WASTE TREATMENT AND IMMOBILIZATION PLANT
CHAPTER 11.0
CLOSURE PLAN

CHANGE CONTROL LOG

Change Control Logs ensure that changes to this unit are performed in a methodical, controlled, coordinated, and transparent manner. Each unit addendum will have its own change control log with a modification history table. The "**Modification Number**" represents Ecology's method for tracking the different versions of the permit. This log will serve as an up to date record of modifications and version history of the unit.

Modification History Table

Modification Date	Modification Number
03/01/2017	8C.2016.Q4
05/23/2016	8C.2016.Q1

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Note: Where information regarding treatment, management, and disposal of the radioactive source byproduct material and/or special nuclear components of mixed waste (as defined by the Atomic Energy Act of 1954 as amended) has been incorporated into this document, it is not incorporated for the purpose of regulating the radiation hazards of such components under the authority of this permit or chapter 70.105 RCW and its implementing regulations but is provided for information purposes only.

This chapter is the Resource Conservation and Recovery Act (RCRA) closure plan for the River Protection Project Waste Treatment Plant (WTP) permitted ~~mixed~~dangerous waste management units~~,~~ (DWMUs), as required per the *Washington Administrative Code* (WAC) 173-303-806(4)(a)(xiii). This closure plan describes the activities that are necessary to close the WTP permitted ~~mixed waste management units.~~DWMUs. The procedures and estimated times to complete these activities are discussed in this plan. Submittal of this closure plan completes the requirement of III.10.C.8.b and Compliance Schedule Item 8.

This closure plan is provided in compliance with the applicable requirements of the WAC 173-303-610, -620, and -806. This plan is also intended to demonstrate compliance with Conditions II.J and III.10.C.8 of the Hanford Facility Dangerous Waste Permit (Ecology 2009).

With several exceptions, this plan follows the format of a typical closure plan as outlined in the *Dangerous Waste Permit Application Requirements* ~~*for Facilities Which Store and/or Treat Dangerous Wastes in Tank Systems and/or Containers* (Ecology 1996).~~ *For facilities that store and/or treat dangerous wastes in tank systems and/or containers. Washington State Department of Ecology Hazardous Waste and Toxics Reduction Program Publication 95-402 (Ecology 2013).* The exceptions are the exclusion of sections that do not apply to the WTP (financial assurance, liability, "already closed disposal unit," and post-closure requirements), and the addition of new sections not addressed in the guidance (closure of tank, miscellaneous unit, container storage, and containment building units).

11.0 INTRODUCTION

This closure plan identifies the steps and procedures necessary to close any WTP permitted ~~mixed waste management unit~~ DWMU at any point in its active life. This includes the removal of dangerous and mixed waste and the decontamination of the permitted ~~mixed waste management units~~DWMU, ancillary equipment, and the associated secondary containment systems. The RCRA closure activities will be consistent with the requirements of the WTP deactivation, decontamination, and decommissioning plan to be prepared under separate authorities. They will be revised as necessary to maintain consistency between the plans. Deactivation of the WTP is discussed further in Sections 11.3.2 and 11.7.0.

11.1 Closure Plan Overview

Mixed waste will be handled and stored in the following areas of the WTP, as identified in the Dangerous Waste Permit (DWP) and Chapter 4:

- Pretreatment plant building
- WTP portion of the waste transfer lines from the double-shell tank (DST) system
- Intra-facility transfer lines between WTP buildings
- WTP portion of the effluent transfer lines from the WTP to the Liquid Effluent Retention Facility (LERF)
- Low Activity Waste (LAW) vitrification building
- High-Level Waste (HLW) vitrification building

- Laboratory
- Effluent Management Facility (EMF)
- Failed Melter Storage

The permitted ~~mixed waste management units~~DWMUs ~~-~~in the WTP are identified in Chapter 4. The WTP ~~mixed waste management units~~permitted DWMUs, including ancillary equipment, secondary containment areas, supporting structures and underlying soil, are addressed in this closure plan. Closure of the pipelines connecting the WTP with the DST system unit and the Liquid Effluent Retention Facility/Effluent Treatment Facility (LERF/ETF) will be integrated with those respective facilities. Closure criteria will be developed jointly by United States Department of Energy (DOE), its contractors, and Ecology prior to initiating closure activities. DOE will be responsible for implementing the cleanup standards.

The closure plan indicates several potential Hanford treatment, storage, and disposal (TSD) units that may be used to manage dangerous and mixed wastes generated during closure of the WTP permitted ~~mixed waste management units.~~DWMUs. These identifications are preliminary and are subject to change as the Hanford facility is developed, and as the Hanford Facility Dangerous Waste Permit (Ecology 2009) is modified in the future.

The remainder of the closure plan provides the following information:

Section 11.2.0 of the closure plan identifies the regulatory standards that apply to closure, and the processes to be used for developing specific cleanup standards that may be achieved during closure.

Section 11.3.0 describes the overall approach for removing the mixed waste inventory, flushing and decontamination operations, removing and disposing of contaminated equipment and residues, and inspections and sampling to verify clean closure.

Section 11.4.0 describes other activities, including certification of completion of closure, control of run-on and runoff during closure, and equipment reuse.

Section 11.5.0 provides the maximum possible mixed waste inventory.

Section 11.6.0 describes the closure procedures for each type of permitted ~~mixed waste management unit~~DWMU.

Section 11.7.0 provides the schedule for closure.

Section 11.8.0 describes the demonstration required to support a request to extend the standard 90- and 180-day mixed waste removal and closure completion time limits, as specified in WAC 173-303-610(4)(a) and (b).

11.1.1 Closure Plan Revisions

Clean closure is the goal for the WTP permitted ~~mixed waste management units~~DWMUs. The closure plan will be revised if efforts to achieve the clean closure standards are unsuccessful. The WTP may also be closed as a landfill, as provided in WAC 173-303-610, if the clean closure standards cannot be achieved through the removal of radiological contamination levels and the closure performance standards cannot be achieved. The revised closure plan will be accompanied by a written request for modification of the permit.

The design life of the WTP is 40 years after the initiation of waste treatment operations. The actual operating life of the plant may change depending on expansion in treatment capacity, improvements in treatment technology, or many other factors. The closure plan will be revised and submitted for approval under WAC 173-303-830 (Permit Changes) to incorporate future advances in decontamination

technology, changes in plant capacity, newly designated dangerous waste, or other factors that may affect the closure of the WTP permitted ~~mixed waste management units~~DWMUs.

The closure plan may also be revised before the start of closure work, based on relevant information from the operational history of the WTP and the permitted ~~mixed waste management units~~DWMUs, and when information such as decontamination and access of high rad areas becomes available. The final revised closure plan will provide the necessary final detailed decontamination schedule and procedures, sampling and analysis plan, health and safety plan, interface with DST system unit and LERF/ETF closure plans, and additional information dependent on future conditions, as indicated in the following pages. Also, if necessary, a post-closure plan presenting details of any post-closure processes and activities will be submitted to Ecology in accordance with WAC 173-303-610(8).

11.2 Closure Performance Standard

The WTP permitted ~~mixed waste management units will~~ DWMUs will be closed in accordance with the requirements of Conditions II.J and III.10.C.8 of the Hanford Facility Dangerous Waste Permit (Ecology 2009). Clean closure requires decontamination or removal and disposal of dangerous/mixed waste, waste residues, contaminated equipment, soil, or other material, in accordance with the clean closure performance standards of WAC 173-303-610(2). Clean closure as described in this closure plan will accomplish the following:

- Minimize the need for future maintenance.
- Control, minimize, or eliminate, 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.
- Return the land to the appearance and use of the surrounding land areas to the degree possible given the nature of the previous dangerous waste activity.

Activities beyond that point will be decided and documented in the revised plan prior to closure. The WTP buildings will not be used for RCRA-regulated TSD activities following clean closure, unless a new permit is issued.

The appearance of the land where the WTP buildings are located will be consistent with the appearance and future use of the surrounding processing land areas, after completion of clean closure activities. The WTP buildings will remain at the site until final disposition is determined and implemented. The WTP buildings may be demolished, if the buildings will have no future mission. Future land use decisions may be considered during the WTP decommissioning process. The final decision on building disposition and the appearance and use of the plant area will be integrated with the decisions on disposition of the buildings in the adjacent 200 East Area.

The long-term future use of the WTP site and the adjacent 200 Areas was addressed in the *Final Hanford Comprehensive Land-Use Plan Environmental Impact Statement* (DOE 1999). The Central Plateau as defined in that document includes the United States Ecology commercial waste disposal facility, the DOE Environmental Restoration and Disposal Facility (ERDF), and the 200 West and 200 East Areas, as well as the WTP site.

Permitted units where mixed or dangerous wastes have been treated or stored will undergo closure activities. Contaminated equipment, debris, and solid decontamination residues generated during the closure of the WTP permitted ~~mixed waste management units will~~ DWMUs will be designated and packaged in accordance with the appropriate regulatory requirements (expected to be the WAC dangerous waste regulations in effect at the time of closure). The dangerous and mixed waste will then be transferred to a permitted TSD unit either on or off the Hanford Site. Equipment and debris that are not adequately decontaminated will be treated to comply with land disposal restriction requirements. Liquid

decontamination solutions or agents generated during closure activities will be collected, designated, and disposed of at an appropriate TSD unit.

If a product, residual waste, or decontamination fluid is spilled or released to the environment during closure activities, spill response will be initiated as described in Chapter 7 ~~and Chapter 7A (*River Protection Project – Waste Treatment Plant Emergency Response* Contingency Plan)~~, and in accordance with WAC 173-303-145(2) and 173-303-360(2)(d) reporting requirements. The residual waste will be collected, designated, and managed appropriately. The waste will be managed in accordance with the appropriate regulatory requirements.

Clean Debris Surface

This closure plan proposes use of a "clean debris surface," defined in the following paragraph, as the clean closure performance standard for the WTP metal structures and equipment and concrete structures that will remain after closure, as well as all of the DWP equipment used for waste management; Attainment of a clean debris surface can be verified visually in accordance with the standard in WAC 173-303-610(2)(b)(ii), incorporating 40 CFR 268.45, Table 1, footnote 3, which states:

> "Clean debris surface" means that the surface, when viewed without magnification, will be free of all visible contaminated soil and hazardous (dangerous) waste except that residual staining from soil and waste consisting of light shadows, slight streaks, or minor discolorations, and soil and waste in cracks, crevices, and pits may be present provided that such staining and waste and soil in cracks, crevices, and pits will be limited to no more than 5 % of each square inch of surface area."

The clean debris surface standard will be achieved by using the physical and chemical extraction techniques identified in ~~40 CFR 268.45, Table 1, incorporated by reference WAC 173-303-140~~40 CFR 268.45, Table 1, incorporated by reference WAC 173-303-140. The primary method of decontamination may be water washing, followed by a choice of using chemical decontamination solutions, ultrahigh-pressure water technologies, impact technologies such as sand blasting and CO_2 blasting, or other new technologies that may be developed prior to closure. Also, to meet this standard the surface layer may be need to be removed using mechanical equipment such as striking piston heads, saws or rotary grinding wheels, or scabbling equipment. The concrete surface will then be examined to meet the requirement for clean debris surface. These p~~P~~hysical extraction methods that remove up to 0.6 cm of concrete will be used only after the previous technologies have failed to result in a clean-debris surface, or if there has been a failure of the coated concrete surface. Visual verification may be performed by direct worker observation with written inspection documentation (Figure 11-1, Sample Clean Debris Surface Checklist), or by other means such as remote-operated closed circuit television and videotape.

Concrete surfaces may be protected with a contamination-resistant protective coating. Protective coatings in good condition may be decontaminated using one of the technologies described above, then inspected to determine if a clean debris surface is present in the same manner as steel or other metal surfaces. If there is evidence that a dangerous/mixed waste release has occurred, such as confirmation of contamination behind a stainless-steel lined breach or identification of damaged or deteriorated protective coating on a concrete floor where a dangerous/mixed waste release has occurred, and if the concrete is adjacent to soil, a contamination investigation may be performed.

If the concrete protective coating exhibits more damage than hairline cracks and has lost integrity, the concrete surface under the deteriorated coating will be treated with aggressive physical extraction technologies, such as high pressure water or scabbling, to remove at least 0.6 cm of material below the original surface. This approach also applies to uncoated concrete behind or beneath stainless-steel ~~lined breaches.~~liners. The exposed concrete will again be inspected to verify that the clean debris surface standard is met. The treatment will be repeated until the clean debris surface standard is met. Closure standards for soil underlying the WTP are addressed in Section 11.2.1.

If the clean debris surface standard as described cannot be performed or cannot not be achieved, an alternative method will be proposed in the revised Closure Plan as required by DWP Conditions III.10.C.8.c and III.10.C.8.d.

~~Designation Limit~~Risk Based Clean Up Standard

Some waste handling equipment metal surfaces cannot be visually inspected (for example, internal pipe, pump, and tank surfaces). A component or portions of a component may be flushed with decontamination solutions if it cannot be decontaminated to meet the clean debris surface standard, or if it cannot be inspected to verify that it meets the standard. The decontamination solution, or rinsate, will be sampled and analyzed using methods complying with *Test Methods for Evaluating Solid Waste, Physical Chemical Methods* (EPA 1986) for indicator constituents. Analytical data that meet the criteria defined in WAC 173-303-610(2)(a) and (b) will indicate successful decontamination and attainment of the clean closure performance standard. The rinsate analysis criterion is hereafter referred to as the ~~designation limit~~ risk based clean up standard.

Closure Strategy for Tank Systems

The general closure strategy for tank systems is outlined in flowcharts in Figures 11-2 and 11-3. Triple-rinsing followed by visual inspections is an accepted method of decontaminating tanks. However, modification of this technique may be necessary, if determined at a later date.

Figure 11-2 shows that internal flushing and decontamination of tanks and ancillary equipment, inspection of the secondary containment area, and sealing of observed stainless-steel lined breaches will be performed prior to final decontamination efforts. Disposition of solid and liquid treatment residuals is shown only at the initial flushing step (below "flush tanks, piping"), to avoid unnecessary complexity in Figure 11-2. The residuals from the following internal and external decontamination steps are expected to follow the same paths.

The two "more decon?" decision boxes in Figure 11-2 (following determinations that decontamination efforts so far have been inadequate) are the symbols for the key decisions the future closure managers may have to make:

1. Perform additional decontamination to meet the clean closure standard.
2. Stop decontamination and designate that tank or ancillary equipment as mixed waste debris to be removed, reduced in size, encapsulated, packaged, and disposed.

Figure 11-2 does not show that additional decontamination of external tank or other surfaces may be required to continue on the disposal path (after "remove, dispose of as mixed waste") because such additional decontamination, if required, will be due to radiological dose concerns, not dangerous/mixed waste requirements. Figure 11-2 also illustrates the assumption that internal surfaces of tanks and ancillary equipment cannot be adequately or efficiently decontaminated and/or inspected to demonstrate that the clean debris surface standard is met, and that the decontamination solution or rinsate ~~designation limit~~ risk based clean up standard will apply to all internal tank system surfaces.

Closure Strategy for Secondary Containment Areas

Figure 11-3 shows the strategy for closure of secondary containment areas. These steps illustrate the approach for decontaminating stainless steel liners and coated concrete surfaces. Secondary containment area liner breaches may need to be sealed prior to decontamination or removal of equipment. The general procedure for investigating liner breaches or breaks, and decontaminating the concrete behind or below such breaches, is shown in Figure 11-3. The closure strategy for concrete with intact protective coatings is straightforward. If a release of dangerous or mixed waste in the permitted unit has not been documented in the facility operating record, and no evidence of a release is found during the initial closure inspection, the assumption will be made that the concrete floor surface meets the clean debris surface standard.

If a release has been documented, and the concrete does not meet the clean debris standard, decontamination technologies, as described in Section 11.2.0, will be performed until the clean debris standard can be met and documented.

If evidence is found that a release has occurred on a concrete floor where the protective coating has even minor cracking, physical extraction will be required. Physical extraction of the concrete surface may also be required if sampling of the area determines there is dangerous waste contamination in areas where the protective coating is substantially damaged or deteriorated; for example, if it is broken or peeling. The extraction will be followed by an inspection and sampling of the surface to verify and document the presence of a clean debris surface. If a release is documented at such a location and the concrete at that location is resting on or against soil, ~~a~~ soil ~~investigation~~ sampling may be required. These steps are illustrated in the last two boxes before the final decision box, "Visible Crack or Decomposed Concrete?" in Figure 11-3.

Closure Strategy for Soil

The criteria for determining whether additional soil ~~investigation~~sampling is required are shown in ~~the final decision box in~~ Figure 11-4. Contaminated soil will be removed to meet risk-based concentration limits, referred to as the soil cleanup limits (see Section 11.2.1). Soil sampling and analyses will be performed after removal to verify compliance with the soil cleanup standard. Figure 11-4 shows the strategy for addressing potential impacts to soil ~~and groundwater~~.

Compliance with this plan and attainment of the closure standards will be documented by ~~videotape~~electronic media or written inspection records, such as those shown in the sample checklist in Figure 11-1, the example Closure Certification Statement in Figure 11-5, and other supporting records as discussed in Section 11.4.1.

11.2.1 Closure Standards for Soils, Groundwater, Surface Water, and Air

The design of the WTP mixed waste management units is intended to prevent the release of dangerous/mixed waste to the soil, groundwater, surface water, or air. Clean closure of the soil beneath the WTP mixed waste management units will be accomplished by demonstrating that the stainless-steel process cell liners, and the coated concrete walls and floors in the secondary containments, have not lost integrity and have therefore prevented contaminants from reaching the soil. If loss of secondary containment integrity has occurred, the potential for soil contamination will be investigated. The demonstrations will consist of performing and documenting inspections and decontamination work, and soil sampling and removal, if necessary.

The need for sampling of soil will be determined on a unit-specific basis ~~per WAC 173-303-610(~~in accordance with WAC 173-303-610(2)(b)(i), and will take into consideration the mixed waste management unit operating history.

Where a dangerous/mixed waste release is known or suspected to have occurred, the following conditions indicate probable secondary containment failure and potential soil contamination: the observation of potential through-thickness cracks or crumbling concrete at a liner breach location or in a secondary containment area with deteriorated concrete floor coating. Potential soil contamination will be investigated through coring and sampling of both the concrete and the soil. Biased sampling will be focused in the vicinity of the liner defect or coating defect, concrete cracks, or in the known or suspected release location. Samples will be analyzed for constituents of concern (COCs). The proposed COCs will be submitted to Ecology with the revised closure plan submitted before the start of closure. The COCs to be used will be developed using process knowledge, operating record, and waste characterization analyses, whenever possible.

The appropriate risk-based cleanup standard will be consistent with the future land-use classification. The standard will be reviewed prior to initiating closure to ensure it is still appropriate. Clean closure

concentration limits for soils will be established in accordance with WAC 173-303-610(2)(b)(i). Given the long operating life of the WTP and the current state of assumptions for toxicity data, and regulatory guidance, calculation of specific limits is not appropriate at this time.

In establishing soil clean closure concentration limits, consideration will also be given to "area background", as defined in Ecology's *Guidance on Sampling and Data Analysis Methods* (Ecology 1995) and in accordance with WAC 173-303-610(3)(a)(v). The *TWRS Phase 1 Privatization Site Preconstruction Characterization Report* (HNF 1998), the *Hanford Site Background Part 1, Soil Background for Nonradioactive Analytes* (DOE/RL 1995), or other site-specific soil background information will be used to assist in determining background levels in the soil. If the closure soil sample data are at or below the calculated soil cleanup levels, or the site-specific background concentrations, whichever is greater for each constituent, the soil will be considered clean-closed.

Due to the level of secondary containment provided at the WTP, non-permitted releases of dangerous/mixed wastes to soil, groundwater, surface water, or air are not anticipated.

Areas in which soil could have become contaminated will be mapped during the liner or concrete secondary containment area inspection and decontamination process. Soil sampling is addressed in Appendix A, Sampling and Analysis for Closure of WTP Facility (SAP). As necessary, a more detailed sampling and analysis plan may be included in a future revision to the closure plan in accordance with DWP Conditions III.10.C.8.c and III.10.C.8.d.~~that is required under permit condition III.10.C.8.d.~~ The revised closure plan will be submitted to Ecology for review and approval prior to the initiation of closure. The current SAP is consistent with the Guidance for Clean Closure of Dangerous Waste Units and Facilities (Ecology 2005), as incorporated by reference at WAC 173-303-140(2)(a).

11.2.2 Closure Standards for Decontamination of Structures and Equipment

Some of the dangerous/mixed waste-contaminated structures and ancillary equipment that will undergo decontamination during the closure of the WTP consist of equipment with smooth metal surfaces. Concrete and protective coating surfaces in secondary containment areas with stainless-steel liners will also be decontaminated as part of closure. The types of structures and associated equipment that may be decontaminated to meet the clean debris surface standard include, but are not limited to:

- Interior and exterior tank and pipe surfaces
- Secondary containment area stainless steel liners
- Uncoated concrete floors and walls behind stainless-steel liners
- Coated concrete walls and ceilings above stainless-steel lined secondary containment, as necessary
- Coated concrete floors in secondary containment areas

Decontamination of interior surfaces of tanks and pipes and documentation that they meet the clean debris surface standard may or may not be possible, given the current state of decontamination and inspection technologies. At present, the available ~~miniature~~ equipment may not be adequate to remove hardened waste or contaminated corrosion coatings from relatively inaccessible interior tank and pipe surfaces. Similarly, available video equipment may not provide the inspection capability necessary to demonstrate attainment of the clean debris surface standard on interior surfaces. The criteria for whether or not decontamination is possible will be developed and submitted for approval prior to initiating closure activities. In addition, for areas such as the PT and HLW Facility Black Cells and Hot Cells, they are currently provided with spare penetrations that can be used for spray wands if needed during closure activities to facilitate dangerous waste decontamination. If, after decontamination, safe physical access in black cells is not available to perform visual verification during the closure period to ~~enable~~ determine if the use of the clean debris surface standard, which requires visual verification, other technologies such as remote operated CCTVs may be used.

Decontamination of equipment and stainless-steel lined secondary containment or liners will be conducted by using water washing and spraying or ultrahigh-pressure water jetting, or other technologies listed in Section 11.3.0. Residues from these extraction operations will be collected, sampled ~~as necessary, designated~~ in accordance with WAC 173-303, and transferred to a TSD facility such as the LERF/ETF or the Central Waste Complex (CWC) for treatment, storage, and/or disposal.

Decontamination of intact secondary containment protective coating surfaces on concrete to meet the clean debris surface standard will also be performed primarily through water washing and spraying. Additional technologies that may be used include chemical decontamination solutions, ultrahigh-pressure water technologies, impact technologies such as sand blasting and CO_2 blasting, or other new technologies that may be developed prior to closure. The secondary containment protective coating on concrete is designed and applied to provide a durable, non-porous surface. If decontamination of the impermeable protective coating surface in secondary containment areas cannot be completed through chemical extraction, or if the protective coating has broken, cracked, or peeled away from the concrete, then at least 0.6 cm (0.24 inches) of the underlying concrete will be removed using one or more of the physical extraction technologies. The physical extraction performance standard for concrete is removal of 0.6 cm of the surface layer and treatment to a clean debris surface, as noted in the *Guidance for Clean Closure of Dangerous Waste Units and Facilities* (Ecology 2005), Section 5.6, and as noted in 40 CFR 268.45, Table 1, as incorporated by reference at WAC 173-303-140(2)(a).

Metal surface areas of equipment that cannot be documented to meet the clean debris surface standard may be decontaminated using water washing, followed by a choice of chemical decontamination solutions, ultrahigh-pressure water technologies, impact technologies such as sand blasting, or other new technologies that may be developed prior to closure. Rinsate may be sampled and analyzed, using methods complying with *Test Methods for Evaluating Solid Waste, Physical Chemical Methods* (EPA 1986) for Ecology-approved indicator constituents. If other analytical methods are developed and chosen for use, the closure plan will be revised and submitted for approval. ~~Indicators~~ Indicator will be determined on the basis of process knowledge, operating record, and waste characterization analyses, whenever possible.

Analytical data less than ~~designation~~ risk-based limits will indicate successful decontamination and attainment of the clean closure performance standard for the tank, piping, or other metal structures and equipment. Documentation ~~of the representative character~~ of the sample and laboratory quality control and quality assurance data will be entered into the closure record as specified in Sections 11.3.4 and 11.4.1. Concrete and protective coated concrete surfaces will not be addressed using ~~designation~~ risk-based limits.

If the metal structure or equipment cannot be considered decontaminated using the clean debris surface or ~~designation~~risk-based limit criteria, or if further decontamination is determined to be impractical due to high radiation levels, waste minimization, cost considerations, or other reasons, it will be packaged using the debris treatment standard for immobilization by encapsulation. The waste will be designated on the basis of process knowledge and transported to a permitted dangerous or mixed waste disposal facility such as Hanford Low Level Burial Ground (LLBG) mixed waste trenches. Examples of equipment that may undergo encapsulation and disposal include, but are not limited to:

- Tanks and pipes
- Melter off-gas duct work, scrubber, condenser, precipitator, and washout holding vessels
- Pumps, agitators, wash rings, and ejectors

Contaminated items and solid decontamination residues removed from the WTP permitted ~~mixed waste management units will~~DWMUs will be designated, packaged, and treated as necessary to meet the waste acceptance criteria of the receiving facility. Sampling of items and solid residues known to be contaminated and intended for disposal is not necessary if process knowledge is adequate to accurately

designate the wastes with the proper dangerous waste identification codes. The closure plan will be revised prior to start of closure and will address treatment and disposal plans in more detail.

11.2.3 Closure Standards for Tank Systems

At closure of a tank system, the owner or operator is required by WAC 173-303-640(8)(a) to remove or decontaminate dangerous/mixed waste residues, contaminated secondary containment system components (such as liners), contaminated soils, and structures and equipment contaminated with dangerous/mixed waste, and manage them as dangerous/mixed waste, with few exceptions.

For the purposes of the WTP RCRA closure, the standard is interpreted to mean that each tank and associated ancillary equipment, including the secondary containment area, will meet the clean debris surface standard and/or ~~designation~~risk-based limit criteria for rinsate. Indicator constituents or COCs to be used for rinsate evaluation will be determined using process knowledge, including consideration of the available waste characterization data, and other relevant information in the facility operating record.

Inspectable surfaces may be declared clean if they meet the definition of a clean debris surface, including portions of concrete secondary containment with intact protective coating surfaces, and physically-extracted concrete surfaces behind stainless-steel lined breaches, or under abraded or loose protective coating that have had at least 0.6 cm of material removed from the original surface. Rough or inaccessible metal surfaces such as corroded tank secondary containment area liner surfaces, or tank and pipe interior surfaces, may be declared clean when the decontamination solution sample is analyzed, with appropriate quality control and quality assurance as noted in Section 11.3.4, and the indicator parameter or COC data are determined to be less than or equal to the ~~designation~~risk-based limits.

If decontaminating a tank system in place is not feasible or is ineffective, an alternative method is to remove the tanks, disassemble them, and decontaminate the tank parts using extraction technologies described under alternative treatment standards for hazardous debris (40 CFR 268.45), as incorporated by reference at WAC 173-303-140(2)(a). With Ecology's concurrence, the decontaminated debris can then be disposed of as non-dangerous (but possibly controlled as radioactive) waste, as indicated in Section 5 of *Guidance for Clean Closure of Dangerous Waste Units and Facilities* (Ecology 2005).

Tank systems will be inspected for compliance with the clean debris surface standard by observing the external and internal metal surfaces. Portions of a tank system that cannot be fully inspected (such as interior surfaces of tanks and attached piping, pumps, ejectors, and welded pipe connections or penetrations) or that may pose as low as reasonably achievable (ALARA) compliance problems, may be decontaminated with chemical or physical extraction technologies. The decontamination solutions from these portions of the system will be sampled and analyzed for indicator parameters, and the results will be compared to waste ~~designation~~risk-based limits. Solid residues will be removed, containerized, designated, and disposed of at a permitted disposal facility as required. The tank or ancillary equipment, if not decontaminated to meet clean debris standard, will be removed, treated as necessary, and disposed of in a permitted landfill. Treatment may include macro-encapsulation or micro-encapsulation, or other processes that comply with land disposal restrictions.

Standards for clean closure of tank system secondary containment are identical to standards for decontamination of secondary containment areas for the container storage, containment building, and miscellaneous units; that is, clean debris surface standard and/or ~~designation~~risk-based limits.

The proposed COCs will be submitted to Ecology and finalized in the revised closure plan to be submitted before the start of closure.

11.2.4 Closure Standards for Container Storage Areas

In addition to the requirements of WAC 173-303-610, WAC 173-303-630(10) requires that at closure, dangerous/mixed waste and residues will be removed from the secondary containment system.

Remaining containers, liners, bases, and soil contaminated with dangerous/mixed waste or residues will be decontaminated or removed.

Standards for clean closure of ~~clad~~ container storage secondary containment are identical to standards for decontamination of secondary containment areas for the tank system, containment building, and miscellaneous units (that is, clean debris surface standard and/or ~~designation~~risk-based limits). Special requirements for clean closure of several secondary containment areas with coated concrete floors were explained in Section 11.2.2.

11.2.5 Closure Standards for Containment Buildings

At closure of a containment building system, the owner or operator is required by WAC 173-303-695 (incorporating 40 CFR 264.1102(a)) to remove or decontaminate dangerous/mixed waste residues, contaminated secondary containment system components (such as liners), contaminated soils, and structures and equipment contaminated with waste and leachate, and manage them as dangerous waste, unless WAC 173-303-070(2)(a)(ii) applies.

Standards for clean closure of containment building units are identical to standards for decontamination of secondary containment areas for the tank system, container storage, and miscellaneous units (that is, clean debris surface standard and/or ~~designation~~risk-based limits).

11.2.6 Closure Standards for Miscellaneous Units

The owner or operator is required by WAC 173-303-680(2) to close miscellaneous units in a manner that will ensure protection of human health and the environment. Miscellaneous units at WTP include, but are not limited to, melters, scrubbers, condensers, precipitators, reboilers, oxidizers, adsorbers, and filters. The LAW and HLW melters will be removed and replaced several times during the operational life of the WTP. Removal and replacement are not considered closure or partial closure activities. Melters may be replaced according to the schedule based on the design life of the melter components, or replaced when unplanned failure of a component occurs. In either case, ancillary equipment will be removed or disconnected from the melter after molten glass has been removed to the maximum practical extent.

Openings to the LAW locally shielded melter (LSM) will be sealed and the melter will be removed from the LAW vitrification building, after surface decontamination, as a single container.

Spent HLW melters will be placed in a specially designed shield overpack and then removed from the HLW vitrification building to a disposal facility. Failed melters will be placed in the WTP failed melter storage building (container storage area). ~~During closure of the WTP, the failed HLW melters will be dispositioned to meet disposal site waste acceptance criteria.~~

Spent LAW and HLW melters may also be stored in the WTP failed melter storage building (container storage areas) if necessary to accommodate scheduling of treatment and disposal operations, or for other reasons. The melters will be shipped to permitted treatment and disposal facilities. ~~The WTP miscellaneous units that treat liquid mixed waste will be housed in containment building units, caves, and process/hot cells that provide secondary containment.~~

Standards for clean closure of the miscellaneous unit secondary containment areas are ~~the~~identical to standards for decontamination of secondary containment areas for the tank system, container storage, and containment building units (that is, the clean debris surface standard and/or ~~designation~~risk-based limits).

11.3 Closure Activities

This section describes closure activities that will be conducted to meet the clean closure performance standards. Details provided here may change, and if necessary, the plan will be revised to reflect those changes. The facility is scheduled to close at the end of its operating life. If the WTP is shut down prior to this time, an updated closure plan will be submitted prior to start of closure activities. If partial

closures of the WTP mixed waste management units are necessary, updates to the closure plan will be submitted prior to initiating closure activities.

Section 11.3.1 describes the maximum extent of operations. Section 11.3.2 describes the process for removing dangerous (mixed) wastes from permitted units. Section 11.3.3 identifies several chemical and physical extraction technologies that may be used to achieve the clean debris surface standard. Section 11.3.4 describes the approach for verification sampling and analysis to confirm that decontamination and/or removal activities have attained the ~~designation~~risk-based limit standard. Section 11.4.0 describes the procedures to be followed in order to comply with closure certification requirements, to control run-on and runoff during closure, and to reuse equipment from the plant. Section 11.5.0 provides the estimated maximum mixed-waste inventory for each type of dangerous/mixed waste management unit. Section 11.6.0 describes how each of the four types of permitted units will be closed. The goal for closure of the WTP permitted ~~mixed waste management units~~DWMUs is clean closure, which is contingent on achievement of the clean debris surface standard or verification that indicator constituents in decontamination solutions from the permitted ~~mixed waste management units~~DWMUs are not present in concentrations above ~~designation~~risk-based limits.

Partial closure may be considered for some of the mixed waste management units; that is, one or more treatment processes or tank systems may be closed prior to the start of closure of the entire plant. Closure of a single mixed waste management unit or group of units could be necessary if a process were to be redesigned, eliminating the previous functions of the permitted ~~mixed waste management units.~~DWMUs. Abnormal occurrences could also force partial closure, such as plugging of a tank or piping. Partial closures of the plant are not planned but could result from unforeseen circumstances. The closure plan will be revised to address the specific details for the permitted ~~mixed waste management units~~DWMUs if partial closure is necessary, and the revised plan will be submitted to Ecology for review, approval, and incorporation into the permit prior to start of closure activities.

The following assumptions were made in developing the closure plan:

- The maximum inventory will be present approximately nine months or more before the start of the closure period. This is the case because of the batch nature of the entire WTP treatment scheme. The treatment systems within the WTP will operate normally until the last portions of this final transfer are treated.
- The pretreatment building and the HLW melter will treat mixed waste and may be fully operational at the start of the closure period. These portions of the WTP will continue to operate during the closure period until the tank system flush solutions and residues are removed from each system to the maximum practical extent and treated before final decontamination begins.
- Operating records documenting the constituents and volumes of the mixed wastes in the storage and treatment areas, and of the mixed wastes previously processed through the facility, will be available. The operating record also will include detailed information on historical releases of dangerous/mixed wastes into secondary containment areas, previous decontamination work, and equipment that is present in secondary containment areas. This information will be directly relevant to final detailed planning of decontamination steps and procedures, especially treatment and disposal of the decontamination solutions and residues that will be generated.
- A release of dangerous/mixed wastes outside ~~permitted mixed waste management unit~~DWMU secondary containment areas will not occur.
- Equipment necessary for dangerous/mixed waste removal and equipment decontamination will be functional or will be repaired or replaced.
- Permitted TSD facilities will be available to receive dangerous and mixed wastes that will be generated during closure.

Overall Closure Approach

After the final waste feed shipment or inventory is processed, the LAW LSM units will be closed and removed from the site. Tanks and piping will be flushed. The flush solutions will be treated in the pretreatment building by filtration and evaporation, and concentrated solids will be immobilized in glass produced in the HLW melter. Immobilized waste may or may not be acceptable at the facilities that accepted standard immobilized low-activity waste (ILAW) and immobilized high-level waste (IHLW) during the operating life of the WTP. Specific disposal plans for this type of waste may not be finalized until submittal of the final revised closure plan prior to start of closure.

The next step in the overall closure approach is to decontaminate the WTP mixed waste management units' components to the maximum feasible extent and remove components that cannot be decontaminated to meet the clean debris performance standards. Contaminated components will be disposed of~~, and the residues and decontamination fluids remaining after treatment operations at the WTP mixed waste management units have ceased will be transferred to the CWC, LERF/ETF or another Hanford Site permitted TSD facility. Other Hanford Site TSD facilities that may be considered for treatment or disposal of closure wastes in addition to the CWC and LERF/ETF include the LLBG, the Waste Receiving and Processing (WRAP) facility, and the Integrated Disposal Facility (IDF~~ in accordance with WAC 173-303-610(5).

Vitrification treatment will not be available after the last melter is shut down, near the completion of WTP deactivation work. Small quantities of feed waste or flushing residues may remain in tanks after the last melter is shut down, in addition to insoluble adhered coatings in piping and tanks. The remaining aqueous residues may have to be transferred to the LERF/ETF or the CWC for evaporation, precipitation, filtration, solidification, or other treatment.

General Sequence of Closure Activities

The general sequence of activities necessary to close permitted ~~mixed waste management units~~DWMUs within the WTP, and the basis for establishing the order of performing these activities, is summarized in the following discussion:

Dangerous/Mixed Waste Inventory Removal

- Dangerous/mixed waste removal: The nonradioactive dangerous waste, if present, will be removed from the WTP to minimize the possibility of release. Note: dangerous wastes may be generated at the WTP throughout the closure period from maintenance activities.
- Inventory removal: The mixed waste inventory present in the WTP mixed waste management units at the beginning of the closure (primarily heels in the bottoms of tanks) will be removed and processed (pretreated and vitrified) to the maximum practical extent. This removal will minimize the possibility for release and allow decontamination of the equipment to proceed. Tank systems, miscellaneous units, and ancillary equipment will undergo flushing as part of closure activities.

Decontamination

- Liner inspection: After removal of mixed wastes (flushing), but before final decontamination of tanks and other permitted ~~mixed waste management units~~DWMUs begins, each secondary containment area will be inspected to identify potential or apparent breaks, cracks, or separation of the liner or protective coating from the concrete floors and walls. These locations (if any) will be mapped and documented, and sealed by welding or by application of patching or protective coating material, to prevent entry of contaminants during decontamination activities.
- Decontamination: Tank systems and other equipment in the ~~permitted mixed waste management units~~DWMUs will be decontaminated. Additional chemical or physical extraction may be performed before tank systems, piping, or the equipment and equipment support structures in the ~~permitted mixed waste management units~~DWMUs are removed. Extraction will be performed not only to meet clean debris standards detailed in Section 11.2.0, but also to minimize the

amount of mixed waste constituents that could be readily available for migration or release during equipment removal.

- Equipment may be left in place as clean-closed if it can be successfully decontaminated.

Inspection

- Equipment inspection: Tank/miscellaneous units systems and ancillary equipment will be inspected to ensure that the clean debris surface standard and/or rinsate analyses ~~designation~~risk-based limits are met. If necessary, the equipment will be identified as requiring removal, encapsulation, and disposal.

Removal

- Equipment removal: If the permitted equipment cannot be decontaminated to meet the closure performance standard, it will be removed, treated by encapsulation, and disposed at a permitted facility. Size reduction treatment may also be performed.
- Permitted equipment decontamination: After the last batch of waste feed has been fully processed through the WTP, the LAW LSMs will be shut down and removed. Pretreatment process vessels and lines will be flushed with water or other solutions. Flushing liquids will be determined prior to initiation of closure activities, and if a liquid other than water is identified for use, the closure plan will be revised and submitted for approval prior to initiating closure activities. Flushing wastes will be treated in the pretreatment evaporation, cesium removal, and ultrafiltration processes. The concentrates will be transferred to a HLW melter. Water condensate will be routed to the LERF/ETF. One HLW melter may be operated after shutdown of the LAW LSMs to provide treatment for the solid flushing residues and evaporator concentrates. At the completion of treatment operations, the HLW melter will be shutdown by procedure for melter change out. The HLW failed melters will be disposed of in accordance with LDR requirements and to the degree necessary to meet disposal facility waste acceptance criteria (Section 11.3.3). LAW LSMs are not expected to require decontamination or size reduction treatment, other than surface decontamination after the operating equipment openings are closed. Spent HLW melters will be overpacked, and shipped to a permitted disposal facility.

Structure Decontamination

- Building structure decontamination, stainless steel-lined secondary containment areas: Liners in the ~~permitted mixed waste management unit~~DWMU secondary containment areas will be decontaminated using chemical or physical extraction technologies, or both. Most of the secondary containment areas in the mixed waste management units will be lined with stainless steel. Coated concrete floors in secondary containment areas will be decontaminated using only chemical extraction technologies, unless the protective coating is damaged or deteriorated. Damaged protective coating in secondary containment areas, and contaminated concrete under or behind liner breaches, will be decontaminated using physical extraction technologies. Decontamination solutions may be sampled to determine treatment requirements and transferred via existing pipelines to the LERF/ETF if they meet the LERF/ETF acceptance criteria or to another permitted Hanford TSD unit. Structure decontamination activities are described in Section 11.3.3.
- Building structure decontamination, concrete secondary containment areas: Examples of mixed waste management units that have coated concrete secondary containment without stainless steel include the condensate tank system, the LAW LSM gallery containment building, ILAW container finishing containment building, and several secondary waste container storage areas. At the time of closure, the facility operating record will be reviewed and each mixed waste management unit will be inspected to determine if releases of dangerous/mixed wastes have occurred in these areas. If a release of dangerous/mixed waste has occurred on a secondary

containment concrete floor where the protective coating is even slightly damaged or deteriorated, the concrete in that secondary containment area will be physically extracted to remove at least 0.6 cm of concrete from the original surface. This effort will demonstrate compliance with the clean debris surface standard. If a release is not documented or suspected, minor or hairline cracks may still be accepted in determining that the clean debris surface standard is met. If the secondary containment protective coating is intact, the surface may be decontaminated by chemical extraction. If chemical extraction is unsuccessful, or if the coating is damaged by the chemical extraction, physical extraction will be performed.

- Building examination to verify decontamination: After each mixed waste management unit in each building has been decontaminated, the mixed waste management units will be inspected and closure documentation will be examined to verify that the clean closure standards have been met.

Soil Investigation, Removal, and Verification

- Potentially contaminated soil identification: Areas in which soil could have become contaminated will be mapped during the liner or concrete secondary containment area inspection and decontamination process. Soil sampling protocols will be established and implemented if potentially contaminated areas are identified.
- Soil decontamination: Soil removal will be performed if necessary. A revised closure plan and a post-closure plan per WAC 173-303-610(3) and WAC 173-303-610(7) will be submitted if removal to the established risk-based standards is not feasible.
- Soil sampling to verify decontamination for indicator constituents: The soil will be sampled and analyzed for indicator constituents after the contaminated soil has been removed.

NOTE: Sampling of soil to verify decontamination will be addressed per the SAP and is included as Appendix A of the Closure Plan.

Disposition of Decontamination Wastes

- Disposition of decontamination fluids: Wastewater or chemical extraction solutions from decontamination activities will enter an existing collection system for waste characterization and verification against LERF/ETF waste acceptance criteria. At the final stage of closure, when the transfer pipeline to the LERF/ETF is taken out of service, decontamination solutions may be containerized and transported to the LERF/ETF by truck. Characterization of the closure residues in the permitted ~~mixed waste management units~~DWMUs will be documented based on process knowledge or analysis of the mixed waste treated in the units. If the wastewater cannot be accepted by LERF/ETF, it may be solidified and transferred to the CWC or another available permitted unit.
- Disposition of the building air emission control equipment (i.e., HVAC): Building air emission control equipment will remain in place until decontamination of other WTP components meets the clean closure performance standards. The HVAC equipment will be decontaminated to meet the clean closure performance standard, or will be removed, designated, and packaged to meet the waste acceptance criteria of a permitted disposal facility.
- Disposition of decontamination equipment: Equipment or materials used in performing closure activities will be decontaminated or disposed of at a permitted disposal facility. Personal protective equipment will be disposed of as appropriate.

The general order of closure activities was selected to minimize the potential for release of mixed waste constituents by removing the bulk of the mixed waste constituents early in the closure process. This order of closure also minimizes waste generation by reducing the possibility that decontaminated areas will become contaminated again by ongoing closure efforts.

Detailed scheduling of closure activities depends on the necessary facility functions required to be maintained during the closure period and the degree of contamination in each permitted ~~mixed waste management unit~~DWMU, especially after the mixed waste inventory is removed and decontamination activities start. The large number of tank systems increases the potential for a highly complex schedule. Similar tank systems and other types of permitted ~~mixed waste management units~~DWMUs may be grouped for the purpose of minimizing the bulk and complexity of plans for closure activities. The detailed decontamination operations schedule will be included in the revised closure plan to be submitted before the start of closure activities (see Section 11.7.0).

Work will be performed in a manner that minimizes worker exposure to dangerous and/or mixed waste or other workplace hazards and will meet the ALARA principles.

Additional detail will be provided describing waste removal, equipment decontamination, and closure-generated dangerous/mixed waste disposal activities in the revised closure plans to be submitted prior to start of closure.

11.3.1 Maximum Extent of Operations

The maximum extent of operations during the active life of the WTP corresponds to the maximum mixed waste inventory with full feed tanks, the melters operating at design capacity, and full storage areas.

The general arrangement drawings in Chapter 4 show the locations of tanks, melters, miscellaneous units, containment buildings, and container storage areas. The dimensions of the permitted dangerous/mixed waste management units are included in Chapter 4 tables.

11.3.2 Removing Dangerous/Mixed Waste

The mixed waste feed inventory present in the WTP after the final receipt of waste feed from the DST system unit will be processed before the start of the first phase of closure. The mixed waste will be removed from tank systems to the maximum practical extent. Removal will be continued by processing the last bulk volumes of waste feed through the applicable pretreatment and vitrification systems, and transferring treated ILAW and IHLW to other TSD units or facilities from the container and canister shipping docks. These activities will follow normal operating procedures.

The following description of mixed waste removal is intended to provide a brief overview of the WTP permitted ~~mixed waste management units~~DWMUs closure activities.

At the completion of mixed waste treatment operations, DOE and its contractor will close the permitted ~~mixed waste management units~~DWMUs and deactivate the WTP facilities. Deactivation, when completed, will leave the facilities in a safe, stable, and passive state that can be monitored with minimal cost and minimal requirements for service support from either personnel or active equipment.

The WTP deactivation operations will comprise a large portion of the RCRA closure activities of the permitted ~~mixed waste management units~~DWMUs that will occur between the start of the closure period, as defined in WAC 173-303-610(3)(c)(ii), and the final shutdown of the HLW vitrification system. Closure operations for some permitted ~~mixed waste management units~~DWMUs may begin before the completion of treatment of the final batch of waste feed from the DST system unit.

Overlaps between dangerous/mixed waste management unit closure and the WTP facilities' deactivation activities, and the overall TSD facility permitting process, as defined in the *Hanford Federal Facility Agreement and Consent Order* (Ecology, EPA and DOE 2011) and the implementing attachment known as the *Tri-Party Agreement Action Plan*, Section 6.3, are illustrated in Figure 11-6. The full extent of necessary interfaces, and detailed definition of the intermediate points in this timeline, will not be determined until deactivation and closure planning are finalized before the start of closure.

Vitrified waste in storage at the WTP at the start of the closure period will be shipped to disposal units on the Hanford Site or to other appropriate facilities. If the inventory of untreated waste feed cannot be treated at the WTP, it will be transferred to a permitted TSD facility. Circumstances under which the waste feed inventory would not be treated through vitrification are not accounted for in this closure plan and would require revision of the plan. Properly completed shipping papers and certifications, as applicable, will accompany waste shipments. Once the final batch of waste feed has been processed, residual heels will be flushed from the tank systems in accordance with deactivation procedures. Wastewater from flushing and decontamination solutions will be filtered, evaporated, and further treated as necessary in the WTP pretreatment building. The removed solids will be sent to the HLW melter. Wastewater will be sent to the LERF/ETF for treatment if acceptance criteria is met, or it will be transported to the CWC or another permitted TSD unit for storage, treatment, and disposal. Treatment in containers could be performed at the WTP if necessary or preferable, and if the resulting waste will meet the CWC or another TSD unit's waste acceptance criteria. The treatment in containers alternative is not likely to be used, due to the relatively large volumes of flush solutions that will be generated.

If non-radioactive waste is present as inventory at the start of the closure period at the dangerous/mixed waste container storage unit, it will be transferred to a permitted off-site facility for treatment or disposal. Non-radioactive dangerous waste generated during the closure or deactivation work will be managed similarly.

The TSD units available at the time of closure, and their waste acceptance criteria, may include additional units that are not available today.

Complete records will be kept as to the date of shipment, waste characterization, waste quantity, destination facility, land disposal restriction certifications and notifications, and other appropriate information for removed dangerous/mixed waste. Specific documentation requirements are discussed in Chapter 3A. This information will be included in the closure documentation supporting certification, which is described in Section 11.4.1.

The specific types of off-site treatment and disposal units for dangerous wastes generated during closure will be determined and provided in the revised closure plan to be submitted before closure begins. Interfaces with the DST system unit and LERF/ETF will be specified in the revised plan to be submitted before the start of closure.

11.3.3 Decontaminating Structures, Equipment, and Soils

The only structures and equipment that may be contaminated at the start of the closure period are within the ~~permitted mixed waste management unit~~DWMU secondary containment areas. Some of the types of waste handling equipment that may be located in each permitted ~~mixed waste management unit~~DWMU can be determined by review of the design drawings and operating plans. Examples include, but are not limited to, cranes, power manipulators, and welding machines. Many other types of hand tools, instruments, lights and cameras, radiation monitors, buckets, and other equipment may be present in one or more ~~permitted mixed waste management unit~~DWMU secondary containment areas. If contaminated with dangerous/mixed waste, these structures, tools, and equipment will be decontaminated, if feasible, using one or more of the following technologies to achieve the clean closure performance standard:

- Ultrahigh-pressure water jet
- Rotating cavitation water jet
- Soap scrubbing and wet vacuuming
- Steam vacuuming
- Vacuum abrasive blasting
- Soda blasting
- Shot blasting

- Ice blasting
- Hydroblasting
- Grit blasting
- Cryogenic CO_2 pellet blasting
- Sponge blasting
- Etching
- Rotating brushes/honing

More aggressive decontamination methods may be used on concrete if it becomes necessary to remove mixed waste accumulations that extend into the concrete:

- Needle scaler
- Paving breaker or chipping hammer
- Piston scabbler

These decontamination technologies were chosen based upon demonstrated effectiveness in a radioactive environment and the ability to successfully achieve the RCRA closure performance standard. These technologies are covered under the generic physical or chemical extraction technology categories listed in 40 CFR 268.45, Table 1. This approach is consistent with Ecology guidance (Ecology 2005) to achieve clean closure.

Specific methods of decontamination (and removal and disposal if required) of the permitted ~~mixed waste management unit~~DWMU components and equipment will be determined at the time of closure. These methods will be based on information in the operating record, including historical mixed waste releases, and DOE plans for future use of the buildings. The feasibility, or practicality, of decontamination depends on many factors that cannot be fully defined until the closure plan is finalized. Decision criteria may include, but are not limited to, radiation hazards, secondary mixed waste volumes, schedule and budget restrictions, and availability of TSD facilities to receive secondary mixed wastes. Equipment and debris that are not decontaminated will be disposed of as mixed waste.

Decontamination solutions from interiors of tanks, attached piping, and other equipment will be collected in tank drain piping and collection tanks. Decontamination solutions from tank and pipe exterior surfaces, and from decontamination of other free-standing ancillary equipment and secondary containment walls and floors in the four types of permitted ~~mixed waste management units~~DWMUs will be collected in secondary containment area sumps, then transferred by pumping or gravity drainage to plant wash collection tanks. Exceptions to this process may include decontamination of small surface areas where drainage may be captured in portable collection basins or buckets. Transfers of decontamination solutions to the LERF/ETF, CWC or another on-site TSD unit, or if the waste is ~~non-~~not a dangerous mixed waste, to an off-site TSD facility, are addressed in Section 11.3.2.

The decontamination solutions and residues will be designated on the basis of process knowledge, or sampling and analysis if necessary, and transferred by existing hard piping to the LERF/ETF. The pipe connection to the LERF/ETF will be one of the last WTP components to be taken out of service, after decontamination activities are complete. The last few decontamination activities may require the collection of wastewater in a temporary sump and container, and will be transported by truck to the LERF/ETF.

Solid residues will be collected into containers by vacuuming or mechanical means (such as sweeping or shoveling), treated, if necessary, at the WTP, CWC, or WRAP to stabilize or solidify the residues, and disposed in the LLBG or a permitted disposal unit on the Hanford Site. Off-site mixed-waste landfill disposal facilities may be considered if an appropriate Hanford Site unit is not available.

Contaminated debris and solid decontamination residues removed from the WTP will be designated and packaged to meet the waste acceptance criteria of the receiving facility. Sampling of equipment and solid residues that are known to be contaminated and are intended for disposal is not necessary, if process knowledge is adequate to accurately designate the waste with the proper dangerous waste identification codes. Process knowledge includes the operating record, which should provide adequate waste analyses and waste processing histories for each permitted ~~mixed waste management unit~~DWMU in the WTP.

Information to support disposal of melters and other debris will be provided in a revised closure plan to be submitted before the start of closure.

11.3.3.1 Secondary Containment Structures and Associated Equipment

Within most of the process areas, stainless steel liners supported by steel reinforced concrete structures provide secondary containment for the process tanks, miscellaneous units, HLW melters, LAW melters, and ancillary equipment. Coated concrete surfaces (the walls and ceilings above the liners) in lined mixed waste management areas are not part of the required dangerous waste secondary containment structure, although additional controls may be provided for splashes and airborne contamination. Concrete in stainless-steel lined permitted secondary containment areas, where control of splashes, washdown sprays, or airborne contamination is necessary, will be coated during construction with a durable chemical-resistant impermeable protective coating. Top edges of the liner plates in these secondary containment areas will be sealed to the concrete surface.

Steel liners and coated concrete surfaces will be inspected visually. The visual inspection may be conducted remotely using CCTV. The purpose of the inspections will be twofold: to identify and map cracks that might provide a migration pathway for contaminants and to identify areas that are potentially contaminated with mixed waste or waste residues.

Identified cracks in secondary containment areas will be sealed to prevent infiltration of decontamination solutions between the stainless steel liner and the concrete, or migration into cracks in concrete. Coated concrete and liner surfaces will be decontaminated to achieve the clean debris surface standard using chemical extraction, or if necessary, through physical extraction as described in Section 11.2.0.

Secondary containment areas with concrete surfaces are eligible for decontamination by chemical extraction only if the protective coating is intact. Minor cracking in the protective coating will not disqualify the concrete surface from being eligible for classification as a clean debris surface, if that surface has not been directly exposed to dangerous waste as a result of a container leak or some other release mechanism. The facility operating record will be consulted before decontamination work begins to identify those permitted ~~mixed waste management units~~DWMUs where leaks or other dangerous/mixed waste releases have occurred. These permitted secondary containment areas will also be ~~physically~~visually inspected to determine whether the protective coating is intact, and whether undocumented evidence of a mixed waste release is present.

Secondary containment areas with intact protective coatings may be decontaminated with water washing if necessary. If additional decontamination is necessary, other technologies will be used, such as chemical decontamination solutions, ultrahigh-pressure water technologies, impact technologies such as sand blasting and CO_2 blasting, or other new technologies that may be developed prior to closure. Physical extraction methods that remove up to 0.6 cm of concrete will be necessary on concrete surfaces where the protective coating has peeled, bubbled, or is broken (before or after decontamination), exposing bare concrete. Stainless-steel liners may also require physical extraction treatment to remove mixed waste residues or corrosion. Inspections of the concrete and liner surfaces for a clean debris surface will be documented in an inspection record. Details of the decontamination methods to be used will be developed and submitted for approval prior to initiating closure activities.

Concrete and steel grinding, scaling, or scabbling residues will be collected, placed in containers, and sampled and analyzed for indicator constituents~~.~~ (COCs). The ~~parameters, or the~~ residues~~,~~ will be designated based on knowledge of the process or the waste that contaminated the concrete or steel.

The operating record will be reviewed prior to closure to determine if decontamination procedures should be performed in any areas outside the permitted unit secondary containment areas. These areas may include equipment decontamination bays or secondary containment sumps in transfer tunnels, or other locations where mixed wastes may have been generated or transferred during the operating life of the WTP and accidentally released. A final revised closure plan that includes areas identified as a result of the operating record review will be submitted to Ecology for review and approval before closure starts. Floors and walls in non-permitted areas of the building (such as offices, lunch rooms, or bulk storage areas for non-hazardous materials) that do not have documented releases of dangerous or mixed waste are not included in this closure plan.

11.3.3.2 Building Air Emission Control Equipment

Building air emission control (i.e., heating, ventilation, and air conditioning, HVAC) equipment will remain in place and in operation as necessary to facilitate deactivation and decontamination of the WTP. HVAC equipment will be taken out of service in stages as radiological contamination is progressively removed or reduced. Compliance with applicable air emission standards and permits will be maintained. Air permits for operations will be evaluated to determine if they will support closure activities. The permits will be modified if necessary.

After completion of decontamination operations that may generate fumes, vapors, or dust that will be controlled by the building ventilation system, the HVAC equipment will be decontaminated, then dismantled, and reduced in size to the extent necessary to facilitate preparation for disposal. DOE may determine that the HVAC equipment will remain in place after closure.

Modifications to air emission standards or other appropriate standards to prevent or minimize the release of dangerous waste or dangerous waste constituents to the air or surrounding environment during closure will be specified in the revised closure plan to be submitted before the start of closure.

11.3.3.3 Soil

Discovery of an apparent or potential breach in a cell liner or in the protective coating in unlined permitted secondary containment areas, on an exterior wall, or bottom floor adjacent to soil will require further investigation. The presence of soil contamination will be a unit-specific determination based on WTP records and direct visual or CCTV inspection of the stainless-steel liners and concrete surfaces as described in Section 11.2.0. The liner will be removed to allow access for additional investigation and decontamination if this inspection reveals areas of poor liner integrity such as severe corrosion, weld breaks, or other damage to the steel. Coring and soil sampling will be performed if a liner breach or damaged protective coating is found on a wall or floor adjacent to external soil and if the concrete has lost integrity at that location. If the concrete is not cracked, deteriorated, or porous, and a clean debris surface can be obtained by physical extraction treatment, no further investigation or soil removal may be necessary. If soil is sampled, it will be analyzed for indicator constituents of concern identified on the basis of the mixed wastes contained in that permitted ~~mixed waste management unit~~DWMU during the operating life of the plant.

If soil having levels of contamination that exceed the risk-based soil cleanup levels is found, it will be removed and managed as media containing dangerous waste, and will be designated and disposed of accordingly at a permitted disposal facility. Soil at the limits of excavation will be sampled and analyzed after removals are completed to confirm that the concentrations of dangerous waste constituents are below the risk-based exposure limits. The appropriate risk-based cleanup standard will be consistent with the future land-use classification from the *Final Hanford Comprehensive Land-Use Plan Environmental*

Impact Statement (DOE 1999). Risk assessment principles will be used to establish clean closure concentration limits for soils in accordance with WAC 173-303-610(2)(b)(i).

11.3.4 Sampling and Analysis to Identify Extent of Decontamination/Removal and to Verify Achievement of Closure Performance Standard

If there are stainless-steel lined secondary containment breaches or concrete that has lost integrity, efforts to define the extent of contamination will use a graded approach using field screening and survey followed by verification sampling if needed. This section is an outline for a SAP that describes the approach that will be followed for verification sampling. The SAP will also assist in confirming that decontamination and/or removal activities have attained the closure performance standard. Sampling may be employed where the clean debris surface standard cannot be met, such as interior tank and pipe surfaces, or where evidence is found indicating apparent failure of ~~permitted mixed waste management unit~~DWMU secondary containment such as liner cracks.

However, the SAP cannot be finalized at this time because the dangerous waste COCs at each permitted dangerous/mixed waste management unit and restrictions on sampling and analysis activities due to high radiation levels are not adequately defined. Prior to closure, this closure plan will be revised to specify sampling and analysis techniques in a site-specific SAP that may include: sampling to determine the closure performance standards are met, specify extent of dangerous/mixed waste contamination, sampling objectives, analytical parameters, sampling methods and locations, identification of sampling preservation, sampling and data quality control, the evaluation and reporting of data, and the chain-of-custody record.

Additional information, as follows, may be provided in the revised closure plan to be submitted prior to closure:

- Health and safety plan
- Details on sampling equipment
- COC indicator parameters for decontamination solution analyses
- Analytical methods that deviate from *Test Methods for Evaluating Solid Waste, Physical Chemical Methods* (EPA 1986), if any

11.3.4.1 Sampling to Confirm Decontamination of Structures and Soil

Sampling of decontamination solutions may be conducted for equipment, structures, and debris that do not meet the clean debris surface standard following the decontamination process. This sampling will serve to define the extent of remaining contamination or confirm adequate decontamination of equipment, structures, or debris. The sampling process will be repeated after each subsequent round of decontamination effort until the decontamination effort is either determined to be successful, or is terminated, and the contaminated component is removed and disposed of as dangerous or mixed waste.

Soil found to be contaminated will be removed as part of the closure activities, and sampling will be performed to confirm that levels of contamination in the remaining soil do not exceed Ecology-approved risk-based soil cleanup levels. The Sampling and Analysis Plan for WTP is referenced in Appendix A.

11.4 Other Activities

This section describes the procedures to be followed in order to comply with closure certification requirements, to control run-on and runoff during closure, and to reuse equipment from the plant.

11.4.1 Certification of Closure

WAC 173-303-610(6) requires that within 60 days of completion of closure activities of the permitted dangerous/mixed waste management units, a closure certification will be submitted to Ecology. Following completion of closure, DOE (or the DOE-selected contractor) and an Independent Qualified

Registered Professional Engineer will submit certifications that the permitted ~~mixed waste management units~~DWMUs have been closed in accordance with the approved closure plan. The certifications will be submitted in accordance with the Hanford Facility Dangerous Waste Permit (Ecology 2009) Condition I.I.1 to the following address:

Program Manager, Nuclear Waste Program
Washington State Department of Ecology
3100 Port of Benton Boulevard
Richland, Washington 99354

The following documentation will be prepared to support the closure certification, and will be provided or accessible to Ecology on request:

- Field notes related to closure activities
- A description of deviations from the approved closure plan and justifications for these deviations
- Documentation of the final disposition of dangerous wastes and dangerous waste residues, including contaminated media, debris, and treatment residuals
- Laboratory and field data (including quality assurance and quality control data) for samples and measurements, including those taken to determine background conditions or to determine or confirm clean closure
- A summary report that itemizes the data reviewed by the independent qualified registered professional engineer and tabulates the analytical results of samples taken to determine or confirm clean closure

A draft decontamination documentation checklist and an example of RCRA closure certification statement are provided in Figure 11-1 and Figure 11-5, respectively. Ecology will verify that the requirements for closure certification are properly completed per WAC 173-303-610(6). ~~If the closure certification is accepted, Ecology will inform DOE of the acceptance in writing.~~

11.4.2 Run-on and Runoff Control

No runoff or run-on resulting from precipitation or surface water flows is anticipated in the areas undergoing closure. The WTP permitted dangerous/mixed waste management units are enclosed within highly secure reinforced concrete and steel frame buildings, with the exceptions noted below. Wash water or other liquids resulting from decontamination activities will be contained by WTP containment structures - floors, walls, ceilings, sumps, and catch tanks.

The only permitted ~~mixed waste management units~~DWMUs that may be exposed to direct precipitation are the two process condensate vessels outside the pretreatment building. The failed melter storage building will be a separate freestanding unit, and run-on or runoff control will be assured for this unit before and during operation of the WTP, as well as during the closure period. There will be no changes in the secondary containment capacities or runoff control design for this unit during closure activities.

Activities such as groundwater monitoring and run-on and runoff control will be described in a revision to the closure plan prior to closure.

11.4.3 Equipment Reuse

Equipment may be decontaminated and reused during or after closure, if practicable. For example, contaminated (radiological) material and handling equipment such as shield doors, cranes, and power manipulators may be decontaminated in order to reduce radiation dose rates. This will allow initial or repeated personnel entry to areas where additional decontamination, debris size reduction, or packaging and encapsulation activities will be conducted. Equipment described in Sections 11.3.0 and 11.6.0 will be decontaminated using methods selected from those specified under 40 CFR 268.45, or equivalent technologies.

Criteria for determining whether equipment will be reused or disposed of include the following:

- Degree of contamination (radiological)
- The need to minimize potential worker radiation and dangerous/mixed waste exposures during decontamination; the amount of decontamination residues that would be generated
- The value of the equipment
- Compliance with the approved schedule and budget

Equipment that could be used by DOE in future operations at the WTP site, in other Hanford projects, or at different DOE facilities, may be decontaminated first.

11.5 Maximum Waste Inventory

The estimated maximum mixed waste inventory for each type of permitted ~~mixed waste management unit~~DWMU is listed in Table 11-1. These are total storage capacity volumes from the WTP Part A ~~form in Chapter 11~~.

The actual volumes present at the start of the closure period will be much less than values shown in the table. For example, the containment buildings and container storage areas may be empty or nearly empty on the date of completion of treatment of the final volume of waste feed, and the tank systems are not likely to contain more than a few percent of the maximum capacity.

11.6 Closure of Tanks, Container Storage, Containment Buildings, and Miscellaneous Units

This section of the closure plan identifies specific closure requirements for each type of permitted ~~mixed waste management unit~~DWMU at the WTP, and describes the removal of wastes and equipment, decontamination of the unit, and disposition of decontamination residues. A summary of the closure standards and activities for each type of permitted ~~mixed waste management unit~~DWMU is provided in Table 11-2. The performance standards and closure activities for many of the mixed waste management unit components are similar or identical for the four types of units, as indicated in the table. Differences in the detailed closure procedures will be due in part to variations in permitted ~~mixed waste management unit~~DWMU design, and different ancillary equipment present in various units, even in units of the same type. In the process cells/caves secondary containment areas for tanks or miscellaneous units, initial decontamination activities will be performed remotely, while the same types of activities may be performed by personnel in most of the other mixed waste management units, such as container storage units.

An overall estimate of the volume of closure wastes to be generated has not been prepared, due to the uncertainties regarding final disposition of the WTP equipment and structures. The estimate of the volume of closure wastes will be provided in an amended closure plan and submitted for approval prior to initiating closure activities. The volume of decontamination wastes that will be generated may be relatively large if most of the tanks, piping and related equipment, and major portions of the concrete and steel structures are removed and disposed of as waste. Volume of wastes may also be large if the same equipment and structures are completely decontaminated, resulting in large amounts of secondary residues, personnel protective equipment, and decontamination solutions. The volume of immobilized waste that will be generated during the closure period depends in part on the composition of the final batch of waste feed, which cannot be predicted at this time.

11.6.1 Closure of Tank Systems

Tank systems will be decontaminated using chemical and/or physical extraction technologies. Types of tank systems that will be decontaminated include, but are not limited to, the following:

- LAW and HLW feed and storage tank systems

- Evaporators and condensers
- Waste filtration tanks
- Ion exchange tanks
- PTF condensate tanks
- EMF tank systems

Types of ancillary equipment that may be decontaminated include, but are not limited to, the following:

- Waste transport, rinse, and washdown piping
- Pumps, agitators, wash rings, and ejectors
- Air, steam, and water lines in secondary containment areas
- Intra-facility pipelines

Decontamination of tank systems including tanks, piping, and other ancillary equipment will be conducted using chemical extraction technology and water washing and spraying. High-pressure steam or other physical extraction technologies identified in Section 11.3.3 will also be used to remove contamination if necessary. The decontamination procedures for closure of tanks will include, but may not be limited to, the following:

- Tank systems will be flushed after the final batch of bulk waste has been processed through that tank system. Large-volume flush solutions will remove as much waste as possible before smaller scale decontamination work begins. Flush water will be transferred to the pretreatment evaporation and ultrafiltration systems, and the concentrates will be sent to the HLW melter for vitrification, if the HLW vitrification system is operating. (If either or both vitrification systems will not be operating during the first phase of the closure period, this closure plan will be revised to account for changes in treatment and disposal of waste feed and flushing wastes, as necessary.) Water condensate from the evaporator will be routed to the LERF/ETF. The HLW melter will be shut down after flushing wastes are treated. Tank decontamination activities to be performed after completion of flushing may involve any of the chemical or physical extraction technologies identified in Section 11.3.3. Used decontamination solutions will be transferred to the LERF/ETF or another permitted TSD facility.
- Physical evidence of mixed waste contamination in the secondary containment systems may be used, in addition to the operating record, to determine whether decontamination of the exterior of a tank system is needed. Before using decontamination solutions on the outside of a tank, the floor and wall liners will be inspected for cracks or other breaches. The cracks will be sealed before beginning decontamination treatment, or other engineered containment devices (such as collection basins) will be used to collect and contain solutions. The outer tank surface then will be cleaned with water or detergents, or other technologies as necessary, and rinsed. Decontamination of secondary containment for permitted ~~mixed waste management units~~DWMUs will be similar or identical to the procedures used for mixed waste container storage and containment building units.
- After the tanks are decontaminated, the tank interiors may be inspected using CCTV cameras to determine compliance with the clean debris surface standard. Because of possible radiation exposure, visual inspection of the process cells may be performed remotely using a camera with a zoom lens, or using another device that allows verification that the standard is met. Inspections will be documented in an inspection record.
- The outside of the tanks also will be inspected for compliance with the clean debris surface standard, and inspections will be documented in an inspection record.

- If tanks or ancillary equipment cannot be determined by visual inspection to meet the clean debris surface standard, the tanks may undergo further decontamination, or rinsate samples may be obtained to determine if the decontaminated tank meets the ~~designation~~risk-based limit performance standard for clean closure. Before or after decontamination efforts, a tank system may be designated as mixed waste debris, removed, reduced in size, packaged, treated by encapsulation, and sent to a permitted disposal facility.
- Decontamination residues will be collected, designated, and transferred to a permitted disposal facility.

The decontamination procedures for piping and ancillary equipment will include, but will not be limited to, the following activities:

- The facility design and process information, in combination with operating records, will be used to identify the equipment associated with treatment of mixed waste. Piping that may have carried mixed waste or may have become externally contaminated with mixed or dangerous waste will undergo decontamination. Contaminated piping may include waste transfer piping, sump contents transfer piping, nitric acid transfer piping, and other piping associated with waste treatment and secondary waste transfer.
- The piping will undergo bulk flushing at the same time the tanks are flushed. Flushing of the pipes and other ancillary equipment will remove the waste in order to meet the clean debris surface standard. Chemical and/or physical extraction technologies may be used to attempt to remove the remaining waste from piping and other ancillary equipment. Where it is not possible to visually verify that the clean debris surface standard has been met, verification may be attempted by rinsate sampling, analysis, and comparison of analyses with ~~designation~~risk-based limits.
- If it is not possible to meet the clean debris surface standard or ~~designation~~risk-based limits, contaminated portions of the piping and ancillary equipment will be removed, designated as dangerous/mixed waste, packaged in waste containers, transferred to the CWC or another permitted unit, encapsulated, and disposed of at a permitted landfill disposal unit on the Hanford Site. Encapsulation may be performed at the CWC or elsewhere.

11.6.2 Closure of Container Storage Areas

Each permitted mixed waste container storage unit will be evaluated for historical spills or other releases of dangerous or mixed wastes by review of the facility operating records and by visual inspection. The visual inspections will determine if the container storage unit can be declared clean using the clean debris surface standard by checking for signs of any spills and/or releases of waste and loss of integrity, breaks, cracks, gaps, and other signs of deterioration of container storage area floors. If the record review and inspection support the conclusion that no releases of dangerous/mixed waste to the floor occurred, no further decontamination or sampling work will be required for that permitted mixed waste container storage unit. If either the inspection or record review indicate that dangerous/mixed waste releases to the floor of a mixed waste container storage occurred, decontamination will be required. If the protective coating is intact, physical extraction treatment will not be performed. If the coating is cracked or more severely damaged, physical extraction treatment will be required to remove at least 0.6 cm from the original surface. If the extent of the historical releases (the actual location on the floor) cannot be determined, the entire floor surface of the container storage area will be treated. If the resulting surface cannot be documented as a clean debris surface, the treatment may be repeated or the full thickness of the floor may be removed. The solid residues or rubble produced by treatment or removal will be disposed of as dangerous/mixed waste, unless sampling and analyses are performed to support a request for an Ecology determination that the rubble is not dangerous/mixed waste.

The presence of through-thickness cracks or other loss of integrity, if found in concrete floors that rest directly on soil, in secondary containment areas where dangerous/mixed waste releases are documented or suspected, may require a soil contamination investigation. Examples of adequate evidence that a release may have occurred include discoloration or staining of the concrete, odor, or elevated radiation readings observed during the initial closure inspection. Soil and possibly concrete samples will be obtained by coring in the vicinity of known or suspected mixed waste releases. Soil contaminated at concentrations above the risk-based soil cleanup levels will be removed, and confirmation samples will be taken at the limits of the excavation to confirm adequate removal. If analytical results are less than the Hanford soil background levels but greater than the risk-based soil cleanup concentrations, a request for approval of a clean closure-determination will be submitted to Ecology. The request will be supported with the analytical and other pertinent data for that mixed waste container storage unit.

If soil contamination is so extensive that the zone of contamination cannot be practically removed, or if groundwater contamination could result, the closure plan will be revised to provide for additional investigation and measures to address corrective action requirements. Decontamination documentation will be prepared as described in Sections 11.3.4 and 11.4.1.

11.6.3 Closure of Containment Building Units

One containment building unit, the pretreatment plant hot cell maintenance area containment building unit, will be used for secondary waste (mostly debris) decontamination, size reduction, and packaging operations throughout the operating life of the WTP. It may be used for these same functions during the closure period. The HLW melter (cave) containment building may be used for similar operations during closure, after the normal melter operations have been completed. In particular, the HLW melter containment building may be used to partially decontaminate and overpack failed HLW melters that were stored in the failed melter storage building (container storage area) during the operating life of the plant.

After completion of operations to facilitate closure of other permitted ~~mixed waste management units~~DWMUs, the melters and associated spent parts, feed apparatus, and off-gas control equipment will be removed. The containment buildings will be closed in the same manner, following the same inspection, decontamination, and documentation requirements identified in Sections 11.6.1 and 11.6.2 for tank system secondary containment areas and mixed waste container storage units. Several significant differences in design and mixed waste types may result in substantially longer time requirements for closure of the permitted containment building units, as compared to mixed waste container storage units. For example, most operations in the HLW melter cave will be conducted with remotely operated equipment until the final decontamination stages are reached. Complex remote operations are necessarily slow, and the full extent of necessary decontamination, size reduction, and packaging work will not be known until the final stages of closure. The ILAW ~~container finishing line and container fixative~~ containment building units are also larger and contain more equipment than most of the mixed waste container storage units.

Other containment building units are more similar to mixed waste container storage units, including coated concrete rather than cladded floors and walls. These containment buildings will be closed in the same manner as the mixed waste container storage units (Section 11.6.2), with the added complications of various types of waste handling equipment such as power manipulators, cranes, and the LAW LSMs.

11.6.4 Closure of Miscellaneous Units

The HLW and LAW melters are miscellaneous units. Several times during the life of the WTP, spent melters will be removed from the HLW melter cave and LAW LSM gallery containment buildings. Removal and replacement of spent melters is not considered closure. One or more of the LAW melters may actually be removed and not replaced before the start of the closure period. The HLW melter is planned to be operating during the deactivation period (the first part of the closure period). If necessary, the HLW melter may be removed and replaced during the closure period to provide treatment for the

residues from tank system flushing operations. Such removal and replacement would not be considered closure, although it may occur during the closure period.

LAW melter operating equipment openings will be closed and the exterior surfaces decontaminated. The melters will be removed from the LAW melter gallery as intact assemblies, encapsulated, if required, and shipped to the LLBG or another permitted treatment/disposal unit. Failed HLW melters may be stored during the closure period, while treatment, transport, and disposal operations are arranged. HLW melters may be partially decontaminated and packaged in an overpack in the HLW melter cave during the final phases of closure activities. HLW melters in the failed melter storage building (container storage area) may be returned to the HLW melter cave for partial decontamination and packaging. Both types of melters will be treated in accordance with the immobilization treatment standard and disposed of at permitted mixed waste disposal facilities.

Removal of melter components will be accomplished according to standard procedures for the operational period of the plant. Special HLW melter closure activities, such as size reduction, decontamination of components, or packaging of components and decontamination residues, may require the development of new procedures or the installation of new equipment.

Other miscellaneous units such as offgas scrubbers, condensers, precipitators, reboilers, oxidizers, and adsorbers will be closed in the same manner, following the same inspection, decontamination, and documentation requirements identified in Sections 11.6.1 and 11.6.2 for tank systems and container storage areas.

11.7 Schedule for Closure

For the purposes of this closure plan, the design life of the WTP is estimated at 40 years of operations. The estimated three-year schedule for closure is provided in Figure 11-7.

As required by WAC 173-303-610(3)(c), WTP will notify Ecology at least 45 days before the date on which the closure period is expected to start. In addition, WAC 173-303-610(3)(c) requires that the closure period begin no later than 30 days after the date on which WTP receives the final volume of dangerous waste. Due to the complexity of the WTP operations, the 30-day requirement to start closure activities will likely be unable to be met. Processing of the final batch of waste feed may require approximately nine months after receiving the final waste feed transfer from the DST system unit. Additional evaluation of the schedule will be conducted prior to closure.

The date of receipt of the final volume of bulk waste feed in the melters and various other specific individual permitted ~~mixed waste management units~~DWMUs within the WTP will be at the end of the processing of that final batch of waste feed. This date will roughly correspond to the date of the start of deactivation operations. The pretreatment and HLW feed preparation and melter systems may continue to operate for several months after the start of the closure period. These systems will be processing the tank system flush solutions and producing immobilized waste glass containing most of the residual waste constituents left in the tanks at the start of the closure period.

The year the WTP permitted ~~mixed waste management units~~DWMUs close will depend on the time required for the initial portion of the tank waste inventory to be processed, the degree of success in this mission, and whether the WTP will be used to continue to process the remaining Hanford tank waste inventory. Other factors that could affect the year of closure include changes in operational requirements, lifetime extension upgrades, a different operating contractor, and other unforeseen factors.

This estimated three-year closure schedule is necessarily general and is not meant to be definitive. For example, completion of decontamination of the pretreatment building and residue removal is shown at approximately 21 months after the start of the closure period. However, decontamination of the LAW, EMF and HLW vitrification plant tanks and other permitted ~~mixed waste management units~~DWMUs is expected to require use of pipelines through the pretreatment building to transfer decontamination

solutions and rinsates to the LERF/ETF. Therefore, the final decontamination of piping and collection tanks in the pretreatment building may not be completed until after the LAW, EMF and HLW vitrification plant tanks and other permitted ~~mixed waste management units~~DWMUs are decontaminated.

A more specific schedule will be provided in the revision of this closure plan prior to the start of closure activities. The revised schedule will take advantage of final design and operating procedure information that is not available at this time. The schedule for closure will include a breakdown of activities to be performed after the date of completion of vitrification processing of the last batch of waste feed from the DST system.

11.8 Extension for Closure Time

The following discussion addresses the extension of the dangerous/mixed waste removal and closure time periods as specified in WAC 173-303-610(4)(a) and (b), respectively. The first citation requires that within 90 days after receiving the final volume of dangerous waste (the DST waste), the owner or operator will treat, remove from the dangerous/mixed waste management unit, or dispose of all dangerous wastes in accordance with the approved closure plan. The second requirement is that all closure activities will be completed within 180 days after receiving the final volume of dangerous waste.

The need for more than 90 days to remove dangerous/mixed wastes and more than 180 days to complete closure activities is anticipated. This need is due in part to the high radiation fields in many of the mixed waste management units, even after the entire bulk waste inventory has been processed and the residues (the inventory present at the start of the closure period) are removed by flushing. Processing of the final batch of waste feed may require approximately nine months of operation at or near design capacity of the plant, prior to the start of deactivation and closure work. As explained in Section 11.7.0, these processing operations will be completed, or nearly completed, at the start of the closure period.

The large number of mixed waste management units and extensive integrated ancillary equipment such as piping, valves, filters (mostly welded together), and the need to coordinate closure activities with other TSD units both at Hanford and offsite, means that more time will be required for closure than would be necessary for a typical dangerous waste management facility. The decontamination operations described in this closure plan are intended to avoid excessive secondary waste generation and to provide for the recycling of some pieces of equipment. The decontamination operations will include extensive use of chemical and physical decontamination treatment technologies. Incineration is not considered as an option for dangerous/mixed wastes to be generated during closure. Solidification, encapsulation, and landfilling of dangerous and mixed wastes will be deliberately minimized. The volumes of wastes that will be disposed of will also be minimized to the extent practical by physical size reduction. Size reduction will allow packaging of large tanks, pipe, and support structures in relatively small, densely packed drums or waste boxes. These waste management priorities are emphasized to support this request for extension of the waste removal and closure periods, as suggested in Section 8.3 of the Ecology *Guidance for Clean Closure of Dangerous Waste Units and Facilities* (Ecology 2005).

The WTP operator will take the actions necessary to prevent threats to human health and the environment from the unclosed but not operating WTP, including compliance with applicable permit requirements. During the first several months of the closure period, a large portion of the plant will be operating to remove waste residues from the tank systems to the maximum practical extent. Flushing, vitrification, and other deactivation activities will require continued security and monitoring of the other non-operating portions of the plant, and no part of the plant will be unsecured or abandoned during the closure period.

If necessary, an extension of the three-year closure schedule will be requested and the need for the extension demonstrated in accordance with WAC 173-303-610(4)(a) and (b). The request would be determined prior to initiating closure activities, or during closure activities should closure conditions necessitate. A revised closure plan will be submitted for approval if an extension is necessary.

Condition II.R.1 Hanford Facility Dangerous Waste Permit (Ecology 2009) requires the Permittees to notify Ecology in writing, as soon as possible, of deviations or expected deviations from the schedules of the permit. The Permittees will include with the notification information supporting their claim that they have used best efforts to meet the required schedules. If Ecology determines that the Permittees have made best efforts to meet the schedules of the permit, Ecology will notify the Permittees in writing by certified mail that the Permittees have been granted an extension. Such an extension will not require a permit modification under Condition I.C.3. Should Ecology determine that the Permittees have not made best efforts to meet the schedules of the permit, Ecology may take such action as is deemed necessary. Copies of correspondence regarding schedule extensions will be kept in the operating record.

Condition II.R.1 Hanford Facility Dangerous Waste Permit (Ecology 2009) provides that any schedule extension granted through the approved change control process identified in the *Hanford Federal Facility Agreement and Consent Order* (Ecology, EPA, and DOE 1998) will be incorporated into the permit. Such a revision will not require a permit modification under Condition I.C.3.

1

Table 11-1 Maximum Waste Inventory

Mixed Waste Management Unit	Maximum Inventory [a]
Total container storage	1,089,000 gal
Total tank storage	5, ~~276~~717,000 gal

[a] Miscellaneous (e.g., melter and offgas equipment) and containment building units are not counted, as they will be processing the volumes previously stored in tanks, and producing treated and secondary wastes that are included in the container storage total.

2

Table 11-2 Clean Closure Performance Standards and Activitiesa

Mixed Waste Management Unit Type	Components	Performance Standards	Closure Activities
Tank system	Exterior surfaces Interior surfaces Ancillary equipment Secondary containment	Clean debris surface, ~~designation~~risk-based limits, or removal	Extraction technologies or removal of tanks Liner and concrete decontamination and/or removal
Container storage area	Floor, walls, and ancillary equipment	Clean debris surface, ~~designation~~risk-based limits, or removal	Extraction technologies Liner and concrete decontamination and/or removal
Containment building	Floor, walls, and ancillary equipment	Clean debris surface, ~~designation~~risk-based limits, or removal	Extraction technologies Liner and concrete decontamination and/or removal
Miscellaneous units (melter)	Melters and ancillary equipment	Removal	Removal
Miscellaneous units (others)	Exterior surfaces Interior surfaces Ancillary equipment Secondary containment, as applicable	Clean debris surface, ~~designation~~risk-based limits, or removal	Extraction technologies or removal of miscellaneous units Liner and concrete decontamination and/or removal

3 [a] Refers to WAC 173-303-610 and 40 CFR 268.45, Table 1, as incorporated by reference at WAC 173-303-140 (2)(a).

DECONTAMINATION CHECKLIST

This checklist is intended to document decontamination work and the attainment of a clean debris surface for the following components, structures, and materials.

1 Building or location:
2 Component or Area:
3 Material (such as concrete, metal):
4 Decontamination treatment method[1]:
5 Decontamination treatment parameters:
– Temperature
– Propellant
– Solid media (such as shot, grit, beads)
– Pressure
– Residence time
– Surfactants
– Detergents
– Grinding or striking media (such as wheels, piston heads)
– Depth of surface layer removal in cm (in concrete, for example)
– Other

The decontamination of the building, component, or material identified in steps 1 through 3 was completed as specified at steps 4 and 5.

_____ _____ / _____
Title Signature Date

6 Performance Standard:

I have visually inspected the above-identified material before / after (circle one) decontamination or treatment in accordance with the closure plan. Dangerous waste residues have / have not (circle one) been removed to attain a clean debris surface[2].

_____ _____ / _____
Authorized Representative Signature Date

Notes:

1 Decontamination treatment will use a chemical or physical extraction method as listed in Table 1, Alternative Treatment Standards for Hazardous Debris (40 CFR 268.45).
2 Clean debris surface as defined in Table 1, Alternative Treatment Standards for Hazardous Debris (40 CFR 268.45): "'Clean debris surface' means the surface, when viewed without magnification, will be free of all visible contaminated soil and hazardous waste except that residual staining from soil and waste consisting of light shadows, slight streaks, or minor discolorations, and soil and waste in cracks, crevices, and pits may be present provided that such staining and waste and soil in cracks, crevices, and pits will be limited to no more than 5 % of each square inch of surface area."

1 **Figure 11-1 Sample Clean Debris Surface Checklist**

2
3

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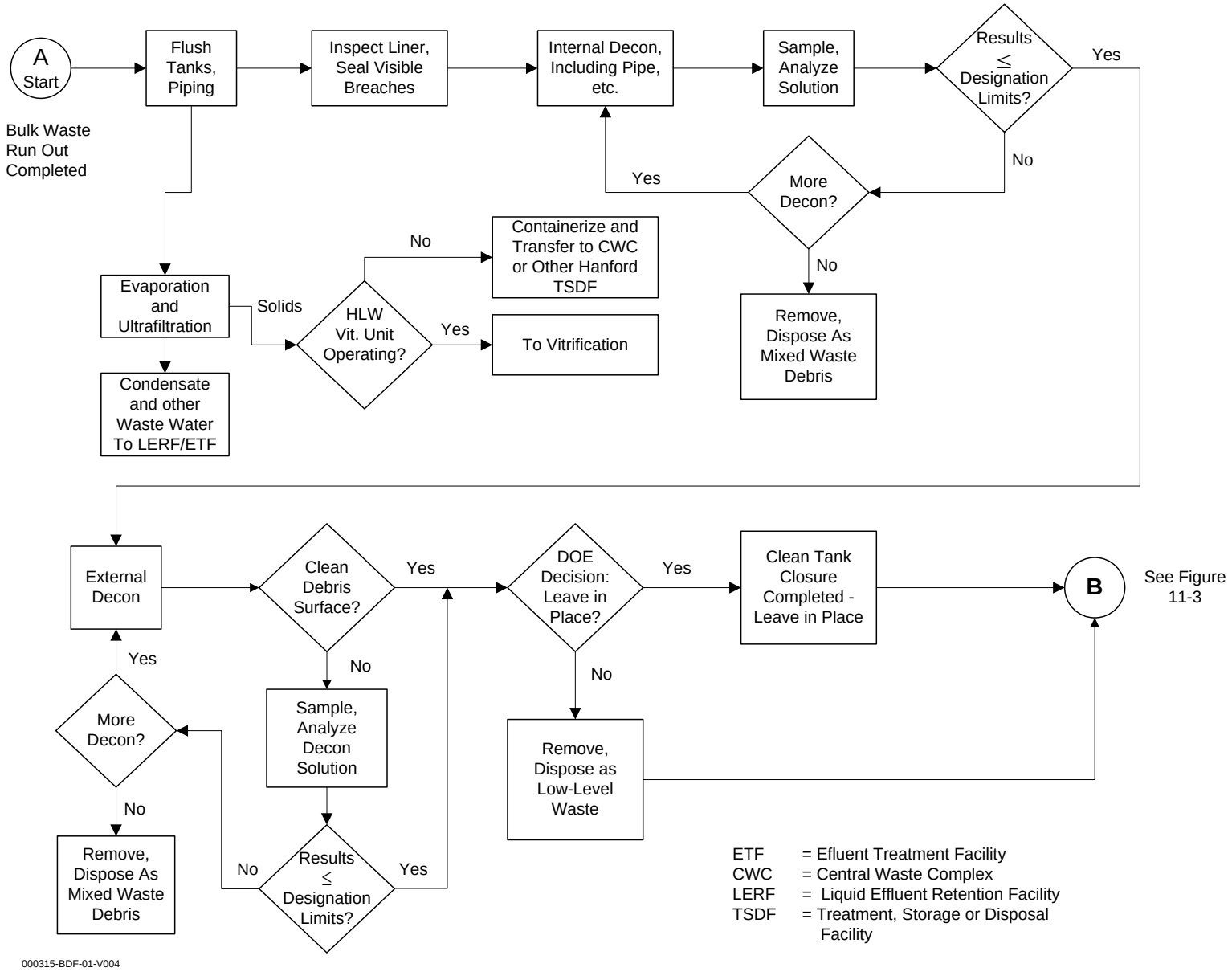

Figure 11-2 Closure Strategy Flowchart for Tank Systems

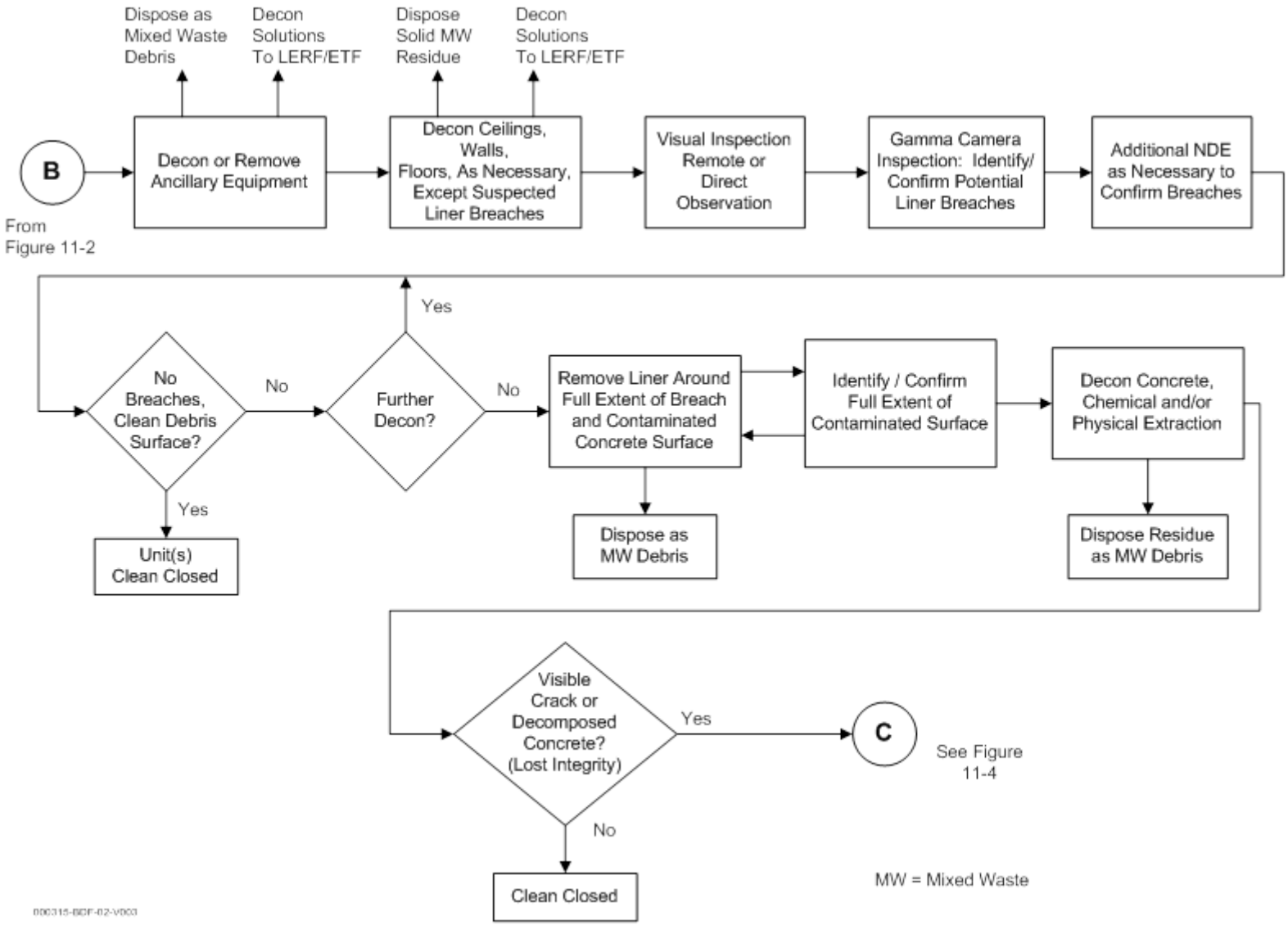

Figure 11-3 Closure Strategy for Container Storage, Containment Building, Miscellaneous Unit, and Tank System Secondary Containment Areas

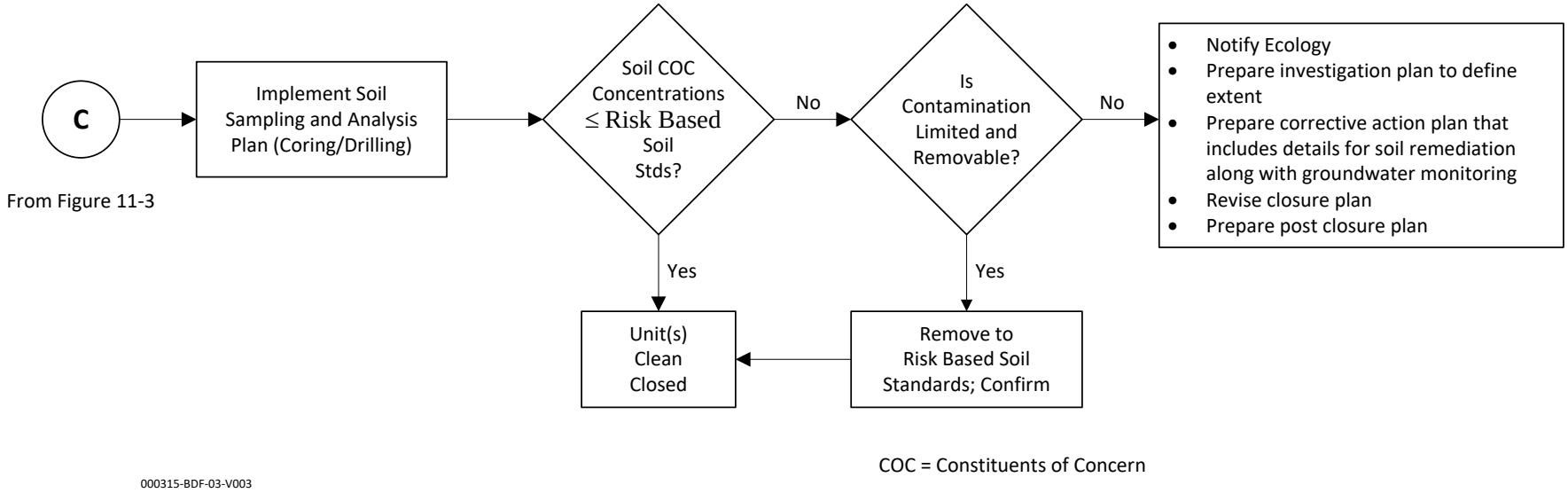

Figure 11-4 Closure Strategy Flowchart for Soils and Groundwater

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RCRA CLOSURE CERTIFICATION
FOR

River Protection Project – Waste Treatment Plant
Hanford Site
US Department of Energy, Richland Operations Office

We, the undersigned, hereby certify that _____ closure activities were performed in accordance with the specifications in the approved closure plan.

Owner/Operator	Signature	/ Date
Contractor Representative	Signature	/ Date
Independent Registered Professional Engineer	Signature	/ Date

Washington State PE # _____

Figure 11-5 Example Closure Certification Statement

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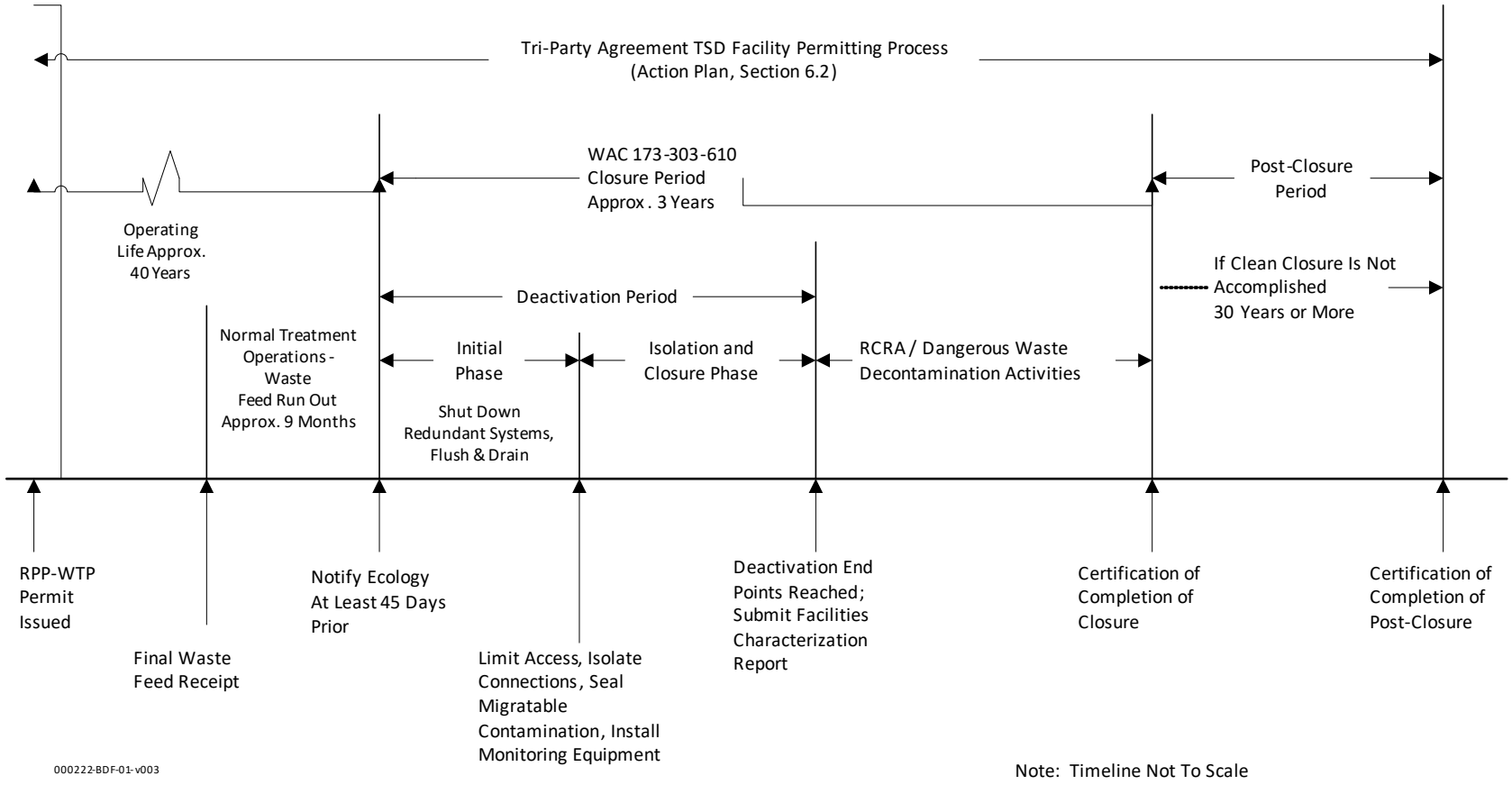

Figure 11-6 WTP Permitting, Deactivation, and Closure

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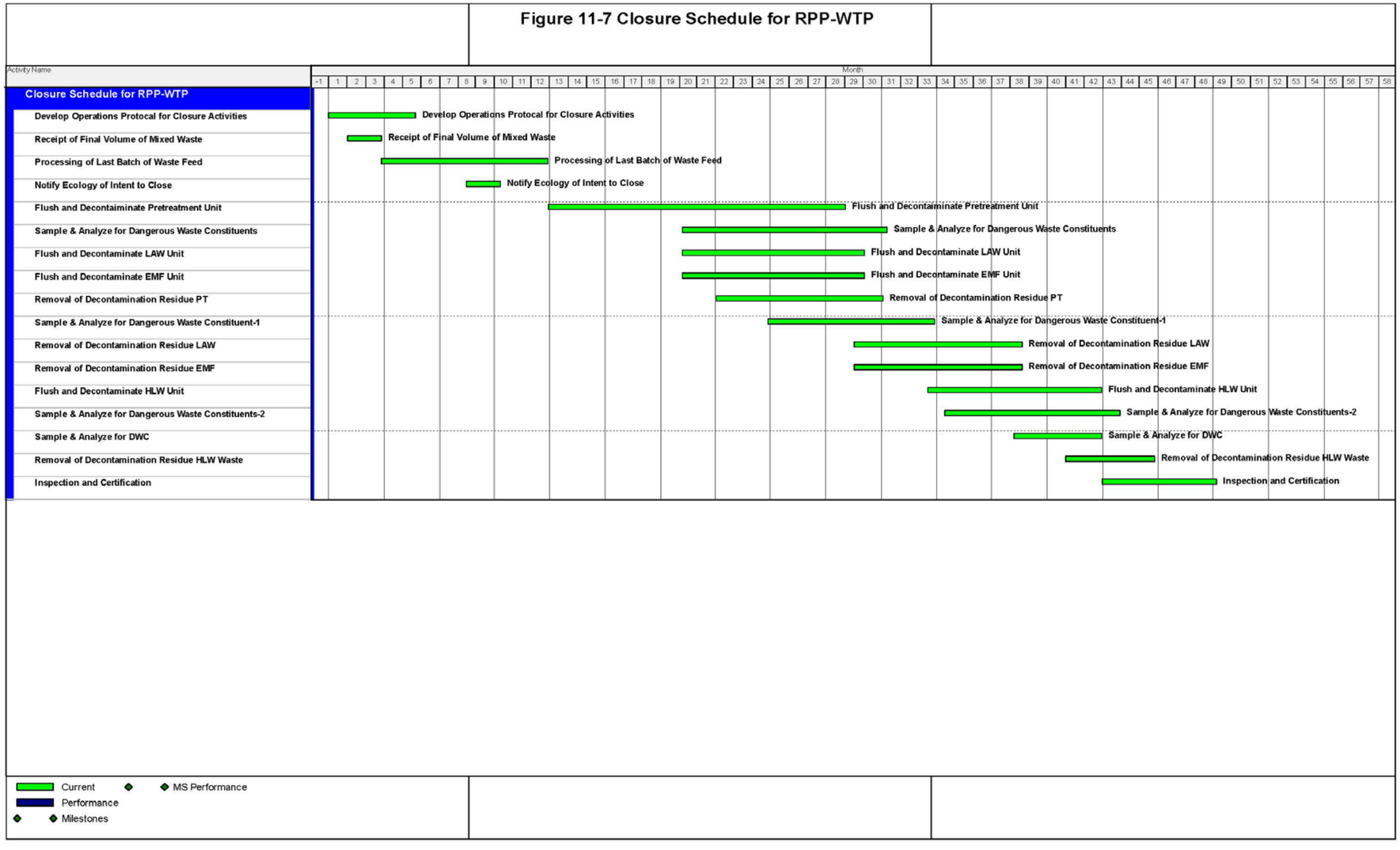

Figure 11-7 Closure Schedule for WTP

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