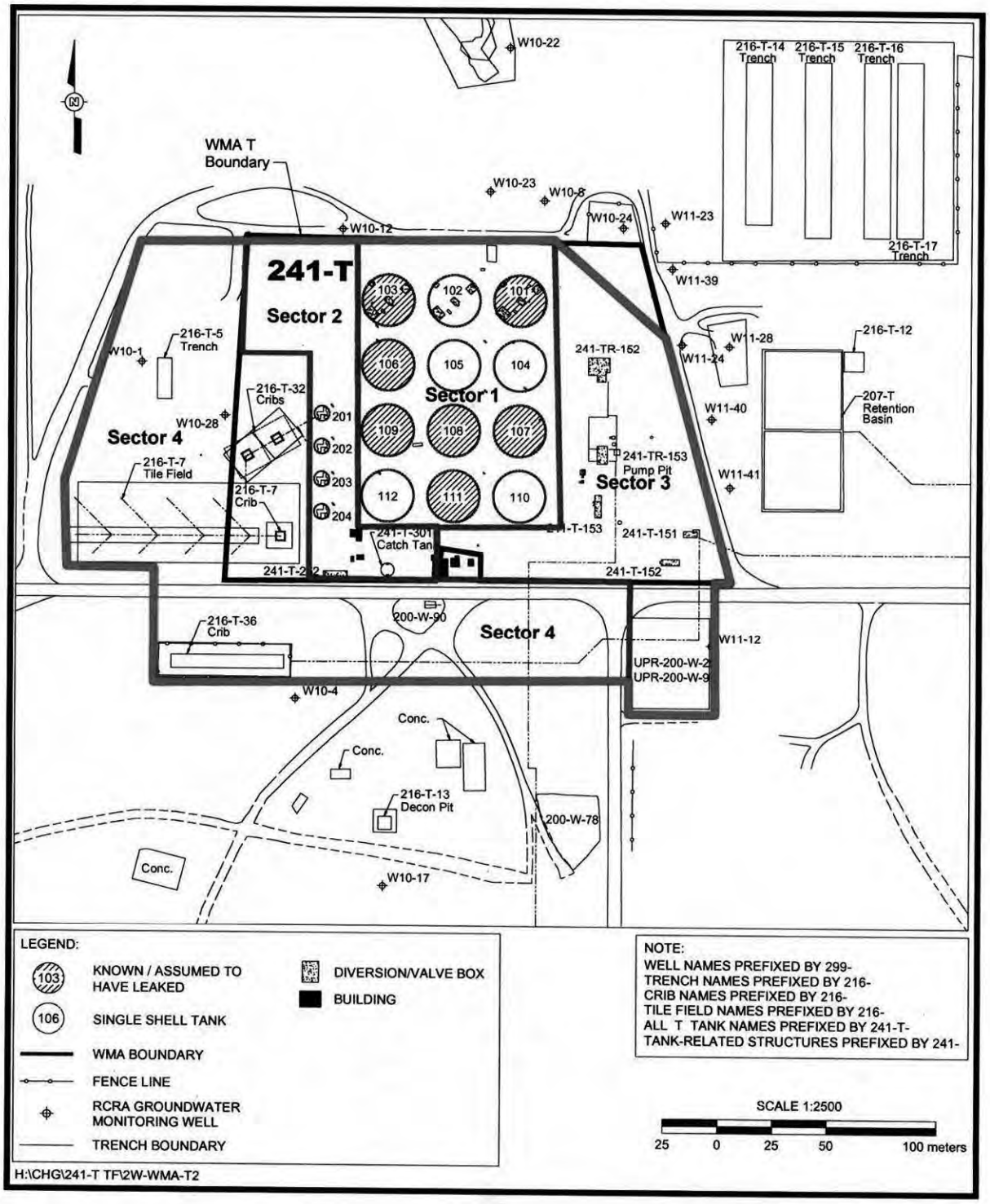
The major components within each sector are identified in the following list. Selection is based on current tank farm system knowledge of physical waste characteristics (including the UPRs) in and adjacent to WMA T, as well as the regulatory drivers for each of the component groupings that make up the WMA C closure sectors.

- **Sector 1** – The twelve 100-series SSTs with their associated pits, risers, and internal pipes; and two UPRs (UPR-200-W-147, and UPR-200-W-148).
- **Sector 2** – The four 200-series SSTs with their associated pits, risers, and internal pipes; one diversion box (241-T-252); catch tank 241-T-301B; CH-TRUM packaging equipment; and external piping.
- **Sector 3** – Four diversion boxes (241-T-151, 241-T-152, 241-T-153, and 241-TR-152) including one pump pit (241-TR-153) with associated French drain and booster pump; external piping; and six UPRs (UPR-200-W-7, 200-W-78, 200-W-79[9], UPR-200-W-29, UPR-200-W-64 and UPR-200-W-97.
- **Sector 4** – Three cribs 216-T-32, 216-T-36, and 200-W-52 crib (a.k.a. 216-T-7 crib); trench 216-T-5; tile field 216-T-7; internal piping; and two UPRs (200-W-79 and 200-W-90).

The general boundaries of the WMA T sectors are shown in Figure 2-2.

[9] Note that UPR 200-W-79 has multiple contaminated areas, some of which would be remediated as part of Sector 3 and the remainder as part of Sector 4.

Figure 2-2. Waste Management Area T Integration Study Sectors.



3.0 REGULATORY SETTING

This section identifies the regulatory background and requirements that are relevant to the closure of WMA T and how compliance with these requirements is expected to be achieved based on current knowledge of site conditions. Although characterization has not been completed, information contained in the best-basis inventory for WMA T tanks provides a solid basis from which to proceed with closure planning. Refinements to this basis will be ongoing as more information is gathered during closure.

3.1 DRIVERS FOR CLOSURE

There are several drivers that directly influence and guide closure activities at the Hanford Site. The primary drivers include the following:

- HFFACO
- RCRA
- *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA)
- NEPA
- "Washington State Environmental Policy Act (SEPA)"
- *Atomic Energy Act of 1954* as implemented through *Radioactive Waste Management* (DOE O 435.1)

3.1.1 HFFACO Milestones

The HFFACO establishes a high-level schedule for overall SST system closure activities. The milestones that have been negotiated in the HFFACO provide a structure for developing detailed plans that specify activities and requirements for SST system closure. Key HFFACO milestones pertinent to the planning approach presented in this WMA T Integration Study are presented in Table 3-1.

Table 3-1. HFFACO Milestones Applicable to Waste Management Area T Integration Study.

Milestone Reference	Summary of Milestone	Completion Date
M-045-00B	Submittal of the first two WMA integration studies	6/30/2005
M-45-55-T03	Submittal to Ecology a facility investigation report for WMA T	7/31/2005
M-045-55	Submittal to Ecology of Phase 1 RFI Report for all WMAs	1/31/2007
M-045-58	Submittal to Ecology of CMS for interim corrective measures for all WMAs	6/30/2007
M-045-60	Submittal to Ecology of RFI/CMS work plan for interim corrective measures for all WMAs	9/30/2007
M-45-00	Complete closure of all SSTs and requirements that all SST retrieval and closure actions be conducted in compliance with the HFFACO Appendix I process	9/30/2024

CMS = corrective measures study.
Ecology = Washington State Department of Ecology.
HFFACO = *Hanford Federal Facility Agreement and Consent Order.*
RCRA = *Resource Conservation and Recovery Act of 1976.*
RFI = RCRA facility investigation.
SST = single-shell tank.
WMA = waste management area.

3.1.2 RCRA

The certified SST system closure plan, RPP-13774, was submitted to Ecology on January 19, 2004 under the provisions of RCRA and the "Hazardous Waste Management Act" and in fulfillment of HFFACO Milestone M-45-05H. The SST system closure process consists of three tiers:

- **Tier 1** – The framework plan for SST system closure, which provides a general description of the system closure process.

- **Tier 2** – The WMA closure action plans (one for each of the seven WMAs), which describe actions that will be taken to support remediation and closure of an entire WMA. These include risk assessments (RAs), groundwater monitoring, planning for design of a final cover, and integration of the WMA-wide actions with adjacent or site-wide remediation and closure strategies.

- **Tier 3** – Component closure activity plans that document descriptions of the activities leading to closure of the components that comprise a WMA (tanks, ancillary equipment, contaminated soil, and groundwater). These plans may address individual structures or similar structures within a component grouping.

The SST system closure process emphasizes closure at the WMA level. Input from this WMA T Integration Study can be used to support modification of RPP-13774 and subsequently the RCRA Site-Wide Permit (Ecology 2004). Modifications are expected to bring more information into the closure plan and permit actions for groups of components within the WMA by way of common and systematic implementation of retrieval, characterization, and closure.

RCRA requirements, as implemented through "Dangerous Waste Regulations" (WAC 173-303) will be specified in the SST system portion of the RCRA Site-Wide Permit upon its modification. The permit will specify closure actions that must be performed to comply with RCRA requirements, whether the closure action is defined in association with tanks or ancillary equipment under a RCRA closure plan, or with contaminated soil and associated components under a RCRA corrective measure study (CMS). These specifications may impact the assumptions that form the basis for this WMA T Integration Study. If such an impact should occur, the planning identified in this study will need to be re-examined.

The RCRA closure requirements call for meeting both the general closure performance standards of WAC 173-303-610 and the landfill closure performance standards of WAC 173-303-665(6) (as specified in WAC 173-303-640[8] [b]). In planning integrated closure actions within the WMA, these standards will determine how closure is achieved under RCRA requirements.

The general closure performance standards of WAC 173-303-610(2) and the planning assumptions used to meet these requirements are discussed in detail in Section 4.0. General performance standards require that the facility be closed in a manner that:

- Minimizes the need for further maintenance;
- Controls, minimizes, or eliminates, to the extent necessary to protect human health and the environment, post-closure escape of dangerous waste, dangerous constituents, leachate, contaminated runoff, or dangerous waste decomposition products to the ground, surface water, groundwater, or the atmosphere;
- Returns the land to the appearance and use of surrounding land areas to the degree possible, given the nature of the previous dangerous waste activity.

3.1.3 RCRA Corrective Action Requirements

Contaminated soil within WMA T would undergo an alternatives analysis within an RFI/CMS in accordance with the requirements of the HFFACO. Decisions concerning appropriate soil cleanup or corrective actions would be determined through the RFI/CMS process defined in condition II.Y of the RCRA Site-Wide Permit (Ecology 2004), WAC 173-303-645, WAC-173-303–646, HFFACO Milestone M-45-55, and the RCRA corrective action process, as described in the HFFACO.

There are two primary steps in the WMA T soil component closure activities: (1) characterizing the nature, extent, and mobility of the contamination in the soil column, and (2) performing necessary cleanup in accordance with WAC 173-303-610 and WAC 173-303-645.

Characterization of soils involves an assessment of known and suspected contamination. Characterization information is then used to prepare an RA that evaluates the relative risk from the contaminated soil. A RCRA past-practices CMS, based on the RA, is then conducted to identify any appropriate remediation methodologies. Finally, the corrective measures alternative(s) are implemented. The RFI/CMS process is depicted in Figure 3-1.

3.1.4 CERCLA Remedial Action Requirements

If it is determined that groundwater corrective actions associated with WMA T are necessary, groundwater remediation may be performed pursuant to a CERCLA ROD (interim and final) developed for the associated groundwater OU (200-ZP-1). Groundwater monitoring and response actions are integrated within the context of HFFACO Milestones M-24 and M-45 and, as feasible, would be integrated with, but separate from, the WMA T and Central Plateau regional closure strategy.

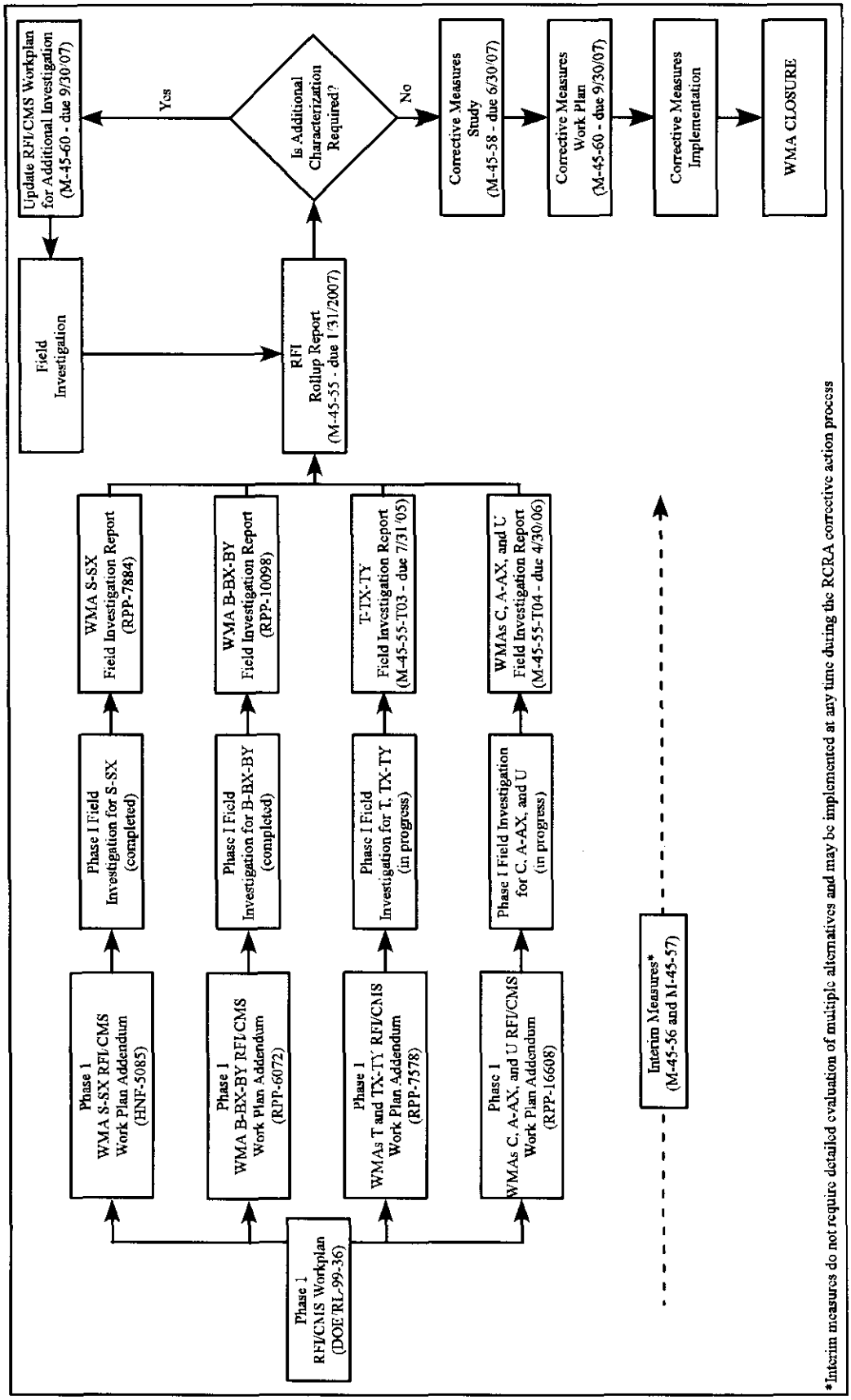
3.1.5 NEPA and SEPA

In addition to RCRA closure requirements, other regulatory programs would drive closure planning within WMA T. NEPA was created to integrate environmental awareness and environmental factors early in the planning process of all federal actions. Compliance with NEPA provisions calls for federal agency planning and analysis that fully considers and documents, on a timely basis, the environmental considerations and alternatives to the proposed action.

NEPA requires federal agencies to consider environmental impacts when proposing federal actions that may significantly affect the quality of the human environment. An environmental review is conducted early in the planning and decision-making process to determine whether significant environmental impacts are anticipated. This review is used to determine if the proposed action can be modified or redesigned to lessen or eliminate environmental impacts and to determine if further investigation is required before proceeding with the action.
An environmental assessment may be prepared for use as a screening document to determine if an environmental impact statement (EIS) must be prepared or if a finding of no significant impact (FONSI) can be made. An EIS, which is a much more comprehensive analysis of the impacts of the proposed action and alternatives, may also be prepared directly, without the use of an environmental assessment.

The draft TC-EIS being developed under NEPA will analyze SST system-wide closure issues. The TC-EIS will evaluate various closure alternatives including clean and landfill closure. After completion of the NEPA process, the TC-EIS will form the basis for DOE decision-making regarding closure, as set forth in a ROD. This WMA T Integration Study does not represent a DOE decision to landfill close in advance of completing the NEPA process, but is only intended to provide additional information regarding potential closure approaches.

Figure 3-1. RCRA Facility Investigation/Corrective Measures Study Process.



SEPA is intended to ensure that environmental values are considered during decision-making by state and local agencies. SEPA requires decision-making agencies, such as Ecology, to conduct an evaluation of proposals in accordance with "SEPA Rules" (WAC 197-11) to determine the potential significance of impacts to the environment and public health. In lieu of preparing a separate SEPA EIS, Washington State has the option to adopt a NEPA EIS if certain requirements in WAC 197-11-610(3) are met, or if they cooperated with a federal agency that is preparing an EIS. As a cooperating agency, Ecology may participate in a range of activities associated with the preparation of an EIS, including co-authoring a document, providing input to development of alternatives, or similar actions. The decisions that result from both the Final TC-EIS and subsequent SEPA determinations could impact closure planning at WMA T. Assumptions used in this WMA T Integration Study are consistent with those used to support certain alternatives as currently defined in the draft TC-EIS. However, these may need to be revisited upon issuance of the TC-EIS ROD.

3.2 TANK CLOSURES AND WASTE DETERMINATIONS

Chapter IV of *Radioactive Waste Management Manual* (DOE M 435.1-I) specifies criteria and processes for ensuring that low-level radioactive wastes are disposed of in a manner that is protective of human health and the environment. HFFACO Milestone M-45 sets forth waste retrieval objectives for SSTs that provide for the retrieval of at least 99% of the wastes in those tanks.[10] HFFACO Appendix I sets forth an integrated closure process for SSTs with residues following HFFACO-compliant waste retrieval that also results in the closures being compliant with relevant requirements set forth in DOE M 435.1-1, Chapter IV. The HFFACO integrated closure process obviates the need to also conduct a DOE M 435.1-1 closure process, which would be largely duplicative. Relative to the residues in SSTs following waste retrieval, DOE M 435.1-I, Chapter II specifies criteria and processes that enable DOE to determine that the residues meeting those criteria can be managed as low-level waste (LLW), even though they may have been in some fashion derived from wastes associated with the reprocessing of spent nuclear fuel. Those processes and criteria provide assurance that, once solidified, the residues will not contain fission products (or other radionuclides) in sufficient concentrations to require disposal in a geologic repository and, therefore, no longer need to be managed as high-level radioactive waste. Waste residues remaining in tanks at closure will be managed as mixed wastes under RCRA.

[10] The 99% objective was used to establish a maximum volume of residue in tanks following retrieval. The large 100-series tanks can contain no more than 360 ft^3 of residue following retrieval and the smaller 200-series tanks can contain no more than 30 ft^3 of residues following retrieval. HFFACO Appendix H provides a means for Ecology to approve a greater residue volume than stated above on a case-by-case basis if it is not technically practical to reach the HFFACO objective for any given tank. Appendix H also requires DOE to consult with the U.S. Nuclear Regulatory Commission.

4.0 CLOSURE/REMEDIATION SEQUENCING

To develop a sequencing approach for an integrated closure strategy, it is necessary to establish a set of closure and remediation assumptions. Specifically, what are the regulatory assumptions and how do the closure and remediation planning assumption used in this integration study comply with the general closure performance standards of WAC 173-303-610(2).

4.1 REGULATORY ASSUMPTIONS

Closure/remediation assumptions provide the basis for planning WMA T closure in lieu of final regulatory decision making. These assumptions would require reexamination once the TC-EIS ROD is issued, as closure progresses and final regulatory decisions are made for WMA T.

Initial closure planning has already begun within WMA T, and the information collected during these actions has been used to develop these assumptions. Site-specific analyses conducted for S-SX tank farm performance assessment (PA) is extrapolated to the remaining farms in the 200 West Area including WMA T. In the preliminary work being conducted for the SST PA assumptions were drawn from this progress and are summarized as follows:

- The WMA T tanks will contain waste residuals that meet HFFACO Milestone M-45-00C waste retrieval volume goals (below 360 ft^3 for 100-series tanks and below 30 ft^3 for 200-series tanks).
- Tanks will be filled with a cement-based grout after all appropriate regulatory approvals are obtained.
- An engineered surface barrier will be placed over the footprint of WMA T, thereby greatly reducing recharge through the vadose zone.
- Upon completion of waste retrieval from the T farm, placement of grout fill of those tanks, and placement of a barrier over WMA T, the risk to human health and the environment will be greatly reduced because:
  - Primary contributors to groundwater contamination are contaminants resulting from past leaks from tanks and ancillary equipment.
  - Cumulative dose from residuals left in all WMA T SSTs is below the drinking water value of 4 mrem in a year at the perimeter of WMA T.
  - Cumulative incidental lifetime cancer risk exceeds the 1.0×10^{-5} target value at the WMA T perimeter for tank and ancillary waste residuals, but not at the core zone boundary or the Columbia River for both the *Hanford Site Baseline Risk*

Assessment Methodology (DOE/RL-91-45) Industrial and Residential receptors with technetium-99 responsible for the majority of the estimated risk.

- The Hazard Index does not exceed the target value for residual waste, past leaks, or hypothetical retrieval leaks for nonradiological constituents.
- No nonradiological contaminants in WMA T contribute to groundwater contamination above drinking water standards at the fenceline.
- Under a conservative assumption that 25% of pipeline volume is filled with waste and left in place, risk levels are protective to human health and the environment. (Note that the pipelines in WMA T were typically drained and flushed after use; therefore, the amount of residual remaining in the pipelines is expected to be much smaller than the 25% used in this estimate).

Compliance with landfill closure performance standards is assumed for components in WMA T except for the CH-TRUM packaging system, which is assumed to be clean-closed based upon its closure plan (DOE/ORP-2003-22). As such, removal of waste from large, belowgrade ancillary equipment (e.g., inactive miscellaneous underground storage tanks) to the limits of technology and void space filling is assumed for planning purposes where waste inventories exist and they are practicable to remove. Given the low, long-term risk potential associated with smaller ancillary equipment (e.g., transfer piping), it is assumed that no additional waste residuals will be removed from ancillary equipment (i.e., no flushing will occur). Historically, transfer piping was typically flushed with water following transfer of waste through the piping. Failed piping was not flushed. The low, long-term risk associated with leaving these components in place under a surface barrier balanced with concerns associated with the removal and disposal of ancillary equipment, including higher worker exposure, questionable integrity of the ancillary equipment, and the necessity for disposal of removed waste within the Central Plateau, are the primary rationales for this assumption in closure planning.

For contaminated soil, WMA T closure planning assumes that some removal of soil may be required in highly contaminated areas. An alternatives analysis will define specific corrective actions within WMA T as required under HFFACO Milestone M-45-60.

4.2 COMPLIANCE WITH GENERAL CLOSURE PERFORMANCE STANDARDS BASED ON CLOSURE/REMEDIATION ASSUMPTIONS

The following sections discuss how the planning assumptions for this WMA T Integration Study will comply with the general closure performance standards of WAC 173-303-610(2).

4.2.1 General Performance Standard #1

General Performance Standard #1 minimizes the need for further maintenance.

Planning Assumptions: Removal of waste from tanks in accordance with HFFACO Milestone M-45-00 and other components that may contain a significant waste inventory will serve to meet this performance standard. Low-maintenance approaches to directly enhance containment of any residual (those left in the tank after having met the limits of waste retrieval technology) will be accomplished by grouting tanks and large below grade ancillary structures such as catch tanks and vaults. A secondary aspect to the filling of the tank is to help shed water around the tank and any residual waste. The third aspect is to maintain a basic environment that minimizes corrosion as well as leaching of the residuals. Abovegrade buildings and temporary structures/facilities will be removed or leveled to near ground level to meet the site preparation requirements for the final engineered barrier. Finally, the construction of the barrier (see Section 7.0) will greatly reduce contaminant infiltration of and intrusion into the vadose zone, thus minimizing the need for future maintenance.

4.2.2 General Performance Standard #2

General Performance Standard #2 controls, minimizes, or eliminates – to the extent necessary to protect human health and the environment – post-closure escape of dangerous waste, dangerous constituents, leachate, contaminated runoff, or dangerous waste decomposition products to the ground, surface water, groundwater, or the atmosphere.

Planning Assumptions: Many of the measures described in Section 4.2.1 will also have the consequence of ensuring compliance with this general performance standard. Waste retrieval from SSTs will result in the greatest reduction of risk to human health and the environment from WMA T contaminants. To date, no RA has been performed on residuals remaining in WMA T. However, it is assumed, similar to WMA C, that their contribution to risks to human health and the environment is minimal. Characterization of non-SST components (as identified through the DQO process), will ensure that residual inventory is protective of human health and the environment by validating that closure performance standards are being achieved. Closure actions that will contribute to further mitigation of risk will include stabilization of SST and certain large belowgrade ancillary equipment. Isolation of components will ensure that remaining contaminated structures do not become pathways for the mobilization of remaining constituents of concern.

As stated under the first general performance standard, it is not expected that smaller WMA T components (e.g., transfer piping) will require removal or decontamination before placement of the barrier. However, certain exceptions to this may be made on a case-by-case basis where:

- Inventory may be found to be significant or is readily removable;
- Removal of combined or adjacent soil or components is already occurring;
- Components may create a preferential pathway for contaminant transport to groundwater;
- The WMA footprint could be further optimized through component removal;
- Component removal is more cost-effective than characterization or treatment.

The removal/decontamination, treatment, or containment of contaminated soil as needed to achieve protection of human health and the environment will also require integrated planning to meet this general performance standard.

The installation of engineered barriers that meet RCRA criteria will effectively eliminate direct exposure concerns for both human and ecological receptors as specified under the requirements of "Model Toxics Control Act Cleanup Regulation" (WAC 173-340). The installation of groundwater monitoring systems to meet the post-closure monitoring goals, and the inspection and maintenance procedures to ensure the effectiveness of these protective measures will also contribute towards meeting this performance standard consistent with post-closure groundwater monitoring for the Central Plateau.

4.2.3 General Performance Standard #3

General Performance Standard #3 returns the land to the appearance and use of surrounding land areas to the degree possible, given the nature of the previous dangerous waste activity.

Planning Assumptions: Closure planning must evaluate administrative, engineering, and regulatory measures that are necessary to protect public health and the environment in the future. After closure of the SST system, other than surface barriers that will rise above ground level, the ground surface will be returned to the approximate appearance and use of the surrounding land areas. This is consistent with obligations under WAC 173-303-610 to return the land to the appearance and use of surrounding areas. Institutional controls that are robust and layered and that rely heavily on passive measures will reduce the potential for future adverse impacts on the environment and diminish public exposure to residual SST waste contaminants through the air, soil, and groundwater. These controls will need to be factored into planning during the post-closure phase of WMA T.

The closure sequence of a WMA would ideally follow a logical progression that transitions from one sector of the WMA to another in such a manner that multiple actions can be optimized without creating conflicts between ongoing, concurrent activities. In developing a general closure/remediation sequencing approach, there are several assumptions that should be regularly reviewed and validated during the process. These assumptions are supported in part by the experience gained from the retrieval of waste from tank 241-C-106. These assumptions include:

- The WMA will be isolated from external components to prevent inadvertent infiltration into the WMA during waste retrieval and closure actions.
- Waste retrieval will generally be prioritized to first retrieve from the 100- and 200-series tanks followed by the retrieval from any inactive miscellaneous underground storage tanks, catch tanks, and other large-volume components as required; however, as opportunities arise, retrieval from these latter components may be undertaken to optimize closure progress.
- Sectors within the WMA will be defined based on their internal similarities and distinctness from other sectors.

- Isolation of sectors within the WMA will be conducted such that the decontamination of pits and vaults will be completed before any down-gradient receiving tank has been isolated (i.e., to provide a pathway for decontamination liquids to a collection low point for future removal).

- The sequence for conducting closure activities within sectors will be defined to minimize interference and minimize rework.

4.3 WASTE MANAGEMENT AREA T INTEGRATED CLOSURE SECTOR SEQUENCE APPROACH

The concept of the sector sequence approach is to isolate the T tank farm and its components to prevent any further waste or liquids from entering WMA T from outside sources. Isolation of WMA T from external connections is accomplished by cutting and capping the 16 transfer pipelines that feed into and out of the tank farm. WMA T should be isolated from external waste and liquid sources early in the sequencing of closure activities and should be coordinated with the Central Plateau to define the location of the isolation points. This external isolation is expected to occur at or very near the perimeter of the barrier footprint. Equally important is the isolation of the sectors inside of the WMA from each other. This includes that multitude of pipelines within the boundary of the WMA and includes the junction points at diversions boxes of the 16 external transfer pipelines. This will ensure that waste and liquids do not enter a sector in which retrieval and closure activities have commenced or are completed. Isolation within a sector is further discussed in Section 4.4.

The next major activity is completion of waste retrieval operations. The sector waste retrieval strategy will involve isolation of each sector. Waste retrieval operations in WMA T have not established the layout of waste retrieval equipment and facilities (see sections 4.8.2 and 4.9.2 for discussions on actions related to retrieval and supporting equipment by Sector). Waste from at least four SSTs (the T-200-series tanks) in WMA T will be retrieved and packaged as CH-TRUM for off-site disposal. These retrievals would occur within WMA T and do not involve waste transfers outside of the WMA. In addition, the waste from up to four additional T-100-series tanks may be retrieved and packaged as either CH-TRUM or remote-handled transuranic (TRU) waste. The waste in any tank that can not be retrieved and packaged as either CH-TRUM or remote-handled TRU waste is planned to be retrieved and initially transferred to the SY tank farm. This is consistent with the current retrieval process that uses overground transfer lines to send the SST waste to the double-shell tank (DST) system.

The T tank farm is located approximately 3.2 km (2 mi) north of the SY DST farm.
In contemplating how to move the T tank farm waste to the SY tank farm, it is not apparent that the overground transfer lines could be routed for the 3.2-km (2-mi) distance, because of interferences; other facilities (e.g., the plutonium finishing plant); roads; and pumping concerns. There is currently no infrastructure available to transfer these wastes. The River Protection Project baseline does include construction of a waste retrieval facility to support this effort.
A possible alternative, with the approval of Ecology, would be re-establishing the 244-TX double-contained receiver tank (DCRT) and some existing transfer lines for operational purposes

to support transfers. This issue needs further evaluation to determine the best alternative to transfer waste.

One approach to sequencing waste retrieval activities within WMA T would be to complete any necessary waste retrievals from the diversion boxes in Sector 3. This would allow for initial closure of this sector to progress while retrievals were being conducted in Sectors 1 and 2. This assumes that closure activities in Sector 3 would not create a conflict or interfere with the equipment and facilities used in retrieval of the 100- and 200-series tanks, including operation of the CH-TRUM packaging system.

Retrieval would finish in Sector 2 with the retrieval of waste from catch tank 241-T-301B as the final retrieval site in the WMA, if determined necessary. This would be the last retrieval point within WMA T because it represents the lowest down-gradient point of the WMA waste transfer system. At the completion of the catch tank retrieval, the waste retrieval campaign would be complete and activities would transition over to grouting operations in Sectors 1, 2, and 3.

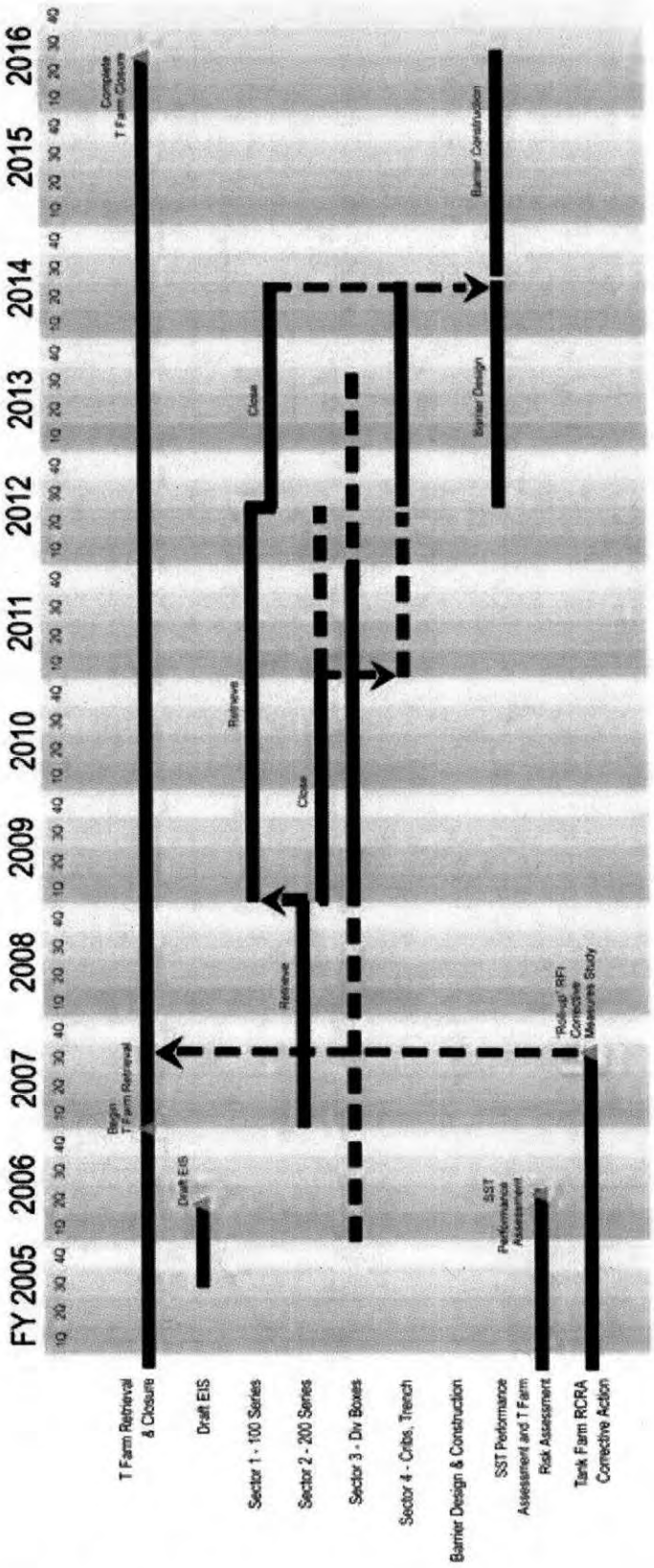
It is necessary to flush and remove temporary waste transfer lines, hose-in-hose transfer lines and LDMM equipment during waste retrieval. Flushing may also be needed for decontamination of the CH-TRUM packaging equipment once packaging is completed. Line flushing needs to be considered in association with retrievals (i.e., where will flushed liquids be collected). The initial field activities for closure would commence with site preparation (removal of retrieval equipment and facilities) and installation of grouting equipment and facilities.

Grouting activities are predicated upon several regulatory decisions: (1) the ROD for the TC-EIS being published documenting the DOE-selected approach to closure of the SST system, (2) the Component Closure Plan being accepted and the Site-Wide Permit modified accordingly by Ecology, and (3) the determination that any residual waste in the SSTs is LLW and non-TRU.

It is anticipated that vadose monitoring using the drywells will continue through retrieval of waste from SSTs and the post-retrieval monitoring period established in the Tank Waste Retrieval Work Plan. Drywell vadose monitoring may need to be extended to support implementation of some corrective measures until it is determined that the data or subsurface access they provide is no longer necessary. As part of the site preparation for placement of the barrier, the vadose monitoring wells will be decommissioned in accordance with WAC 173-160 as well as to meet any additional barrier design requirements. Additional monitoring wells may be installed beyond the barrier footprint if necessary to support groundwater OU remedial actions and to satisfy long-term Hanford Site monitoring requirements. A time-phased sequence of sector closure and placement of a final barrier or engineered cap along with other activities on the Central Plateau is shown in Figure 4-1.

The information that follows focuses on the integration of closure activities and approaches within the WMA closure sectors and sites immediately adjacent to the WMA. Section 5.0 discusses the integration approach for the vadose zone and soil components of WMA T, and Section 6.0 describes the integration of WMA T closure actions with those of the Central Plateau.

Figure 4-1. Time-Phased Sequence of Sector Closure and Barrier Design Construction.



Note: Dashed lines associated with sectors indicate that sector closure actions may occur anywhere within the span of the timeline.

4.4 ISOLATION OF COMPONENTS

A key element in closing the WMA T sectors is to develop an isolation strategy to eliminate the potential for waste or liquid entering that sector. The SSTs within the T tank farm have been partially isolated; however, the other components and groupings within the tank farm have been isolated only to a very limited degree.

Isolation can occur 'externally,' applying to the boundaries of the sector, or 'internally,' applying to components within the sector. An initial assessment of the hydraulics of the external transfer pipeline system will be performed to determine through a pipeline assessment which lines have been cut and capped, which have been previously flushed, and which are assumed to be plugged or otherwise failed in service. This assessment will identify low points in the system, and then trace them back up-gradient. The objective is to track the possible down-gradient systems that an up-gradient component may affect if it is flushed and to locate where it would be possible to isolate a transfer line system from the WMA. Appendix C presents the status of isolation that has occurred that is associated with the external waste transfer lines.

The basic strategy for isolating components and groupings internally is to generally follow hydraulic gradients. The strategy may require working from an up-gradient high point down, from a low point up-gradient, or from both ends toward the middle. The objective of isolation is two-fold: (1) to minimize the potential of waste being inadvertently released to the environment within a sector by activities being conducted within the sector such as retrieval of wastes and (2) to prevent additional waste from entering from outside the sector once waste has been removed.

This strategy is applied in WMA T with catch tank 241-T-301B as the low point and last component to be retrieved. Alternatively, to prevent any waste from entering a low point component (i.e., SST) that would complicate waste retrieval, it may be advantageous to isolate that component from the up-gradient components. Isolation not only includes the physical separation of one component from another, but also the stabilization and post-isolation monitoring of components.

Post-isolation monitoring is typically performed only at the hydraulic low point of the system. Because it can reduce the number of monitoring points, it is often advantageous to isolate pipelines by installing blanks in diversion boxes and pits rather than cutting and capping the connecting pipelines. Additionally, the blanking of a pipeline can be performed inside the diversion box or pit and does not involve excavation to the line outside the pit/diversion box.

4.5 WASTE MANAGEMENT AREA PERFORMANCE ASSESSMENTS

To support making final retrieval or closure decisions, a PA will be developed for the SST system and will be periodically updated to include the latest characterization information. WMA PAs will be generated within the SST PA. Lastly, individual tank component RAs will be developed using post-retrieval sampling information. These PAs and RAs will be approved by Ecology and DOE pursuant to their respective authorities and will be incorporated into the RCRA Site-Wide Permit through the closure plans.

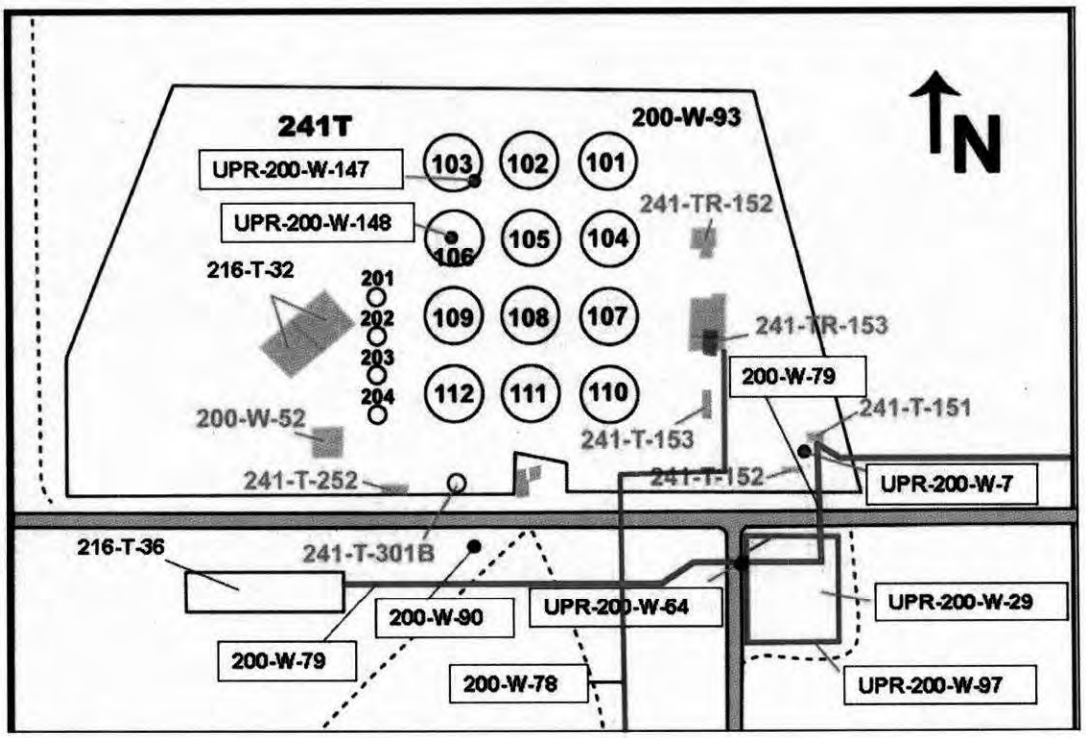
As individual components are retrieved or characterized, or other component closure activities are completed, the resulting component characterization information will be incorporated into the WMA PA to determine its relative risk compared to the entire WMA performance. As each WMA proceeds toward closure, its respective PA will be updated to address significant results and findings. Final WMA closure decisions will be made after components are retrieved and/or characterized, other component closure activities have been completed, and a final WMA PA is issued.

4.6 WASTE SITES AND UNPLANNED RELEASE SITES

Waste sites including UPRs will be addressed as potentially contributing sources to the soil component of the WMA as well as part of the investigation and cleanup of soil. The proposed approach to integrating soil remediation is discussed in Section 5.0. In addition to waste sites and UPRs that exist within the WMA boundary, there are waste sites and UPR sites that are in close enough proximity to the WMA that they warrant integration in the WMA closure planning. There are 3 UPRs within the WMA T fenceline that have been consolidated into UPR 200-W-93, and 6 additional associated UPRs (i.e., sites outside the WMA boundary but within close proximity).

The following waste sites and UPRs reside within (Section 4.6.1) or adjacent to (Sections 4.6.2 and 4.6.3) WMA T and are currently listed in the site-wide WIDS database. Figure 4-2 shows the location of the waste sites and UPRs in and adjacent to WMA T.

Figure 4-2. Location of Waste Sites in and Around Waste Management Area T.



4.6.1 Waste Sites and Unplanned Releases in Waste Management Area T

200-W-93 (Consolidated UPR) – This WIDS site was created in an effort to consolidate and simplify the management of multiple UPR entries. This UPR, encompassing all the individual UPRs and otherwise contaminated soil, is the soil surrounding the tanks, inside and adjacent to the chain link fence surrounding the T tank farm. UPR-200-W-7, UPR-200-W-147 and UPR-200-W-148 are the consolidated UPRs associated with the T tank farm. Occasionally, radioactive contamination is found adjacent to the outside of the tank farm fence, resulting in a contamination zone extension around the tank farm perimeter. These areas will be considered tank farm soil. Several poorly defined UPRs have occurred at the T tank farm over the years.

UPR-200-W-7 – The release occurred inside the T tank farm adjacent to diversion boxes 241-T-151 and 241-T-152. Work done in the spring of 1950 at those diversion boxes resulted in contamination spread to the ground around both boxes. In 1950, a portion of the contamination was removed and the balance covered with about a foot of clean soil. The area was delimited with rope and posted with radiation zone signs. The diversion boxes have been covered with a protective foam layer.

UPR-200-W-147 – The release is the soil located southeast of, and under tank 241-T-103, inside T tank farm. In 1973, while monitoring wells were being drilled to assess the tank 241-T-106 leak, contamination was identified between monitoring wells 299-W10-116 and 299-W10-118. This contamination plume was determined to be from tank 241-T-103. Subsequent investigations revealed that the leak resulted from a failed grout seal in a spare entry line to tank 241-T-103. Tank 241-T-103 was labeled an assumed leaker and removed from service in 1974. The waste penetrated to a maximum depth of 25 m (82 ft) below ground surface or 37 m (121 ft) above the water table.

UPR-200-W-148 – The release is a contaminated soil plume located adjacent to tank 241-T-106, inside T tank farm. This release occurred while waste was being transferred from tank 241-T-107 tank to 241-T-106. The waste was pumped from tank 241-T-107 to tank 241-T-105, which overflowed into tank 241-T-106. The release occurred during a routine tank filling operation. The release is assumed to have occurred on April 20, 1973 however do to missing data that showed changes in liquid levels in 241-T-106, the release went unnoticed until June 7, 1973. On June 7, 1973 tank data were reviewed and 241-T-106 was determined to be leaking. Emergency plans were made to pump the remaining liquid out of tank 241-T-106. As a result of this release, the tank was labeled a confirmed leaker and removed from service in 1973.

200-W-52 Crib (a.k.a. 216-T-7 Crib) – This crib is located inside the T tank farm east of the 216-T-7 tile field. The site consists of one wooden crib box with inlet and outlet piping and a riser pipe. The box is set into a gravel layer in the bottom of a pit with sloping sides. It is connected to a tile field that is located west of the crib.

216-T-32 Cribs – The cribs are located on the west side inside the T tank farm fence, and north of 200-W-52 crib. The fence on the west side of the T tank farm transects the northwest corner of one of the cribs, but the second crib is located inside the tank farm fence. The cribs are associated with tank 241-T-201; diversion boxes 241-T-152 and 241-T-252; and the 224-T facility.

4.6.2 Waste Sites and Unplanned Releases near Waste Management Area T

Although they lie outside of WMA T, the following waste sites should be considered as part of WMA T final closure because they were the result of tank farm operations and are in the immediate proximity of the WMA.

216-T-7 Tile Field – The 216-T-7 tile field is located adjacent to the west side of the T tank farm fence and north of 23rd Street. A portion of the tile field extends inside the tank farm fence.

216-T-5 Trench – This site is located west of the T tank farm and northwest of the 216-T-32 crib. This trench received 221-T second cycle supernatant that had been stored in tank 241-T-112 via an over-ground pipeline. The trench was active in May 1955.

200-W-78 (multiple UPRs) – This site is an encased, underground pipeline that runs between diversion box 241-TXR-151 in the TX tank farm and diversion box 241-TR-153 in the T tank farm. Outside the tank farm fence, the line is marked with 'Radioactive Pipeline' signs. There are several individually stabilized, radiological postings for areas on top of, or adjacent to, this pipeline near the east side of the TY tank farm perimeter fence.

The Dyncorp Integrated Soil, Vegetation and Animal Control group submitted three posted surface contaminated areas, located on or adjacent to this pipeline, to WIDS as Discovery sites in 2000 when evidence of contaminated biological intrusion above the line was discovered. In April 2001, a fourth area of contamination was identified. The area posted measured 3 by 14 m (10 by 45 ft). The encased transfer line is marked on the surface with signs on posts. There is a schedule 40 steel line that connects the 242-T Evaporator with the 207-T retention basin, a few feet to the east, running parallel with the encased line. It is difficult to determine which line is the source of the contamination being brought to the surface. Areas containing growing, contaminated vegetation and contaminated ant hills have been stabilized with bio-barrier material and gravel.

UPR-200-W-29 (also known as UPR-200-W-27) – This site is located at the southeast corner of the intersection of Camden Avenue and 23rd Street and is associated with diversion box 241-T-152, UPR-200-W-64, and UPR-200-W-97.

On November 15, 1954, a broken, underground process line leading from diversion box 241-T-152 to diversion box 241-TX-153 caused a small subsidence (located 23 m [75 ft] south of 23rd Street and 23 m [75 ft] east of Camden Avenue) over the pipeline to occur. Run off from the release contaminated an area along the east side of Camden Avenue. An un-encased, underground pipeline was being used to transport first cycle waste from tank 241-T-105 to the tank 241-TX-118 for 242-T Evaporator processing. The waste transfer was begun around 2:45 p.m. on November 15, 1954, but was discontinued at 11:30 p.m. because of a leaking jumper. The subsidence and waste runoff was not discovered until 10:00 a.m. on November 16, 1954. A maximum dose rate of 11.5 rad per hour, at a distance of 5 cm (2 in.), was found over the run off area. It was calculated that less than 3,800 L (1,000 gal) of waste actually escaped from the line.

Although some reference documents indicate the release occurred at diversion box 241-TX-153, that box was the waste receiver. The liquid transfer was routing between diversion box

241-T-152, located inside the T tank farm, to diversion box 241-TX-153, located inside the TX tank farm. The underground pipeline being used was not an encased line. The pipeline broke closer to the transfer origin, across 23rd Street, south of the T tank farm.

Following the discovery of the subsidence, in 1954 the area was hosed down to prevent wind-borne spread of contamination. Within six hours of discovery, the subsidence was backfilled and the area was covered with gravel. The area on the southeast corner of 23rd Street and Camden Avenue was surface stabilized in 1978. The contaminated soil adjacent to the zone on the south side was removed to a depth of 1.2 m (4 ft) and on the west side to a depth of 0.9 m (3 ft). The area was backfilled to grade with clean dirt. The new surface was treated with a heavy coating of fiber-film. The area was then covered with 10 cm (4 in.) of sand and treated with urea-bore herbicide. To prevent wind erosion, 10 cm (4 in.) of gravel was applied to the surface.

UPR-200-W-97 (also known as UPR-200-W-62) – The site is located at the corner of 23rd Street and Camden Avenue and is associated with the underground pipeline connecting diversion box 241-T-152 and diversion box 241-TX-153. UPR-200-W-97 occurred at the same location as UPR-200-W-29, adjacent to UPR-200-W-64. In May 1966, liquid waste surfaced and ran to the edge of Camden Avenue. This is the same location of UPR-200-W-29, a waste transfer line break that occurred in 1954. This release occurred when the broken waste line was mistakenly tested, causing liquid waste to surface again.

In 1966, the contaminated area was isolated. Contamination in the soil was removed to a depth of 0.92 m (3 ft) and buried in the 200 West Area burial grounds. The dose rate was increasing as the depth of the excavation increased, so the excavation activities were stopped. The dose rate at the bottom of the 0.9-m (3-ft) hole was 9 rad per hour. The remaining contamination was covered with 0.9 m (3 ft) of clean soil. In 1978, the site was surface stabilized. Contaminated soil on the south side was removed to a depth of 1.2 m (4 ft) and on the west side to a depth of 0.9 m (3 ft). The area was backfilled to grade with clean dirt. The new surface was treated with a heavy coating of fiber-film. The area was then covered with 10.2 cm (4 in.) of sand and treated with urea-bore herbicide. To prevent wind erosion, 10.2 cm (4 in.) of gravel was applied to the surface.

UPR-200-W-64 – The release is located between the east shoulder of Camden Avenue and the posted URM area (UPR-200-W-29/UPR-200-W-97), near the corner of 23rd Street and Camden Avenue.

On February 13, 1969, contamination up to 600 counts per minute was found in mud samples next to Camden Avenue. The contamination was found to be on the shoulder of the roadway, but no detectable contamination was found on the road blacktop. It is believed that the contamination source was the adjacent radiation zone (UPR-200-W-29 and UPR-200-W-97) where two previous underground radioactive waste line leaks had occurred. Runoff from heavy snow may have caused the contamination movement. Dirt samples from the radiation zone to the east and roadway shoulder samples showed cesium-137 to be the only detectable radioactive isotope.

In 1969, the area was blocked temporarily, allowing traffic to flow but preventing access to the east shoulder. The radiation zone adjacent to the corner of 23rd Street and Camden Avenue was surface stabilized in 1978. The contaminated soil adjacent to the zone on the south side was removed to a depth of 1.2 m (4 ft) and on the west side to a depth of 0.9 m (3 ft). The area was backfilled to grade with clean dirt. The new surface was treated with a heavy coating of fiber-film. The area was then covered with 10.2 cm (4 in.) of sand and treated with urea-bore herbicide. To prevent wind erosion, 10.2 cm (4 in.) of gravel was applied to the surface.

200-W-79 (UPR) – The site is located near a 10-cm- (4-in-) diameter, vitrified clay underground pipeline that fed the 216-T-36 crib. There is three separate posted contamination areas located on top of this pipeline, west of the 216-T-36 crib. In November 2000, a bio-barrier and a layer of clean gravel were placed over the contamination area and the area down-posted to an URM area.

The Dyncorp Integrated Soil, Vegetation and Animal Control group submitted this site to WIDS as a Discovery site. The radiological surveys indicate there is growing, contaminated vegetation on the crib pipeline, inside the posted contamination areas, west of the crib. A radiological survey done in August 1998 identified a rabbit brush plant with radiological readings of 80,000 counts per minute. Other ground surface areas inside the posted area ranged from 600 to 4,000 counts per minute.

200-W-90 (URM) – This waste site is comprised of three posted URM areas. Two are located outside the T tank farm, on the south side of 23rd Street, across from the 218-W-2A burial ground. One is located further east, on the south side of 23rd Street, outside the T tank farm. It is possible the areas are related to UPR-200-W-63.

The Dyncorp Integrated Soil, Vegetation and Animal Control group submitted these posted areas to WIDS as a Discovery Site in 2000. They are similar in size. No radiological survey could be found to describe the radiological conditions inside the posted areas or when they were posted.

216-T-36 (Crib) – This waste site is located southwest of the T tank farm and south of the 216-T-7 tile field. It consists of an interim stabilized crib posted as URM and includes a single vitreous clay distribution pipe resting in a gravel layer that is in a rectangular trench. Backfill covers the pipe and gravel. The crib also has a gauge well riser and a filter riser. The crib started operation in May 1967. While the date the crib was taken out of operation is unclear, available documentation indicates its use stopped sometime between 1970 and 1973.

4.6.3 Other Waste Sites and Unplanned Releases near Waste Management Area T

The following waste sites are near WMA T. These sites have been reviewed and are not recommended for inclusion as part of WMA T final closure.

207-T Retention Basin – The unit was a concrete structure, divided into two sections, with a 3.8 million L (1million gal) capacity. The basin received cooling water effluent from 221-T and 224-T. The basin effluent was released to the 216-T-4-1 and 216-T-4-2 ditches. There was an inlet structure on the east side and an outlet structure on the west side, adjacent to the outside

walls of the basins. Approximately 1830 m (6000 ft) of 61-cm- (24-in-) diameter vitrified clay pipeline was used to convey waste water to and from the basin.

Interim stabilization of the 207-T retention basin and an area of surface soil contamination located east of the basins (200-W-53 alias UPR-200-W-166), was completed in May 1996. Between 8 and 46 cm (3 and 18 in.) of the contaminated soil was scraped from 200-W-53 (UPR-200-W-166) and deposited in the bottom of the basin. The basin was then capped with 46 to 61 cm (18 to 24 in.) of clean dirt. The area was down-posted from a surface contamination area to an URM area.

UPR-200-W-14 – The site is described as the surface above the waste line between the 242-T Evaporator and the 207-T retention basin. Several areas of contamination were identified along the east side and northeast of the TX/TY tank farm in 2000 and 2001 by the Dyncorp Integrated Soil, Vegetation and Animal Control group. The areas were stabilized with clean dirt and posted as URM. Because the exact location of this 1952 UPR is not documented, it is possible one of the areas stabilized in 2001 is in the same location as the 1952 line leak.

200-W-53 (UPR) – This site was identified in 1994 as an area of surface soil contamination located outside T tank farm, east of the 207-T retention basin, resulting in approximately 14,500 m^2 (156,000 ft^2) of land being marked and posted as a soil contamination area. The source of the contamination was assumed to be the T tank farm and the 207-T retention basin. Soil contamination located east of the 207-T basin was excavated and placed inside the 207-T retention basin in 1996 by the Westinghouse Tank Waste Remediation group. The basins were completely backfilled and covered with clean dirt. The excavated area is currently posted as an underground radioactive material (URM) area.

A small URM area surrounding well 299-W11-28, on the west side of the retention basin, is also considered to be part of 200-W-53. The Tank Waste Remediation Group used the waste site number UN-216-W-31 (presently known as UPR-200-W-166) to document their 1996 clean up effort. However, this contaminated soil was not located at the same place as the original UN-216-W-31 that was consolidated and stabilized by the Radiation Area Remedial Action group in 1992. The original UN-216-W-31 area of contamination was described as being located north and east of T tank farm. In 1996, the UN-216-W-31 number was used again for the contamination found further east, because the source of the contamination was assumed to be the same as the source for UN-216-W-31. Because of programmatic responsibility issues, it was necessary to give the second area of contamination a separate site code (200-W-53) to explain the two separate remediation activities.

UPR-200-W-166 – The site was originally defined as a large, irregularly shaped area of surface soil contamination located north and east of the T tank farm. In 1992, soil contamination known as UPR-200-W-166 (UN-216-W-31), located adjacent to the T tank farm fence, was scraped and consolidated along the hillside to the west of the 216-T-14 through 216-T-17 trenches. The contaminated soil was covered with clean dirt and posted with URM signs. In 1994, an additional area of surface soil contamination was identified east of the 207-T retention basin. Because it was assumed that the contamination had also spread with the wind from the T tank farm, the area was also called UPR-200-W-166. This area of contamination was scraped and placed into the 207-T retention basin by the Westinghouse Tank Farm Remediation group in

1996. For programmatic responsibility purposes, reference to the contamination found east of the 207-T retention basin will be known as 200-W-53. In 1996, soil contamination found on the east side of the 207-T basin was scraped and placed inside the 207-T retention basins (see WIDS site code 200-W-53).

In 1991, the contaminated interior fenced area of the T tank farm was decontaminated and covered by a layer of clean gravel. This eliminated one contamination source. It was then feasible to develop a stabilization plan for the soil contamination areas outside the tank farm fence. In 1992, the Radiation Area Remedial Action group scraped the contaminated soil and consolidated on the west slope of the 216-T-14 through 216-T-17 trenches. The slope and the 216-T-14 through 216-T-17 trenches were covered with a layer of clean dirt and posted as an URM area. The scraped area was radiologically surveyed, sampled and released from radiological posting.

216-T-12 Sludge Pit – There is no visible evidence of this waste site. The area around the 207-T retention basin, including the northeast corner where this pit was located, has been stabilized with clean backfill material and posted with URM signs. It is located at the northeast corner of the 207-T retention basin. The sludge pit is not separately marked.

216-T-14, -15, -16, and -17 Trenches – The 216-T-14, 216-T-15, 216-T-16 and 216-T-17 trenches were surface stabilized as a unit. The area is identified with concrete AC-540 markers and is posted with URM signs. The trenches are located north of 23rd Street and northeast of the T tank farm.

4.7 DECOMMISSIONING, DECONTAMINATION AND DISMANTLEMENT

The CH-TRUM packaging system will require decontamination and dismantlement following completion of its operation. The details of these actions are summarized in Section 4.10 and further described in *Hanford Facility Dangerous Waste Permit Application, Contact-Handled Transuranic Mixed Waste Treatment, Packaging, and Storage Facility* (DOE/ORP-2003-22).

4.8 WASTE MANAGEMENT AREA T COMPONENT REGULATORY PATHWAYS TO CLOSURE

RCRA and CERCLA provide the primary pathways to closure for the components, structures, and waste sites associated with WMA T. The closure pathways for the major components are identified in Table 4-1. The following sections describe the approach to sequencing closure within the four sectors of WMA T.

Table 4-1. Waste Management Area T Regulatory Path for Component Closure.

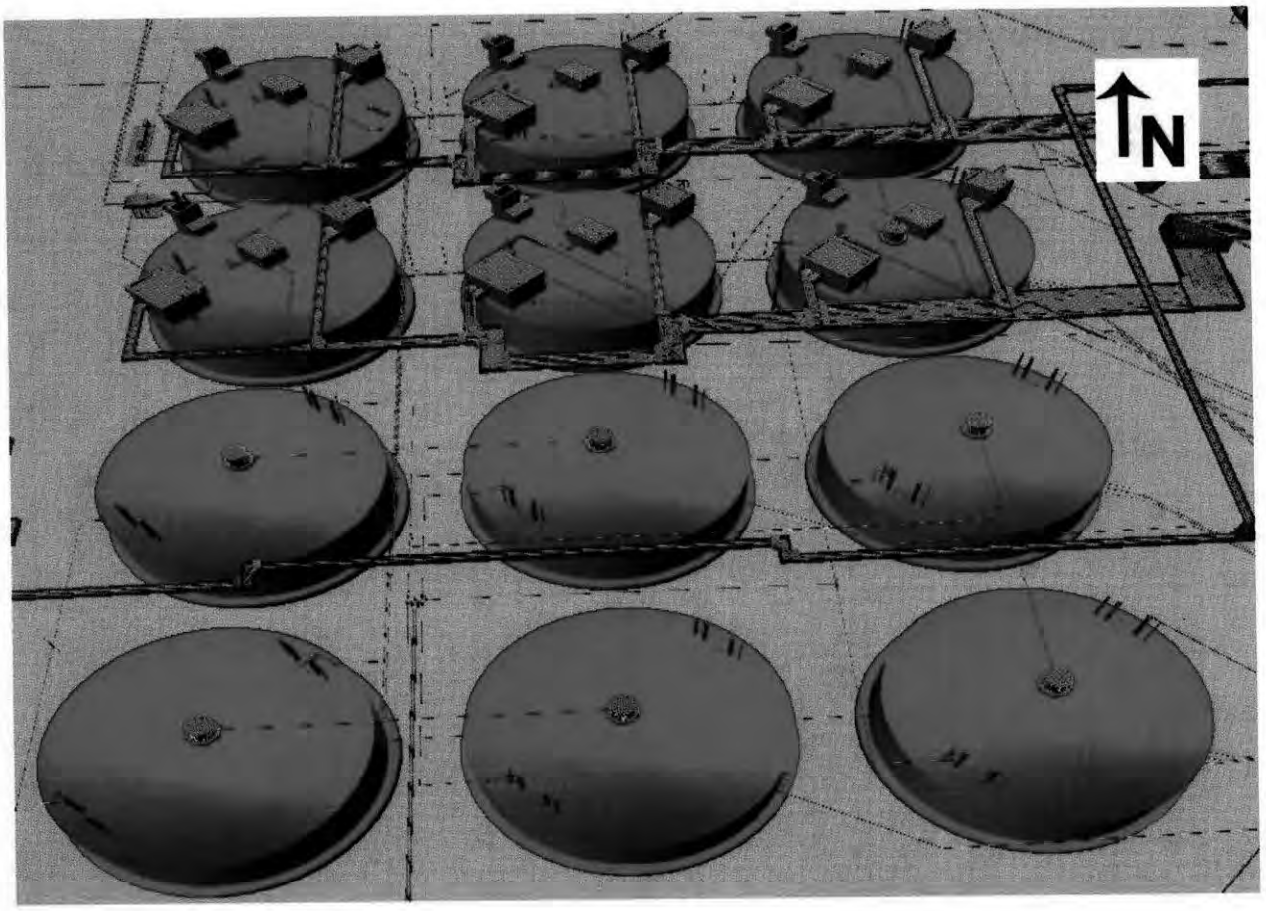
WMA-T Component	Regulatory Path	Comments
Single-Shell Tanks	RCRA Closure Plan/Site-Wide Permit	
SST Ancillary Equipment within WMA-T Barrier Footprint	RCRA Closure Plan/Site-Wide Permit	Isolated exceptions to this regulatory path could occur if ancillary equipment is remediated as part of corrective actions for soil (e.g., removed)
SST Ancillary Equipment outside of WMA-T Barrier Footprint	CERCLA Record of Decision/ Site-Wide Permit • 200-IS-1 • 200-PW-1 • 200-TW-1 • 200-CW-5 • 200-UR-1 • 200-MW-1	CERCLA decisions will be integrated into RCRA closure actions through the Site-Wide Permit
CH-TRUM Packaging Facility	RCRA Closure Plan/Site-Wide Permit	The CH-TRUM Packaging Facility is anticipated to be clean closed
216-T-32, 216-T-36, and 200-W-52 Crib (a.k.a. 216-T-7 Crib); Trench 216-T-5; Tile Field 216-T-7	CERCLA Remedial Action	
Unplanned Releases to Soil	RCRA Corrective Measures Study/Site-Wide Permit	
Groundwater	CERCLA Remedial Action/ Site-Wide Permit • 200-ZP-1	CERCLA decisions will be integrated into RCRA closure actions through the Site-Wide Permit

CERCLA = *Comprehensive Environmental Response, Compensation, and Liability Act of 1980.*
RCRA = *Resource Conservation and Recovery Act of 1976.*
SST = single-shell tank.
CH-TRUM = contact-handled transuranic mixed waste.
WMA = waste management area.

4.9 SECTOR 1 SEQUENCING

Sector 1 includes the twelve 100-series SSTs with their associated pits, risers and internal pipes, and two UPRs (UPR-200-W-147, and UPR-200-W-148). Figure 4-3 is a three-dimensional illustration of the major components in this sector.

Figure 4-3. Sector 1 Components.



4.9.1 Approach

The major remediation and closure activities that would be conducted within Sector 1 include:

- Retrieve tank waste
- Characterize sector components (including UPRs) to the extent required
- Isolate sector (external isolation from other sectors)
- Isolate sector components (internal isolation)
- Fill tanks with grout
- Close pits and risers as required

- Implement interim measures for UPRs, as required
- Prepare site for closure.

Once a tank or other component within the sector has been identified for waste retrieval and closure, the following activities would be undertaken: (1) planning and engineering design for retrieval or remediation actions, as appropriate; and (2) preparing the component closure plan that directs the closure of ancillary equipment. In addition, a Tank Waste Retrieval Work Plan would be prepared to provide the technical basis of the waste retrieval and the evaluation of the retrieval actions.

A DQO was developed for all post-retrieval sampling of SSTs. Ancillary equipment and soil characterization are also expected to follow a DQO process. The DQO process serves as the basis for ensuring sampling and analysis efforts result in information sufficient to support closure decisions. The collected data are then used as part of the evaluation process to guide closure decisions and to evaluate the risk from any residuals that may remain. Other actions include the design, procurement, and installation of the waste retrieval system(s) followed by the conduct of waste retrieval. Post-retrieval evaluations using the DQO process include measurement of the residual waste volume and characterization of the residual waste. Upon determination that retrieval is complete, per HFFACO criteria and approval of closure conditions in the RCRA Site-Wide Permit, the tank can be filled with grout to immobilize any residual waste and to provide structural stability to the tank.

The majority of the pipelines, as indicated in the assumptions, would be closed in place; the primary activities for closure of pipelines would focus on isolation. An initial assessment of the hydraulics of the pipeline system would be performed to determine which lines have been cut and capped, which have been previously flushed, and which are assumed to be plugged. This assessment would define low points, and then trace back up-gradient to high points. This assessment process is considered fundamental to effectively isolating the interior pipeline system (i.e., pipelines within the sector) in preparation for closure. Interior pipelines, including cascade lines, typically would not be flushed, retrieved, or grouted because of structural integrity concerns.

Before the determination that the two Sector 1 UPR sites (UPR 200-W-147, UPR 200-W-148,) will require remediation, a RCRA site assessment will be completed. Based upon the findings of the site assessment, it will be determined if any of these UPRs are a candidate for corrective measures. The approach to UPRs is further discussed in Sections 3.1.2 and 5.0.

4.9.2 Waste Retrieval

The sequencing of tank waste retrieval follows a specific process set forth in HFFACO Milestone M-45-02M. The goal of the tank waste retrieval activity, as stated in Milestone M-45-00, is:

> ...retrieval of as much waste as technically possible, with tank residues not to exceed 360 cubic feet (cu. ft.) in each of the 100 series tanks, 30 cu. ft. in each of the 200 series tanks, or the limit of waste retrieval technology capability, whichever is less.

If the waste retrieval goal is not met for a specific tank, DOE will follow the HFFACO Appendix H process to seek an exception to the criteria or develop sufficient data over the course of multiple retrievals to establish a basis for revising the waste retrieval performance objective. An RA will be performed on the remaining residuals to ascertain their contribution to risks to human health and the environment using methods described in RPP-13774.

Waste retrieval alternatives consider waste types and tank conditions on a tank-by-tank basis (e.g., whether a tank is a suspected leaker or not) including the presence of sludge. Other tank farms may also consider the presence of salt-cake or a hard heel as part of the waste matrix. Leak detection, monitoring, and mitigation plans and decisions required during retrieval are also specified on a tank-by-tank basis by DOE and regulatory agencies and are documented in the Tank Waste Retrieval Work Plan. The conduct of waste retrieval operations within the WMA will involve the design and construction of complex systems that will extend beyond the boundaries of Sector 1. The retrieval system for WMA T has not been designed yet. Once put into place, these facilities cannot be compromised and will create a limitation on other remediation and closure actions that may be able to be conducted simultaneously.

Retrieval will be conducted on a tank to remove liquids and any sludge/solids in accordance with HFFACO Appendix H. The waste retrieval process will be conducted in compliance with field operation procedures that include environmental criteria and appropriate reporting requirements. Following waste retrieval, characterization of the residuals will be conducted including a determination of residual waste volume. The characterization data and remaining waste volume will be used to evaluate the tank's contribution to the total risk associated with the waste by incorporation into the PA for WMA closure. Pending the determination of residual volumes and the tanks' contribution to the PA, a retrieval data report will be prepared and submitted to Ecology. If the waste retrieval effort has not achieved the retrieval performance goals, the data report will include a HFFACO Appendix H exception report.

The pits are associated with each individual tank and are considered part of the tank's ancillary equipment. Caps have been placed on many of the pits to isolate them from water infiltrating the tank. Certain pits have been designated for use during waste retrieval and closure operations and will be modified to support specific waste retrieval/closure equipment. Pits that have been isolated and are not anticipated to be used in retrieval are not expected to be opened to fill the void space. The void space in pits is small and should not cause or contribute to a subsidence problem that would effect barrier performance. Pits used to support waste retrieval would be grouted as part of the final grouting sequence of the specific tank and then a waterproof cap would be installed. Retrieval and closure activities for the pits will be closely integrated with those of the 100-series SSTs. Integration of pit closure with tank closure sequencing should occur during the initial closure planning process.

4.9.3 Waste Characterization

Tanks and UPRs will be characterized to (1) determine residual waste volume and amount of contaminants in the soil, (2) analyze composition of chemical and radiological constituents, and (3) assist in waste retrievals management. The DQO process will guide the sampling and

analysis efforts that support the characterization effort for hazardous waste and will incorporate the requirements of DOE O 435.1, which guides radiological characterization.

Sampling and analysis results pertinent to closure actions will be summarized in response to closure plans and interim corrective measures and made available to regulatory agencies. Characterization will provide data that:

- Support decisions to ensure measures are in place to protect workers, the general public, and the environment
- Determine the volume of waste remaining at completion of retrieval or existing in the soil
- Allow a determination of a defensible estimate of constituents remaining at closure
- Allow determinations that reduce uncertainty in contaminant inventories used in RAs
- Provide samples and analysis to refine conceptual models for PA
- Increase the accuracy and utility of best-basis inventory information.

4.9.4 Post-Retrieval Isolation and Activities

Isolation of tanks, pits, and diversion boxes following waste retrieval prevents intrusion of wastes or inadvertent infiltration of water. The desired physical end state for these components is for penetrations/pathways into the tank and associated at-tank pits (excluding those associated with passive ventilation) to be capped, sealed, plugged, administratively closed, or otherwise obstructed such that liquids cannot enter the tank. Interim isolation actions would typically be reversible. Table 4-2 summarizes isolation actions planned for specific pathways.

Table 4-2. Planned Isolation Actions.

Pathway	Isolation Actions
Cascade lines	Administrative controls until placement of tank fill
Waste transfer lines including concrete encasements into pits or risers	Capped at the high hydraulic end at the edge of the engineered barrier or cap
Utility lines into at-tank pits and tank risers	Severed from active lines and blocked
Temporary waste transfer lines	Disconnected and removed
Pit drains	Plug drain (grout or foam) or leave open since external lines and cover will be isolated
Pit covers	Weather-proofing with a sealant
Weep holes	Left open if pit drains are left open; blocked if pit drains are blocked

Following completion of waste retrieval, a significant amount of disposable and expendable equipment is expected to remain in WMA T. As part of the transitioning between the completion of waste retrieval and the commencement of closure, this equipment would be removed and disposed of as part of the site preparation phase of closure. The waste retrieval equipment to be dispositioned as part of the site preparation includes cross-site transfer lines, ventilation systems, skids, and disposal boxes that housed equipment in support of waste retrieval.

Much of the in-tank equipment (e.g., articulated mast system mast, retrieval pumps/sluicers, level detectors, and thermocouple trees) would be dispositioned as in-tank debris during the tank closure activity. The disposition of in-tank ancillary equipment (e.g., in-tank measuring equipment and tank risers) would be described in the respective tank component closure activity plans.

Closure of a tank would include assessing compliance with the RCRA Site-Wide Permit (Ecology 2004), "Land Disposal Restrictions" (40 CFR 268) requirements, DOE orders, and engineering requirements. Closure would include stabilizing the tank and immobilizing residual waste with placement of a fill material. Grout would be used in WMA T to fill significant void spaces (e.g., tanks, large below-grade ancillary equipment), thereby avoiding subsidence, providing structural stability to prevent settlement of the tank dome, promoting barrier stability, and increasing protection against inadvertent intrusion. Similarly, grout or other stabilization media may be used on larger, belowgrade ancillary equipment, if filling in void spaces is required for structural stability purposes. The fill would be formulated to provide a relatively impermeable and impenetrable monolith, which would provide structural stabilization of void space in the tank and physical/chemical immobilization of residuals in the tank.

A multi-phased approach to filling SSTs would be utilized. Phase I fill would consist of a 30- to 90-cm (12- to 36-in.) base layer of free-flowing grout that will cover waste residuals and debris on a tank bottom and support subsequent fills. Phase II fill will enhance stability for the tank structure and fill the majority of tank volume. Phase III fill will be a high-compressive-strength grout placed in the remaining void space (between the Phase II grout and the tank dome and fill tank risers) to discourage intruder access.

Void space filling and tank stabilization is based upon the assumption that any residual waste is not classified as TRU or high-level waste.

4.9.5 Vadose Zone Monitoring/Drywell Decommissioning

It is anticipated that vadose zone monitoring using the drywells will continue through retrieval of waste from SSTs and that the post-retrieval monitoring period will be established in the Tank Waste Retrieval Work Plan. Drywell vadose zone monitoring might be extended to support implementation of some corrective measures, until it is determined that the data or subsurface access they provide is no longer necessary. Before placement of the barrier, the vadose zone monitoring wells and groundwater monitoring wells in all sectors will be decommissioned to be in accordance with "Minimum Standards for the Construction and Maintenance of Wells" (WAC 173-160) and to meet any additional barrier design requirements. It is expected that new

monitoring wells will be placed outside of the barrier footprint for long term monitoring, as necessary.

4.9.6 Integration

Both waste retrieval and closure activities on each tank have been integrated with planned activities for other components in this sector, as well as with any soil investigation or remediation activities occurring in the area (see Section 4.1). Integration includes coordination of isolation activities before tank closure. Such activities will not preclude the subsequent removal or closure needs of another tank in a series, connecting pipeline(s), or any associated ancillary components. The DQO and sampling and analysis plan process for SST waste characterization can proceed independent of that for UPR characterization because the data collection efforts are supporting different closure activities and decisions.

The currently identified approach is to integrate closure of Sector 1 with Sector 4 in a series, with Sector 1 being closed before Sector 4. This sequencing follows the preferred strategy for downgradient facilities to be closed last. Crib 200-W-52 is hydrologically connected and downgradient of 241-T-112 and 241-T-111 (Figure 4-1 depicts the time-phased sequence).

4.9.7 Status

Process knowledge of the T tank farm has been reviewed to identify tanks that contain CH-TRUM and could be candidates for retrieval and packaging through the CH-TRUM packaging system. Up to four of the 100-series SSTs have been identified as possibly containing CH-TRUM or remote-handled TRU waste.

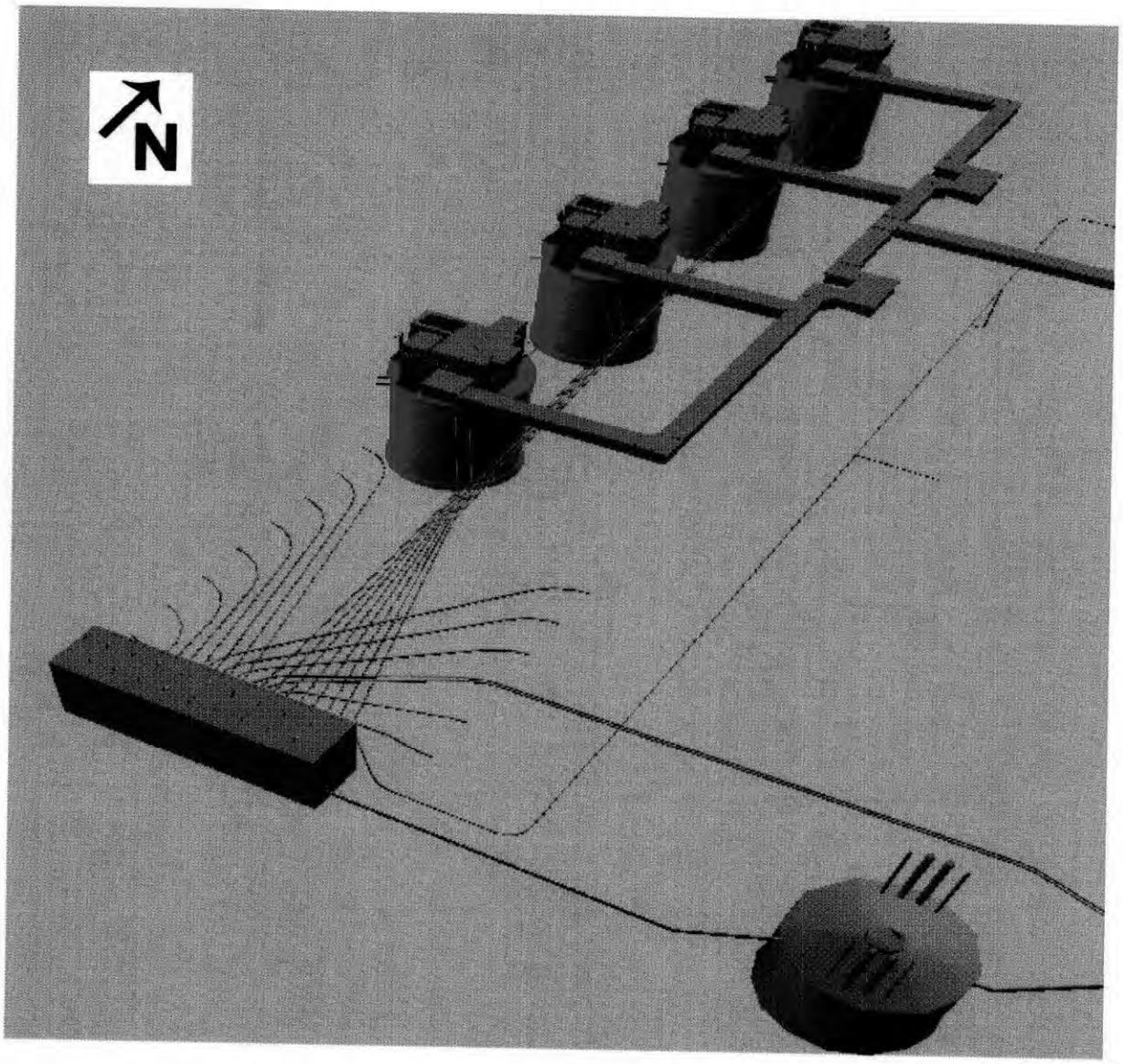
4.10 SECTOR 2 SEQUENCING

Sector 2 includes the four 200-series SSTs with their associated pits, risers, and internal pipes; one diversion box (T-252); catch tank 241-T-301B; the CH-TRUM packaging system; and external piping. The 200-series tanks, diversions box, and catch tank are portrayed in Figure 4-4.

Catch tank 241-T-301B has a working volume of approximately 133,300 L (35,200 gal) and has an inside diameter of approximately 6 m (20 ft) and the maximum operating liquid level is about 5 m (15 ft) above the floor. The tank bottom inside elevation is approximately 195 m (641 ft) (about 9 m [29 ft] below grade elevation). The vertical tank has eight risers. The catch tank is the lowest point in the WMA T drain system.

The diversion box 241-T-252 supported transfers for the 200-series tanks. The floor drain in that diversion box has a 6-in. schedule 40 steel drain line (V727) which is routed from the diversion box low point (elevation 201 m [659 ft]) to the west sidewall penetration of the 241-T-301B catch tank (elevation 200 m [656 ft], approximately 4 m [14 ft] below grade level).

Figure 4-4. Sector 2 Waste System Components.



WMA T, unlike the majority of 200 Areas WMAs, will support retrievals of TRU waste from selected SSTs that will be treated, packaged and temporarily stored at WMA T pending off-site disposal. These activities are supplemental to the retrieval, transfer, and treatment of the balance of non-TRU SST waste that will be stored in the DST system pending treatment at the Waste Treatment Plant or supplemental treatment facilities. The CH-TRUM packaging and storage facility will be supported by its own retrieval system and consists of a slurry tank, CH-TRUM packaging system and a container storage area. This mobile system has been developed to retrieve, package and store CH-TRUM at the T tank farm and at the B tank farm, which will have a second container storage area.

The waste retrieval system and the CH-TRUM packaging system would initially be set up and operated within the northern portion of the B tank farm. Upon completion of the activities at B tank farm, the CH-TRUM packaging system would be relocated to the northwestern portion of the T tank farm to continue treatment and packaging activities (Figure 4-5 provides the location of this system in relationship to the T tank farm). The CH-TRUM packaging system will receive, treat, and package waste streams from four 200-series and up to four 100-series T farm SSTs. Figure 4-6 shows the configuration of the temporary storage facility.

After the TRU wastes are retrieved from the four 200-series tanks and packaged for off-site disposal, these tanks and the associated ancillary equipment (pits, risers, and pipelines), as well as diversion box 241-T-252 and the 241-T-301B catch tank, will be prepared for closure using a similar approach as described in Section 4.9 for the 100-series tanks. Any remaining retrieval and packaging equipment associated with the TRU packaging project would also be removed as part of this sector closure. Figure 4-4 shows the components in this sector.

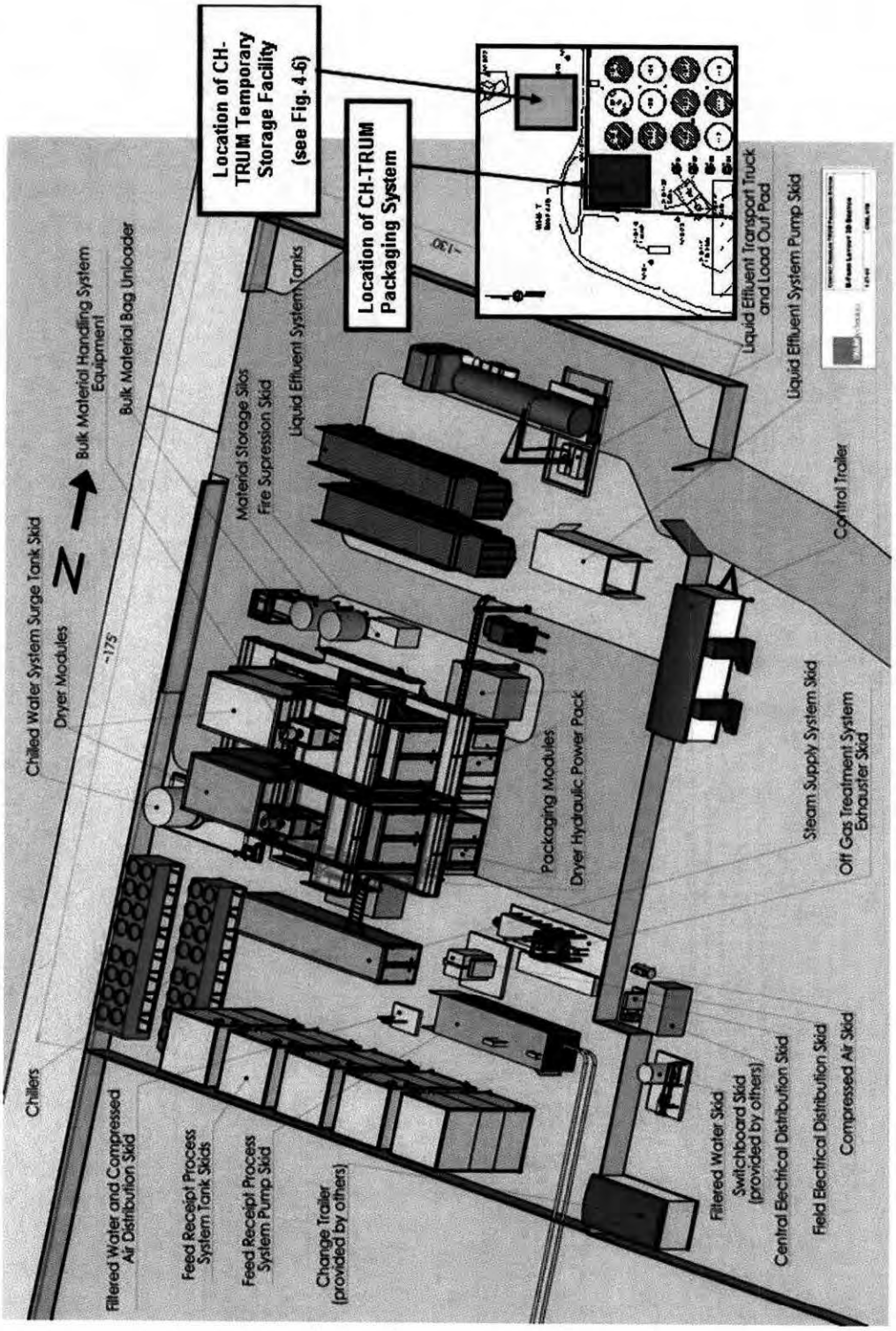
4.10.1 Approach

The approach to the 200-series tanks, catch tank 241-T-301B and diversion box 241-C-252 will be consistent with that described for the 100-series tanks and associated ancillary equipment. The diversion box and associated piping are defined as ancillary equipment. The major activities associated with Sector 2 waste retrieval and closure include:

- Retrieve tank waste
- Retrieve waste (if required) from catch tank 241-T-301B
- Remove/dispose TRU packaging equipment
- Characterize sector components to the extent required
- Isolate sector (external isolation)
- Isolate sector components (internal)
- Fill tanks with grout
- Close pits, risers, and diversion boxes, as required
- Prepare site for closure.

The closure of ancillary equipment that is part of a RCRA-regulated tank system slated for closure will be described in attachments to RPP-13774.

Figure 4-5. Contact-Handled Transuranic Mixed Waste Packaging System.



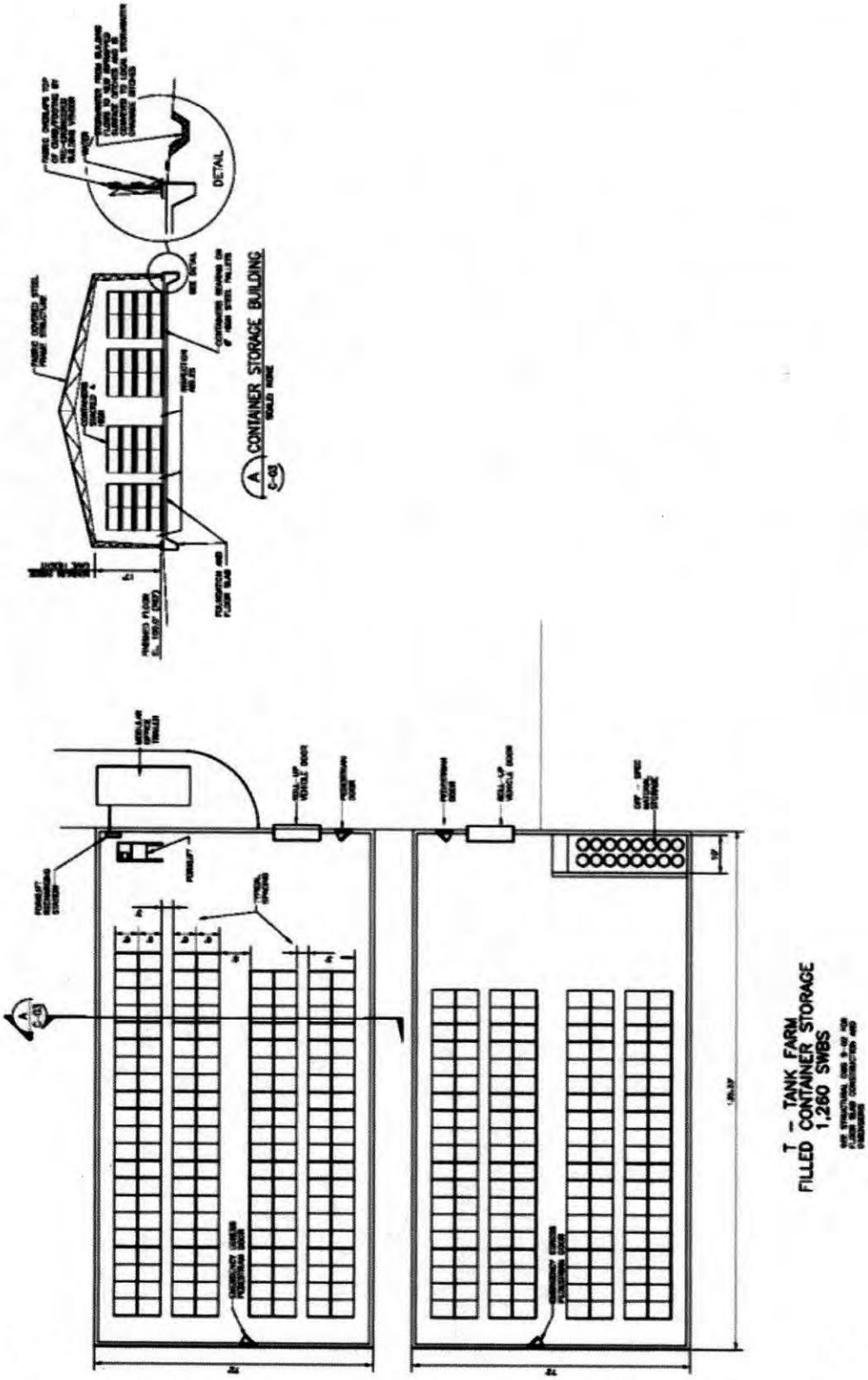


Figure 4-6. Contact-Handled Transuranic Mixed Waste Temporary Storage Facility Layout.

Closure of external transfer pipelines outside of the WMA are defined within a CERCLA OU and are subject to that documentation and review process. Strategies and priorities for closing ancillary equipment are now emerging that address inter-relationships outside the SST system and may be subject to different closure actions or remedies.

The primary documents and actions that will direct the conduct of activities to close ancillary equipment are:

- DOE completes NEPA review (ROD is issued for the TC-EIS).
- DOE submits Closure Activity Plan along with supporting SEPA Checklist to Ecology.
- Ecology issues permit modification along with SEPA determination of no significance.
- DOE requests and the state issues the appropriate Notices of Construction for radioactive and non-radioactive emissions, if necessary.

Tank farms typically have multiple external transfer pipelines coming into the system (see Section 6.2, Figure 6-1). Within Sector 2 there are two waste transfer lines, V-706 and V-707, that connect to diversion box 241-T-252 diversion box. To affect the closure of a WMA, it is necessary to isolate those segments of pipeline to be placed under the final closure barrier from those that will be closed under OU 200-IS-1. The segmentation between 200-IS-1 and the WMA will be established at or near the perimeter of the final barrier with consideration given to hydraulic isolation. This partitioning will place segments of the pipeline associated with the WMA under a barrier and allow remedial actions to be implemented on the 200-IS-1 segments without being constrained by the barrier. These external transfer pipelines interface with the closure sector at the diversion box. For Sector 2, the interface point is diversion box 241-T-252.

DOE/ORP-2003-22 was submitted to Ecology under the provisions of RCRA and the "Hazardous Waste Management Act," and applicable implementing regulations. The Closure Plan addresses hazardous and dangerous waste only and does not address closure actions that DOE may take under its sole authority under the *Atomic Energy Act of 1954*. Therefore, the plan may provide information or discuss materials regulated by DOE under its *Atomic Energy Act of 1954* authority for informational purposes only and not for the purposes of regulating the radiation hazards of such material.

Because the treatment, packaging, and storage activities associated with the CH-TRUM packaging system and container storage areas will be controlled, the areas are not anticipated to become extensively contaminated by dangerous waste regulated by Ecology. Clean closure is the goal for the CH-TRUM packaging system and container storage areas.

DOE/ORP-2003-22 identifies the steps and procedures necessary to complete closure activities for the CH-TRUM packaging system and container storage areas. This includes the removal of dangerous and mixed waste and the decontamination and removal of the permitted units, ancillary equipment, and containment systems. Closure activities will entail decontamination and/or removal and disposal of the structure and all equipment. The general order of closure activities has been selected to minimize the potential release of mixed-waste constituents by

removing the bulk of the mixed-waste early in the closure process. As currently envisioned, the activities to achieve clean closure will be conducted in three phases:

- **Phase 1** – System deactivation; the decontamination and/or removal of contaminated process components, structural components and all surfaces; inspection of tank systems and ancillary equipment to verify that the clean debris surface standard and/or designation limits are met (if these standards are not met, the equipment may be identified for removal, dismantling, reduction (as needed) and disposal); and trailer and concrete containment decontamination. The trailer will be removed from the site. Concrete containment structures may be left in place if decontamination is documented to be complete.

- **Phase 2** – The collection of liquid and solid decontaminants and transfer to an appropriate on-site or off-site disposal unit based upon characterization of the material.

- **Phase 3** –Either re-use of the CH-TRUM packaging system for other similar wastes (i.e., LLW stream) or the dismantling, demolition, and/or transportation of any removed components to an identified disposal site.

4.10.2 Characterization

The WMA T database presents information on the configuration, location, and inter-relationships of diversions boxes. This database also provides process history information about ancillary equipment that will aid in the characterization process. The general approach to characterization is discussed in Section 2.3.

While the waste volume in the diversion boxes is expected to be small in comparison to the SST waste residue inventory, the inventory may prove difficult to define. Substantial mechanical and worker safety issues are associated with accessing the interior of the boxes. In the event it is determined that it is necessary to perform intrusive sampling of any diversion box, the sampling and analysis requirements will be developed pursuant to a DQO/sampling and analysis plan process in recognition of the challenges of accessing the interior of the diversion box and safety issues.

To clean close the CH-TRUM packaging system and container storage areas, it will be necessary to demonstrate that dangerous waste has not been left onsite at levels above the closure performance standard for removal and decontamination.[11] If it is determined that clean closure is

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[11] A sampling and analysis plan will be prepared to evaluate the extent of any contamination and the effectiveness of decontamination at the CH-TRUM packaging system locations and specific components within the systems, as well as the container storage area structures and pads, as required. The sampling and analysis plan describes the approach to be followed for confirming that decontamination and/or removal activities have attained the clean closure performance standard and identifying where clean closure debris surface standards cannot be met (e.g., tank interior and piping surfaces). Source, special nuclear and byproduct materials as defined by the *Atomic Energy Act of 1954*, are excluded from the RCRA definition of solid waste. Such materials at Hanford are subject to management under the sole authority of DOE, even when commingled with a hazardous component that is subject to regulation under the "Hazardous Waste Management Act." Accordingly, any procedures, methods, data, or information provided to regulatory agencies contained in this document that relate solely to radionuclides or to the

not possible or is environmentally impractical, the closure plan will be modified to address required post-closure activities.

4.10.3 Integration

Both waste retrieval and closure activities on each tank can be integrated with planned activities for diversion box 241-T-252 and catch tank 241-T-301B. Integration includes coordination of isolation activities before a given tank closure so as not to preclude the subsequent removal or closure needs of another tank in a series, connecting pipeline, or an associated ancillary structure. The TRU packaging equipment should be removed to facilitate filling tanks the diversion box and catch tank.

The catch tank should be the last component closed and follow Sector 3 in the closure sequence because it is hydrologically connected and downgradient of Sector 3.

4.10.4 Status

The WMA T 200-series tanks process history has been reviewed and it has been determined that the tanks contain TRU waste that could be retrieved and packaged by the CH-TRUM packaging system for off-site disposal at the Waste Isolation Pilot Project.

4.11 SECTOR 3 SEQUENCING

Sector 3 includes five diversion boxes (241-T-151, 241-T-152, 241-T-153, 241-TR-152 and 241-TR-153 with associated French drain and booster pump); external piping; and six UPRs (UPR-200-W-7, 200-W-78, 200-W-79, UPR-200-W-29, UPR-200-W-64 and UPR-200-W-97. The steps involved in preparing this sector for closure include:

- Characterize sector components (including UPRs) to the extent required
- Isolate external piping
- Isolate sector components (internal isolation)
- Close diversion boxes as required
- Implement interim measures for UPRs, as required
- Prepare site for closure.

Figure 4-7 shows the major components in this sector.

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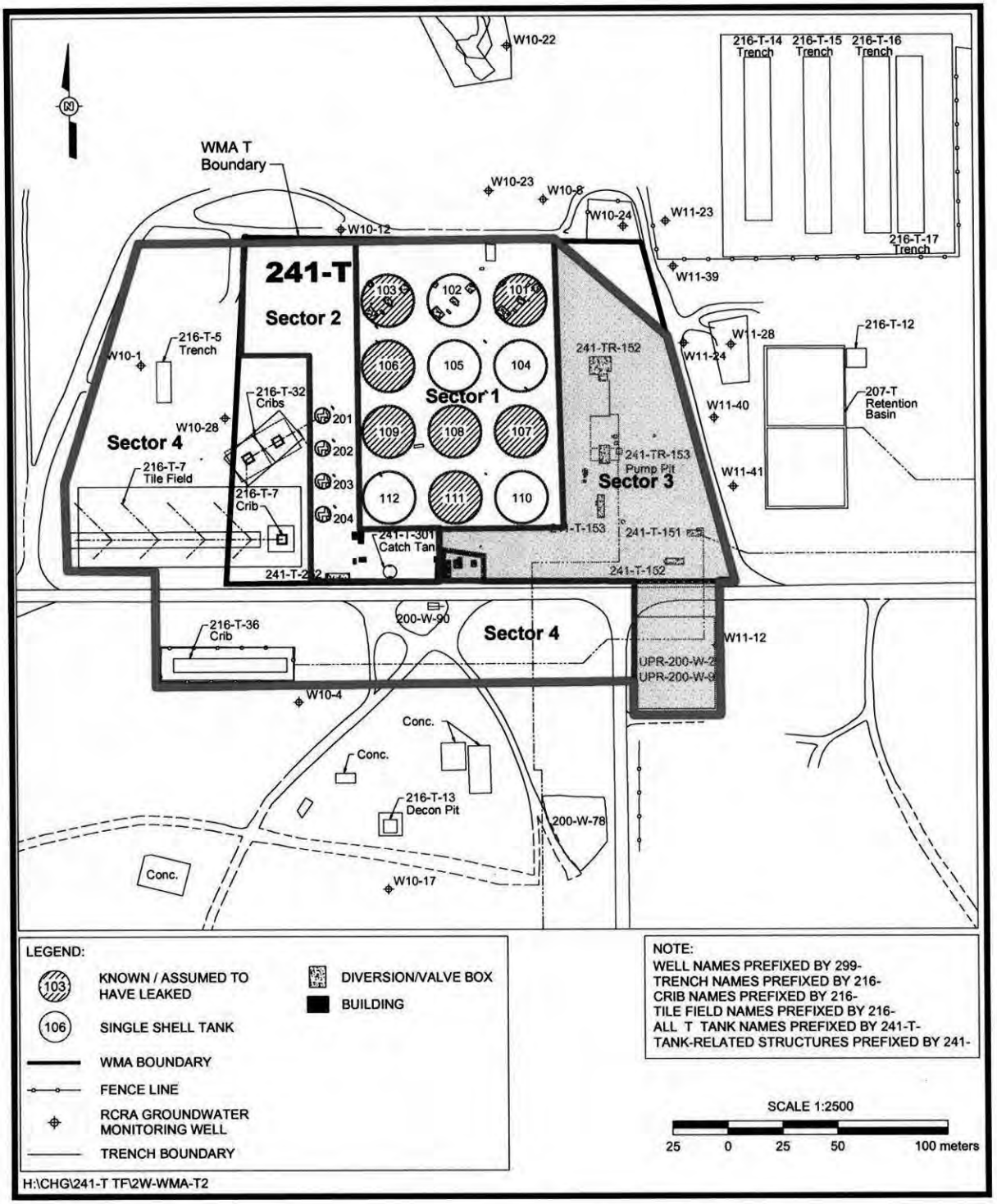
radioactive component of mixed waste are provided for information purposes only and not for purposes of regulating the radiation hazards of these materials. Radionuclides when they are contaminants of concern may be regulated pursuant to CERCLA cleanup actions. The radionuclides discussed in the sampling and analysis plan are regulated pursuant to the *Atomic Energy Act of 1954* and CERCLA in accordance with responsible agency protocols.

Figure 4-7. Sector 3 Components.



Diversion boxes exist in varying sizes and configurations, reflecting the range of functions for which they were designed. Grouping of diversion boxes for closure according to proximity and similarity promotes efficient, coordinated closure actions, and will facilitate integration of regulatory processes. The following is a summary of the diversion boxes in this sector.

Diversion box 241-T-151 supported transfers for the 100-series tanks and has a 6-in. schedule 40 steel drain line (V664) which is routed from the diversion box low point (elevation 203 m [667 ft]).

The diversion box 241-T-152 supported transfers for the 100-series tanks and has a 6-in. schedule 40 steel drain line (V664) which is routed from the diversion box low point (elevation 203 m [667 ft]).

Diversion box 241-T-153 supported transfers for the 100-series tanks and has a 6-in. schedule 40 steel drain line (V664) which is routed from the diversion box low point (elevation 202 m [661 ft]). This drain line is combined with the drain line from diversion boxes 241-T-151 and 241-T-152. The combined drain line (V664) is routed to the east sidewall penetration of catch tank 241-T-301B (elevation 200 m [656 ft], approximately 4 m [14 ft] below grade level).

Diversion box 241-TR-153 (a.k.a., Booster Pump Pit) housed two 50 Hp booster pumps (P-TR-153-1 and P-TR-153-2) that supported sluicing operations/transfers. This diversion box and these pumps had several other pieces of equipment:

- Pump P-TR-153-1 supported transfer operations out of tanks 241-T-101 and 241-T-102 using line 6160, and provided the waste stream to the 241-TXR-151 'master diversion box,' via line 6012. During the saltwell campaign in the 1970s, line 6012 as it entered the south side of T tank farm, was rerouted to tanks 241-T-101, 241-T-104 and 241-T-105. The section of line between where the tie-in occurred and 241-TR-153 was isolated and abandoned in-place.

- Pump P-TR-153-2 received waste from 241-TXR-151 (line 7630) and supported sluicing/transfer operations in tanks 241-T-101, 241-T-102 and 241-T-103, via line 6165. The power for these booster pumps was fed from the 480-volt motor control center (MCC) located on the north side of T tank farm.

- Instrument panel, gantry crane, evaporative cooler, an exhaust fan and stack associated with providing cooling to the pumps, a seal water pump that was housed in the seal water pump house located on the east side of the diversion box. The floor drain in diversion box drains to tank 241-T-102. The control panel, the seal water pump house, the evaporative cooler, exhaust fan and stack and the gantry crane have been removed.

Cascade diversion box 241-TR-152 supported sluicing operations/transfers. The floor drain in the 241-TR-152 cascade diversion box drains to tank 241-T-101 via line 6053. Line 6053 goes into the 241-TR-01C cascade sluice pit and the outlet drains through the floor drain in the pit into tank 241-T-101.

4.11.1 Approach

The regulatory approach for the retrieval and closure of diversion boxes and other ancillary equipment is consistent with that described for the SSTs and diversion box 241-T-252 in Sector 2 (see Section 4.10.1). The soil remediation strategy for UPRs is carried out under RCRA past-practices investigations and is discussed in Section 5.0.

4.11.2 Characterization

The same approach to characterization described for diversion box 241-T-252 in Sections 2.9.2 and 2.3 would be applied to these diversion boxes and ancillary equipment.

4.11.3 Isolation

Diversion boxes will be isolated to prevent intrusion of wastes or inadvertent infiltration of other liquids (e.g., rain water, snow melt). Additionally, pipelines (including external transfer lines) connected to diversion boxes undergoing closure will be isolated to eliminate pathways that would allow inadvertent introduction of waste or other liquids into a diversion box. In some cases, isolation actions may be reversible to ensure that future closure activities are not precluded. Isolation may be accomplished through physical and/or administrative actions.

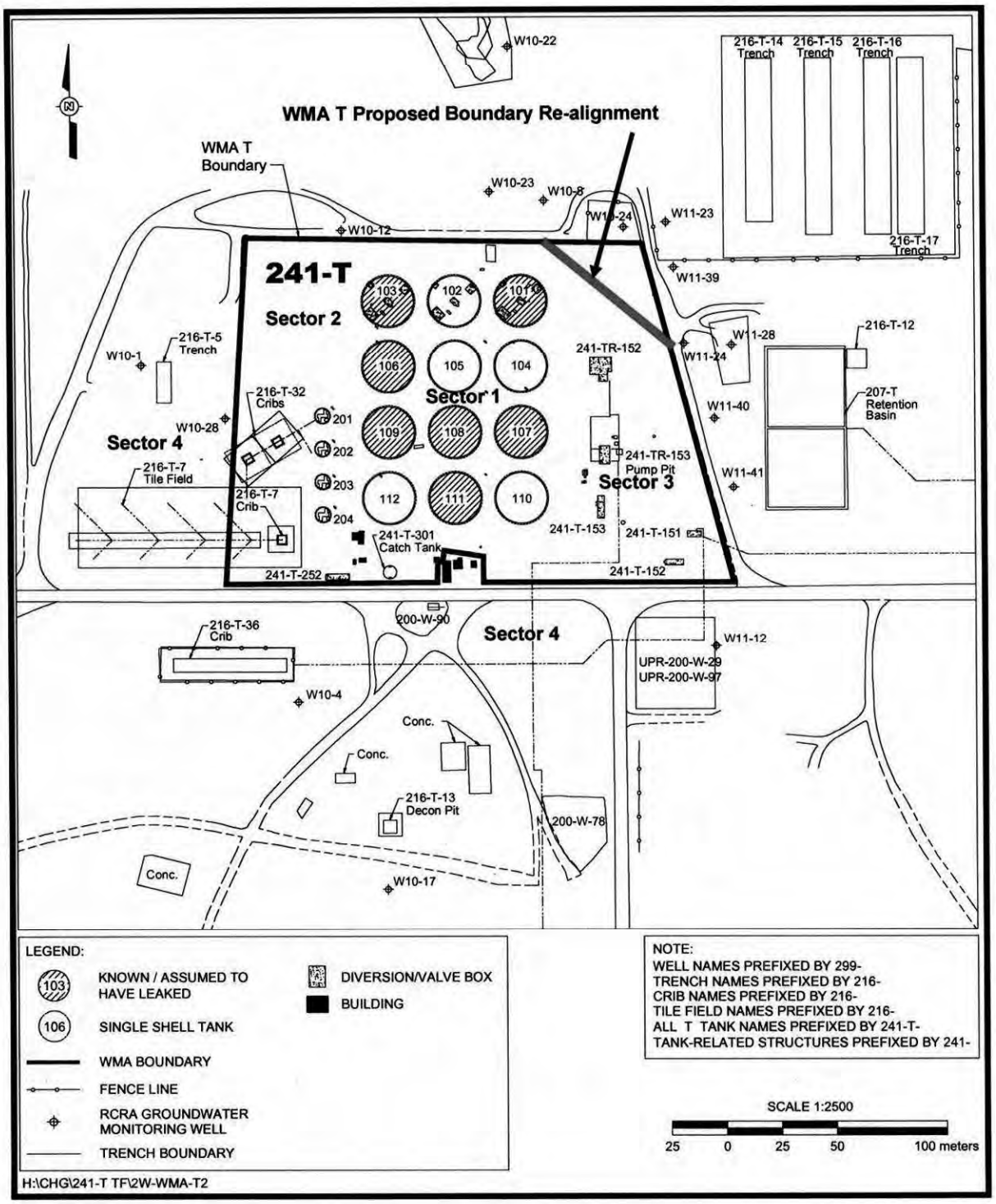
RPP-13774 will be revised to incorporate decisions concerning the design and anticipated timing of construction of the final closure action(s).

4.11.4 Integration

Recently collected data have indicated that there are elevated concentrations of technetium-99 in groundwater monitoring wells in the northeast area of Sector 3. Ecology and the U.S. Environmental Protection Agency (EPA) have requested DOE to conduct further evaluations in this area (see Section 6.0). Developing a solution to this problem is part of the RI/FS process for 200-ZP-1 and may extend beyond the timeframe for closure of WMA T. Furthermore, there are two un-numbered pipelines that transect the northeast corner of WMA T that are not part of the WMA T SST system. One line connects the 221-T with the T-4 pond north of WMA T. The other pipeline connects the 207-T retention basin with the T-4 pond. These lines enter WMA T at a manhole located just inside the east fenceline. Both of these lines should be included in 200-IS-1.

Based upon this information it is recommended that the boundary for WMA T in the northeast corner be re-aligned so as to exclude these from the closure process of WMA T. Figure 4-8 presents a proposed re-alignment of the WMA T boundary to accomplish this segregation.

Figure 4-8. Waste Management Area T Proposed Boundary Re-alignment.



The currently identified approach is to integrate closure of ancillary equipment within a WMA. A RCRA corrective action process for non-tank-like components (e.g., transfer lines, valve pits, diversion boxes, contaminated soils) and either a RCRA component closure process or a CERCLA decontamination and decommissioning process for surplus facilities could be applied.

The currently identified approach is to integrate closure of Sector 3 with Sector 2 such that all pre-barrier construction activities in Sector 3 would be completed ahead of pre-barrier construction activities in Sector 2.

4.11.5 Status

There are currently no closure activities under way in Sector 3.

4.12 SECTOR 4 SEQUENCING

Sector 4 includes three cribs (216-T-32, 216-T-36, and 200-W-52 crib [a.k.a. 216-T-7 crib]); trench 216-T-5; tile field 216-T-7; internal piping; and two UPRs (200-W-79 and 200-W-90).

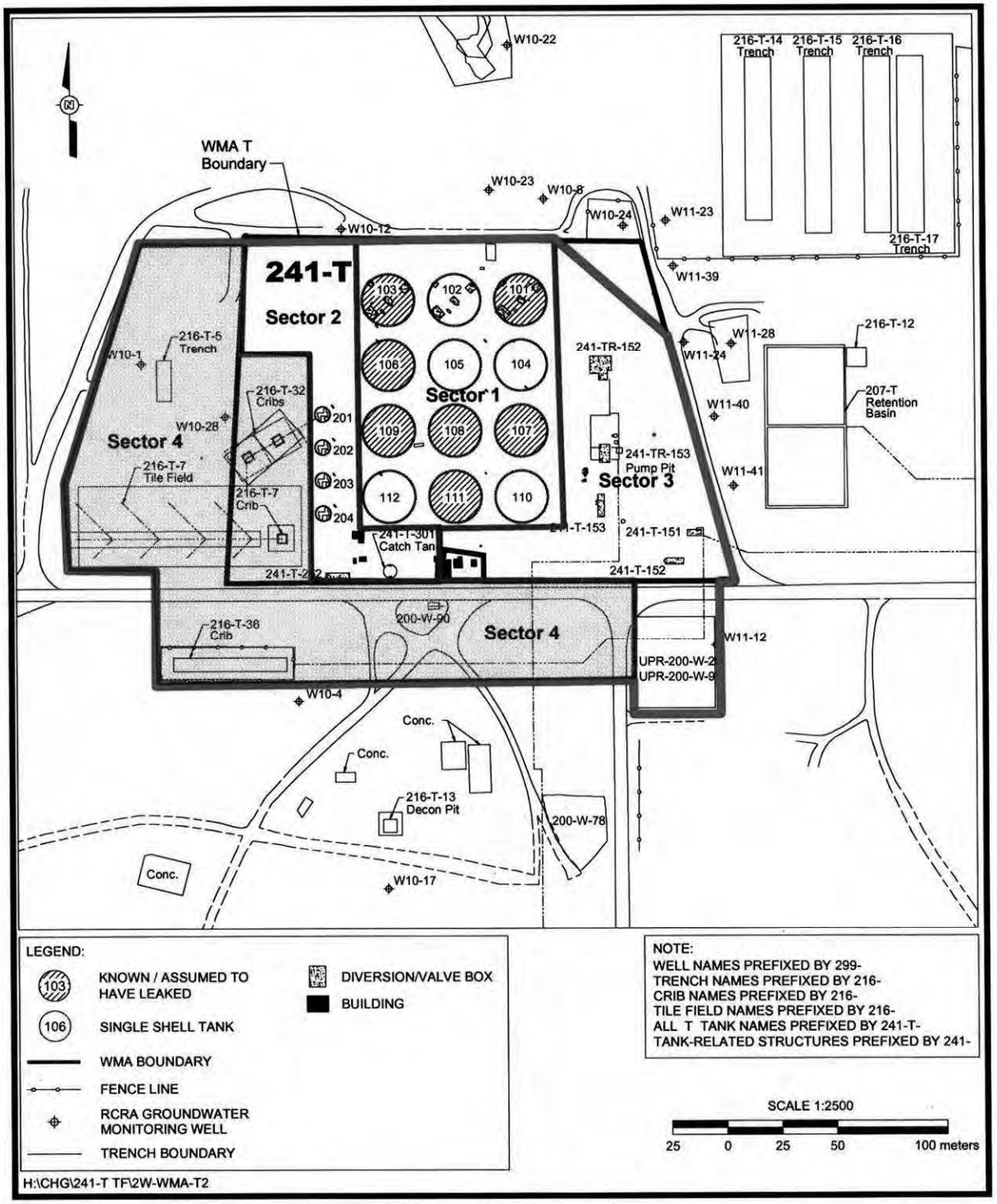
These waste site would be prepared for closure following these steps:

- Characterize sector components to the extent required
- Remediate cribs and tile field, as required
- Prepare site for closure.

The components included in Sector 4 are shown in Figure 4-9 and described below.

The 216-T-32 crib is located west of tank 241-T-202. The 216-T-32 crib consists of two sumps that are 4 m (12 ft) long by 4 m (12 ft) wide by 1 m (4 ft) high. Each sump is made up of 15 cm (6 in.) by 15 cm (6 in.) by (12 ft) timbers that are in a 4 by 4 m (12 by 12 ft) frame. The tops of the sumps are covered with 16 cm (6 in.) by 16 cm (6 in.) by 4 m (12 ft) timbers. The top of the sumps are buried approximately 6 m (20 ft) below grade. A 3-in. stainless steel pipe, sloping towards the sumps, runs from the N-4 sidewall penetration nozzle on tank 241-T-201 out to a 'T' at the first sump and then continues on to the second sump. Each sump previously had a vent pipe associated with it that was installed from the sump to about 2 m (8 ft) above grade. The vent pipes have been removed, but the sumps have not been removed and per design have void space in them. The 216-T-32 crib has no drain field associated with it.

Figure 4-9. Sector 4 Components.



The 200-W-52 crib (a.k.a. 216-T-7 crib) is located southwest of tank 241-T-204. The 200-W-52 crib consists of a single sump that is 4 m (12 ft) long by 4 m (12 ft) wide by 7 ft high. The sump is made up of 15 cm (6 in.) by 15 cm (6 in.) by (12 ft) timbers that are in a 4 by 4 m (12 by 12 ft) frame. The top of the sump is covered with 15 cm (6 in.) by 15 cm (6 in.) by (12 ft) timbers. The top of the sump is buried approximately 6 m (19 ft) below grade. A 3-in. steel pipe runs from riser connections (riser 6 except for tank 241-T-112) at tanks 241-T-105, 241-T-106, 241-T-110, and 241-T-112 (riser 3) and sidewall nozzle 5 on tank 241-T-112 that connects to a 3-in. stainless steel pipe that continues on to the sump (enters the east side of the sump). The sump has a 12-in. concrete or vitrified clay pipe that exits on the west side of the crib, which provides the flow path to the drain/tile field.

The 216-T-7 tile field has 12-in. and some 10-in. concrete or vitrified clay pipe that extends approximately 91 m (300 ft) west of the crib (slopes away from the crib and is located approximately 7 m (22 ft) below grade. The sump previously had a vent pipe associated with it that was installed from the sump to about 2 m (8 ft) above grade. The vent pipe has been removed, but the sump has not been removed and per design has void space in it.

The 216-T-5 trench is located west of the T tank farm (west of tanks 241-T-106 and 241-T-109). The 216-T-5 trench was put in service for receipt of waste from tank 241-T-112. The 216-T-5 trench received approximately 132,000 L (350,000 gal) of waste in 1955 and has not been active since that time. It is assumed an overground transfer line from tank 241-T-112 was used to fill the trench (no underground transfer lines to the trench have been found).

The 216-T-36 crib is located south of the T tank farm (almost directly south of the 200-W-52 crib). The 216-T-36 crib consists of approximately 46 m (150 ft) of 4-in. vitrified clay distributor pipe. The distributor pipe was placed on about 1.4 m (4.5 ft) of gravel (approximately 4 m [12 ft] wide) and covered with a membrane barrier. The distributor pipe is approximately 3 m (10 ft) below grade. There was a vent on the crib that came above grade to a filter. The filter has been removed and the vent pipe is sealed above grade. In the middle of the crib a gage well was placed for monitoring the level of waste/fluid within the crib. The gage well has been sealed. The pipe line feeding the crib originates in the 241-T-151 diversion box. A 3-in. stainless steel pipe (V-663 from nozzle L-8) goes south of the diversion box and then turns west. After about 4 m (12 ft) of pipe in the west direction the line has a 8 by 10 cm (3 by 4 in.) reducer and the stainless steel pipe is mated up to the 4-in. vitrified clay pipe. The joint to the vitrified clay pipe was cemented with a resin cement and packed with an acid proof rope. The 198-m (650-ft) vitrified clay pipe ran between the stainless steel 3-in. pipe and the 4-in. vitrified clay distributor pipe. The original installation called for a gravity test of the crib waste line with 3 m (10 ft) of head for 30 minutes. All visible leaks were to be repaired and the crib line retested.

4.12.1 Approach

Sector 4 closure components consist of waste sites and UPRs. The waste sites, cribs and trenches will be remediated under CERCLA as part of the 200-TW-2 OU as discussed in Section 6.0. The remediation strategy for UPRs is carried out under RCRA past-practices investigations and is discussed in Section 5.0.

4.12.2 Characterization

Before closure, the historical knowledge of the waste sites located in Sector 4 would be reviewed to determine if further characterization would be necessary consistent with the approach described in Section 2.3. The following is a summary of the historical information on these waste sites that is available from the WIDS.

216-T-32 Cribs – Operated from November 1946 to May 1952. They were deactivated due to the buildup of sludge in tanks 241-T-201 through 241-T-204.

200-W-52 Crib (a.k.a. 216-T-7 Crib) – Was active from April 1948 to November 1955 when it reached the prescribed radiological disposal guide limit. The effluent from the 221-T Canyon and the 224-T Building were rerouted to 216-T-19. Due to the lack of waste storage space in the tank farms, second-cycle waste from the bismuth phosphate fuel separation operations, which had been stored in the tank farms, began to be released to cribs and specific retention trenches in 1948. The extracted plutonium went through two decontamination cycles to further purify it. The first cycle waste was combined with the coating waste. It contained 10% of the fission products and 1% of the plutonium. The second decontamination cycle waste contained less than 0.1% of the fission products. The 200-W-52 crib received second cycle supernate from 221-T, 224-T waste and tank 5-6 waste after it cascaded through tanks 241-T-110, 241-T-111, and 241-T-112. The 216-T-7 tile field received overflow from the crib. The crib and tile field are connected by underground piping.

216-T-7 Tile Field – Began operation in April 1948 and was deactivated in November 1955 when it reached the prescribed radionuclide disposal guide limit of the 200-W-52 crib and tile field. In 1992, a 0.8 hectare (2 acre) area between a gravel road and the west side of the T tank farm was posted as a contaminated area. The area included the 216-T-5 crib and the 216-T-7 tile field. Only two areas of contamination were identified within the posted area.
One contaminated area loosely followed the outline of the 216-T-5 crib. The other area measured approximately 3 by 3 m (10 by 10 ft) and was located adjacent to the northwest corner of the T tank farm fence. Both contaminated areas were covered with 0.61 m (2 ft) of clean dirt and posted with URM signs. The surface of the 216-T-7 tile field was surveyed.
No contamination was identified and the tile field was posted with URM signs. The remainder of the area was surveyed and sampled and the radiological posting was removed.

216-T-36 Crib – Started operation in May 1967. While the date the crib was taken out of operation is unclear, available documentation indicates its use stopped sometime between 1970 and 1973. The May 2000 Integrated Site Vegetation and Animal Control Priority List and the Contamination Zone map identify a long, narrow area of posted contamination adjacent to the east side of the 216-T-36 crib (#12 on list). The posted area appears to be located over the buried pipeline that fed the crib (see WIDS 200-W-79).

4.12.3 Isolation

The pipeline to the 216-T-32 crib was blanked east of diversion boxes 241-T-151 and 241-T-152. The effluent was rerouted to the 200-W-52 crib. The 216-T-32 cribs surface was stabilized with gravel, along with the rest of the T tank farm, in 1992.

The pipeline to the 200-W-52 crib (a.k.a. 216-T-7 crib) has been capped. The crib surface was stabilized with gravel, along with the rest of the T tank farm, in 1992.

The pipeline to the 200-W-52 Crib (a.k.a. 216-T-7 Crib) which feed the 216-T-7 tile field has been capped and the effluent was rerouted to the 216-T-19 crib.

216-T-5 trench was deactivated when the specific retention capacity was reached. The aboveground piping was removed and the trench was backfilled.

216-T-36 crib is an interim stabilized crib and is posted as URM, and includes a single vitreous clay distribution pipe resting in a gravel layer that is in a rectangular trench. Backfill covers the pipe and gravel. In July 2000, the vent risers on the crib were sealed as a preventative measure for potential passive radioactive emissions. In November 2000, a bio-barrier and a layer of clean gravel was placed over the contamination area on the pipeline east of the crib and the area was down-posted to an URM area.

4.12.4 Integration

The 200-W-52 crib (a.k.a. 216-T-7 crib) and the 216-T-7 tile field were an integral system. Since the crib is located inside the T tank farm fence and the tile field is located outside the fence, surveillance and maintenance responsibilities have been divided between ORP and RL. The crib was given a separate WIDS site code in 1997 and is the responsibility of ORP. Surveillance and maintenance responsibility for the tile field was assigned to RL.

4.12.5 Status

There are currently no closure activities under way in Sector 4.

5.0 INTEGRATION WITH VADOSE ZONE/SOIL

This section provides an overview of the closure process associated with the vadose zone/soil and UPRs associated with WMA T. The section also describes the status of current closure activities, and proposes approaches to closure activities.

5.1 INTEGRATION OF THE WASTE MANAGEMENT AREA T SOIL COMPONENT CLOSURE PROCESS

There are 12 soil waste sites/UPRs in or adjacent to WMA T that are being addressed through the RFI/CMS process summarized in Section 3.2.3. Soil characterization and corrective measures activities associated with these UPRs will need to be integrated as appropriate with ancillary equipment and groundwater component closure activities and with the Ecology, EPA, and DOE Central Plateau regional closure strategies currently under development.

It is expected that the Phase I corrective action process required by the specified HFFACO milestones will result in adequate characterization to make final closure decisions. Additional characterization either through a Phase II corrective action process or through the development of a component closure activity plan may also be required at a later date. It is expected that in some cases, the RCRA corrective action process will be used to investigate and analyze alternatives for remediation of selected soils and associated ancillary equipment.

After regional closure strategies are finalized, the WMA T closure plan will be revised and the Site-Wide Permit modified in accordance with WAC 173-303-830. The coordination between WMA T closure activities and adjacent Central Plateau closure activities is described in Section 6.0.

5.1.1 Status of Current Soil Component Closure Activities

The presence of contaminants in the vadose zone requires both characterization and a determination of the potential for resultant environmental impacts, which may provide a basis for remediation or closure. The *Site-Specific Single-Shell Tank Phase 1 RCRA Facility Investigation/ Corrective Measures Study Work Plan Addendum for Waste Management Areas T and TX/TY* (RPP-7578) describes planned vadose zone characterization for WMA T. Phase I field investigations for WMA T were initiated in 2003 and the field investigation report is to be completed by July 31, 2005. The investigation included drilling two vertical boreholes to establish the distribution of contaminants at depth in the vicinity of tank 241-T-106.
An evaluation of the adequacy of Phase I field investigations for all WMAs will be documented in a Phase I RFI rollup report due on January 31, 2007. If it is determined that additional characterization is necessary, then a work plan to direct Phase II field investigations would be issued on September 30, 2007.

Recently it was determined that groundwater concentrations of technetium-99 in the northeast corner of WMA-T were increasing. In response to this information Ecology and EPA requested RL and ORP to develop a detailed plan for characterization and remediation of WMA T and associated groundwater ("Plan for Action on the T Single-Shell Tank Farm Waste Management Area and 200-ZP-1 Groundwater Operable Unit" [Wilson and Ceto 2005]). The nature and extent of the contamination plume is to be determined on an urgent basis.

In response to Ecology and EPA, DOE is developing plans for further groundwater characterization efforts. Data collection efforts will use high-resolution resistivity surveys that will be taken across WMA-T and will include soil disposal units adjacent to the WMA. Field work is scheduled to start in May 2005 with a report due September 30, 2005. These data will be used to re-design the groundwater monitoring assessment program to monitor the technetium-99 plume.

5.1.2 Approach to Remaining Soil Component Closure Activities

A CMS is scheduled to be released by June 30, 2007 and a corrective measures work plan will be issued by September 30, 2007. To date, a schedule for implementation of corrective measures has not been established. However, it is recognized that corrective measures associated with soil remediation must be completed according to the HFFACO milestones for the closure of the tank farm. In the event that a Phase II field investigation for WMA T is determined necessary, the release of the CMS would likely be delayed accordingly unless there are corrective measures that could be implemented concurrent with the additional characterization efforts.

6.0 INTEGRATION WITH CENTRAL PLATEAU

In addition to integrating activities within WMA T, it is important to understand the issues involved in WMA T closure integration with the closure of the Central Plateau. The interfaces between the Central Plateau and WMA T must be clearly accounted for in closure planning. The interactions and interfaces between WMA T closure and other Central Plateau remediation and closure actions include waste sites, pipelines, and groundwater. Proposed integration strategies for waste site remediation, pipeline interface definition and remediation, and groundwater decision making and remediation are presented in the following sections. The intent of these strategies would be to ensure that the WMA T closure is closely coordinated with other actions on the Central Plateau and leads to consistency in the actions taken, clarity in the responsibilities for these actions, and completeness in the coverage of all actions that must be taken. Fundamental to the integration between WMA T and the Central Plateau would be a strategy that allows ORP and RL to understand their respective processes to ensure that decisions and strategies will accommodate structures and facilities at the interface areas and be complementary.

6.1 PHYSICAL BOUNDARIES AND INTERFACES

The boundaries for WMAs have been defined for purposes of groundwater monitoring (see Section 2.0). Because there are waste sites and tank farm system components that exist in both WMA T and the Central Plateau, there is a need to clarify the boundaries in the context of WMA/Central Plateau closure that go beyond the requirements for groundwater monitoring. The interface between WMA T (ORPs responsibility)and the T farm closure zone (RLs responsibility) includes waste sites that require a determination of the program overseeing closure.

Table 6-1 lists waste sites or structures that currently lie outside of WMA T, but reside within the T farm closure zone and are considered to be part of the WMA T Integration Study area. Table 6-1 also presents a proposed rationale for the disposition of each site or structure (i.e., whether it is to be integrated with WMA T closure actions or whether a non-WMA process will address its closure). This proposed rationale has not been adopted by DOE and will require further coordination and development between ORP and RL.

The integrating rationale for a site that is outside the WMA T fenceline to be considered for inclusion in the WMA T Integration Study area is that its physical proximity to WMA T may make it cost-effective for the final closure barrier to cover/close it.

RL is currently developing a Central Plateau-wide disposition strategy for surplus facilities (e.g., buildings and structures) that will establish logical categories of facilities and decision pathways for each category. ORP is participating in the development of the RL process to ensure that the decision strategy will accommodate structures and facilities within WMA T.

Table 6.1. Disposition Pathway for Waste Sites and Structures Outside of T Farm. (2 Sheets)

Site Name	Description	Current Operable Unit (Ownership)	Recommended Disposition Pathway	
			Decision Pathway	Remediation or Closure Integration Issues
200-W-52	216-T-7 Crib	200-TW-2 (CH)	Retain with 200-TW-2 for regulatory decision making	Coordinate with WMA T final closure (Sector 4)
216-T-32	Cribs	200-TW-2 (CH)	Retain with 200-TW-2 for regulatory decision making	Coordinate with WMA T final closure (Sector 4)
200-W-93	Consolidated UPR inside WMA T (includes UPR-200-W-7, UPR-200-W-147, and UPR-200-W-148)	RCRA Corrective Action (CH)	Retain with RCRA Corrective Action process for tank farms.	Coordinate with WMA T final closure (Sector 1 for -147 and -148; Sector 3 for -7)
216-T-7	Tile Field	200-TW-2 (FH)	Retain with 200-TW-2 for regulatory decision making	Coordinate with WMA T final closure (Sector 4)
216-T-5	Trench	200-TW-2 (CH)	Retain with 200-TW-2 for regulatory decision making	Coordinate with WMA T final closure (Sector 4)
200-W-78	Pipeline Between 241-TX/TY and 241-T Tank Farms	200-IS-1 (CH)	Retain with 200-IS-1 for regulatory decision making	Coordinate with WMA T final closure for portions of line within WMA T (Sector 3)
200-W-53	Unplanned release	200-UR-1 (CH)	Retain with 200-UR-1 for regulatory decision making	Independent from WMA T
UPR-200-W-29 (27)	Transfer Line Leak at 23rd and Camden (duplicate of UPR-200-W-27)	200-IS-1 (CH)	Retain with 200-IS-1 for regulatory decision making	Coordinate with WMA T final closure (Sector 3)
UPR-200-W-97 (62)	Transfer Line Leak at 23rd and Camden (duplicate of UPR-200-W-62)	200-IS-1 (CH)	Retain with 200-IS-1 for regulatory decision making	Coordinate with WMA T final closure (Sector 3)
UPR-200-W-64	Road Contamination at 23rd and Camden	200-IS-1 (CH)	Retain with 200-IS-1 for regulatory decision making	Coordinate with WMA T final closure (Sector 3)
200-W-79	216-T-36 Crib pipeline	200-SC-1 (FH)	Retain with 200-SC-1 for regulatory decision making	Coordinate with WMA T final closure for portions of line within WMA T (Sectors 3 & 4)
200-W-90	Underground Radioactive Material Areas posted along 23rd Street	200-UR-1 (FH)	Retain with 200-UR-1 for regulatory decision making	Coordinate with WMA T final closure (Sector 4)

Table 6.1. Disposition Pathway for Waste Sites and Structures Outside of T Farm. (2 Sheets)

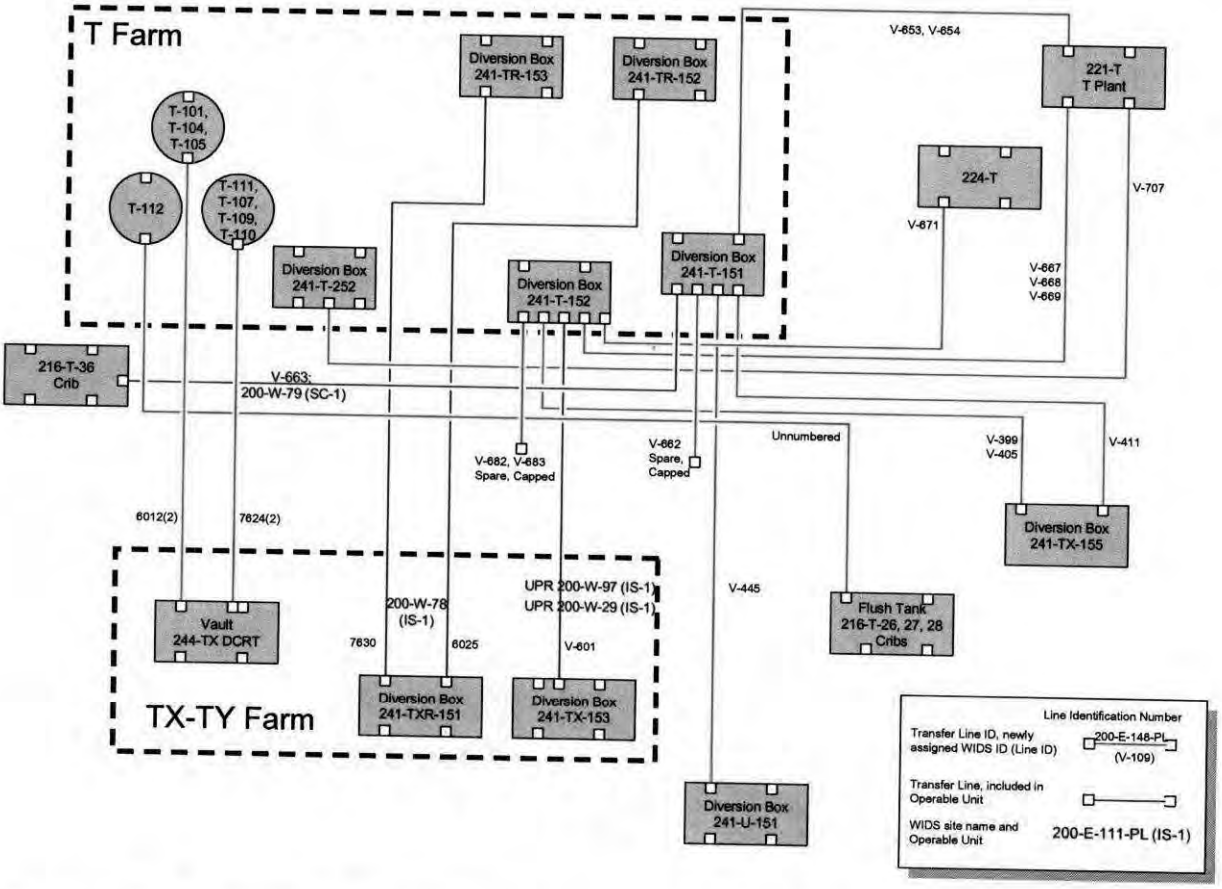
Site Name	Description	Current Operable Unit (Ownership)	Recommended Disposition Pathway	
			Decision Pathway	Remediation or Closure Integration Issues
216-T-36	Crib	200-SC-1 (FH)	Retain with 200-SC-1 for regulatory decision making	Coordinate with WMA T final closure depending on remedy selection. (Sector 4)
207-T	T Plant Retention Basin	200-CW-4 (FH)	Retain with 200-CW-4 for regulatory decision making	Independent from WMA T
UPR-200-W-14	Waste line leak between 207-T retention basin and 242-T evaporator.	200-UR-1 (CH)	Retain with 200-UR-1 for regulatory decision making	Independent from WMA T
UPR-200-W-166	Contamination Migration from 241-T Tank Farm	200-UR-1 (FH)	Retain with 200-UR-1 for regulatory decision making	Independent from WMA T
216-T-12	Sludge Pit, Trench with 207-T	200-CW-4 (FH)	Retain with 200-CW-4 for regulatory decision making	Independent from WMA T
216-T-14 through 216-T-17	Trenches or Cribs	200-TW-2 (FH)	Retain with 200-TW-2 for regulatory decision making	Independent from WMA T

RCRA = *Resource Conservation and Recovery Act of 1976.*
UPR = unplanned release.
WMA = waste management area.

6.2 PIPELINE INTERFACE AND DISPOSITION STRATEGY

The WIDS currently identifies 4 waste sites associated with pipelines that cross the WMA T fence line: 200-W-78, 200-W-79, UPR-200-W-27 and UPR-200-W-97. In addition, this WMA T Integration Study has identified 16 distinct pipelines that connect the WMA T waste transfer system to locations outside of WMA T (e.g., T Plant, locations within TX-TY tank farms). These pipelines are shown in Figure 6-1 along with their line identifiers, and junction points both within and external to WMA T. The extent of this network of transfer lines and access points creates significant challenges for the isolation of WMA T.

Figure 6-1. Waste Management Area T Pipeline External Interfaces.



The framework for a pipeline interface strategy is outlined below and needs to be further developed in conjunction with OU 200-IS-1. Key aspects of this strategy are the need to define boundary conditions for the WMA T and to identify OU responsibilities including development of an integrated isolation strategy (cutting and capping pipelines at boundary of the surface barrier).

The framework for a pipeline interface strategy includes the following key elements:

- The regulatory responsibility for pipeline disposition should be established at the boundary of the final closure barrier for WMA T.
  - The portion of each pipeline not covered by the WMA T final closure barrier should be addressed through the assessment and decision process within the 200-IS-1 OU RI/FS process.
  - The portion of each pipeline covered by the WMA T final closure barrier should be addressed through the WMA corrective action and closure decision processes.
- The pipeline isolation and regulatory strategy should not alter the existing RL or ORP ownership and responsibility for pipelines within or outside of the WMA.
- The locations and approaches for isolating pipelines (e.g., cutting, capping, grouting) should be coordinated between the 200-IS-1 process and the WMA closure process to ensure the integrity and hydraulic isolation of the final barrier system as well as closure sequencing.

The additional pipelines identified above should be included in the WIDS database to ensure that they can be incorporated into the 200-IS-1 OU decision logic.

6.3 INTERFACE WITH 200 AREA GROUNDWATER DECISIONS AND REMEDIATION

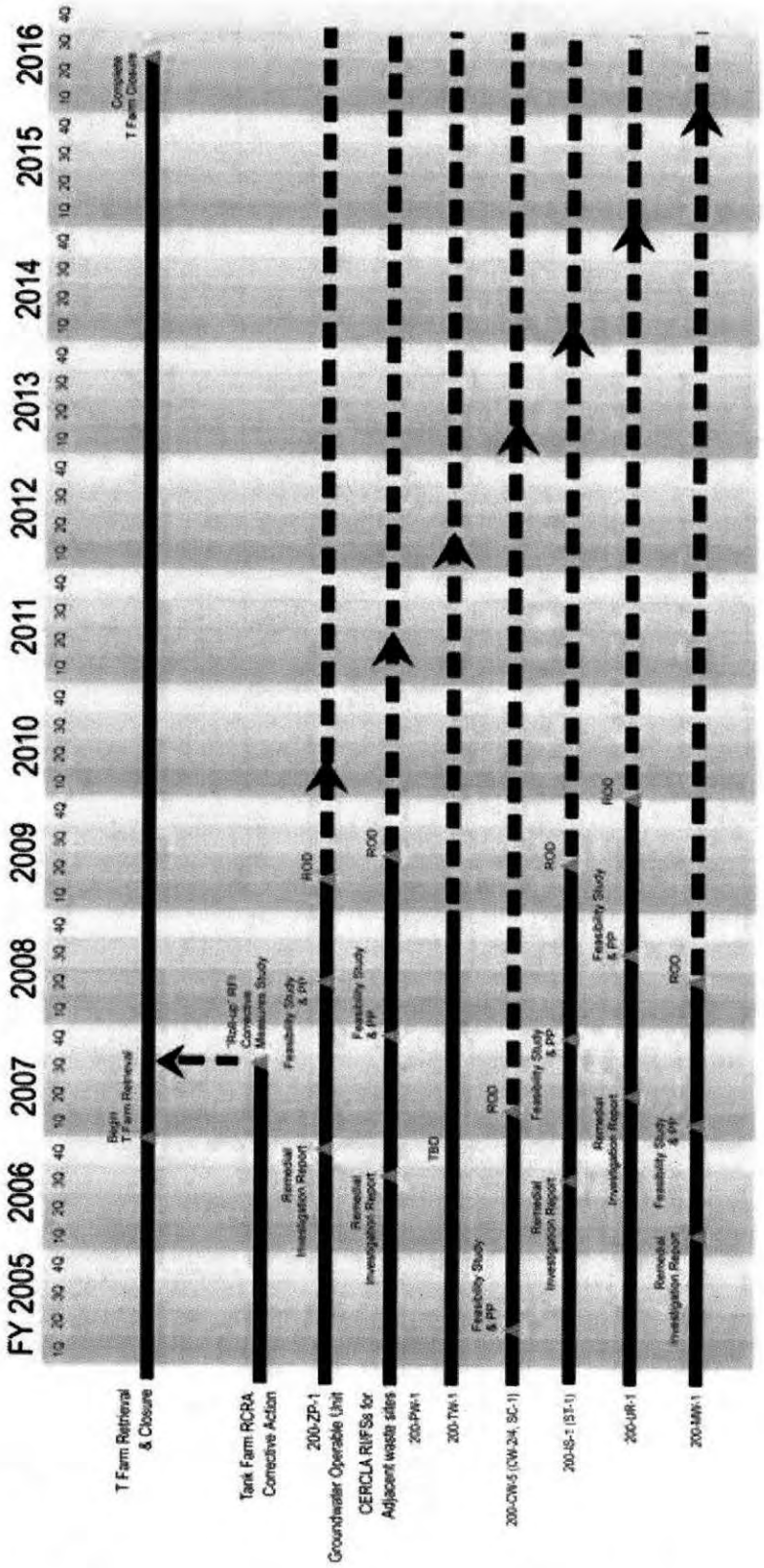
The most challenging interface between WMA T closure and the surrounding areas will be focused on groundwater. There are two groundwater OUs defined in the 200 West Area: 200-ZP-1 and 200-UP-1. 200-ZP-1 underlies the northern half of 200 West Area and decision making for 200-ZP-1 must also address potential impacts from WMA T. The major contamination plumes in this area include carbon tetrachloride, chloroform, trichloroethene, nitrate, chromium, fluoride, tritium, iodine-129, technetium-99, and uranium. Within the 200-ZP-1 OU, interim actions have been implemented for remediation of carbon tetrachloride, chloroform, and trichloroethene in the vicinity of the 216-Z liquid waste disposal units (216-Z cribs and trenches). Remediation of other groundwater contaminants will be determined through the CERCLA RI/FS process for the 200-ZP-1 OU.

Ecology and EPA have requested DOE to develop a schedule for a detailed characterization and remediation at WMA T and its associated groundwater (Wilson and Ceto 2005). This is in response to findings that technetium-99 has increased in downgradient wells and unexpectedly high technetium-99 activity for a recently constructed well on the northeast side of WMA T. A coordinated response to the Ecology and EPA request has been initiated by RL and ORP and the contractors responsible for implementing 200-ZP-1 groundwater OU RI/FS and the WMA T RFI/CMS activities.

The *Hanford Site Groundwater Strategy* (DOE/RL-2002-59) calls for the CERCLA process to integrate all groundwater protection and remediation actions. Therefore, CERCLA RODs for 200-ZP-1 OU will need to address the potential groundwater impacts from tank farm sources, including WMA T. A critical connection exists between WMA T RA (SST PA), the RFI/CMS, and the 200-ZP-1 feasibility studies. The latter feasibility studies will need to integrate the potential contributions from all waste. ORP and RL have initiated a process to integrate risk assessments across the Hanford Site which will better define these relationships. The overall sequence of decisions should be driven by the recognition that the groundwater operable unit decision (200-ZP-1) should follow remedial or corrective action decisions for the potentially contributing source units -- both the past leaks from tank sources and the nearby waste sites CERCLA waste sites (e.g., 216-T-7 tile field with the 200-TW-2 Operable Unit).

A time-phased sequence of Central Plateau closure activities is shown in Figure 6-2.

Figure 6-2. Time-Phased Sequence for Central Plateau Closure Activities.



7.0 CLOSURE CONFIGURATION AND DESIGN ISSUES

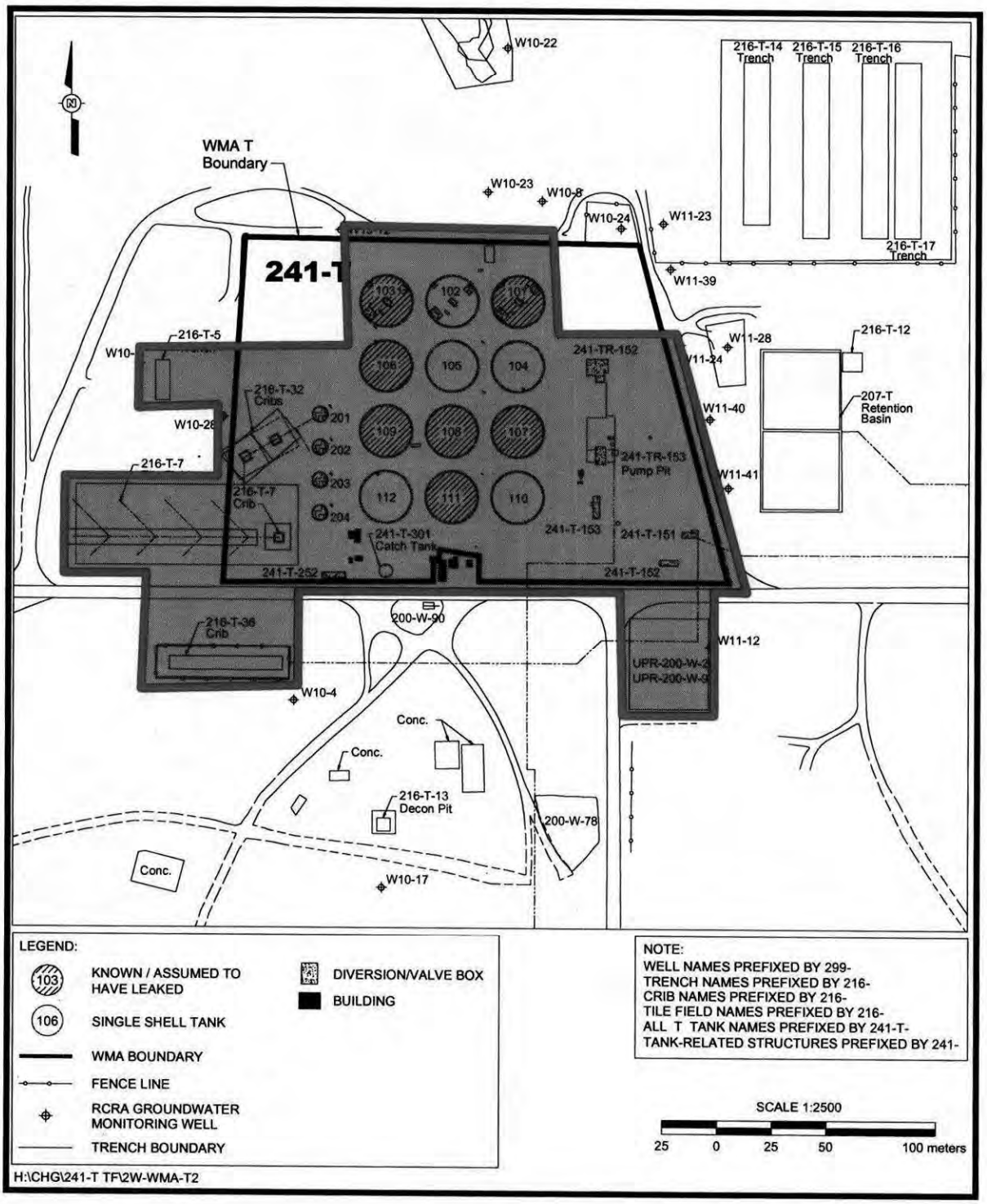
As part of the final closure process, a surface barrier or final cover would be constructed over WMA T and, if appropriate, adjacent contaminated waste sites that are beyond the existing fenceline. The final barrier design and configuration would be approved by Ecology, and the configuration would be dependent upon an analysis that would properly size and orient the barrier given a variety of factors such as a RFI/CMS that may conclude capping is the preferred corrective measure in lieu of removal of contaminated soil. There may be portions of the WMA that do not require a barrier, or there may be adjacent external waste sites that would benefit from a larger barrier. Additionally, to enable flexibility in the final design and aereal extent of the WMA barrier, it may be reasonable to propose "contingent remedies" for nearby CERCLA sites that would allow their final remedy to be determined with later input regarding the cost-effectiveness of extending the WMA barrier over these nearby sites. This approach is analogous to the approach used for waste sites that are in close proximity to the U Plant canyon facility and which could be encompassed by an eventual barrier for that facility.
The cost-effectiveness of the barrier is expected to be one of the factors in establishing the final footprint of the cover. Figure 7-1 shows a conceptual footprint for the WMA T barrier based upon the integrating assumption in this report. As shown in Figure 7-1, the footprint of the barrier could reasonably be expected to extend outside of the existing WMA boundary.

7.1 FINAL WASTE MANAGEMENT AREA T STATUS FOR BARRIER PLACEMENT

This barrier is intended to control the amount of precipitation that may infiltrate into any remaining contaminated media. This will reduce or eliminate the potential leaching of contamination to groundwater. In addition to their hydrological function, barriers may also serve to prevent human and ecological intrusion, limit wind and water erosion, prevent the run-on of surface water, and attenuate radiation.

The construction of the final WMA T closure barrier would require the surface area to be covered and prepared so that the performance design criteria can be met. The barrier design criteria, which are under development, for the U Plant facilities have provided the basis for the design criteria being developed for the WMAs and the proposed barrier described in the IDF closure plan. As these design criteria are further develop and finalized it is expected that some modifications will be made to accommodate specific applications. Site preparation activities would be required to provide a clean and stable foundation for the surface barrier. During the sector closure process, structures (e.g., buildings, equipment, risers, utilities, wells) that obstruct the placement of a surface barrier would generally require removal, realignment, or stabilization in place. Underground pipelines that extend outside the surface barrier footprint would have been evaluated for stabilization in place or removal depending on site-specific conditions during sector closure activities. Existing groundwater monitoring wells that are within the proposed footprint of the surface barrier will be decommissioned.

Figure 7-1. Conceptual Barrier Footprint Based Upon Integrated Closure of Sectors.



A site-specific assessment of the geometry of the areas to be included under the barrier would be needed to properly size the barrier footprint to ensure that the appropriate areas are contained. Some degree of over-sizing of the barrier (referred to as overlap) is expected, depending upon the depth of contamination and unsaturated flow properties. It is currently assumed that an overlap of 6.1 m (20 ft) is appropriate.

7.2 FINAL BARRIER DESIGN CRITERIA

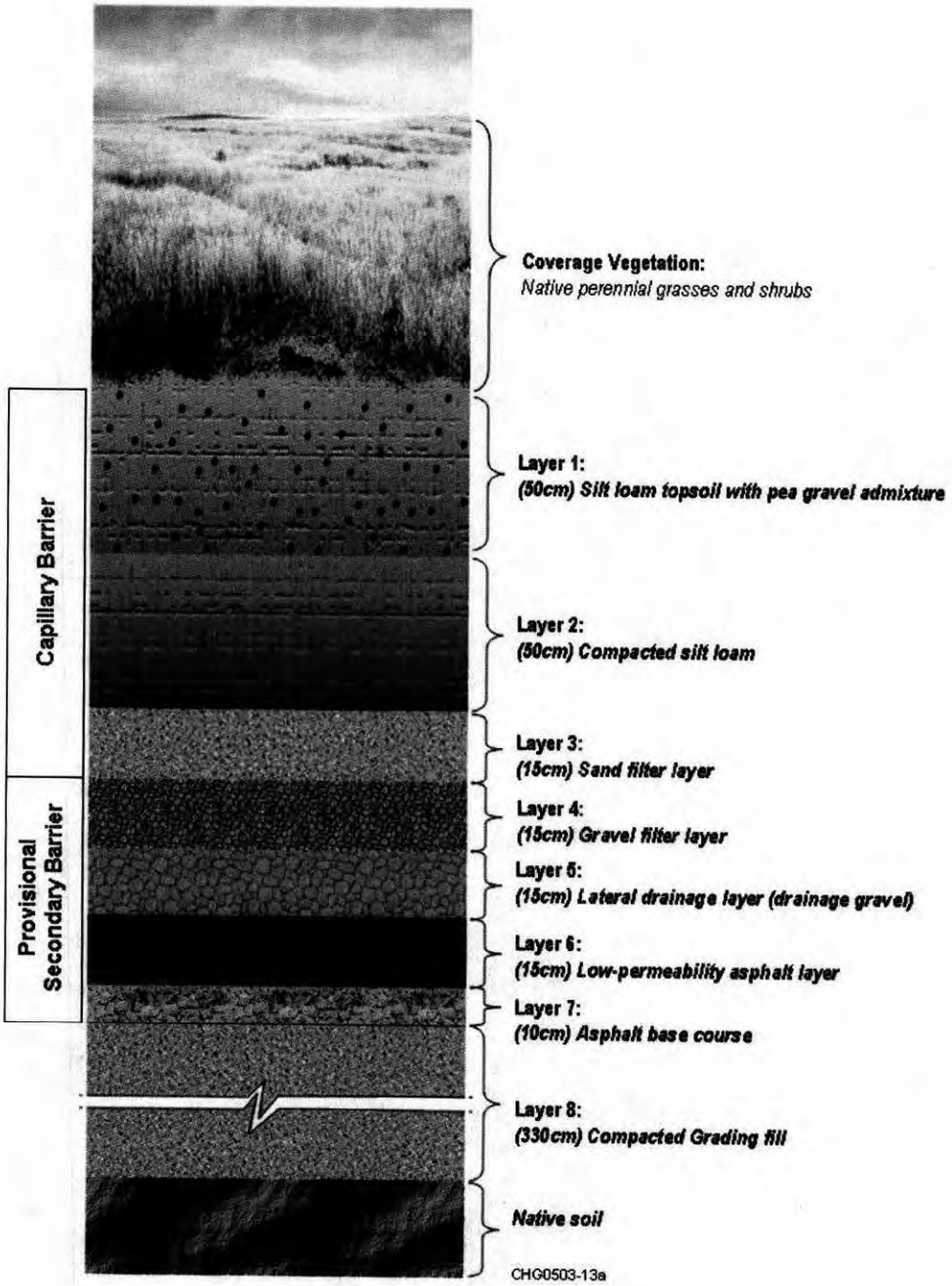
The Modified RCRA Subtitle C Barrier design has been identified as a baseline design for sites containing dangerous waste, Category 3 LLW and/or Category 3 mixed LLW, and Category 1 mixed LLW (*Focused Feasibility Study of Engineered Barriers for Waste Management Units in the 200 Areas* [DOE/RL-93-33,]) consistent with the WMA T inventory. This barrier design provides long-term containment and hydrologic protection for a performance period of 500 years. This design incorporates RCRA "minimum technology guidance" (*Technology Guidance Document - Final Covers on Hazardous Waste Landfills and Surface Impoundments* [EPA/530-SW-89-047]), with modifications for extended performance. One major change is the elimination of the clay layer, which may desiccate and crack over time in an arid environment. The geomembrane component has also been eliminated because of its uncertain long-term durability. This design also incorporates provisions to control ecological and human intrusion (DOE/RL-93-33).

Closure and post-closure requirements for landfills under WAC 173-303-665(6) require that the final cover be designed and constructed to:

- Provide long-term minimization of the migration of liquids through the closed landfill;
- Function with minimum maintenance;
- Promote drainage and minimize erosion or abrasion of the (final) cover;
- Accommodate settling and subsidence so that the cover's integrity is maintained;
- Have a permeability less than or equal to the permeability of any bottom liner system or natural subsoils present;
- Prevent run-on and runoff from eroding or otherwise damaging the (final) cover.

The Modified RCRA C Barrier is composed of eight layers of durable material with a combined thickness of 170 cm (5.5 ft) (Figure 7-2). The design includes evapotranspiration features of 100 cm (40 in.) of silt loam and 15 cm (6 in.) of sand filter layers overlying a secondary barrier system utilizing a low-permeability layer. The secondary barrier layers are provisional, depending on the site-specific need for redundancy in hydrologic protection, a vapor barrier and/or a more robust bio-intrusion layer. The overall thickness of the proposed barrier assumed in the WMA T RA is 5 m, which includes 170 cm (67 in.) for the 8-layered Modified RCRA Subtitle C Barrier and 330 cm (130 in.) of grading fill.

Figure 7-2. Modified RCRA C Barrier Design.



Source: DOE/RL-98-28, *200 Areas Remedial Investigation/Feasibility Study Implementation Plan, Environmental Restoration Program*, Rev. 0, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

A summary of design criteria for the surface barrier based on regulatory requirements is provided in Table 7-1. These design criteria have been reviewed and determined that the barrier designed to these requirements will satisfy regulatory requirements for closure of a disposal facility for dangerous and LLW as required under WAC 173-303-610, WAC 173-303-665, and 10 CFR 61.52(a)(2).

Table 7-1. Summary of Surface Barrier Design Criteria.

Design Criteria
Minimize moisture infiltration through the cover.
Design a multilayer cover of materials that are resistant to natural degradation processes.
Design a durable cover that needs minimal maintenance during its design life.
Design a cover with a functional life of 500 years.
Prevent plants from accessing and mobilizing contamination (i.e., prevent root penetration into the waste zone).
Prevent burrowing animals from accessing and mobilizing contamination.
Ensure that the top of the waste is at least 5 m (16.4 ft) below final grade or include appropriate design provisions to limit inadvertent human intrusion.
Facilitate drainage and minimize surface erosion by wind and water.
Design the low-permeability layer of the cover to have a permeability less than or equal to any natural subsoils present.

Site-specific requirements and criteria, as well as tailoring the performance standards and technical guidance to site-specific conditions, will be considered during the site-specific evaluation and subsequent definitive design of barriers for individual waste sites. Site-specific requirements and criteria may include the following items:

- Results of site characterization studies, including chemical, radiological, and physical characteristics and contamination geometry;
- Adaptation and detailing of conceptual designs to address side-slope design, crown slope geometry, drainage, the size and shape of the cover footprint, and edge effects;
- Design optimization using numerical modeling;
- Settlement and subsidence issues and control measures, including void reduction and subgrade compaction specifications;
- Gas control;
- Evaluations of seismic susceptibility;
- Thickness of barrier layers and materials with respect to shielding needs;
- Availability and properties testing of construction materials;

- Safety and construction quality assurance plans;
- Specification of suitable cover vegetation;
- Monitoring and maintenance plans;
- Grading plans to control runon and runoff;
- Barrier performance monitoring plan.

8.0 POST-CLOSURE

Following completion of waste retrieval, stabilization activities, and construction of a surface barrier compliant with the approved closure plan, each WMA will enter a post-closure care period during which surface barrier inspection, barrier maintenance and performance monitoring, administrative controls, and groundwater monitoring will be implemented. These activities may be integrated with the Hanford Site long-term stewardship program and Central Plateau closure strategies. DOE has authorized programs to develop a site-wide institutional controls plan to provide for the implementation and maintenance of institutional controls including the placing of markings, signs, and/or monuments at the Hanford Site to protect human health and the environment. DOE will specifically integrate the planning, development, and implementation of institutional controls for SST system closure with appropriate elements of the site-wide institutional controls plan. In addition, post-closure groundwater monitoring will be integrated with the Central Plateau regional groundwater monitoring system. New groundwater monitoring wells may be installed, if necessary, to support post-closure groundwater monitoring following construction of the surface barrier.

During closure planning, post-closure actions that might be impacted by WMA closure activities would likely be those activities associated with groundwater characterization or remediation such as ensuring that locations remain available for sampling points or treatment systems. All other post-closure activities are not expected to be impacted by WMA T closure actions.

9.0 REFERENCES

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, as amended.

40 CFR 265, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities," *Code of Federal Regulations*, as amended.

40 CFR 268, "Land Disposal Restrictions," *Code of Federal Regulations*, as amended.

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RPP-13774, 2004, *Single-Shell Tank System Closure Plan*, Rev. 2, CH2M HILL Hanford Group, Inc., Richland, Washington.

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APPENDIX A

SUMMARY OF WASTE MANAGEMENT AREA T DATABASE

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The waste management area (WMA) T database was developed in an effort to collect detailed component-level information of the 241-T Tank Farm. The information contained within the database provides an up-to-date inventory for the purpose of establishing the technical basis of the WMA T Integration Study, which is the first step towards the eventual closure of this WMA.

The component-level information was collected by a team of field investigators who had previously assembled similar information for the double-shell tank system in support of Project E-525. Team members reviewed routing board drawings, as well as other relevant Hanford Site drawings, engineering change notices, pertinent reports related to T farm activities, etc. The database fields were populated as investigative activities took place with cross-checking and peer reviews occurring both as part of the initial investigations, as well as during the finalization of inputs to the database.

The investigations revealed that there were a minimal number of released AutoCad drawings for T farm. Therefore, the team members were required to identify X, Y coordinate data from the information they had available. Z dimension coordinates were subsequently calculated by the 3-D modelers, using an AutoCad subroutine. This information was then provided as input to the WMA T database. The database for WMA T contains approximately 597 records.

APPENDIX B

SUMMARY OF WASTE MANAGEMENT AREA T PROCESS HISTORY

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FACILITIES HISTORICAL BACKGROUND

The 241-T tank farm contains 12 first-generation, reinforced concrete tanks with carbon steel lines covering the sides and bottoms. The tanks are 23 m (75 ft) in diameter and 4.9 (16 ft) deep, with a capacity of 2 million liters (530,000 gal). The tanks are arranged in four rows of three tanks. The tanks in each row are piped together so that when the first tank fills, it overflow (cascades) into the second tank, and the second into the third. Five diversion boxes and a booster pump pit are provided in T farm. The farm also contains four smaller "200-series" tanks that are 6.1 m (20 ft) in diameter and hold 0.2 million L (55,000 gal). These four tanks are piped to diversion box 241-T-252 and to crib 216-T-32.

The 241-TX tank farm contains 18 second-generation tanks similar to T farm tanks, but with a 2.9 million liter (758,000 gal) capacity. The tanks are arranged in three, 4-tank cascades and two, 3-tank cascades. TX farm has four diversion boxes and the 244-TXR process vault. There are no 200-series tanks in TX farm.

The 241-TY tank farm contains 6 tanks of identical design to the tanks in 241-TX farm, arranged in three, 2-tank cascades. TY tank farm contains one diversion box, the 244-TX DCRT, and no 200-series tanks.

Other facilities are contained in and around the T/TX/TY tank farm complex. The 207-T retention basin and the 216-T-12 pit are east of T farm. The 241-T Evaporator Facility includes the evaporator building and control room between the TX and TY farms, the 241-T-151 diversion box and 242-TX receiver value inside TX farm. Piping for saltwell pumping is located throughout the T/TX/TY complex. The 241-TX-155 diversion box and 216-T-20 pit are to the east of TX farm. The 231-Z Facility, southwest of the tank farm complex, includes the isolation building, 231-W-151 sump tank vault, and seven cribs.

The T/TX/TY complex operations can be separated into six distinct operational phases:

- From 1943 to 1945, T farm received liquid waste from the Manhattan Project bismuth phosphate plutonium separation operations in T Plant.
- From 1946 until T Plant shutdown in 1956, the tank farms were expanded and received liquid waste from the bismuth phosphate operations. Liquid waste disposal to the soil column was initiated.
- From 1952 to 1958, high-level waste from the tank farms was sent to U Plant for uranium recovery (UR) and fission product scavenging. Scavenged waste was discharged to the cribs. Low-level process condensate was also discharged to the cribs.
- Since 1958, T Plant has served as the central decontamination facility for the Hanford Site. Decontamination waste was discharged to the cribs until January 1969. Liquid waste from the 300 Area was also discharged to the cribs around T, TX, and TY farms during this time.

- In-tank solidification (ITS) operations occurred from 1965 to 1974, using the 242-T Evaporator Facility. Condensate was discharged to the cribs.

- Tank farm interim stabilization (saltwell pumping) and isolation began in 1975. The 242-T Evaporator and the 231-Z Facility were shut down during this period.

Sanitary waste was not supplied to the T/TX/TY tank farms during wartime bismuth phosphate operations, but was supplied to the 231-W Isolation Building. During the 1950s, sanitary water was supplied to the 242-T Evaporator and the 271-TXR control house. All sanitary water piping to the tank farms is believed to be capped off and abandoned.

Wartime Bismuth Phosphate Operations, 1943-1945

The 241-T tank farm was constructed in 1943-1944 as part of the Manhattan Project Hanford Engineer Works (HEW) to provide storage for the radioactive liquid waste produced at T Plant. T Plant used the bismuth phosphate process to separate plutonium from irradiated fuel slugs.

The bismuth phosphate process produced five waste streams:

- Metal waste (MW) was the byproduct from the plutonium separation phase of the bismuth phosphate process. MW contained unfissioned uranium and approximately 90% of the fission products of the irradiated fuel.

- First-cycle waste (1C) was the byproduct form the first plutonium decontamination cycle of the bismuth phosphate process. This waste contained about 10% of the fission products of the irradiated fuel. This waste stream also contained coating-removal waste.

- Second-cycle waste (2C) was the byproduct form the second and last plutonium decontamination cycle of the bismuth phosphate process. This waste contained less than 0.1% of the fission products of the irradiated fuel.

- The 224 waste was low-level liquid waste from the 224-T Plutonium Concentrator Building. This waste stream was the primary contributor to plutonium contamination of the soil. This waste was routed to the 241-T-361 settling tank, and then discharged to the 216-T-3 reverse well near T Plant. It was later routed to the 200-series tanks for settling and discharged to crib 216-T-32.

- The 5-6 waste was low-level liquid waste from floor drains in individual process cells in T Plant. This waste was discharged to the 216-T-4 pond during the T Plant startup testing "cold run," but was routed to the 5-6 tank in T Plant when processing of irradiated fuel began in December 1944. Waste stored in the 5-6 tank was discharged along with 224 waste to the 241-T-361 tank and the 216-T-3 reverse well.

MW, 1C, and 2C were stored in tanks at T farm. These waste stream were also sent to the 241-U tank farm, which is outside the scope of this study (Parker 1944).

From the 224-T Concentrator Building the plutonium solution was transported by truck to the 231-W Isolation Building (later called 231-Z), where final preparation of the plutonium nitrate

paste was conducted. So-called "clean" waste such as cooling waste steam condensate, and floor drainage went to the 216-U-10 pond via the 216-Z-1 ditch. Process water was neutralized in the 231-W-151 sump tank and discharged to the 216-Z-10 reverse well. The well was plugged on May 6, 1945, and waste was rerouted to the 216-Z-6 temporary crib until the 216-Z-5 double crib was finished on May 31, 1945.

Little documentation is available for pit 216-Z-4, which was also used as a temporary disposal site. Reports from May 1945 describe "temporary" facilities in use within 24 hours, and a "covered' disposal basin (apparently 216-Z-6) in use by May 10, 1945. It is considered most likely that pit 216-Z-4 was dug immediately, but was not large enough to accommodate the waste inflow and may have overflowed. It was used for a day or so until 216-Z-6 was constructed (Acken 1945a; Acken 1945b; DuPont 1945; Owens 1981). The hurried construction and lack of documentation is consistent with HEW priorities of the time: the German surrender occurred during this period, and Los Alamos did not yet have enough plutonium to assemble the Trinity and Nagasaki atomic bombs.

Ground disposal of aqueous industrial waste, relying on the ion-exchange properties of the soil to decontaminate the waste as it percolates to the aquifer, was a commonly accepted method in the 1940s. The ability of Hanford Site topsoil and substrate to adsorb radioactive material was tested at the Clinton site in Tennessee (later Oak Ridge National Laboratory) and at the University of California at Berkeley at 1944. Tests determined that ground disposal of 5-6 and 224 was acceptable, but ground disposal of 1C and 2C was not. Methods to treat 1C and 2C to facilitate ground disposal were investigated at the time, but were unsuccessful (Parker 1944; Patterson 1945; leader 1945).

Postwar Bismuth Phosphate Operations, 1946-1956

In September 1946, the Army Corps of Engineers Manhattan District selected General Electric Company (GE) to replace DuPont as the Site prime contractor. Pursuant to the McMahon Atomic Energy Act of 1946, control of the Hanford Site passed from the Army to the civilian Atomic Energy Commission (AEC) on January 1, 1947. The AEC opted to maintain Hanford as a permanent facility rather than dismantle it, as happened to many other wartime munitions plants. Wartime production had filled all available waste tank storage space, so plans were made to increase high-level waste storage capacity and to recover some tank space. These plans included disposing of the relatively low-level 2C waste into the ground and concentrating the intermediate-level 1C waste in an evaporator. Plans were also made to recover the unfissioned uranium in the MW (by 1947, most of the world's known supply of uranium was in Hanford waste tanks).

From 1947 to 1949, many new facilities were constructed at Hanford. The TX tank farm, facilities for the planned uranium recovery mission (see Section 3.3), and other facilities beyond the scope of this report (BX/BY tank farms, Z Plant, H Reactor, DR Reactor, Hot Semi-Works) were all built during this period (Gerber 1991). The 241-TX-155 diversion box was a central waste distribution facility, capable of routing waste between T Plant, U Plant, T/TX tank farms, and U tank farm. When TY farm was constructed in 1952, it was also connected to the 241-TX-155 diversion box.

Disposal of 224 in a reverse well was quickly recognized as a "definite mistake" because of the potential for groundwater contamination, and the 216-T-3 reverse well was replaced by the 216-T-6 double crib in August 1946. An additional problem was that the 241-T-361 settling tank had filled with very hard sludge, making it unusable as a settling tank. Consequently, the 5-6 waste line was modified in October 1946 to bypass 241-T-361, and 5-6 waste was discharged directly to the 216-T-6 cribs without settling. This was considered unsatisfactory, but necessary. At the same time, the 224 waste line was rerouted to the 200-series tanks in T farm for settling and overflow to the 216-T-32 double crib. The 224 waste discharged to the tanks was sampled for plutonium (Pu) and fission product content, but the final overflow to the crib as not routinely sampled. Occasional checks indicated that "virtually all" radioactivity was retained in the 200-series tanks. The waste discharged to the 216-T-3 reverse well, the 216-T-6 cribs, and the 216-T-32 cribs is summarized blow (USAEC 1946; GE 1946; Brown 1948; Keene 1951; Anderson 1976).

Table B-1. 224 and 5-6 Waste Discharges.

Crib	216-T-3	216-T-6	216-T-32
Dates of Operation	1944-1946	1946-1951	1946-1952
Waste type	224, 5-6	5-6	224
Total waste (L)	1.13E+07	4.50E+07	2.90E+07
Pu (g)	3350	3900	3200
U (kg)	N/A	22.7	22.7
ß emitters (Ci)	2380	18000	1500
^{90}Sr (Ci)	557	360	30
^{106}Ru (Ci)	1280	600	50
^{137}Cs (Ci)	595	300	25
^{60}Co (Ci)	N/A	50	1

Note: Curies are uncorrected for decay.

In February 1947, sludge buildup sealed the bottom of the 216-Z-5 cribs, and the 231-Z Building waste was rerouted to trench 216-Z-7. Construction of the Plutonium Finishing Plant (PFP) in 1949 required replacing part of the 216-Z-1 ditch – from 231-Z to the PFP – with an underground pipeline (Brown 1948; Patterson 1949; Owens 1981).

Ground disposal of waste had always been regarded as an expedient, temporary disposal method, and treatment of 224, 5-6, and other waste types by such means as evaporation, scavenging, or ion exchange were investigated. Experiments with 2C revealed that most activity was concentrated in the sludge settling at the tank bottom, leaving a low-activity supernatant liquid that met existing criteria for ground disposal. The continuing shortage of waste tank space led to the decision to send 2C waste to a crib after cascading and settling (Piper 1949; Burns 1949; Brown 1950).

Crib 216-T-7 and its tile field were constructed in 1947 in T farm to dispose of 2C waste. Initially, the crib was piped to a riser between 241-T-110 and 241-T-111 in T farm, accessible

via an overground line, and waste was discharged 1 month per year. From September 1949 to December 1950, the average activity of 2C discharged to the crib was 3.8 μg/L of Pu and 16 μCi/L of beta emitters. In May 1951, the crib line was piped directly to tank 241-T-112 (the final tank in the cascade series used for 2C storage), and the cascade continuously overflowed to the crib (GE 1947; Keene 1951; GE 1951b).

Research in 1950 determined that combining 5-6 waste with 2C and again allowing it to settle before discharge to a crib was a safer disposal method than direct discharge to crib 216-T-6. In June 1951, 5-6 waste was sent to the 241-T-110/111/112 cascade along with 2C waste, allowed to settle, and overflowed to crib 216-T-7. The average activity of the combined waste stream discharged to the crib was 2.4 μg/L of Pu and 43 μCi/L of beta emitters. In June 1952, 224 was also diverted to this cascade when the 200-series tanks filled with sludge and were no longer usable for settling. The average activity of this waste stream was 1.06 μg/L of Pu and 27.2 μCi/L of beta emitters. Crib 216-T-7 reached its radionuclide limit in December 1955. The crib was isolated and the waste rerouted to crib 216-T-19 (see below). Analytical data for discharges to crib 216-T-7 are in Appendix D (GE 1950a; Ruppert 1952; Ruppert 1954; Heid 1956).

One processing run in early 1955 resulted in an unusually high level of activity in the 2C waste. Even after cascading and settling, the activity was still too high (66 μg/L of Pu and 47 μCi/L of beta emitters) to crib. Approximately half of the batch (2.65 million liters) was sent to specific retention trench 216-T-5 in May; the remainder stayed in 241-T-112 (Paas 1955).

The 242-T Evaporator was built in 1951 to reduce the volume of 1C waste. Operations began late April 1951. The evaporator received 1C waste from feed tank 241-TX-118. Evaporator condensate was sent to crib 216-T-19 and its tile field via the 242-T-151 and 241-TX-153 diversion boxes. This condensate had an average plutonium concentration of 0.049 μg/L and an average beta emitter concentration of 0.044 μCi/L. Analytical data for discharges to crib 216-T-19 are in Appendix E. Cooling water was sent to the 241-T-4 pond via the 207-T retention basin. Evaporator bottoms were sent to tanks 241-TX-113, -116, and -117. This waste was then re-evaporated in a second pass. From startup in 1951 to shutdown in 1954, the 242-T Evaporator reclaimed 34.7 million liters (9 million gal) of tank space in T farm, TX farm, and the newly constructed TY farm (GE 1951c; Ruppert 1952; Anderson 1990).

When the 242-T Evaporator was needed for TBP waste (see next section), ground disposal of 1C was pursued. In May 1953, direct disposal of 1C to specific retention trenches was approved, at a maximum discharge rate of 5,280 L/m^2 (150 gal/ft^2) to ensure retention of waste in the soil. Evaporation of 1C was discontinued in June 1953. Approximately 17 million liters of 1C in 200E and 200W areas had not been evaporated at that time. From January to June 1954, 2.9 million liters of 1C were sent to the T trenches via an overground line from 241-T-106. From June to August 1954, 5 million liters of 1C were sent to the TX trenches via an overground line from 241-TX-110. Trench disposal of evaporator bottoms was approved in June 1954, and 3 million liters were discharged to 216-T-25 in September (Healy 1953; Carpenter 1953; Ruppert 1954; Anderson 1990). Details of 1C discharges to the T and TX trenches, including analytical data, are provided in Appendix F.

Evaporation of TBP waste was discontinued in September 1954, following the development of the ferrocyanide scavenging process. As described in the following section, the scavenging process removed the principal long-lived fission products, ^{137}Cs and ^{90}Sr, from the waste to enable ground disposal of the supernatant. This process was also applied to 1C beginning in October 1954 to remove ^{137}Cs (^{90}Sr concentration in 1C already met existing limits for discharging the waste to cribs). It was necessary to segregate coating waste from 1C to accomplish this. The 242-T Evaporator resumed evaporating stored 1C that had not been pumped to cribs in December 1954, and began evaporation newly generated scavenged 1C in March 1955. After 1C evaporation was finished in July 1955, scavenged 1C was stored in TY farm for settling and supernatant was discharged to crib 216-T-26 (see Appendix F) (Ludlow 1954; Anderson 1990).

Although the evaporator was shut down, discharges to crib 216-T-19 resumed in December 1955. Since crib 216-T-7 had reached its radionuclide limit, the combined 2C/5-6/224 waste stream was diverted from there to 216-T-19 via the 241-TX-155 diversion box until T Plant shutdown in August 1956 (Heid 1957).

In addition to ongoing Pu isolation work for T Plant, 231-Z received Pu solution from the Reduction Oxidation Plant (REDOX) starting in 1953, and from the Plutonium-Uranium Extraction Plant (PUREX) in 1956. (PUREX product was intended to be pure enough to bypass 231-Z and go directly to PFP, but it took one year to work the bugs out of the process.) REDOX and PUREX product streams went directly to PFP after 1956. 231-Z was converted to a plutonium metallurgy laboratory in 1957, and discharges to crib 216-Z-7 ceased (WADCP 1998).

Six unplanned releases (UPRs) are associated with bismuth phosphate operations (waste information data system [WIDS]):

- In 1950, diversion box 241-TX-155 overflowed and 1C ran down the hillside to the west (UPR-200-W-5). WIDS has no further information on this UPR, but a review of all Health Instruments (H.I.) Division Monthly Reports for 1950 suggests that it occurred in March and involved only slightly contaminated water which was pumped from the catch tank to crib 216-T-19 (Patterson 1950).

- Diversion box work in the spring of 1950 resulted in contamination spread to the ground around 241-T-151 and 241-T-152 (UPR-200-W-7).

- In the spring of 1951, a riser leak in the 242-T discharge line allowed "a few gallons" of 1C evaporator bottoms to spill onto the ground (UPR-200-W-12).

- In September 1952, a waste pump being transferred from 241-TX-106 to 214-TX-114 dripped contamination on to the ground, personnel, and vehicles (UPR-200-W-17).

- In October 1952, a leak in the underground line between 242-T and 207-T allowed some contaminated cooling water to leak (UPR-200-W-14).

- In March 1954, 1C escaped from a leaking underground pipe between 241-TX-105 and 241-TX-108 (UPR-200-W-100).

- In 1954, a broken transfer line between the 241-T-152 and 241-TX-153 diversion boxes caused a leak of 3,785 L of 1C and a cave-in of soil (UPR-200-W-29). The area was backfilled and covered with gravel.

Two minor spills occurred during this time frame, but were not assigned UPR numbers. Removal of electrodes from 241-TX-105 in autumn 1951 resulted in the spread of contamination to the surrounding ground area. Construction work in spring 1952 resulted in contamination of the heel and sluice jets of 241-TX-107 (Ruppert 1953).

In December 1954, approximately 10 m^3 of sludge were dredged from the 207-T retention basin and buried in pit 216-T-12. This sludge had the following composition (Clukey 1955):

Table B-2. 216-T-12 Buried Sludge.

Isotope	Curies
Total α	9.1E-01
Total ß	1.4E-03
Rare Earth	6.1E-01
Cesium	1.3E-01
Zirconium	3.3E-02
Ruthenium	6.4E-03
Strontium	4.7E-04
Plutonium	9.8E-05

Note: Curies are uncorrected for decay.

Uranium Recovery Operations (1952-1958)

U Plant was originally constructed during World War II as a bismuth phosphate plant, but was not needed for that purpose so the facility was used as a simulator. It was modified in 1951 for UR operations using the TBP process. For this reason, U Plant was frequently referred to as the "TBP Plant." Beginning in 1952, MW was sluiced from T and TX tank farms, treated in the 244-TXR process vault, and transferred to U Plant. MW from C, B, and U tank farms was also sent to U Plant for uranium recovery. Until T Plant was shut down in 1956, newly generated MW was also sent to U Plant for uranium recovery (Rodenhizer 1987; Anderson 1990).

The uranium recovery facilities in the T/TX/TY tank farm complex include the 271-TXR control house, the 244-TXR vault, four diversion boxes (one for T farm and three for TX farm), the 241-TR-153 booster pump pit, and modifications to the underground piping system.
The TY cribs were also constructed for the uranium recovery mission, but were used for other purposes.

Uranium recovery operations produced two waste streams, TBP waste and low-level waste. TBP waste, concentrate from the waste concentrator, was returned to the tank farms (including the 241-T-107/108/109 cascade, 241-TX-103 and 241-TX-115 in TX farm; and 241-TY-103, 241-TY-104, 241-TY-105, and 241-TY-106 in TY farm). TBP waste was also transferred to

200E Area. The design called for the same volume of TBP waste to be produced as the volume of MW processed, but inefficiencies in the process resulted in approximately twice as much TBP waste produced as the MW processed. A total of 215 million liters of TBP waste was produced. Low-level waste included condensate from the feed concentrator, waste concentrator, and HNO_3 fractionator. This waste was discharged to various cribs that are outside the scope of this report. Cooling water and cell drainage were discharged to U Pond, also outside the scope of this report (Waite 1991; DiLorenzo, et al. 1994; GE 1951a).

Despite additional tank farm construction and ongoing volume reduction efforts, tank space was not sufficient to support both the uranium recovery mission and plutonium production. To reduce the volume of stored waste, TBP waste from T farm was concentrated in the 242-T Evaporator beginning in July 1953. The condensate discharge to crib 216-T-19 had an average concentration of 0.045 μg/L of Pu and 0.086 μCi/L of beta emitters. Additionally, a ferrocyanide scavenging process was developed to remove the principal long-lived fission products, ^{137}Cs and ^{90}Sr, from the TBP waste to enable disposal of the waste supernatant to the cribs. Beginning in September 1954, TBP waste was scavenged in U Plant to remove ^{90}Sr and ^{137}Cs, instead of being evaporated. Scavenged waste was sent to BY tank farm for settling, then to the BY cribs and BC cribs and trenches from 1954 to 1957. These cribs are outside the scope of this report but are described in Williams (1996). The 242-T Evaporator was modified to scavenge TBP waste that was stored in the TX and TY tank farms, but was never used for this purpose and that waste was not scavenged. The 242-T control room was used for other UR operations until the program ended in January 1958. Following the end of uranium recovery operations, many tanks in the T/TX/TY tank farms received REDOX plant waste (Rupert 1954; Anderson 1990; Waite 1991).

Waste from a scavenging process test run in late 1953 was pumped from U Plant to tank 241-T-101 to settle. Because of poor pH control during the test, only half of the waste could be cribbed. This waste was pumped to a test crib, later designated as 216-T-18, from December 8 through December 21, 1953. Approximately 970,000 L of waste were discharged, containing the constituents shown below. There is a discrepancy regarding the type of waste discharged to the crib. Maxfield (1979) describes it as being scavenged 1C, but all contemporary documents (Christy 1954a; Ruppert 1954) describe it as being a test batch of scavenged TBP. Maxfield (1979) is believed to be based on incorrect information.

Table B-3. 216-T-18 Scavenged TBP Test Waste Analysis.

Constituent	Total (Ci)	Concentration (µCi/mL)
Pu	0.089	9.2E-05
U	0.054	5.6E-05
Cs	290	0.27
Sr	49	0.05
Ru	180	0.19
Sb	130	0.14
Y, rare earths	190	0.20
Total	840	0.85

Note: Curies are uncorrected for decay.

Six incidents are associated with the 241-TX-155 diversion box, which was built in 1948 as a central transfer point between T Plant, U Plant, and the tank farms:

- Catch tank 241-TX-302B was constructed of carbon steel. In anticipation of use with acidic waste, Operations requested a stainless steel tank to replace it, but they were overruled by Engineering on cost considerations. The original tank was removed and replaced with an epoxy-painted tank designated 241-TX-302B(R) in February 1952 (GE 1952a; Koberg 1953). No UPR is associated with this incident.

- In November 1952, 1,330 L of 50% HNO_3 was inadvertently pumped from the 241-WR vault to the 241-TX-155 diversion box, and drained to catch tank 241-TX-302B(R). The acid was subsequently neutralized and discharged to pit 216-T-20 that month (GE 1952b).

- In March 1953, a severe jumper leak filled catch tank 241-TX-302B(R). When soda ash (sodium carbonate) was added to the tank to neutralize the waste prior to pumping out the tank, a foamy solution erupted out of the riser (UPR-200-W-131). By now, the catch tank was damaged beyond repair, and it was abandoned in place and later replaced with a third catch tank, this one with the old designation of 241-TX-302B. This tank was made of stainless steel (Keene 1953; Koberg 1953; GE 1954).

- During installation of the new catch tank in April 1954, a 0.7-m (2-ft) sinkhole northwest of the diversion box was noticed. Investigation revealed that the sinkhole was caused by waste leaking from a failed jumper in the diversion box, escaping from the damaged catch tank, and flowing along the 7-66 pipe encasement (UPR-200-W-135). In the spring of 1954, a jumper leak contaminated the area to the west of the diversion box (UPR-200-W-28) (Corley 1954; Christy 1954b). These two UPRs may be the same event.

- Another contamination event occurred in December 1954, but was not assigned a UPR number (Keene 1955).

- Some of the above areas were removed from radiation zone status in 1970. However, radioactive rabbit dung with activity as high as 100 mR/hr was found around the diversion box in 1977. This contamination was spread over a 164 m (500-ft) radius around the box (UPR-200-W-76). As soil was removed in the attempt to decontaminate the site, radioactivity increased due to subsurface contamination. The subsurface contamination was designated as UPR-200-W-113 in 1979. Several decontamination efforts have taken place, most recently in 1990. The site is posted as an "underground radioactive material" area and is surveyed annually. 241-TX-302B is the only inactive miscellaneous underground storage tank that is regularly monitored for liquid level (Hanlon 1999; WIDS).

Central Decontamination and In-Tank Solidification Operations (1960-1974)

Following the end of plutonium separation operations, T Plant was converted into a central decontamination facility in 1958. The 2706-T decontamination annex was built in 1959. Waste was sent to the 241-T-112 tank for settling, and supernate was discharged to the TY cribs beginning in February 1960. The TY crib inlet line was rerouted from TY farm to 241-T-112 for this purpose. Laboratory waste from the 340 Building in 300 Area was also discharged to crib 216-T-28 beginning in October 1963 (previously, it had been discharged to crib 216-S-20, which is outside the scope of this report). This waste was delivered by truck from the 300 Area and discharged via a riser. The 340 Building waste was diverted to crib 216-T-27 beginning in September 1965. Discovery of groundwater contamination under the TY cribs in November 1965 resulted in diverting of 340 Building waste to trench 216-Z-7. No T Plant decontamination waste was cribbed during September-November 1965, but this waste was discharged to 216-T-28 in December 1965 and January 1966. A final discharge was made in July 1966. Details of discharges to the TY cribs, including analytical data, are included in Appendix G. T Plant decontamination waste was discharged to crib 216-T-36 from May 1967 until January 1969. Afterwards, this waste was transferred to tank farms. Trench 216-Z-7 reached its radionuclide capacity in May 1966, and 340 Building waste was discharged to trenches 216-T-34 and 216-T-35. Although trenches 216-T-34 and 216-T-35 are outside the scope of this report, analytical data for them is included in Appendix H, along with data for 216-T-36 (Bayless 1964; Gerber 1994).

Concern over the integrity of single-shell tanks (SST) (the first confirmed tank leak was in 1959) resulted in the decision to remove all liquid waste supernate from SSTs. The In-Tank Solidification (ITS) program was initiated to concentrate nonboiling waste to produce a partially mobile saltcake. In 200E area, in-tank heaters were installed in two tanks to evaporate the waste. The 242-T Evaporator was modified for continuous operation and restarted in December 1965 as the ITS system for 200W Area. New piping was installed to facilitate transfers to 242-T. Evaporator condensate was again sent to crib 216-T-19 (Liverman 1975; Rodenhizer 1987; Williams 1999).

Battelle Northwest Laboratory (now Pacific Northwest National Laboratory [PNNL]) took over 231-Z operations in January 1967, and constructed an office space addition to the south side of the building. Since trench 216-Z-7 had reached its radionuclide capacity, a new liquid waste disposal crib was needed. Waste was discharged to the 216-Z-17 temporary trench during construction of crib 216-Z-16, which began receiving waste in March 1968. The line to these

cribs bypassed the 231-W-151 sump tank vault, which was isolated at this time. During construction, underground contamination was discovered (UPR-200-W-130). A consolidated storage and maintenance facility was constructed on the north since of the building in 1974. Crib discharges continued until the end of 231-Z operations in January 1977. Details of discharges to these cribs, including analytical data, are provided in Appendix I. Although waste-generating activities at 231-Z ended in January 1977, the building was used for other purposes until 1994 (Owens 1981; WADCP 1998).

There is some confusion regarding the discharges to 216-T-19 following the restart of 242-T. Beginning in 1968, steam condensate was reported discharged to 216-T-19, in addition to process condensate. Vacuum jet water was discharged from 1968-1970. These discharges were not reported for 1967, but the total volume was estimated and included as a footnote in the 1968 report. These discharges were not reported in 1966, and it is believed that they resulted from piping changes that occurred in 1967. The 242-T steam condensate was also reported as discharged to the 216-T-4-2 ditch. The discharge information in Appendix E represents the best available information. Since these discharges involve normally uncontaminated water, this discrepancy does not affect the total amount of radioactivity discharged to the crib. When these discharges are added to the evaporator condensate discharges, the total agrees to within 3% with Maxfield (1979).

Since the beginning of 1968, all tanks constructed or planned have been a double-shell design. In 1968, the AEC decided to remove all liquid waste from SSTs by 1975, using ITS. The 242-T Evaporator was modified again in 1972 to concentrate Plutonium Finishing Plant (PFP) high-salt waste as well as tank farm waste. The 242-TA receiver vault was constructed next to the evaporator for this purpose, and received waste from PFP via an encased underground line. Since the 242-A Evaporator was not yet built, 242-T also concentrated high strontium waste from 241-A tank farm, with the bottoms going to the 242-S Evaporator. In 1973, the effluent line to 216-T-19 was modified to bypass the crib and discharge directly to the tile field. Disappointing performance resulted in ITS being superseded by saltwell pumping (see next section) as a method of liquid waste removal, and the ITS program was discontinued in 1974. The 242-T Evaporator continued to operate until 1976, and was formally shut down in 1980 (Roal 1975; Williams 1968; Liverman 1975; Anderson 1990; WIDS).

Seven UPRs are associated with ITS operations. The broken transfer line which had caused UPR-200-W-29 in 1954 was mistakenly used again in 1966, and liquid waste surfaced and ran to the edge of Camden Avenue (UPR-200-W-97). On May 4, 1966, 2C being transferred from 241-T-107 to 242-T escaped from a ruptured transfer line and came to the surface (UPR-200-W-62). These two UPRs may be the same event. This time, the jumper was removed from 241-TX-153. While transporting the jumper to T Plant for decontamination, waste dripped from the jumper and contaminated the 23rd Street roadway (UPR-200-W-63). This area was decontaminated and removed from radiation zone status in 1972. The site was again cleaned up, but mud samples read 600 cpm in 1969 (UPR-200-W-64) and this area is now surveyed annually for radiation (WIDS).

There is a discrepancy regarding the type of waste involved in UPR-200-W-62. WIDS describes the waste as 2C being pumped from 241-T-107 to 242-T. However, Anderson (1990) reports that 241-T-107 held a combination of 1C and TBP in 1966, and 8,000 gal of this was sent to

241-TX-118 (the feed tank for 242-T). This is corroborated by the waste status summary (Roberts 1967). The original occurrence report cited in WIDS is not available. The type of waste is most likely 1C/TBP.

In September 1966, two plumes of airborne material originating from diversion box 241-TX-153 contaminated Camen Avenue (UPR-200-W-99). In January 1971, contaminated caustic sprayed from a pump pit cover in 241-TX-113 during a leak test of a new jumper assembly (UPR-200-W-129). In May 1975, a small amount of airborne contamination was released during replacement of a gasket at the 241-TX-153 diversion box (UPR-200-W-126) (WIDS).

Stabilization and Isolation, 1975-Present

Seven leaking SSTs were identified in T/TX/TY between 1959 and 1977. These leaks are identified in Appendix B. In accordance with Hanford operating policy at the time, liquid waste removal from tanks of questionable integrity was expedited and the tank was removed from service. Interstitial liquid was removed by saltwell jet pumping. The most severe tank leak was a leak of 435,000 L from 241-T-106 in May 1973 (UPR-200-W-148). This leak released approximately 40,000 Ci of ^{137}Cs, 14,000 Ci of ^{90}Sr, 6 Ci of plutonium, and 297,000 Ci of various fission products to the soil (USAEC 1973; Liverman 1975; Anderson 1990; WIDS).

Interim stabilization is the process of removing all supernatant liquid and as much drainable liquid as possible; this process began in 1972. The T/TX/TY complex tanks were interim stabilized beginning in 1976, with the interstitial liquid pumped to receiver tank 241-TX-107, and from there to the 242-S Evaporator (the 242-T Evaporator was shut down). The saltwell system for T/TX/TY farms included a pump pit for each tank, the saltwell and jet pump, piping from the pump pits to the receiver tank, and associated instrumentation and controls.

In 1975, AEC policy was to direct all liquid waste to DSTs. To discontinue the use of an SST, the saltwell waste receiver, 244-TX DCRT was constructed in 1980, tying into the existing saltwell piping. PFP high-salt waste, formerly sent to 242-TA, was also routed to 244-TX. PFP high-salt waste was not generated between 242-T shutdown in 1976 and 244-TX construction in 1980. To facilitate transfer of saltwell liquid waste, the 242-TX-152 diversion box was constructed in 1980 to replace the 241-TX-155 diversion box. The 242-S Evaporator also shut down in 1980, and all waste went to 242-A for evaporation via 241-TX-152 (Mirabella 1977a; Hanson 1980).

Eight tanks in the T/TX/TY farm complex were interim stabilized prior to construction of 244-TX. Most tanks were stabilized in 1983. All tanks in the T/TX/TY complex are now interim stabilized (Hanlon 2000).

Following interim stabilization, SSTs were interim isolated by establishing at least one physical barrier between the tank contents and the environment, to preclude inadvertent addition of liquid. Cutting and blanking all process piping to and from the tank, blanking all risers and equipping the tank with a filtered ventilation system accomplished this. Eleven T farm tanks (including the 200-series tanks) are interim isolated, and five tanks are partially interim isolated. All TX and TY farm tanks are interim isolated. The 244-TXR vault, the 241-T-301B, 241-TX-302A, 241-TX-302B, 241-TX-302X, 241-TY-302A, and 241-TY-302B catch tanks, and all diversion

boxes (except 241-TX-152) and associated transfer lines were isolated by project B-231 in 1984-1985. The 244-TX DCRT is currently the only facility available to transfer waste out of T farm. 244-TX also receives waste from PFP and T Plant, and transfers all waste to DSTs via 241-TX-152 and 244-S DCRT (Liverman 1975; Hanlon 2000; WIDS).

Spills have not been recorded since 1977. Surface contamination from TY farm that had migrated beyond tank farm boundaries over the years was cleaned up in 1986 and designated as UPR-200-W-167. Similar contamination around T farm was cleaned up in 1992 and designated as UPR-200-W-166.

APPENDIX C

STATUS OF EXTERNAL TRANSFER LINE ISOLATION

Interim Stabilization External Transfer Lines Isolation

Transfer Line No.	From Location in T Tank Farm	From Location Information	To Location	To Location Information	Fluid Hydraulics (from T Tank Farm)
6012	T-101, T-104, T-105	All transfer lines originate in the saltwell pump pit at the center of each tank: T-101, and T-105 pipe nozzles have process blanks installed, T-104 open	244-TX, Nozzle H	Open	Downhill slope
7624	T-107, T-109, T-110, T-111	All transfer lines originate in the saltwell pump pit at the center of each tank: T-107, T-109 and T-111 pipe nozzles have process blanks installed, T-110 open	244-TX, Nozzle I	Open	Downhill slope

Diversion Box Isolation

Diversion Box	Information Regarding the Diversion Box
241-T-151	Weather covered and isolated – 10/15/80: drain line appears to be open; drain line V664 slopes downhill to 241-T-301B Catch Tank
241-T-152	Weather covered and isolated – 9/14/83: drain line appears to be open; drain line V664 slopes downhill to 241-T-301B Catch Tank
241-T-153	Weather covered and isolated – 10/24/80: drain line appears to be open; drain line V664 slopes downhill to 241-T-301B Catch Tank
241-T-252	Weather covered and isolated – 10/24/80: drain line appears to be open; drain line V727 slopes downhill to 241-T-301B Catch Tank
241-TR-152	Inactive 8/9/82; Weather covered and isolated: Floor drain plugged 8/9/82; drain line 6053 slopes downhill to tank T-101 (241-TR-01C Sluice Pit)
241-TR-153	Inactive 11/11/83; Weather covered and isolated: Floor drain plugged 11/11/83; drain line 6172 slopes downhill to tank T-102 (tank sidewall nozzle N-4)

Miscellaneous External Transfer Lines Isolation

Transfer Line No.	From Location in T Tank Farm	From Location Information	To Location	To Location Information	Fluid Hydraulics (from T Tank Farm)
No Identification	241-T-112	Near Southwest Tank Risers	Flush Tank and Cribs – 216-T-26, 216-T-27 & 216-T-28		Downhill Slope

Diversion Box External Transfer Lines Isolation (2 Sheets)

Transfer Line No.	From Location in T Tank Farm	From Location Information	To Location	To Location Information	Fluid Hydraulics (from T Tank Farm)
V653	241-T-151, U3	Nozzle open	221-T, Section 10	Process blank	Uphill slope
V654	241-T-151, U4	Nozzle open	221-T, Section 9	Process blank	Uphill slope
V411	241-T-151, U2	Connected via jumper to V658 (241-T-153, U8 – open)	241-TX-155, L18	Open	Uphill slope
V445	241-T-151, L6	Nozzle open	241-U-151, U1	Isolation blank	***Downhill slope (see Note 1)***
V663	241-T-151, L8	Nozzle open	216-T-36 Crib		Downhill slope
V667	241-T-152, U4	Nozzle open	221-T, Section 5	Process blank	Uphill slope
V668	241-T-152, U5	Nozzle open	221-T, Section 15	Process blank	Uphill slope
V669	241-T-152, U6	Nozzle open	221-T, Section 15	Process blank	Uphill slope
V671 [a.k.a., V706(3)]	241-T-152, U9	Process blank	224-T, C Cell		Uphill slope
V399	241-T-152, U7	Connected via jumper to V675 (241-T-153, U6 – open)	241-TX-155, L6	Open	Uphill slope
V405	241-T-152, U3	Nozzle open	241-TX-155, L12	Open	Uphill slope
V601	241-T-152, L10	Nozzle open	241-TX-153, U9	Open	Downhill slope
V706 [a.k.a., V706(1)]	241-T-252, U4	Isolation blank, line cut & capped near 241-T-111 tank	224-T, C Cell	Line rerouted see V671 above	Uphill slope

Diversion Box External Transfer Lines Isolation (2 Sheets)

Transfer Line No.	From Location in T Tank Farm	From Location Information	To Location	To Location Information	Fluid Hydraulics (from T Tank Farm)
V707	241-T-252, U5	Isolation blank	221-T, Section 10	Process blank	Uphill slope
6025	241-TR-152, U10	Process blank	241-TXR-151, U20	Isolation blank	Downhill slope
6012	241-TR-153, U13	Isolation blank and pipe cut and capped in pipe trench inside T tank farm	241-TXR-151, U10	Isolation blank, pipe cut and capped in pipe trench near 244-TX, rerouted and used for saltwell transfers (see saltwell transfer line information above)	Downhill slope
7624	241-TR-153, U14	Isolation blank and pipe cut and capped in pipe trench inside T tank farm	241-TXR-151, U14	Isolation blank, pipe cut and capped in pipe trench near 244-TX, rerouted and used for saltwell transfers (see saltwell transfer line information above)	Downhill slope
7630	241-TR-153, U9	Open	241-TXR-151, U17	Process blank	Downhill slope

1. Although this is a downhill slope the difference in elevation is only 4 feet over approximately a one mile run. For all intents and purposes this transfer line shall be considered to be level.
2. An isolation blank is a vapor seal.
3. A process blank is a fluid pressure seal.

Task# ORP-TPD-2005-0052

E-STARS™ Report
Task Detail Report
06/21/2005 0244

TASK INFORMATION			
Task#	ORP-TPD-2005-0052		
Subject	Concurrence: 05-TPD-062 Submittal of WMA Integration Studies in Partial Fulfillment of HFFACO Milestone M-45-00B		
Parent Task#		**Status**	CLOSED
Reference	05-TPD-062	**Due**	
Originator	Perez, Annez	**Priority**	High
Originator Phone	(509) 372-1382	**Category**	None
Origination Date	06/20/2005 0858	**Generic1**	
Remote Task#		**Generic2**	
Deliverable	None	**Generic3**	
Class	None	**View Permissions**	Normal
Instructions	bcc: TOD OFF FILE TOD RDG FILE MGR RDG FILE J. E. Rasmussen, ED S. J. Olinger, ORP S. D. Stubblebine, ORP C. J. Bosted, TF T. Z. Smith, TF D. C. Bryson, TED D. L. Noyes, TPD R. A. Quintero, TPD Record note: This closes CARS action item		

ROUTING LISTS		
1	Route List	Inactive
	• Noyes, Delmar L - Review - Concur - 06/21/2005 1442 *Instructions:*	
	• Rasmussen, Jim E - Review - Cancelled - 06/21/2005 1445 *Instructions:*	
	• Stubblebine, Scott D - Review - Cancelled - 06/21/2005 1445 *Instructions:*	
	• Smith, Thomas (Zack) - Review - Concur with comments - 06/21/2005 0944 *Instructions:*	
	• Schepens, Roy J - Approve - Approved - 06/21/2005 1347 *Instructions:*	

ATTACHMENTS	
Attachments	1. 05-TPD-062.raq.dln.eco.doc

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Task# ORP-TPD-2005-0052	
COLLABORATION	
COMMENTS	
Poster	Smith, Thomas (Zack) (Struthers, Deborah J) - 06/21/2005 0906
	Concur
	Chris Bosted concurred for Zack Smith 6/21/05
TASK DUE DATE HISTORY	
No Due Date History	
SUB TASK HISTORY	
No Subtasks	

-- end of report --

Task# ORP-TPD-2005-0052

E-STARS™ Report
Task Detail Report
06/20/2005 0902

TASK INFORMATION			
Task#	ORP-TPD-2005-0052		
Subject	Concurrence: 05-TPD-062 Submittal of WMA Integration Studies in Partial Fulfillment of HFFACO Milestone M-45-00B		
Parent Task#		**Status**	Open
Reference	05-TPD-062	**Due**	
Originator	Perez, Annez	**Priority**	High
Originator Phone	(509) 372-1382	**Category**	None
Origination Date	06/20/2005 0858	**Generic1**	
Remote Task#		**Generic2**	
Deliverable	None	**Generic3**	
Class	None	**View Permissions**	Normal
Instructions	bcc: TOD OFF FILE TOD RDG FILE MGR RDG FILE J. E. Rasmussen, ED S. J. Olinger, ORP S. D. Stubblebine, ORP C. J. Bosted, TF T. Z. Smith, TF D. C. Bryson, TED D. L. Noyes, TPD R. A. Quintero, TPD Record note: This closes CARS action item		

ROUTING LISTS

1	Route List	Active
	• Noyes, Delmar L - Review - Awaiting Response pw 6/20 *Instructions:*	
	• Rasmussen, Jim E - Review - Awaiting Response *Instructions:* MEB for JR 6/20/05	
	• Stubblebine, Scott D - Review - Awaiting Response *Instructions:*	
	• Smith, Thomas (Zack) - Review - Awaiting Response *Instructions:* 6/21/05	
	• Schepens, Roy J - Approve - Awaiting Response *Instructions:*	

ATTACHMENTS

Attachments	1. 05-TPD-062.raq.dln.eco.doc

Task# ORP-TPD-2005-0052
COLLABORATION
COMMENTS
No Comments
TASK DUE DATE HISTORY
No Due Date History
SUB TASK HISTORY
No Subtasks

-- end of report --