RPP-14824, Revision 0

CONTENTS OF RISK ASSESSMENTS TO SUPPORT THE RETRIVAL AND CLOSURE OF TANKS FOR THE WASHINGTON STATE DEPARTMENT OF ECOLOGY

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LIST OF TABLES

Acronyms

BBI	Best Basis Inventory
DOE	U.S. Department of Energy
DQO	data quality objective
DST	double-shell tank
Ecology	Washington State Department of Ecology
EPA	U.S. Environmental Protection Agency
FIR	field investigation report
ILAW	immobilized low-activity waste
ILCR	incremental lifetime cancer risk
MUST	miscellaneous underground storage tank
ORP	Office of River Protection
PA	performance assessment
RCRA	Resource, Conservation, and Recovery Act
RPE	retrieval performance evaluation
SST	single-shell tank
TFC	tank farm contractor
TPA	Tri-Party Agreement (also known as the Hanford Federal Facility Agreement and Consent Order)
WMA	waste management area

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1.0 INTRODUCTION

At the Department of Energy's (DOE) Hanford Site in south central Washington State, there are 177 large underground tanks with associated facilities that are used to store radioactive hazardous waste. Some of these tanks have leaked, with the result that there is tank waste in the Site's groundwater. DOE's Office of River Protection (ORP) plans to remediate these storage facilities (RPP-13678, *Integrated Mission Acceleration Plan*) by retrieving waste from the tanks, performing facility stabilization, and implementing soil cleanup. Before such work can be performed, risk assessments of various options must be performed for ORP, DOE Headquarters, and the Washington State Department of Ecology (Ecology). Because of the large number of risk assessments for each tank and the large number of tanks, risk assessments for the different agencies will be integrated to the maximum extent possible. This document focuses on the risk assessments for Ecology.

There are three types of large underground tanks at Hanford: single-shell tanks (SSTs), double-shell tanks (DSTs), and miscellaneous underground storage tanks (MUSTs). The SSTs have a storage capacity ranging from 50,000 to 1,000,000 gallons. Although waste is still present, they do not meet current regulatory requirements for the addition of waste. The DSTs have a storage capacity ranging from 500,000 to 1,160,000 gallons and are expected to meet current regulatory requirements. The SSTs are grouped into 12 tank farms (A, AX, B, BX, BY, C, S, SX, T, TX, TY, and U). For regulatory purposes, the 12 tank farms are grouped into 7 waste management areas (WMAs) (A/AX, B/BX/BY, C, S/SX, T, TX/TY, and U), although the T and TX/TY WMAs are often treated as a unit. The DSTs are grouped only into tank farms (AN, AP, AW, AX, AY, AZ, and SY). MUSTs are smaller tanks (maximum size of 50,000 gallons) that are scattered in various farms

Section 2.0 provides a general description of the risk assessment document to be supplied to Ecology as well as a general description of the contents. Section 3.0 provides a description of the requirements that apply to all the documents. The following sections provide a detailed discussion of the contents of each document.

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2.0 OVERVIEW

Most of the risk assessments to be performed for Ecology can be grouped under one of the following categories or in support documents found in one of these categories:

- Field Investigation Reports
- Pre-Retrieval Functions and Requirements
- Post-retrieval Tank Risk Assessment
- Pre-Closure Tank Risk Assessment
- Tank Farm Feasibility Study
- Tank Farm Closure Risk Assessment

The first category covers reports that are part of the Resource, Conservation, and Recovery Act (RCRA) Corrective Action Program and deals with past leaks. The next three categories deal with decisions on single tanks, but put the information in context of an entire tank farm/WMA. The Feasibility Study and Tank Farm Risk Assessments deal with decisions on a tank farm/WMA basis. The last five categories will include past leaks, potential retrieval leaks, and residual waste as sources of contamination. The last four categories will also include the impact of auxiliary equipment.

The next section provides general requirements and comments that apply to all risk assessments. They involve consistency among documents, performance objectives and metrics, data documentation, computer codes, and interactions with other projects.

The following sections will treat each category in detail. Each section will be broken into the following subsections as needed:

1. Overview
2. Decisions Supported
3. Scope
4. When Submitted
5. Types of Assessment
6. Sources of Contaminants
7. Types of Data Needed
8. Numeric Calculations Performed
9. Analysis
10. Relationship with Other Categories

Details about each subsection are given in Table 1.

As more data is gathered and analyses performed on tanks in a farm or a WMA, the document's quality will improve. It is expected that subsequent assessments will build on previous assessments, allowing documents to reference material, rather than repeat it.

Table 1. Details of Subsections

Subsection	Description
Overview	Summary of the purpose of the documents in the category, previously established requirements, previous examples, and other significant information
Decisions Supported	Description of decisions that will be based on the information presented. Description of the decision maker(s)
Scope	Description of information covered.
When Submitted	Description of prior events needed.
Types of Assessments	Description of type of risk assessments. Examples are long-term groundwater pathways (including transport to the Columbia River), long-term air pathways, long-term inadvertent intrusion, long-term ecological assessment, and short-term worker risk.
Sources of Contaminants	1) Past Leaks, 2) Leaks during retrieval, 3) Residual waste, 4) waste in ancillary equipment and surface spills
Types of Data Needed	Data that distinguishes this category from others. Generic data (it is assumed that, recharge, hydraulic, geochemical, and geologic data is needed for any transport numeric simulation.
Numeric Calculations Performed	Description of numeric simulations to be run
Analysis	Description of analyses/options to be performed
Relationship with other categories	Description of other categories in this document

3.0 GENERAL REQUIREMENTS

The following sections will provide detailed descriptions and requirements for the various categories of risk assessments to be performed in tank retrieval/closure. This section looks at requirements that apply to all categories.

3.1 CONSISTENCY AMONG DOCUMENTS

There will be a large number of documents produced, both because of the number of document categories, but also because of the large number of tanks, tank farms, and WMAs. The intent is to build on previous documents whether in different categories for the same tank, or for the same category for different tanks. Data and methods are expected to improve in a systematic way as additional documents are produced.

3.2 PERFORMANCE OBJECTIVES AND METRICS

As noted in the "Recommended Long-Term Risk Assessment Approach" in Appendix C of the *Single-Shell Tank System Closure Plan* (RPP-13744), the early establishment of performance objectives is important. These objectives will be defined in the *Performance Objectives for Tank Closure Risk Assessments* (Mann et al. 2003) after consultation with Ecology. The objectives, as formally modified, will be used in all risk assessments in this document.

3.3 DATA

As noted in the section above on consistency in documents, data is expected to improve in a systematic way as additional documents are produced. These risk assessments are expected to depend heavily on data actually collected, rather than on assumptions or extrapolations. As new data is collected for each major waste type and geographical unit, they will be put into the context of what is already known and new conceptual models may develop. Data (particularly inventory, release data, and other inputs to contaminant transport modeling), as well as conceptual models, will be changed only when convincing argument shows the new data is better than currently in the database.

Some data will be common among all risk assessments. As noted above, such data will be formally controlled. Dosimetry data will similarly be controlled and will be defined in *Exposure Scenarios and Unit Dose Factors for Hanford Tank Waste Performance Assessment* (Rittmann 2003).

3.4 COMPUTER CODES

All numeric codes used for contaminant transport will meet the requirements in the *Computer code Selection Criteria for Flow and Transport Code(s) To Be Used in Vadose Zone*

Calculations for Environmental Analyses in the Hanford Site's Central Plateau (Mann et al. 1999). The *STOMP Subsurface Transport Over Multiple Phases, Version 2.0 Users Guide* (White and Oostrom 2000) and *VAM3DF – Variably Saturated Analysis Model in Three Dimensions for the Data Fusion System: Documentation and User's Guide, Version 2.0* (Huyakon and Panday 1999) computer codes have been used for Ecology-reviewed ORP risk assessments (Field Investigation Reports (FIRs) and the Immobilized Low-Activity Waste Performance Assessment (ILAW PA), respectively), and both codes meet the requirements in Mann et al. (1999).

3.5 SHORT-TERM RISK ASSESSMENT

Tank waste retrieval and tank closure activities will be designed so that any short-term impacts (whether to the workers or to the public) are as low as reasonably achievable. However, ORP may find that this goal is in conflict with the goal of minimizing long-term risks. For these cases or for cases where costs are extreme, the relevant documents will report short-term risks (occupational injuries, illnesses, and fatalities) for workers and the general public and costs based on the analyses of relevant accident scenarios or design costs.

3.6 INTERACTIONS WITH OTHER PROJECTS

A variety of other projects are producing risk assessments at the Hanford Site, or produced data, that are useful for such risk assessments. Extremely successful relationships have already been formed. Relationships will be maintained among:

- Tank Closure Project
- River Protection Project's Strategic Planning and Mission Analysis Group
- ILAW PA
- Solid Waste burial Ground Performance Assessment
- Groundwater Protection Program
    - Characterization of Systems
    - Science and Technology Project
    - Site-Wide Assessments Project
    - Waste Site Remedial Actions Project
- Environmental Impact Statement Activities

Many of the risk assessments require that the impacts be placed in context of Hanford Site impacts. Such a context will be based on work done by the Site-Wide Assessments Project, whether the work is formal updates of the Hanford Site composite Analysis (*Composite Analysis for Low-Level Waste Disposal in the 200-Area Plateau of the Hanford Site,* Kincaid et al. 1998) or special runs of the System Assessment Capability (*An Initial Assessment of Hanford Impact Performed with the System Assessment Capability,* Bryce et al. 2002).

Once DOE establishes a Hanford Site Risk Assessment Coordination Panel, this activity will play an active role in its tasks and will follow the Hanford Site standards that the panel creates.

4.0 FIELD INVESTIGATION REPORTS

4.1 OVERVIEW

The FIRs are secondary documents under the *Hanford Federal Facility Agreement and Consent Order* or Tri-Party Agreement (TPA, Ecology 1989) Milestone M45-55. They are part of the RCRA Corrective Action Program. They document:

- Existing data on existing contamination in a WMA from past tank leak events,
- New field, laboratory, and analysis information obtained during the effort,
- Numerical simulations of such past leak events on groundwater,
- Corrective actions (known as interim measures) taken to mitigate impacts on groundwater, and
- Recommendations for additional data collections, analyses, or interim measures.

The requirements for FIRs are specified in the *Phase 1 RCRA Facility Investigation/Corrective Measures Study Work Plan for Single-Shell Tank Waste Management Areas* (known as the Master Work Plan) (DOE/RL-99-36).

4.2 DECISIONS SUPPORTED

The tank farm contractor (TFC, presently CH2M Hill Hanford Group, Inc.), ORP, and Ecology use the FIR information to determine whether any additional data collections, analyses, or interim measures are needed. The TFC or ORP can implement such actions on their own. The information is also used during later phases of the RCRA Corrective Action program (i.e., during the Corrective Measures phase) to determine whether more extensive activities are needed. The baseline data and information will also support Tier-1, -2, and –3 closure plans (RPP-13744).

4.3 SCOPE

The FIRs are part of the RCRA Corrective Action Program dealing with past tank leak events. They analyze the impacts to groundwater to determine whether corrective actions are needed to mitigate the impacts.

4.4 WHEN SUBMITTED

Dates are established in the TPA and are independent of retrieval/closure decisions. The *Field Investigation Report for Waste Management Area S-SX* (Knepp 2001) was submitted to Ecology in January 2002. The *Field Investigation Report for Waste Management Area B-BX-BY* (Knepp 2002) was submitted to Ecology in January 2003. The FIR for T and TX/TY WMAs is scheduled for submission to Ecology in January 2005, while the FIRs for WMA A/AX and C and for WMA U are scheduled for 2006 and 2007.

4.5 TYPES OF ASSESSMENT

The FIRs investigate only the long-term impact to groundwater from past tank leaks. Impacts from tank residuals or from waste left in ancillary equipment are not investigated. There are no short-term assessments, nor are other transport pathways investigated.

4.6 SOURCES OF CONTAMINANTS

The FIRs only investigate past tank leaks (actual leaks, tank spills). They do not investigate other sources of contaminants.

4.7 TYPES OF DATA NEEDED

Most of the focus of the field investigations is on the amount and distribution of the leaked contaminants. Other data is collected to support transport calculations. The data from the Science and Technology Project of the Groundwater Protection Program, a collaboration of various National Laboratories that uses the soil samples obtained during the effort, has provided important insights.

A significant effort is to determine the information already known about the specific WMA. Such data is summarized and referenced in the following Subsurface Conditions Descriptions Reports: *Subsurface Conditions Description for the S-SX Waste Management Area, Subsurface Conditions Description of the B-BX-BY Waste Management Area, and Subsurface Conditions Description of the T and TX-TY Waste Management Areas;* (Wood et al. 1999, Wood et al. 2000, Wood et al. 2001) and in the following inventory reports: *Inventory Estimates for Single-Shell Tank Leaks in S and SX Tank Farms, Inventory Estimate for Single-Shell Tank Leaks in T, TX and TY Tank Farms, and Preliminary Inventory Estimates for Single-Shell Tank Leaks in B, BX ,and BY Tank Farms, and Groundwater/Vadose Zone Integration Project: Hanford Soil Inventory Model* (Jones et al. 2000a, Jones et al. 2000b, Jones et al. 2001, and Simpson et al. 2001). Through such reports, important data gaps are noted and discussed through a data quality objective (DQO) process. A formal data collection plan has historically been issued as appendices to the Master Work Plan (Henderson 1999, *Preliminary Site-Specific SST Phase 1 RFI/CMS Work Plan Addendum for WMA S-SX;* Knepp and Rogers 2000, *Site-Specific SST Phase 1 RFI/CMS Work Plan Addendum for WMA S-SX;* Rogers and

Knepp 2000, *Site-Specific SST Phase 1 RFI/CMS Work Plan Addendum for WMA B-BX-BY;* Crumpler 2002, *Site-Specific SST Phase 1 FRI/CMS Work Plan Addendum for WMAs T and TX-TY*).

Data collection has focused on the collection of contaminated soil samples in the highest area of contamination in the WMA. Soil samples are also collected from areas where significant contamination is expected. Also part of the field program is geophysical logging of the new soil penetrations and of existing boreholes.

Laboratory measurements of the soil samples consist of sets of experiments depending on the nature of contamination found. Auxiliary experiments have provided important data on chemical processes used at the Hanford Site as well as in-tank characterization. The work has been extensively documented in works such as *Characterization of Uncontaminated Sediments form the Hanford Reservation – RCRA Borehole Core Samples and Composite Samples; Geologic and Geochemical Data Collected from Vadose Zone Sediments from Borehole 299-W23-19 [SX-115] in the S/SX Waste Management Area and Preliminary Interpretations; Geologic and Geochemical Data Collected from Vadose Zone Sediments from Borehole SX 41-09-39 in the S/SX Waste Management Area and Preliminary Interpretations; and Geologic and Geochemical Data Collected from Vadose Zone Sediments from Slant Borehole [SX-108] in the S/SX Waste Management Area and Preliminary Interpretations* (Serne et al. 2001a, Serne et al. 2001b, Serne et al 2001c, Serne et al 2001d).

4.8 NUMERIC CALCULATIONS PERFORMED

The purpose of the numeric calculations is to estimate whether contamination already released will violate groundwater standards and whether corrective measures would mitigate this impact. A base analysis no action case is defined. Sensitivity cases examine the most important assumptions. Additionally, numeric cases are run to investigate the effect of various corrective actions.

Contaminants modeled are limited to those thought to be the most important based on previous modeling and on field/laboratory measurements. Other key parameters are defined in the Master Work Plan.

4.9 ANALYSIS

Areas of analysis include improvements of the conceptual model for inventory amount and distribution from past leaks and for transport of contaminants, discussion of installation of corrective actions already performed and their expected impact, and recommendations for additional corrective actions.

The quality of the report should assume approval would be by ORP staff and by the Ecology management at the Kennewick office.

4.10 RELATIONSHIP WITH OTHER CATEGORIES

The data collected and the conceptual models generated in the FIRs are expected to form the backbone of the data and models used in all the remaining categories. The numeric simulations used in the FIRs should form the transition into modeling of tank farm contaminants.

5.0 PRE-RETRIEVAL FUNCTIONS AND REQUIREMENTS

5.1 OVERVIEW

Pre-Retrieval Functions and Requirements reports provide the function and requirements for the design of tank waste retrieval system. An important part of this information is the long-term environmental and short-term worker risk information. The reports will be based on the best available existing data to the maximum extent possible, with little new data collected for the creation of the document. Long-term risk assessments will be based on Technetium-99 (Tc-99) impacts to groundwater.

In previous Retrieval Function and Requirements documents, *Single-Shell Tank C-104 Full Scale Sludge/Hard Heel, Confined Sluicing and Robotics Technologies, Waste Retrieval Demonstration Functions and Requirements*; *Single-Shell Tank S-112 Full Scale Saltcake Waste Retrieval Demonstration Functions and Requirements*; and *S-102 Initial Waste Retrieval Demonstration Functions and Requirements* (Carpenter 2001, Crass 2001, Crass 2002), a full retrieval performance evaluation (RPE) was performed and included as an appendix to these documents.

This new approach will provide needed design data in a clearer format and show the underlying assumptions more clearly. An example of this new approach is *Single-Shell Tank 241-U-107 Waste Retrieval Functions and Requirements* (Baide 2003)

5.2 DECISIONS SUPPORTED

Pre-Retrieval Functions and Requirements documents support the design of the tank waste retrieval system (RPP-13744).

5.3 SCOPE

Pre-Retrieval Functions and Requirements provide figures and tables allowing designers and regulators to understand the short and long-term risk of leaving various amounts of Tc-99 in the tank (including no action) and of having various amounts leak during retrieval. Tc-99 has been chosen as the major contaminate of concern based on earlier tank waste studies (Knepp 2001; Knepp 2002; and Mann et al. 2001, *Hanford Immobilized Low-Activity Tank Waste Performance Assessment*) as well as on Hanford Site work *Composite Analysis for Low-Level Waste Disposal in the 200-Area Plateau of the Hanford Site*, and *An Initial Assessment of Hanford Impact Performed with the System Assessment Capability* (Kincaid et al. 1998 and Bryce et al. 2002).

5.4 WHEN SUBMITTED

Pre-Retrieval Functions and Requirements documents are submitted before final design of the retrieval method and leak detection monitoring is established.

5.5 TYPES OF ASSESSMENT

The reports will cover long-term groundwater impacts for the various retrieval options being studied. The results of the tank being studied will be put into context of all tanks in the farm or WMA.

5.6 SOURCES OF CONTAMINANTS

The sources of contamination to be included are past leaks, waste presumed to be left in the tank(s), and potential retrieval leaks. Tc-99 is the contaminant of concern for groundwater risk.

5.7 TYPES OF DATA NEEDED

Present inventory values will be taken from best available existing data, such as the Best Basis Inventory (BBI) and published soils inventory data. As no transport calculations will be performed, data supporting such calculations are not needed.

5.8 NUMERIC CALCULATIONS PERFORMED

Contaminant transport calculations will not be performed. Rather the effect of release and transport will be taken from previous studies that are the most relevant to the case being studied. For initial assessments, these are previous RPEs for the impacts from residual waste and previous FIRs for past leaks and potential retrieval leaks. For later assessments, it is expected that detailed contaminant transport calculations from retrieval and closure risk assessments will be available. There will be no short-term risk assessment of worker or general public exposure since these are design requirements that include the mandate to minimize such exposures.

5.9 ANALYSIS

The analysis will provide long-term groundwater risk in the format of graphs and tables. At a minimum, graphs showing:

- Incremental lifetime cancer risk (ILCR) as a function of Tc-99 left in the tank
- ILCR as a function of Tc-99 leaked from the tank, including the effects of past leaks
- ILCR as a function of both Tc-99 in residual waste and Tc-99 leaked from the tank.

Since the amount of Tc-99 left or potentially leaked is strongly influenced by design decisions, it is premature to express metrics in terms of residual volume or potential leak lost volumes.

Tables will be provided to put such risks into prospective given the other tanks in the tank farm or WMA. Assumptions for the analysis will be clearly stated.

The quality of the Pre-Retrieval Functions and Requirements should assume approval would be by ORP staff and by the Ecology management at the Kennewick office.

5.10 RELATIONSHIP WITH OTHER CATEGORIES

The Pre-Retrieval Functions and Requirements are expected to build on the data and methods of other categories.

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6.0 POST-RETRIEVAL TANK RISK ASSESSMENT

6.1 OVERVIEW

Post Retrieval documents are part of the Appendix H process of the TPA. They are part of the information to determine whether additional retrieval of tank waste is needed. Such documents will consider all sources of contamination and put the information in context of the tank farm, WMA, and Hanford Site.

6.2 DECISIONS SUPPORTED

The Post Retrieval Tank Risk Assessments support the decision on whether additional retrieval from a particular tank is needed.

6.3 SCOPE

The Post Retrieval Tank Risk Assessments provide the human health environmental impact of not retrieving additional waste and the short-term risks if additional waste is to be retrieved or if interim closure actions (such as installation of a stabilization layer) are to be performed.

6.4 WHEN SUBMITTED

The Post Retrieval Tank Risk Assessments shall be submitted after retrieval for a particular tank is thought to have been completed and supporting information from analyses of residual waste and potential tank leak inventory and volume is available.

6.5 TYPES OF ASSESSMENT

The following type of assessments will be covered

- Long-term human health and environment assessment of groundwater pathway (include impacts on surface waters)
- Long-term human health and environmental assessment of the air pathway
- Long-term human health assessment assuming inadvertent intrusion

Long-term ecological risk analysis is not required. Short-term risk assessments will be required for any additional retrieval to be done or for interim closure activities to be performed.

6.6 SOURCES OF CONTAMINANTS

All sources of contamination will be considered. These shall include waste remaining in tanks, waste remaining in tank farm auxiliary facilities, tank waste in the soils, and tank waste in the groundwater. Impacts from sources in the tank farm or WMA shall be compared with the impacts from all Hanford Site sources.

All significant contaminants (whether radiological or chemical) will be analyzed. A screening assessment (in the manner of that performed for the ILAW PA [Mann et al. 2001]) will be part of the document.

6.7 TYPES OF DATA NEEDED

All data (inventory, facility design, geology, hydraulic, geochemical, and dosimetry) used in a contaminant fate and transport calculation are needed. Data will be kept under configuration control. Based on past Hanford Site assessments (FIRs [2001 and 2002b] and ILAW PA [Mann et al. 2001]), the most important data is:

- The inventory of key contaminants,
- The release rate of such contaminants,
- The rate at which moisture enters the system, and
- The groundwater flow rate.

The last two data items, as well as other needed transport data, are expected to be obtained from the FIRs and from other Hanford Site programs.

Data on the inventory and release rate of key contaminants for the tank of interest (whether residual in the tank or leaked from the tank) will come from measurements from samples taken after the retrieval is complete or based on measurements on samples taken during retrieval. Data for other tanks, for auxiliary equipment, and for soil contamination from other tanks will be based on the best available data, which is expected to be previous sampling campaigns, BBI, and soil inventory data.

6.8 NUMERIC CALCULATIONS PERFORMED

Numeric simulations will be performed for the no further action case (i.e., the simulations for residual waste will assume no impact from tank filler material). Other cases (e.g., barrier installation, tank fill) will also be performed for information. No credit or debit will be taken for the tank itself, unless credible information on tank degradation is available.

Key contaminants, as determined from screening calculations, will be explicitly modeled. Other contaminants will be grouped with key contaminants having similar physical and chemical properties. Sensitivity cases will be performed to determine the sensitivity of assumptions and the values of key data.

6.9 ANALYSIS

The analysis should provide a “reasonable expectation” of whether the amount of residual waste and associated leaks existing after retrieval protects human health and the environment would require additional retrieval. For those data, processes, and assumptions that are most significant to the results, sensitivity analyses will be performed to establish the reasonable expectation.

The analyses will put all results in context with other tanks/systems in the tank farm or the WMA as well as in context of other past and expected releases from the Hanford Site Central Plateau.

The quality of the Post-Retrieval Risk Assessments should assume approval would be by senior ORP management and by the Head of the Nuclear Waste Division of Ecology.

6.10 RELATIONSHIP WITH OTHER CATEGORIES

The Post-Retrieval Risk Assessments will build on the data, process, models, and insights gained in the FIRs for the transport of contaminants once they have left the tank. The following risk assessments will build on the inventory and release rates for residual materials estimated in this category of documents

It is expected that as experience grows, the Post Retrieval Risk Assessment and the Pre-Closure Tank Risk Assessment will merge into one document.

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7.0 PRE-CLOSURE TANK RISK ASSESSMENT

7.1 OVERVIEW

These reports document the design and methods to perform component closure of the tank. These reports should fulfill requirements under RCRA and under the DOE order 435.1, *Radioactive Waste Management*.

7.2 DECISIONS SUPPORTED

The Pre-Closure Tank Risk Assessments support the decision to perform component closure on a tank. These documents should also serve to fulfill the risk assessment requirements under DOE O 435.1 (High-Level Waste Facility Closure Plan Risk Assessment and Low-Level Waste Radiological Performance Assessment).

7.3 SCOPE

The Pre-Closure Tank Risk Assessments cover all short- and long-term risk information needed by the regulators to allow tank component closure to proceed.

7.4 WHEN SUBMITTED

The Pre-Closure Tank Risk Assessments shall be submitted after retrieval for a particular tank is completed and enough information is available to estimate with reasonable expectation the short- and long-term risk associated with tank closure. This assessment for a particular tank assumes that the post-retrieval tank risk assessment has been approved or is part of this document.

7.5 TYPES OF ASSESSMENT

The following type of assessments will be covered:

- Long-term human health and environment assessment of groundwater pathway (include impacts on surface waters)
- Long-term human health and environmental assessment of the air pathway
- Long-term human health assessment assuming inadvertent intrusion

Long-term ecological risk analysis is not required. Short-term risk assessments will be required for all closure activities under consideration.

7.6 SOURCES OF CONTAMINANTS

All sources of contamination will be considered. These shall include waste remaining in tanks, waste remaining in tank farm auxiliary facilities, tank waste in the soils, and tank waste in the groundwater. Impacts from sources in the tank farm or WMA shall be compared with the impacts from all Hanford Site sources.

All significant contaminants (whether radiological or chemical) will be analyzed.

7.7 TYPES OF DATA NEEDED

Inventory and contaminant transport data will be obtained from the corresponding Post-retrieval Tank Risk Assessment. Additional information needed is release rates from any grouted materials, hydraulic properties of the fill material as well as degradation rates for man-made structures (such as the proposed surface barrier, the tank, and man-made fill materials).

7.8 NUMERIC CALCULATIONS PERFORMED

Numeric simulations will be performed for the residual waste in tank and for waste released from the tank. The simulations for residual waste will include the effects of tank degradation as well as effects from tank filler material.

Key contaminants, as determined from screening calculations, will be explicitly modeled. Other contaminants will be grouped with key contaminants having similar physical and chemical properties. Sensitivity cases will be performed to determine the sensitivity of assumptions and the values of key data.

7.9 ANALYSIS

The analysis should provide a “reasonable expectation” of whether tank component closure as planned protects human health and the environment. For those data, processes, and assumptions that are most significant to the results, sensitivity and uncertainty analyses will be performed to establish the reasonable expectation.

The analysis will put all results in context with other tanks/systems in the tank farm or the WMA as well as in context of other past and expected releases from the Hanford Site Central Plateau.

The quality of the Pre-Closure Tank Risk Assessments should assume approval would be by DOE/headquarters and by the Head of the Nuclear Waste Division of Ecology.

7.10 RELATIONSHIP WITH OTHER CATEGORIES

The Pre-Closure Tank Risk Assessments will build on the data, process, models, and insights gained in the FIRs and the Post-Retrieval Risk Assessments. Following risk assessments will build on the release rates for residual materials in closed tanks estimated in this category of documents.

It is expected that as experience grows, the Post-Retrieval Risk Assessment and the Pre-Closure Tank Risk Assessment will merge into one document. After most of the tanks in a farm are closed, it is possible that the Pre-Closure Risk Tank Assessments for the remaining tanks will be combined with the Tank Farm Feasibility Study.

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8.0 TANK FARM FEASIBILITY STUDY

8.1 OVERVIEW

These reports assess the impact of additional remediation work after the tanks in the tank farm or WMA have been component closed. It is expected to mainly affect tank farm soils and auxiliary equipment. Most of the data and numeric simulations should have been gathered or performed by earlier assessments.

Depending on the amount and source of contamination, there may be interim tank farm feasibility studies to address the contamination. These reports will build on the Field Investigation Reports described in Section 3.0.

8.2 DECISIONS SUPPORTED

The Tank Farm Feasibility Studies support the decision on what additional remediation is needed after tanks in the tank farm or WMA have been component closed. It is expected to mainly affect tank farm soils and auxiliary equipment.

8.3 SCOPE

The Tank Farm Feasibility Studies cover all short- and long-term risk information needed for the regulators to allow closure of the tank farm or WMA.

8.4 WHEN SUBMITTED

The reports should be submitted after all tanks in the tank farm or WMA have been filled and isolated from the rest of the tank far system (component closed).

8.5 TYPES OF ASSESSMENT

The following type of assessments will be covered

- Long-term human health and environment assessment of groundwater pathway (include impacts on surface waters)
- Long-term human health and environmental assessment of the air pathway
- Long-term human health assessment assuming inadvertent intrusion
- Ecological risk assessment

Short-term risk assessments will be required for all activities under consideration.

8.6 SOURCES OF CONTAMINANTS

All sources of contamination will be considered. These shall include waste remaining in tanks, waste remaining in tank farm auxiliary facilities, tank waste in the soils, and tank waste in the groundwater. Impacts from sources in the tank farm or WMA shall be compared with the impacts from all Hanford Site sources.

All significant contaminants (whether radiological or chemical) will be analyzed.

8.7 TYPES OF DATA NEEDED

Inventory, contaminant transport parameters, and other data needed for the numeric calculations are assumed to be available from previous work. Measures to determine inventory data for tank farm soils and/or auxiliary facilities may be needed.

8.8 NUMERIC CALCULATIONS PERFORMED

Numeric simulations will be performed for the residual waste in tank and for waste released from the tank. The simulations for residual waste will include the effects of tank degradation as well as effects from tank filler material.

Key contaminants, based on screening calculations, will be explicitly modeled. Other contaminants will be grouped with key contaminants having similar physical and chemical properties. Sensitivity cases will be performed to determine the sensitivity of assumptions and the values of key data.

8.9 ANALYSIS

The analysis should provide a “reasonable expectation” of whether tank farm or WMA closure as planned protects human health and the environment would require additional retrieval. For those data, processes, and assumptions that are most significant to the results, sensitivity and uncertainty analyses will be performed to establish the reasonable expectation.

The analysis will put all results in context with other tanks/systems in the tank farm or the WMA as well as in context of other past and expected releases from the Hanford Site Central Plateau.

The quality of the Tank Farm Feasibility Studies should assume approval would be by DOE/headquarters and by the Head of the Nuclear Waste Division of Ecology.

8.10 RELATIONSHIP WITH OTHER CATEGORIES

The Tank Farm Feasibility Study will build on the data, process, models, and insights gained in the earlier risk assessments. The Tank Farm Closure Risk Assessment will validate the closure efforts proposed in this category of documents.

After most of the tanks in a farm are closed, it is possible that the Pre-Closure Risk Tank Assessments for the remaining tanks will be combined with the Tank Farm Feasibility Study.

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9.0 TANK FARM CLOSURE RISK ASSESSMENT

9.1 OVERVIEW

These reports assess whether the closure activities specified in earlier documents (tank closure risk assessment, and tank farm feasibility study) have been sufficient to remediate the tank farm or WMA. It is expected that this will be the last risk assessment dealing explicitly with the tank farm and WMA, and that its results will feed the risk assessment supporting final Hanford Site closure. This risk assessment is also expected to meet the DOE requirements under DOE O 435.1 for a closure performance assessment.

It is expected that data collection and numeric analyses will be minor, as previous documents should have provided the information.

9.2 DECISIONS SUPPORTED

The Tank Farm Closure Risk Assessments support the decision on whether additional remediation is necessary to close the tank farm or WMA and enter into the post-closure monitoring phase.

9.3 SCOPE

These reports cover all short- and long-term risk information necessary to make the decision that remediation has been completed. Information provided should be sufficient to satisfy RCRA, Comprehensive Environmental Response, Compensation, and Liability Act, and DOE Order requirements.

9.4 WHEN SUBMITTED

The Tank Farm Closure Risk Assessments should be submitted after all remediation in the tank farm or WMA (with the possible exception of placement of the final closure barrier) is complete.

9.5 TYPES OF ASSESSMENT

The following type of assessments will be covered:

- Long-term human health and environment assessment of groundwater pathway (include impacts on surface waters).

- Long-term human health and environmental assessment of the air pathway.

- Long-term human health assessment assuming inadvertent intrusion.
- Long-term ecological risk assessment.
- Short-term risk assessment of remediation options considered.

Additional types of risk assessment may be needed as more experience is obtained in closing tank farm systems.

9.6 SOURCES OF CONTAMINANTS

All sources of contamination will be considered. These shall include waste remaining in tanks, waste remaining in tank farm auxiliary facilities, tank waste in the soils, and tank waste in the groundwater. Impacts from sources in the tank farm or WMA shall be compared with the impacts from all Hanford Site sources. All significant contaminants (whether radiological or chemical) will be analyzed.

9.7 TYPES OF DATA NEEDED

It is expected that data and numeric analyses needed will have been gathered or performed previously. If conditions (e.g., new data, different designs, different implantations) have changed to make previous work unreliable, then new data and/or numeric simulations will have to be collected or run.

It is expected that where the inventory and/or release of such contaminants are significant to the impacts estimated, the values used will be based on measurement.

9.8 NUMERIC CALCULATIONS PERFORMED

It is expected that data and numeric analyses needed will have been gathered or performed previously. If conditions (e.g., new data, different designs, different implantations) have changed to make previous work unreliable, then new data and/or numeric simulations will have to be collected or run.

9.9 ANALYSIS

The analysis should show whether a “reasonable expectation” exists that no further remediation activities are needed. For those data, processes, and assumptions that are most significant to the results, sensitivity and uncertainty analyses will be performed to establish the reasonable expectation.

The quality of the Tank Farm Closure Risk Assessments should assume approval would be by DOE headquarter, Environmental Protection Agency (EPA) Regional 10 office, and by the Head of the Nuclear Waste Division of Ecology.

9.10 RELATIONSHIP WITH OTHER CATEGORIES

This is the final risk assessment for the tank farm or WMA.

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10.0 SUMMARY

The various categories of risk assessment to support tank farm operations, retrieval, and closure have been presented. The purpose and efficient features of each category are presented in Table 2.

Table 2. Important Features of Risk Assessment

Category	Purpose	Significant Feature
Field Investigation Reports	Determine whether addition correction actions are needed to address past leaks	Gather field/laboratory data to fill in data gaps. Perform numeric calculations to understand transport conceptual model. Recommend additional corrective actions, if any.
Pre-Retrieval Functions and Requirements	Provide environmental information for the design of retrieval systems	Use existing data to estimate risk (based on Tc-99) of no action, of residual waste, and of potential future leaks.
Post-retrieval Tank Risk Assessment	Determine whether additional retrieval of waste is necessary	Determine inventory of key contaminants in residual waste in tank and in any retrieval leaks. Perform numeric calculations of impacts of waste remaining (including impacts from other tanks and equipment in farm or WMA) assuming no impacts from tank fill.
Pre-Closure Tank Risk Assessment	Determine whether closure of tank can proceed using the methods proposed	Determine impacts from various options to close (including fill and barriers) a tank. Impacts will include impacts from other tanks and equipment in farm or WMA. Provide worker risk information for proposed closure options.
Tank Farm Feasibility Study	Determine actions that are needed to close a tank farm or WMA	Determine impacts from various options to close tank farm or WMA. Provide worker risk information for proposed closure options.
Tank Farm Closure Risk Assessment	Determine whether closure actions as implemented have been successful	Determine impacts from closed tank farm or WMA, once all closure activities (except possibly final surface barrier) are completed.

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