SINGLE-SHELL TANK SYSTEM CLOSURE PLAN

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PREFACE

This *Single-Shell Tank System Closure Plan* (Closure Plan) is being submitted to the State of Washington, Department of Ecology (Ecology), under the provisions of the *Resource Conservation and Recovery Act* (RCRA), the *Hazardous Waste Management Act* (HWMA), and applicable requirements thereunder. Consequently, this plan addresses hazardous and dangerous wastes only (as defined by these statutes and regulations) and does not address waste classification determinations and radioactive waste-specific closure actions that the U.S. Department of Energy (DOE) may take under the *Atomic Energy Act of 1954* (AEA). To the extent that this plan provides data or discussions about materials regulated under the AEA, that information is provided for informational purposes only.

Revision 0 of the Closure Plan was submitted on December 19, 2002, pursuant to Hanford Federal Facility Agreement (HFFACO) Milestones M-45-06A and M-45-05H. Revision 1 is being submitted in response to Revision 0 comments submitted by Ecology and subsequent comment resolution. Since submittal of Revision 0, the United States District Court, District of Idaho, issued a Judgment in *Natural Resources Defense Council, et al, v. Spencer Abraham, et al*, Civ. No. 01-0413-S-BLW (July 3, 2003) holding invalid certain portions of Order 435.1 relating to incidental waste. On August 27, 2003, DOE appealed this judgment to the U. S. Circuit Court of Appeals for the Ninth Circuit. This plan does not address the waste incidental to the reprocessing evaluation process described in DOE Order 435.1 and its accompanying Guidance and Manual. However, this plan does discuss other aspects of DOE O 435.1, DOE M 435.1-1, and DOE G 435.1-1.

The timing of certain actions contemplated in this plan, such as mixing grout with waste residuals during the closure process, may require decisions that must be made under the AEA and/or in accordance with other applicable requirements. Accordingly, even where apparently mandatory phrases such as "DOE will…" are used in this plan, the actions these phrases refer to are conditional based on the successful completion of required precursor actions which may be affected by the outcome of the litigation referred to above. No irreversible final closure actions will be taken for the RCRA purposes discussed in this plan unless and until they are shown to be consistent with radioactive waste management requirements DOE must address under the AEA, DOE Orders, and any other applicable requirements. As a specific example, grout will not be added to stabilize tank waste residuals for RCRA purposes unless and until DOE has determined that the waste characteristics of the residuals are suitable for addition of grout in the tank under applicable requirements and Ecology has issued the appropriate permits. In some cases, the paths forward to make the radioactive waste determinations are still under development and may impact schedule dates contemplated in this plan.

This *Single-Shell Tank System Closure Plan* describes the process for closure of 149 single-shell tanks at the Hanford Site, Washington, including the tanks themselves, ancillary equipment, contaminated soil, and contaminated groundwater, in accordance with the requirements of applicable laws and regulations. The document consists of three main sections that are arranged in a hierarchy. The highest-level document section (Tier 1) addresses closure topics and issues pertaining to the single-shell tank system. The mid-level section (Tier 2) addresses specific groupings of one or more single-shell tank farms known as waste management areas (WMAs). The lowest level document in the hierarchy (Tier 3) addresses closure activities for specific components within a particular WMA. The following summarizes the general content of the Tier 1, 2, and 3 sections of the *Single-Shell Tank System Closure Plan*:

- Tier 1 – *Framework Plan for Single-Shell Tank System Closure:* Referred to as the Framework Plan, this section provides a general overview of the single-shell tank system, a general description of the administrative framework and process for closure, including key definitions, and a description of the process for incorporating Tier 2 and Tier 3 with soil and groundwater corrective actions, single-shell tank closure performance standards, an overall closure schedule, and an overall description of the certification and postclosure process.

- Tier 2 – *Waste Management Area Closure Action Plans*: This tier consists of appendices to the Tier 1 Framework Plan, one for each of the seven single-shell tank farm WMAs at Hanford. The seven WMAs include WMA A-AX; WMA B-BX-BY; WMA C; WMA S-SX; WMA T; WMA TX-TY; and WMA U. Each appendix provides a general description of the WMA, a description of the WMA groundwater monitoring effort, a general description of closure activities, a risk evaluation of the WMA, a closure schedule for the WMA, and a description of the certification and postclosure process.

- Tier 3 – *Component Closure Activity Plans* (for specific WMA components): This section of the *Single-Shell Tank System Closure Plan* consists of attachments to the Tier 2 appendices. Each attachment provides component closure actions for one or more components within each WMA, such as for individual single-shell tanks or pieces or groupings of ancillary equipment.

FRAMEWORK PLAN FOR SINGLE-SHELL TANK SYSTEM CLOSURE

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AEA	Atomic Energy Act of 1954
BBI	best basis inventory
C-106	single-shell tank 241-C-106
CFR	Code of Federal Regulations
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act of 1980
CLUP	Comprehensive Land-Use Plan
DOE	U.S. Department of Energy
DST	double-shell tank
DQO	data quality objective
Ecology	Washington State Department of Ecology
EDE	effective dose equivalent
EIS	environmental impact statement
EPA	U.S. Environmental Protection Agency
ERA	ecological risk assessment
ERDF	Environmental Restoration Disposal Facility
ERPG	emergency response planning guidelines
FIR	field investigation report
FR	Federal Register
HFFACO	Hanford Federal Facility Agreement and Consent Order
HI	hazards index
HLW	high-level waste
HWMA	Hazardous Waste Management Act
ILCR	incremental lifetime cancer risk
ILAW	immobilized low activity waste
LAW	low activity waste
LCF	latent cancer fatality
LDMM	leak detection, monitoring, and mitigation
LDR	land disposal restriction
LLBG	low-level burial grounds
LLW	low-level waste
MCL	maximum contaminant level
MEI	maximally exposed individual
MTCA	Model Toxics Control Act
NEPA	National Environmental Policy Act of 1969
NPL	National Priorities List
OGT	overground transfer lines
PPS	past practice sluicing
RBE	relative biological effectiveness
RCRA	Resource Conservation and Recovery Act of 1976
RCW	Revised Code of Washington
RFI/CMS	RCRA Facility Investigation/Corrective Measures Study
ROD	Record of Decision

SAP	sampling and analysis plan
SEPA	Washington State Environmental Policy Act
SMWU	solid waste management unit
SST	single-shell tank
TEDE	total effective dose equivalent
TEEL	threshold emergency exposure limit
TRU	transuranic waste
TSD	treatment, storage, and disposal
WAC	*Washington Administrative Code*
WIPP	Waste Isolation Pilot Plant
WMA	waste management area
WTP	waste treatment plant
X/Q	Atmospheric Dispersion Coefficents

KEY DEFINITIONS

Absorbed Dose. The amount of ionizing radiation energy absorbed by matter, including human tissue. The unit of absorbed dose is the rad or gray.

Activity. The rate of disintegration (transformation) or decay of radioactive material. The units of activity are the curie (Ci) and the Becquerel (Bq).

Acute Exposure. The intake of a contaminant over a short period of time.

Acute Release. A release of radioactive or other hazardous material to the environment that occurs over a relatively short period of time (e.g., minutes or hours versus years).

Alpha Particle. A positively charged particle, consisting of two protons and two neutrons, that is emitted during radioactive decay from the nucleus of certain nuclides. It is the least penetrating of the three common types of radiation (alpha, beta, and gamma).

Americium. A transuranic element of the actinide series, having isotopes with mass numbers from 232 to 248 and half-lives from 55 seconds to 7,380 years. The longest-lived isotopes (241 and 243) are alpha-ray emitters used as radiation sources in research.

Ancillary Equipment. *Ancillary equipment* means any device including, but not limited to, such devices as piping, fittings, flanges, valves, and pumps, that is used to distribute, meter, or control the flow of dangerous waste from its point of generation to a storage or treatment tank(s), between dangerous waste storage and treatment tanks to a point of disposal onsite, or to a point of shipment for disposal offsite in accordance with WAC-173-303-040. Examples of ancillary equipment include components both internal and external to the tank including pipelines, conduit, pits, diversion boxes, ventilation systems, electrical/service connections, tank risers, pumps, measuring equipment (such as liquid level detection systems, thermocouples), shield plugs, and dip legs.

Diversion Boxes – Diversion boxes are below-grade, reinforced concrete structures that provide a flexible method of directing liquid waste from a given point to any other given point. The top of the diversion box is a concrete cover block that usually extends above-grade. Cover blocks vary in thickness from box to box. Some diversion boxes are lined with steel. Transfer lines are connected in the diversion box by installing a jumper between the connecting nozzles. Jumpers can be either fixed or flexible. Jumper installation or removal can be a complex operation requiring a crane to remove and handle the cover block and to install the jumper.

Miscellaneous Structures – These are special structures that support SST functions and do not fit into other listing categories.

Valve Pits – Valve pits are reinforced concrete structures located below ground that contain valve and jumper assemblies to route the liquid waste through the connected pipelines within a tank farm. Heavy, thick, grade-level blocks cover each of the valve pits. When several tanks are undergoing simultaneous pumping to a single receiver tank, the flow is routed to a valve pit. In the valve pit, the transfer lines of the sending tank are manifolded to the receiver tank line by means of a series of valves and jumper connections. Two- and three-way valves are built into each rigid jumper assembly to divert the flow in the required direction. Waste also can be routed through the valve pit with stainless steel flex jumpers. Each valve pit is equipped with a leak detection that is interlocked to shut down pumps. Each valve pit also has a flush line connected to a flush pit or a drain line connected to an underground storage tank.

Flush Pits – The components for pipeline back flushing and decontamination operations are located in flush pits. In-line backflow preventers protect the flush pit system from contamination from mixed waste backflowing into the flushing system.

Single-Shell Tank Pits – SST pits are located atop the tanks and provide a pathway into the tanks for pumps and monitoring equipment.

Waste Transfer Vaults – These vaults are shielded enclosures used to collect, clarify, and allow physical and chemical modification of contents before such contents are transferred elsewhere.

Transfer Lines – Piping used to transfer waste from one location to another.

Aquifer. A body of permeable rock, rock fragments, or soil through which groundwater moves.

Basalt. Dark to medium-dark colored, fine-grained rocks, volcanic in origin.

Best Basis Inventory (BBI). Best available estimate of chemical and radionuclide inventory of wastes in a SST.

Cancer. A subset of lesions of the disease neoplasia, which in turn, is defined as a heritably altered and relatively autonomous growth of tissue.

Carbon-14. A radioactive isotope of carbon with a mass number of 14 and half-life of 5,730 years (plus or minus 40 years). It occurs naturally as a result of reactions between atmospheric nitrogen and neutrons resulting from cosmic-ray collisions.

Carcinogen. An agent that causes or induces cancer.

Cascade. Tanks connected in series and placed at different elevations creating a downhill gradient for liquids to flow freely from one tank to another.

Cascade Line. Sloping transfer pipelines allowing fluid in one SST to flow by gravity to another SST.

CEDE. Committed effective dose equivalent. The sum of the products of absorbed dose from internally deposited radionuclides and appropriate factors to account for differences in biological effectiveness due to the quality of radiation and its distribution in the body of reference man over a fifty-year period. The units for this are the rem or siervert.

Cesium-137 (Cs-137). A gamma emitting radioisotope with a half-life of 30 years. Cesium-137 is generated during fission of uranium-235.

Cobalt-60 (Co-60). A radioactive isotope of a hard, brittle metallic element found associated with nickel, silver, lead, copper, and iron ores and resembling nickel and iron in appearance. This isotope has a mass number 60 and a half-life of 5.27 years. It is an intense gamma-ray emitter, used in radiotherapy, metallurgy, and materials testing.

Code of Federal Regulations (CFR). A documentation of the regulations of Federal executive departments and agencies.

Committed Dose Equivalent. Total dose equivalent accumulated in an organ or tissue in the 50 years following a single intake of radioactive materials into the body. The units for this are the rem or siervert.

Compliance Schedule. Timetable for completion of WMA and component closure activities when resource, safety, and technology constraints prevent closure from being practicably accomplished within normal regulatory time limits.

Component. *Component* is defined in WAC 173-303-040 as either the tank or ancillary equipment of a tank system. The meaning of the word 'component' is being expanded in this SST system closure plan to mean a subunit of a dangerous waste management unit associated with the SST system for which closure actions identified in the SST system closure plan may be implemented. For example, an individual tank, a piece or grouping of ancillary equipment, a contiguous area of contaminated soil, and a groundwater plume are each defined as components. Waste piles listed in Addendum 1 to this Framework Plan are also components. Figure 1-2 illustrates the components that make up the SST System.

Component Care Activities. Actions such as monitoring or inspection taken to ensure continued isolation of a component between completion of closure activities at the component and final closure.

Component Closure Activities. *Component closure activities* means actions on components taken in compliance with WAC 173-303-610 that contribute to closure of dangerous waste management units and to SST system final closure in accordance with WAC 173-303-610, HFFACO, and the Site-Wide Permit. By themselves, component closure activities do not constitute final closures. A component closure activity plan will address all of the requirements of a closure plan that are applicable to the specific closure activity described either directly or by reference to other applicable sections of the closure plan. It will demonstrate that closure activities can be achieved in compliance with closure requirements in WAC 173-303-610, including how the activities contribute to final closure and compliance with the closure performance standards of WAC 173-303. Evaluation of component closure activities will ordinarily include consideration of the risk associated with the end-state of the component in question and the risk associated with remaining WMA components.

After completion of closure activities of a component, DOE will take additional actions to care for the component until final closure. Component care activities may include actions such as monitoring or inspection of the component to ensure continued isolation.

Confined Aquifer. A subsurface water-bearing region that has defined, relatively impermeable upper and lower boundaries. The impermeable boundary is referred to as a confining layer.

Contaminant. Any gaseous, chemical or radioactive material that contaminates (pollutes) air, soil, or water. This term also refers to any hazardous substance that does not occur naturally or that occurs at levels greater than those naturally occurring in the surrounding environment (background).

Corrective Action. *Corrective action* means the process taken to address past and potential future tank system waste releases to the environment as necessary to protect human health and the environment including solid waste management units, areas of concern at the facility, and releases that have migrated beyond the facility boundary. This process will comply with Section 7.0 of the HFFACO, Condition II.Y of the Site-Wide Permit, WAC 173-303-646, and, for releases from a regulated unit after closure, WAC 173-303-645(1)(c). At the time of initial *SST System Closure Plan* submittal, contaminated soil at WMAs B/BX/BY, S/SX, and TX/TY is being investigated to assess the need for possible corrective actions.

Crib. An underground structure designed to receive liquid waste that can percolate into the soil directly or after traveling through a connected tile field. This is similar in concept to a septic tank system.

Criteria. General guidelines or principles from which more quantitative or definitive standards are prepared to regulate activities.

Curie (Ci). A unit of measurement of radioactivity or the quantity of a radionuclide, equal to 37 billion (3.7×10^{10}) disintegrations or nuclear transformations per second.

Dangerous Waste Management Unit/WMA. *Dangerous waste management unit* means a tank farm or group of tank farms that form a contiguous area. For the SST system, these groupings also are called WMAs. Seven SST WMAs have been identified in HFFACO Appendix B, as follows:

WMA A-AX:	241-A and AX tank farms
WMA B-BX-BY:	241-B, BX, and BY tank farms
WMA C:	241-C tank farm
WMA S-SX:	241-S and SX tank farms
WMA T:	241-T tank farm
WMA TX-TY:	241-TX and TY tank farms
WMA U:	241-U tank farm.

Dangerous Wastes. Those solid wastes designated in Washington Administrative Code as dangerous, or extremely dangerous, or mixed waste. In general, these include wastes classified as hazardous under the Federal Resource Conservation and Recovery Act (RCRA).

Data Quality Objective (DQO). A process implemented in accordance with the U.S. Environmental Protection Agency (EPA), *Guidance for the Data Quality Objectives Process QA/G4*. The DQO serves as a tool for determining type, quantity, and quality of data needed to support Agency decisions.

Decontamination. Those activities employed to reduce the levels of contamination in or on structures, equipment, materials, and personnel.

Disposal. The discharging, discarding, or abandoning of dangerous wastes or the treatment, decontamination, or recycling of such wastes once they have been discarded or abandoned. This includes the discharge of any dangerous wastes into or on any land, air, or water.

Dose Equivalent. Product of the absorbed dose, the quality factor, and any other modifying factors. The dose equivalent is a quantity for comparing the relative biological effectiveness (RBE) of different kinds of radiation on a common scale. The unit of dose equivalent is the rem or sievert. A millirem is one one-thousandth of a rem.

Downgradient. In hydrologic terms, this is used to designate downstream (e.g., direction of groundwater flow).

Drop Leg. Secondary drainage tube from a piece of equipment installed in a pit, such as a slurry distributor, which is routed to a riser.

Dry Well. Well, consisting of a steel cased borehole that terminates above groundwater, and is used for detecting and monitoring migration of tank waste constituents, mostly gamma-emitting radionuclides from a nearby source.

Dry Well Logging. Spectral or gross gamma-ray logging of dry wells to determine radionuclide levels of gamma-emitting radionuclides in soils and their variability with depth.

Effective Dose Equivalent (EDE). The sum over specified tissues of the products of the dose equivalent in a tissue and the weighting factor for that tissue. The units for this are rem or sievert.

ENRAF. Trade name for a liquid level measurement device.

Exhauster . Powered ventilation system for a storage tank

Exposure. Contact of an organism with a chemical or physical agent.

Field Investigation Report (FIR). Report stating findings and results of physical examination of a potentially contaminated area. The examination may include sampling and analysis or other characterization activities to develop information defining the existence, extent, and concentration of contaminants in the study area.

Final Closure of the SST System. *Final closure of the SST system* means the closure of all dangerous waste management units within the facility in accordance with all applicable closure requirements so that dangerous waste management activities are no longer conducted at the facility. For the purposes of this *SST System Closure Plan* and contingent closure and postclosure plan, the SST system is regarded as the "facility." Final closure of the SST system will occur after all components of the SST system have been added to the *SST System Closure Plan* portion of the Site-Wide Permit and all closure actions for WMAs and components have been completed.

At final closure, all closure activities will be completed and WMA/component postclosure care activities will be implemented. Postclosure care activities will include actions such as monitoring or inspection of the component to ensure continued isolation. **Groundwater.** Water occurring beneath the earth's surface in the intervals between soil grains, in fractures, and in porous formations.

Groundwater Gradient. The slope of the water table that, together with permeability of the rock and soil material, determines the direction and rate of groundwater movement. Groundwater gradients include both a horizontal and vertical dimension.

Gross Alpha. The total alpha radiation from all sources (e.g., radioactive materials) reported in one measurement.

Gross Beta. The total beta radiation from all sources (e.g., radioactive materials) reported in one measurement.

Gross Gamma. The total gamma radiation emitted from all gamma-emitting radionuclide sources.

Grout. A thin mortar-like mixture, usually of Portland cement, water, sand and other agents.

Half-Life. Length of time in which a radioactive substance will lose one-half of its radioactivity by decay. Half-lives range from a fraction of a second to billions of years, and each radionuclide has a unique half-life.

Hazard Index (HI). The sum of more than one hazard quotient (i.e., ratio of a single substance exposure level over a specified time to a reference dose for that substance derived from a similar time) for multiple substances and/or mulitple exposure pathways. HI is unitless.

HFFACO. Hanford Federal Facility Agreement and Consent Order, also known as Tri-Party Agreement (TPA), an agreement signed in 1989 by the U.S. Department of Energy, the U.S. Environmental Protection Agency, and the Washington State Department of Ecology that identifies milestones for key environmental restoration and waste management actions.

Hydraulic Conductivity. A measurement that indicates the ease with which a porous medium permits fluids (e.g., water) to flow through it and the ease with which the fluid flows given its physical characteristics.

Incremental lifetime cancer risk (ILCR). A measure of the probability of developing cancer based on exposure to radionuclides or carcinogenic chemicals over a lifetime.

Institutional Controls. Methods to protect against intrusion on closed areas or waste sites. Controls include site access, restrictions, monitoring, and maintenance.

Iodine-129 (I-129). Beta emitting radioisotope with a half-life of 15,700,000 years. It is generated during the fission of uranium-235.

Isolation . Actions to control all potential pathways for liquid intrusion into a retrieved SST.

Isotope(s). Different forms of the same chemical element that are distinguished by different numbers of neutrons in the nucleus. A single element may have many isotopes. some may be radioactive and some may be nonradioactive (stable). For example, the three isotopes of hydrogen are protium, deuterium, and tritium.

Jumper. A prefabricated piping device used to make a temporary connection between two waste transfer nozzles, or between a nozzle and a piece of equipment (e.g., pump, sluicer). Usually remotely installed.

Latent Cancer Fatality (LCF). A delayed fatality resulting from cancer caused by an exposure to radionuclides or carcinogenic chemicals.

Lateral. Extension toward the side; extension horizontally rather than vertically. Also, part of a system of drywells extending horizontally beneath self-boiling SSTs in A and SX Tank Farms.

Maximally Exposed Individual (MEI). A hypothetical individual who, by virtue of location and living habits, could receive the highest dose from exposure to radionuclides or chemicals.

Mixed Waste. A dangerous, extremely hazardous, or acutely hazardous waste that contains both a nonradioactive hazardous component and, as defined by the 10 CFR 20.1003, source, special nuclear, or by-product material subject to the Atomic Energy Act of 1954 (42 U.S.C. 2011 et seq.).

Monitoring. Periodic or continuous surveillance or testing to determine the level of compliance with regulatory requirements and pollutant levels in various media or in humans, animals, and other living things. This term also refers to actions intended to detect and evaluate radiological conditions.

Monitoring Wells. Boreholes drilled to groundwater to various depths, some of which are completed as Resource Protection Wells per WAC 173-160 where instruments are lowered or water samples are taken to determine what is present.

Neptunium. A silvery, metallic, naturally radioactive element with the atomic number 93. It is the first of the transuranium elements and has 13 isotopes with mass numbers from 228 to 243 and half-lives ranging from one minute to 2.14 million years. Neptunium is found in trace quantities in uranium ores and is produced synthetically by nuclear reactions.

Organics. Compounds that contain carbon.

Parameter. In statistics, a numerical quantity (such as the mean) that characterizes the distribution of a random variable or a population.

Permeability. The property or capacity of a porous rock, sediment, or soil for transmitting a fluid such as water.

pH. A measure of the relative acidity or alkalinity of a solution. A neutral solution has a pH of 7, acids have a pH of less than 7, and bases have a pH of greater than 7.

Pit. A covered, below grade facility, usually concrete, used for waste routing (with jumpers), servicing, monitoring, and for equipment installation and connection. Major pits directly connected to SSTs are heel pits, pump pits, salt well pits, and sluice pits. Farm support pits include diversion boxes and valve pits. Other pit facilities include condensate pump pits, condensate valve pits, condenser pits, flow meter pits, flush pits, heat exchanger pits, hold-up tank pits, instrument pits, jet pump pits, leak detection pits, receiver pits, salt tank pump pits, and service pits.

Plume. The distribution of contaminants a distance away from a point source in a medium like groundwater or air. It is a defined area of contamination.

Point of Compliance. A vertical surface located at the hydraulically downgradient limit of the waste management area that extends down into the uppermost aquifer underlying the regulated units.

Postclosure Actions. *Postclosure actions* mean actions taken after final closure of a waste management area (WMA) or closure of the entire SST system if contaminants are left in place that require postclosure monitoring and maintenance of the WMA or the entire SST system. Postclosure actions will include performing maintenance activities, and developing long-term monitoring systems. Postclosure actions will also include deed restriction and administrative controls, groundwater monitoring, and cover maintenance. Most postclosure actions will not be implemented until after a WMA has been closed and some may not be implemented until after the entire SST system has been closed. Postclosure actions will be detailed in WMA postclosure plans. Postclosure actions pertaining to the entire SST system will be detailed in the Framework Plan. The contingent postclosure plan for each WMA is contained in the WMA closure action plan and is discussed further in Section 1.4.1 of this framework plan.

Plutonium. A heavy, radioactive, anthropogenic metallic element consisting of several isotopes. One important isotope is plutonium-239, which is produced by irradiating uranium-238 with neutrons.

Postclosure Plan. Plan describing how the owner and/or operator will meet requirements placed on portions of the SST system closed as a landfill or landfills after closure to ensure their environmental safety for a number of years after closure.

Radionuclides. Nuclides that are radioactive. A nuclide is a species of atom with a specific mass, atomic number, and nuclear energy state. Standard practice for naming radionuclides is to use the name or atomic symbol of an element followed by its atomic weight (e.g., cobalt-60 or Co-60).

Rem. Units for dose equivalent. The dose equivalent in rem is equal to the absorbed dose in rad mulitplied by the quality factor.

Record of Decision (ROD). An official document that states the decision on a selected action. A ROD is based on information, technical analysis, and consideration of any public comments and stated community concerns.

Retrieval. Removal of liquid and solid wastes from storage tanks.

Riser. Vertical access pipe from the dome of a single shell tank to the surface. Risers vary in diameter from ½ in to 42 in, and may terminate above grade on the floor of a pit.

Risk. Probability of an adverse outcome.

Single-Shell Tank (SST). Underground reinforced concrete containers with one carbon-steel liner, which are covered with 2 to 3 meters of earth. Capacity ranges from 209,175 liters to 3.79 million liters (55,000 gallons to 1 million gallons). The tanks have been used to store radioactive wastes.

SAC. System Assessment Capability. Computational tool for use in preparing the Hanford site-wide composite analysis of long-term impacts to groundwater.

Sampling Analysis Plan (SAP). A plan established for conducting sampling and analysis of waste to support regulatory requirements.

Seal Pot. A vapor trap. A liquid filled vertical loop of tubing designed to prevent the escape of vapors from a waste handling component.

Source Term. Quality and quantity of source material.

SST System Postclosure Permit. *SST postclosure permit* means the SST system portion of the Site-Wide Permit that will be issued after final closure of the SST system should removal or decontamination of all SST components not be achieved. Actions required to comply with the postclosure provisions of WAC 173-303-610 and -665(6) will be contained in this permit.

SST System. *SST system* means tanks and ancillary equipment, waste vaults, pits, diversion boxes, waste transfer lines, and associated devices as well as any soils and groundwater that have been contaminated by operation of the physical system. As such, the SST system contains multiple dangerous waste management units.

Stabilization. Removal of all flowable liquids from a SST, transfer of the liquids to a double shell tank, and solidification of any residual wastes.

Stratigraphy. The origin, composition, distribution, and succession of different layers or strata of rock or earth.

Strontium-90 (Sr-90). A heavy radioactive isotope of strontium that is hazardous because it can be assimilated by and deposited much like calcium in the bones of organisms. It is a beta emitter with a half-life of 28.6 years.

Technetium-99 (Tc-99). A pure beta emitting radioisotope with a half-life of 212,000 years. Technetium-99 is generated during the fission of uranium-235.

Topography. The general configuration of a land surface including its relief and its natural and manmade features.

TEDE. Total effective dose equivalent. The sum of the EDE due to external exposures and the CEDE due to internal exposures.

Thermocouple. Temperature measuring device consisting of two wires of different alloys welded at each end to form a circuit. One end is placed at the measurement location. The measured temperature is a function of the current flow.

Toxicological Health Effect. Adverse health effects which can span a range of biological effects including immediate versus delayed, reversible versus irreversible, and local versus systemic.

Transuranic Elements. Those elements having an atomic number greater than that of uranium (92).

Tritium. A radioactive isotope of hydrogen with one proton and two neutrons. This isotope has a half-life of 12.3 years.

Unconfined Aquifer. A subsurface water-bearing region that does not have impermeable confining boundary layers to restrict water movement. In an unconfined aquifer the water table forms the upper boundary.

Uranium. A naturally-occurring radioactive element found in natural ores with the atomic number 92 and an average atomic weight of approximately 238. The two principal natural isotopes are uranium-238 (99.3 percent of natural uranium) and uranium-235. Natural uranium also includes a minute amount of uranium-234.

Vadose Zone. The subsurface zone above the water table in which some water may be suspended within the pores of the soil and moving downward toward the water table or laterally toward a discharge point. Over time, contaminants in the vadose zone often migrate downward to the underlying aquifer.

Vault. A below grade concrete structure consisting of one or more cells usually containing tanks. Vaults were used as waste unloading points and for mixing and chemical adjustments prior to transfer to a storage tank.

Waste Analysis Plan (WAP). A plan that establishes the characterization frequency and analytical requirements to be satisfied for proper management of dangerous waste.

WMA Closure Actions. *WMA closure actions* mean actions that support and lead to final closure of a waste management area and ultimately to final closure of the SST system.

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1.0 INTRODUCTION

For more than four decades beginning in 1944, the Hanford Site produced defense materials, primarily from uranium fuels. The process of extracting defense materials from irradiated fuels generated radioactive and dangerous wastes. Between 1943 and 1964, 149 single-shell tanks (SST) were constructed in the 200 East and 200 West Areas to store waste underground. Figure 1-1 shows the location of the 200 Areas. Grouped into 12 tank farms, the tanks, piping, ancillary equipment, soil, and groundwater make up the SST system. These 12 tank farms have been geographically grouped into seven waste management areas (WMA), shown in Figure 1-2, for regulatory purposes. The seven WMAs are treatment and storage units under the Washington State Department of Ecology (Ecology) *Hazardous Waste Management Act of 1976* (HWMA), *Revised Code of Washington* (RCW) 70.105, and "Dangerous Waste Regulations" contained in *Washington Administrative Code* (WAC) 173-303.

From 1944, the U.S. Department of Energy (DOE) and its predecessors routed wastes from spent fuel reprocessing and other operations in the Hanford Site 200 East and 200 West Areas via buried lines to underground tanks for storage. The maximum quantity of waste in the SSTs was approximately 293,400,000 L (77,500,000 gal) in 1966. As of July 31, 2003, the SSTs contained 118,100,000 L (31,200,000 gal) of radioactive mixed waste.

DOE previously elected to manage the waste in Hanford's tanks as mixed (mixtures of dangerous waste and radiological contaminants) high-level waste (HLW) during the time the waste is stored in the tanks. For over a decade, the U.S. Nuclear Regulatory Commission and DOE have publicly acknowledged that not all waste stored in Hanford's tanks is mixed HLW. A number of these tanks contain mixed transuranic waste (TRU) from non-reprocessing sources and others may contain mixed low-level waste (LLW).

Over time, some waste has leaked from the SST system or has been discharged in an unplanned manner immediately adjacent to or within the SST farms. The maximum estimated volume of leaked waste from the SSTs is approximately 3,800,000 L (1,000,000 gal).

In 1989, Ecology, the U.S. Environmental Protection Agency (EPA), and DOE entered into an agreement and consent order, the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989, hereinafter referred to as HFFACO) as provided for under the *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* (CERCLA), to clean up the Hanford Site. The agreement, an enforceable document, includes provisions for closing the SST system in accordance with the Washington State "Dangerous Waste Regulations" (WAC 173-303), primarily WAC 173-303-610. Proposals for closure actions under these provisions are to be submitted through this closure plan for regulatory approval and as a basis for modification of the dangerous waste portion of the *Hanford Facility Resource Conservation and Recovery Act Permit for the Treatment, Storage, and Disposal of Dangerous Waste*, Rev. 7 (Ecology 2001, hereafter referred to as the Site-Wide Permit). Definitions used in this document can be found in a glossary beginning on page ix.

1 Figure 1-1. Location of 200 Areas.

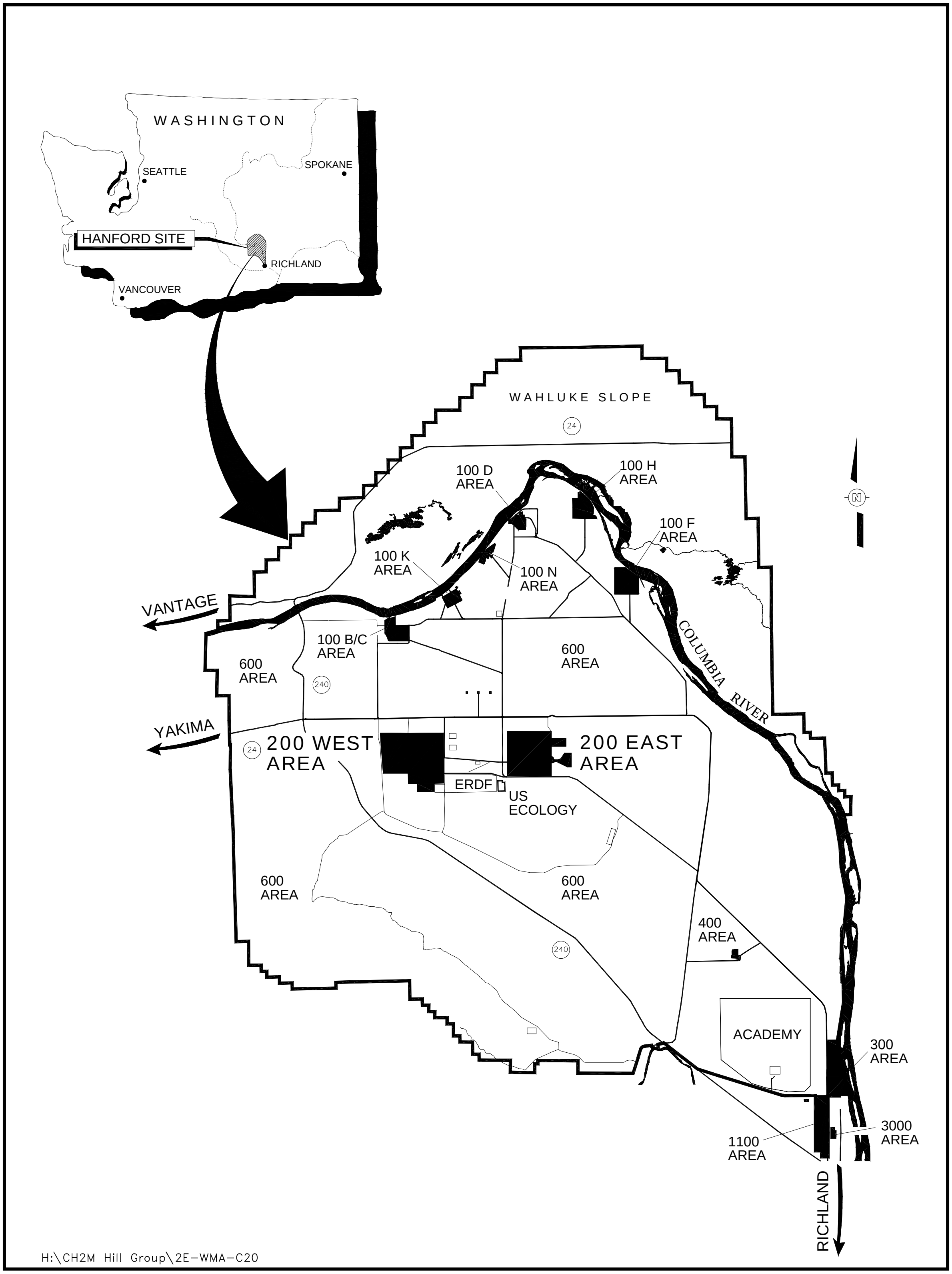
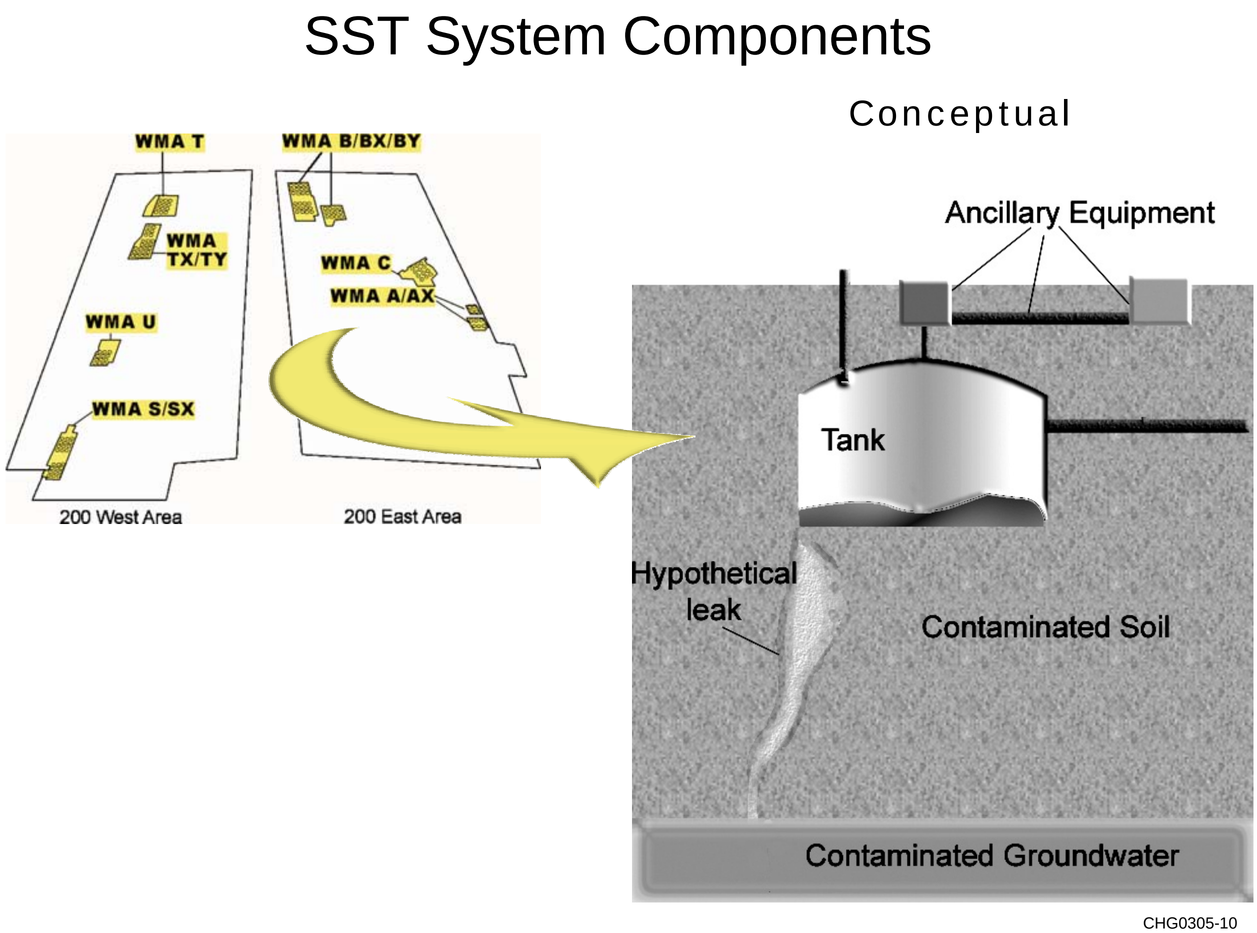


Figure 1-2. Location of Tank Farms.



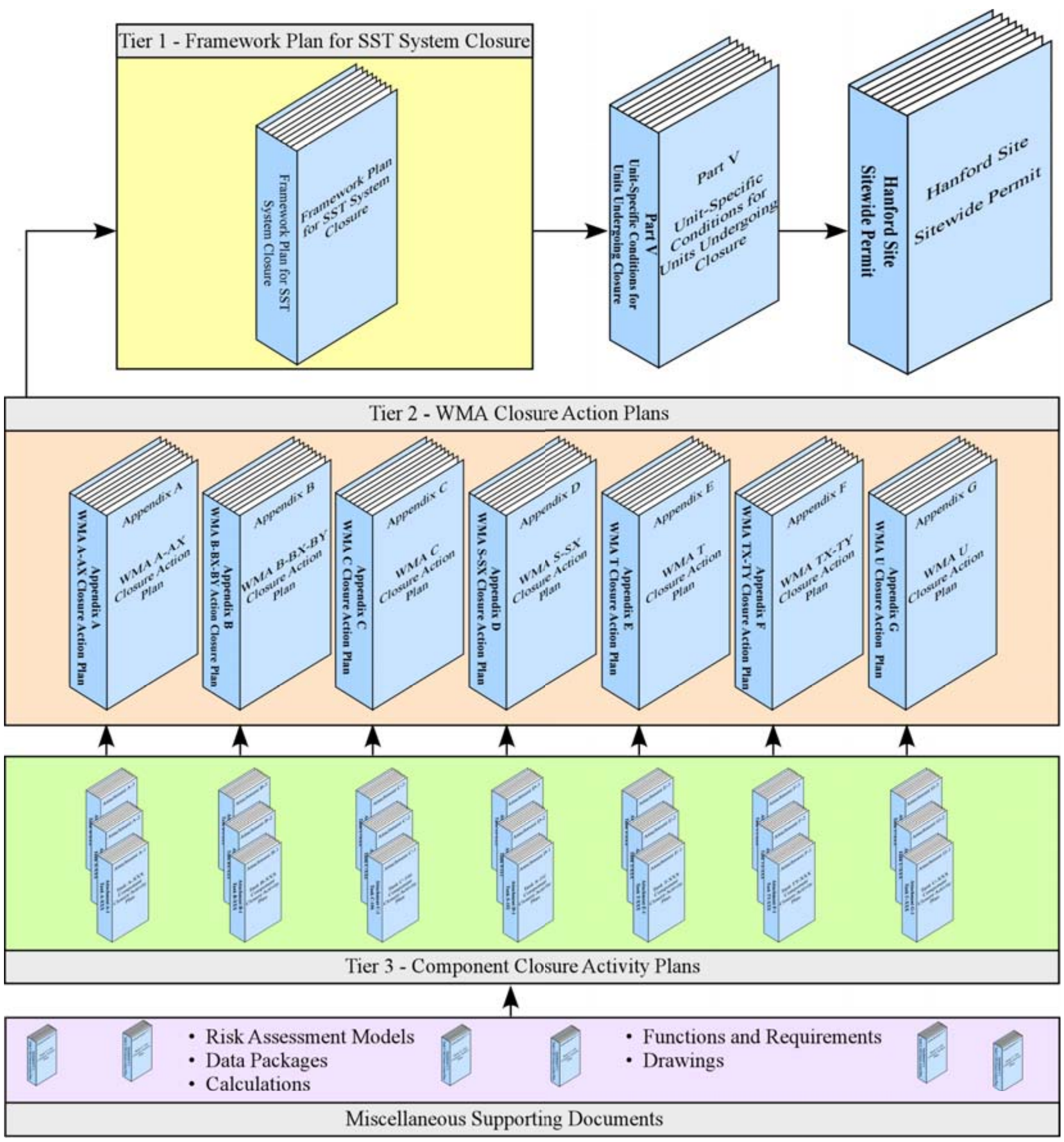
1.1 PURPOSE AND SCOPE

The purpose of this document is to comply with HFFACO Milestone M-45-06A and WAC 173-303 requirements. Milestone M-45-06A requires the submittal of this *SST System Closure Plan* along with submittal of a component closure activity plan for tank 241-C-106 (C-106), the first component closure activity for the SST system under WAC 173-303-610. The C-106 closure activity must also comply with WAC 173-303-640(8) for tank systems or WAC 173-303-665(6) for landfills.

The *SST System Closure Plan* describes the process for closing the entire SST system, including tanks, ancillary equipment, contaminated soil, and contaminated groundwater. Groundwater will be remediated and monitored as part of the tank closure effort, though certain final decisions regarding groundwater may be deferred until final closure of the Central Plateau or the Hanford Site.

The *SST System Closure Plan* consists of three tiers. The first, Tier 1, provides a general description of the system closure plans. Tier 1 is entitled *Framework Plan for Single-Shell Tank System Closure*, and is referred to as the Framework Plan. In Tier 1, the administrative framework and process, including key definitions, are described to identify how the SST system will be closed as a HWMA treatment, storage, and disposal (TSD) unit pursuant to implementing regulations of WAC 173-303. This first tier also contains a description of the process for incorporating WMA closure and postclosure action plans (second tier) and individual component closure activity plans (third tier) with vadose zone and groundwater corrective actions. It also describes how the SST system postclosure plans will be developed and integrated into Part V of the dangerous waste portion of the Site-Wide Permit. Figure 1-3 illustrates how these tiers are organized to make up the *SST System Closure Plan*.

Figure 1-3. *SST System Closure Plan* Document Structure.



1.1.1 Process for Incorporating Changes into the SST System Closure Plan

The *SST System Closure Plan* will be incorporated into Part V of the Site-Wide Permit as a separate chapter and will serve both as a skeletal structure for locating individual component and WMA closure action plan conditions and as the overall final closure document for the SST system. This section will describe the process for modifying the plan to incorporate component closure activity plans for individual SST components, component groups, and WMAs as closure actions proceed.

New information pertinent to making closure decisions will be provided as necessary in accordance with the WAC 173-303-830 permit modification process.

Final closure of the system will be accomplished on a WMA basis. No individual component closures will be deemed final until closure of the associated WMA. Each WMA closure must be preceded by a risk assessment. If risk associated with a final WMA closure is unacceptable, additional retrieval, stabilization, or isolation activities involving individual components for which closure actions have already taken place will be required to further mitigate risk.

When a component or group of components is scheduled for closure, closure activities will be developed in a plan specific to the component(s). DOE will not take component closure actions that hinder, interfere with, or in effect preclude final and/or adjacent component closure actions. The approved component closure activity plans will be attached to the appropriate WMA closure action plan, which will be an appendix to the Framework Plan. The addendums to the WMA closure action plan will be approved through a modification to Part V of the Site-Wide Permit.

The permit will require modification through time as closure actions and corrective actions are developed for the various WMAs and the components within the 200 Areas. Physical structures and contaminated media will be addressed to complete system closure actions. The SST system closure plan ultimately will describe closure actions and compliance with closure performance standards for the entire SST system. The SST system closure plan (including a contingent closure and postclosure plan) will be completed in accordance with WAC 173-303-610 (3). Section 3.0 of this plan discusses closure performance standards.

1.1.2 Process for Incorporating Corrective Actions on Soils into the SST System Closure Plan

Contaminated soil within the WMAs will undergo alternatives analyses within a *Resource Conservation and Recovery Act of 1976* (RCRA) Facility Investigation/Corrective Measures Study (RFI/CMS) approval document in accordance with the HFFACO. The RFI/CMS process is summarized in Section 3.2.1.5. All SST WMAs contain some contaminated soil. Decisions on appropriate soil cleanup or corrective actions will be determined through closure plans or the RFI/CMS process defined in condition II.Y of the Site-Wide Permit, WAC 173-303-645 and –(646, HFFACO Milestone M-45-55, and the RCRA corrective action process, as described in the HFFACO Action Plan.

Condition II of the Site-Wide Permit sets forth general conditions under which DOE must conduct operations, closures, and postclosure actions for RCRA dangerous waste management units on the Hanford site. Condition II.Y establishes specific conditions DOE must adhere to if it conducts corrective actions to protect human health and the environment from releases of dangerous waste and dangerous constituents from solid waste management units and areas of concern at the facility. Decisions regarding how the soil will be remediated through the HFFACO corrective action process will be documented in accordance with Condition II.Y of the Site-Wide Permit and applicable HFFACO milestones. The *SST System Closure Plan* will incorporate these decisions through reference to Part IV of the permit. Completion of corrective actions may be required to satisfy requirements of SST closure plans.

1.1.3 Process for Incorporating Corrective or Remedial Actions on Groundwater into the SST System Closure Plan

Contaminated groundwater will be remediated as part of an integrated Site-Wide Permit action in accordance with the HFFACO. Site-Wide Permit condition II.Y.3, DOE/RL-99-36, and HFFACO Milestones M-45-51, -52, -53, -54, and -55 address groundwater corrective actions. WMAs U, S-SX, B-BX-BY, T, and TX-TY are all under groundwater quality assessment programs.

Both federal and state requirements guide groundwater corrective action on the Central Plateau. Effectiveness and efficiency can be promoted if requirements of these programs can be met through a single, integrated groundwater program. While such a program has not to date been established for the Central Plateau, a collaborative effort among the regulatory agencies and DOE to support the objective of a single, integrated groundwater program is ongoing. As the collaborative process develops integrated remediation approaches applicable to SST closures, DOE will address and incorporate such measures into this *SST System Closure Plan.*

Groundwater actions associated with SSTs will be conducted within the integrated, long-term management approach set forth in HFFACO Milestone M-45 and the associated monitoring requirements of Milestone M-24. Condition II.Y.2 of the Site-Wide Permit recognizes and accepts work completed under the HFFACO for both CERCLA and RCRA past-practice units as potentially satisfying corrective action requirements. CERCLA Records of Decision (ROD) are accepted for integration within the closure process upon approval through incorporation into the Site-Wide Permit. At the Hanford Site, interim and final RODs to address RCRA solid waste management units (SWMU) and TSDs have been issued and are subject to the Hanford Site-Wide permitting process.

The SST System postclosure permit conditions in the Site-Wide Permit will be developed on a WMA-by-WMA basis. Postclosure care for each WMA will be performed to satisfy WAC-173-303-610(7) requirements. Postclosure care will be performed on a WMA-by-WMA basis and, at a minimum, will include: groundwater monitoring and reporting as required by WAC 173-303-645 and –665, and maintenance and monitoring of waste containment systems. Groundwater monitoring conducted during postclosure will be performed in accordance with performance standards of WAC 173-303-645 and at WMA-specific points of compliance as defined by WAC 173-303-645(6).

1.1.4 Process for Developing SST System Postclosure Permit Conditions

DOE will prepare contingent postclosure plans that comply with the requirements of WAC 173-303-610 (8). The SST system postclosure permit conditions in the Site-Wide Permit may be developed on a WMA-by-WMA basis. It is anticipated that general administrative postclosure requirements such as access controls may be developed on a Central Plateau-wide basis. Nevertheless, the potential integration of WMA closures with other cleanup activities on the Central Plateau will not change SST system points of compliance, which remain the physical boundaries of subject WMAs, in accordance with the HWMA. Information on boundaries for specific WMAs will be provided in WMA closure action plans.

1.2 OVERVIEW OF SST FARMS

1.2.1 SST System Components

Part A of the *Dangerous Waste Permit Application, Single-Shell Tank System* (DOE/RL-88-21) defines the interim-status operating SST system for which closure actions will be developed within this *SST System Closure Plan*. Addendum 1 to this plan includes the most complete list currently available of components that comprise the SST system. This addendum, and any modifications to it based on new information, forms the basis for the identification of SST system components to be closed. DOE is undertaking a systematic effort to identify and define system components. The SST system includes 12 SST farms that contain a total of 149 mixed-waste storage tanks, ancillary equipment, active and miscellaneous underground storage tanks, miscellaneous facilities, and soils and groundwater that are contaminated from past leaks and unplanned releases. Most of the SST system is located within the WMAs; however, some components of the system, such as transfer lines and support facilities, are located outside WMA boundaries. The SST system contains:

- 133 100-series SSTs (2 to 3.8 million L [530,000 to 1 million gal] capacity)
- 16 200-series SSTs (200,000 L [55,000 gal] capacity)
- Waste transfer vaults and associated tanks
- Tanks pits, valve pits, and flush pits
- Pumps and valves
- 54 diversion boxes
- Numerous pipelines

- Above ground buildings and structures
- Other mechanical equipment.

The system piping is made of carbon steel and stainless steel. Much of the piping was placed underground to provide radiation shielding to protect workers. Transfer piping consisted of direct-buried pipe, steel-encased pipe, or single-wall pipe embedded in concrete encasements. The piping network allowed for transfer of waste between SSTs, tank farms, and various facilities that conducted waste management activities.

Cribs and other source features that have been identified either as RCRA past-practice sites, or as part of CERCLA operable units, are not included in the SST system unless otherwise noted in Addendum 1. The cleanup, closure, and/or remediation of such features are regulated under separate provisions of the HFFACO.

1.2.2 Composition of SST System Waste

SST waste is classified as mixed waste, meaning that it contains both radioactive and dangerous waste. The description of dangerous waste given in the RCRA Part A permit states that the dangerous waste information is based on a computer model and past process knowledge rather than on chemical analysis of waste. The SST waste has undergone chemical analysis for characterization to support the waste designation. The approach for waste characterization, in accordance with WAC 173-303, is described in the *Waste Characterization Plan for the Hanford Site Single-Shell Tanks* (WHC-EP-0210).

The bulk of the tank waste constituents are sodium hydroxide; sodium salts of nitrate, nitrite, carbonate, aluminate, oxalate, and phosphate; and hydrous oxides of aluminum, iron, and manganese. Radioactive components consist primarily of fission products (such as strontium-90 and cesium-137) and actinide elements (such as uranium, plutonium, thorium, and americium). There is a wide tank-to-tank variation in the waste type, volume, and inventory. A partial list of waste constituents stored in the SSTs is presented in Table 1-1.

Waste constituents of principal interest to closure planning are those contaminants that are persistent and mobile in the environment and therefore have the potential to impact groundwater over the long-term, or pose a threat to a receptor who inadvertently intrudes into the waste site. Specific constituent lists for SST WMA and component closure activities will be defined within individual component data quality objectives (DQOs) and other WMA characterization documents.

Engineering evaluations are underway to identify the potential waste volumes and characteristics associated with different types of ancillary equipment. Volumetric data is currently available for these facilities. Table 1-2 summarizes existing information. Table 1-3 provides supporting information on the transfer line system itself. Continuing efforts will provide additional information on waste characteristics associated with ancillary equipment.

Table 1-1. Partial Summary of SST Constituent Waste Inventories. (2 pages)

Analyte	Unit	Quantity	Analyte	Unit	Quantity
Aluminum	kg	5.92 E+06	Europium-154	Ci	5.43 E+04
Bismuth	kg	5.54 E+05	Europium-155	Ci	3.09 E+04
Calcium	kg	2.16 E+05	Radium-226	Ci	6.80 E-02
Chloride	kg	4.93 E+05	Actinium-227	Ci	1.30 E+02
Chromium	kg	4.95 E+05	Radium-228	Ci	5.62 E+01
Fluroide	kg	7.76 E+05	Radium-229	Ci	2.05 E+00
Iron	kg	1.06 E+06	Protactinium-231	Ci	2.70 E+02
Mercury	kg	1.68 E+03	Uranium-232	Ci	3.88 E+01
Potassium	kg	2.40 E+05	Uranium-233	Ci	4.93 E+02
Lanthanum	kg	3.14 E+04	Uranium-234	Ci	1.93 E+02
Manganese	kg	1.39 E+05	Uranium-235	Ci	8.09 E+00
Sodium	kg	3.32 E+07	Uranium-236	Ci	4.03 E+00
Nickel	kg	1.05 E+05	Neptunium-237	Ci	5.89 E+01
Nitrite	kg	5.84 E+06	Plutonium-238	Ci	3.05 E+03
Nitrate	kg	4.39 E+07	Uranium-238	Ci	1.81 E+02
Lead	kg	7.16 E+04	Plutonium-239	Ci	5.74 E+04
Phosphate	kg	4.92 E+06	Plutonium-240	Ci	9.42 E+03
Silicon	kg	7.76 E+05	Americium-241	Ci	5.31 E+04
Sulfate	kg	3.10 E+06	Plutonium-241	Ci	7.53 E+04
Strontium	kg	3.88 E+04	Curium-242	Ci	7.20 E+01
Total Inorganic Carbon as Carbonate	kg	6.63 E+06	Plutonium-242	Ci	5.30 E-01
Total Organic Carbon	kg	6.65 E+05	Americium-243	Ci	1.84 E+00
Total Uranium	kg	5.42 E+05	Curium-243	Ci	4.18 E+00
Zirconium	kg	1.23 E+05	Curium-244	Ci	7.92 E+01
Ruthenium-106	Ci	3.60 E-02	Hydrogen	Ci	8.93 E+03
Cadmium-113m	Ci	8.49 E+03	Nickel-59	Ci	1.01 E+03
Antimony-125	Ci	4.27 E+03	Cobalt-60	Ci	4.07 E+03
Tin-126	Ci	3.69 E+02	Nickel-59	Ci	9.38 E+04
Iodine-129	Ci	2.99 E+01	Selenium-79	Ci	7.29 E+01
Cesium-134	Ci	2.47 E+01	Strontium-90	Ci	3.43 E+07

Table 1-1. Partial Summary of SST Constituent Waste Inventories. (2 pages)

Analyte	Unit	Quantity	Analyte	Unit	Quantity
Cesium-137	Ci	1.61 E+07	Yttrium-90	Ci	3.43 E+07
Barium-137m	Ci	1.52 E+07	Niobium-93m	Ci	2.59 E+03
Carbon-14	Ci	2.59 E+03	Zirconium-93	Ci	3.13 E+03
Samarium-151	Ci	2.32 E+06	Technetium-99	Ci	1.55 E+04
Europium-152	Ci	6.79 E+02	—	—	—

Source: *Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-shell Tanks at the Hanford Site, Richland, WA (Inventory and Source Term Data Package)* (DOE/ORP-2003-02).

Note: Inventories reflect tank contents as of July 1, 2002.

Table 1-2. SST System Ancillary Waste Volume Inventories

Component Type	**Liquid**	**Solid**	**Total**
	Vol (gal)	**Vol (gal)**	**Vol (gal)**
IMUSTs	11,000*	63,000*	74,000*
Vault Tanks Cells	 45,000* 16,000*	 50,000* 15,000*	 95,000* 31,000*
Evaporator tanks and vessels	9,000*	0	9,000*
Transfer Piping	0	1,200	1,200
Pits	0	450	450
Tank Ventilation	0	0	0
Totals	**81,000***	**130,000***	**211,000***

* Volumes rounded to nearest 1000 gal.

Reference: RPP- 11095, Rev.0; *SST Engineering Compliance and Assessment Summary Report*

Table 1-3. Characteristics of SST Transfer Line System.

Transfer Line System Characteristics	Data
Transfer lines associated solely with the SST system (estimated)	1400
Diameter of transfer lines associated solely with the SST system	Range: 2 to 6 inches Average: 3 inches
Length of transfer lines associated solely with the SST system (estimated)	506,880 feet, (96 miles)
Number of known plugged transfer lines	5*

*Hydraulic profiles for the piping system (Drawings H-2-44502 and H-2-44512) show that lines are generally sloped to allow self-drainage exist in a pipe. If low points exist in a pipe, they typically have low-point drains that feed into tanks.

Reference- RPP- 11095, Rev.0 (primary information source for RPP-11095: *H-14-104175 & H-14-104176 Routing Boards*)

1.3 INTEGRATED CENTRAL PLATEAU AND SST SYSTEM CLOSURE

Closure of the SST system will take place within the same time frame as other planned Central Plateau closure actions. These other closure actions involve facilities and operable units currently regulated under both RCRA and CERCLA. Certain facilities and operable units listed for closure are geographically adjacent to parts of the SST system. Closure of these facilities and units may require activities substantively similar to SST closure actions. As closure actions proceed for the SST system, achievement of protectiveness pursuant to CERCLA for all hazardous substances must be considered.

The existence of proximate facilities scheduled for closure in the same general time frame as the SST system and involving similar closure activities creates a potential to accelerate cleanup, increase efficiency, and avoid both duplicative effort and regulatory conflicts by integrating closure actions, where feasible. While SST system closure must ultimately satisfy RCRA and HWMA requirements, closure actions accomplished in accordance with CERCLA can address RCRA and HWMA requirements, including closure performance standards in WAC 173-303-610(2), and Site-Wide Permit standard condition II.Y.2.

Any closure action on SST system components or portions of WMAs that exist outside of the WMA boundary/fenceline must comply with all requirements/approvals set forth in this closure plan, addendums/attachments to this plan, and as specified in the Site-Wide Permit.

DOE, Ecology, and EPA are presently identifying and evaluating opportunities for integration of closure and postclosure activities on the Central Plateau through the Central Plateau regional strategy effort. As specific opportunities are defined for integrating actions involving the SST system, DOE will incorporate corresponding proposals into future modifications of this plan and into subsequently submitted WMA closure action plans and component closure activity plans.

The SST system includes seven WMAs. Closure of the SST system requires closing the WMAs and conducting closure activities for individual system components within the WMAs. DOE will develop WMA closure action plans and component closure activity plans, or alternate decision processes such as corrective measures studies or CERCLA remedial investigation/ feasibility study, upon approval through incorporation into the Site-Wide Permit, to describe how the components or groups of components will be disconnected, dismantled, decontaminated, removed, and/or stabilized.

Figure 1-4 presents a relative timeline for major WMA closure activities. Together, these figures represent the relative timing for completion of closure and postclosure activities for the SST system. Key closure dates have been developed and are described in HFFACO Milestone M-45.

This timeline and major closure activities have been developed based upon an assumption that the WMAs would be landfill closed, if it is demonstrated that clean closure cannot be practicably achieved. The actual closure mode has yet to be determined. The contingent landfill requirements are contained in WAC 173-303-640(8). The first three columns in the timeline represent intervals during which closure activities occur. The fourth column represents Hanford's long-term stewardship program. WMA closure action plans contain detailed discussions of timeline elements.

Column one of the timeline generally includes performance of major component closure activities. The relative starting points for ancillary equipment, soil, and groundwater activities depict a logical order for these activities. Relative starting points for various closure activities may differ between WMAs. For instance, soil characterization activities for WMA S-SX have been initiated as part of the RFI/CMS process. Groundwater component closure activities are shown to extend beyond the dotted vertical line because programs outside the SST RCRA closure program (CERCLA operable unit corrective actions and the Central Plateau closure strategies) largely determine the completion of this component activity.

The second column represents the period during which WMA closure activities are completed. This period begins when closure activities on all SSTs, ancillary equipment, and soils in the WMA have been completed in accordance with WAC 173-303-610(2), and groundwater has been characterized and appropriately-dispositioned. Completion of the WMA closure action occurs when the final remedy (such as an engineered surface barrier) for the WMA has been implemented.

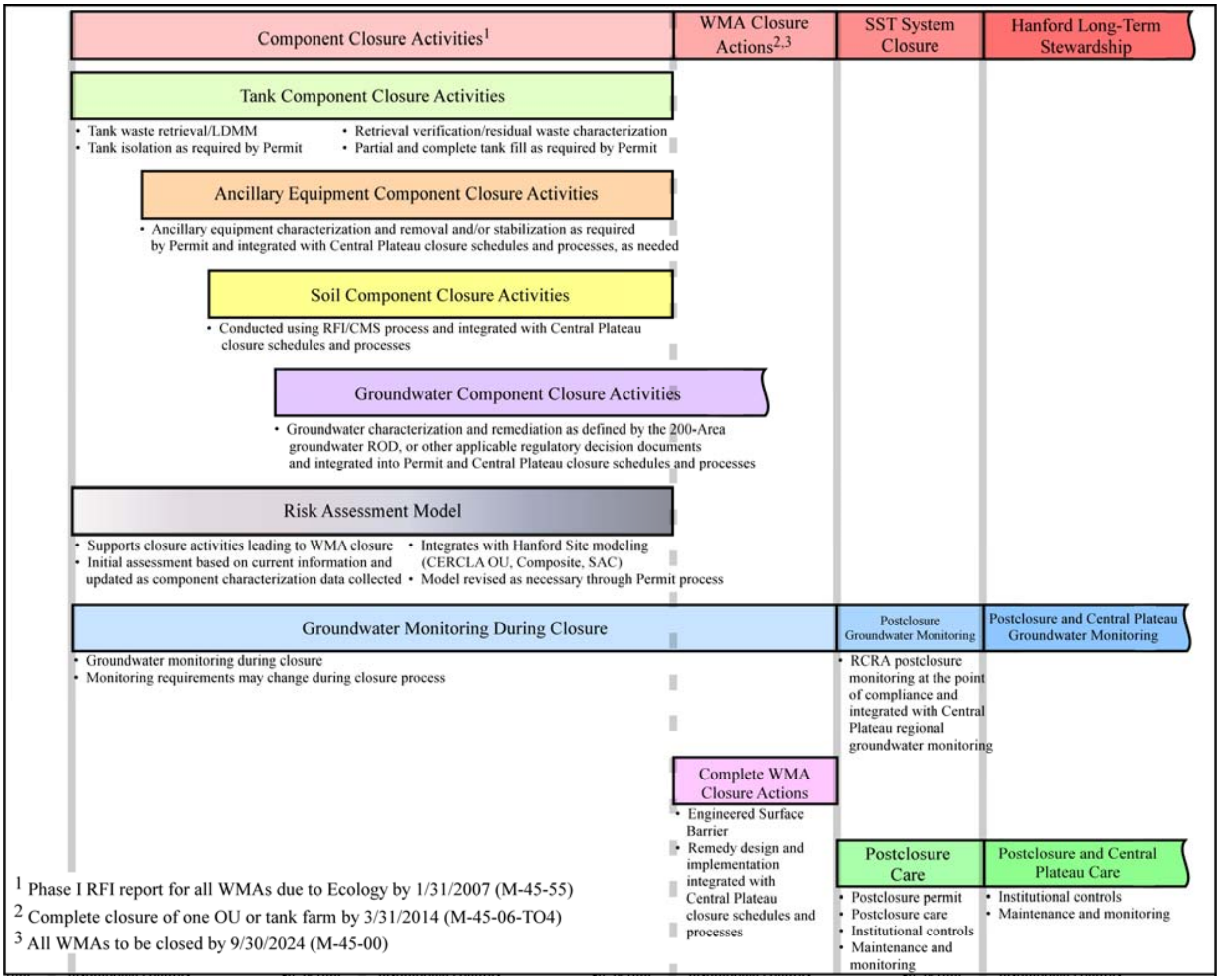
The third column represents the period during which WMA post-closure activities are performed, if required. During this period, other WMA closure actions within the SST system are ongoing. The period ends when the final WMA closure action is completed. Where possible, information obtained from WMA-specific groundwater monitoring will be integrated with Central Plateau regional groundwater monitoring. WMA-specific postclosure monitoring required by WAC 173-303-645 and –665 will be performed.

The fourth column depicts the integration of SST post-closure activities with the Hanford long-term stewardship program. Since the SST WMAs are located in the 200 Areas, the post-closure activities will be integrated as specified in the Site-Wide Permit with the Central Plateau closure strategies currently under development by Ecology, EPA, and DOE. These integration activities include:

- A relative timeline for general SST system closure and postclosure activities,
- A relative timeline for closure and postclosure actions involving other Central Plateau units and facilities, and
- Elements of a strategy and process for integrating SST closure and postclosure actions with the actions anticipated for other units and facilities.

The figure presents information in three rows from left to right, moving from the present period through completion of closure actions and into the period of postclosure activities. The figure depicts a strategy and process for integrating SST system closure and postclosure actions (bottom row) with similar actions planned for closure of other Central Plateau units and facilities (top row). Integration (middle row) would start with application of the *National Environmental Policy Act of 1969* (NEPA) and *Washington State Environmental Policy Act* (SEPA) processes to planned activities. Identification of closure elements as candidates for integration on the basis of characteristics such as geographic proximity and commonality of constituent wastes would be followed by evaluation against planning and strategy documents and regulatory process requirements. Decision documents and processes drawn from existing procedures would be used to define integrated activities and address the full range of applicable requirements. DOE would then take specific steps designed on an integrated basis to complete closure and postclosure activities and fulfill all requirements.

Figure 1-4. Relative Timeline of Major Activities for Closure of a Typical WMA.



1.4 REGULATORY BACKGROUND

The regulatory framework for SST system closure is complex, including requirements regarding planning and protection of human health and the environment. Closure activities are driven by requirements of the HFFACO, the *Atomic Energy Act of 1954* (AEA), as amended, and RCRA. The primary regulatory driver for this RCRA/dangerous waste SST closure plan is WAC 173-303. The radioactive portion of mixed waste is regulated under the AEA; the nonradioactive dangerous portion of mixed waste is regulated under RCRA, the HWMA, and WAC 173-303. Both radioactive and dangerous waste constituents will be considered and dealt with during the closure process (see Section 1.4.2 below).

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 AEA) has been incorporated into this plan, it is not incorporated for the purpose of regulating such components under the authority of the Site-Wide Permit and the HWMA. To the extent that RCRA/HWMA requirements are inconsistent with requirements under the AEA, Section 1006 of RCRA provides that the inconsistent RCRA requirements yield to those of the AEA.

As part of implementing the AEA, RCRA, and/or other regulatory requirements, either DOE or Ecology will identify potential conflicts in requirements and both parties will discuss the source of the conflict and the potential solution for the conflict through the closure process.

WAC 173-303-610 sets forth state requirements for closure and postclosure of dangerous waste TSD facilities such as the SST system. WAC 173-303-640 and 40 *Code of Federal Regulations (*CFR) 265.196 and 197 set forth state requirements for closure and postclosure care of tank systems incorporating by reference standards contained in WAC 173-340, the Model Toxics Control Act (MTCA) cleanup regulation.

DOE will attempt to achieve removal or decontamination standards on all SST system tanks and ancillary equipment; however, this may not be an achievable goal. In that event, DOE will demonstrate why it cannot practicably remove contaminants to these standards and subject to Ecology approval, will then close the WMA, and perform closure and postclosure care in accordance with landfill closure and postclosure requirements set forth in WAC 173-303-665(6) and with landfill requirements contained in WAC 173-303-610.

DOE proposes to close the Hanford Site 200 Areas SST system by 2028 in a manner compliant with the requirements of WAC 173-303-610 (2) and the HFFACO Milestone M-45. The SST system includes tanks, ancillary equipment, and associated contaminated soils and groundwater.

1.4.1 RCRA/HWMA Applicability

The HFFACO designates Ecology as the lead agency for SST closure. Ecology regulates the SSTs as hazardous waste storage and treatment units under the HWMA and WAC 173-303, which implement RCRA. The SSTs must be closed in accordance with applicable closure and postclosure portions of WAC 173-303-610. The HFFACO (Action Plan, Section 6.3.2) requires that TSD units close under final status closure requirements (WAC 173-303-610) irrespective of permit status. Thus, SSTs will be closed under final status standards. WAC 173-303-610 provides general closure requirements and references specific closure requirements for individual types of waste units. For tank systems such as the SST system, the specific requirements are provided in WAC 173-303-640(8).

WAC 173-303-610(2) and WAC 173-303-640(8) set out the fundamental closure performance standards applicable to closure of the SST system. Section 3.0 of this plan presents the exact language of those requirements, as well as other key federal and state requirements, and detailed information on the steps DOE will take to meet the requirements and ultimately to accomplish closure of the system.

It is not known whether removal and decontamination to clean closure standards in accordance with WAC 173-303-610(2)(b) can be achieved for SSTs; consequently, the SST system closure plan includes both clean and contingent landfill options for closure allowed under WAC 173-303-640(8) and WAC 173-303-665(6). Under WAC 173-303-610 requirements, closure options include clean closure and landfill closure, where appropriate.

The baseline HWMA requirement for clean closure, as stated in WAC 173-303-610(2)(b)[1], is to remove or decontaminate tank waste residues and structures to the extent required by the closure performance standard (WAC 173-303-610(2)(a)(ii) for controlling, minimizing, or eliminating postclosure escape of dangerous waste constituents to the environment). Ecology clean closure guidance (Ecology F-HTWR-94-144) states that clean closure decontamination levels for metal tanks are generally considered to be satisfied upon meeting the performance treatment standards contained in 40 CFR 268.45, Table 1 (debris rule treatment standards). Clean closure of environmental media (such as soils and groundwater) that have been contaminated by SST system operations will require that SST dangerous waste constituents not exceed the cleanup levels stated in WAC 173-303-610(2)(b), which are primarily the numeric cleanup levels calculated according to WAC 173-340.

DOE will attempt to remove or decontaminate all waste residues from contaminated SST system components, contaminated soils, and structures and equipment, and evaluate removal and decontamination in accordance with WAC 173-303-610 and -640 requirements. DOE anticipates difficulty in accomplishing clean closure because of the extent and depth of contamination and because of potential worker safety issues. Therefore, DOE anticipates that a combination of landfill closure and clean closures may be used to achieve system closure.

Consequently, in accordance with WAC 173-303-640(8)(c), closure action plans for WMAs and component closure activity plans will be submitted both as clean closure plans and as contingent[2] landfill closure and postclosure plans. For closure as a land disposal unit, a contingent closure plan is required for each WMA that addresses design and placement of a barrier system and in addition, a contingent postclosure plan is required for each WMA that addresses maintenance and inspection activities, groundwater monitoring requirements, and final corrective actions implemented under the WMA closure action plan.

1.4.2 HFFACO Applicability

The HFFACO, signed by DOE, Ecology, and EPA on May 15, 1989, is an enforceable document that requires DOE to clean up and dispose of radioactive and hazardous waste at the Hanford Site and close facilities that have been used to generate, treat, store, or dispose of such waste. The HFFACO establishes work requirements (milestones), methods for resolving problems, and an action plan for cleanup that addresses priority activities.

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[1] WAC 173-303-610(2)(b) references WAC 173-303-640(8) closure and post-closure care for tanks.

[2] WAC 173-303-640(8)(c) requires that a tank system owner or operator whose tank system does not have secondary containment must submit both a clean closure plan and a contingent landfill closure and postclosure plan (i.e., a landfill closure plan that will be used if clean closure cannot be accomplished).

The HFFACO also recognizes the applicability of RCRA and its amendments to the Hanford Site. The HFFACO incorporates a regulatory strategy that specifically places SST activities, including waste retrieval, facility cleanup, remediation, waste disposal, and closure under the HWMA. Ecology serves as lead regulatory agency for all provisions of the HWMA, including those that have not been authorized pursuant to Section 3006 of RCRA. DOE is required to comply with the HFFACO requirements that establish terms for closing tank farms at the Hanford Site.

In its work requirements, specifically in the text of Milestone M-45-00, the HFFACO links tank waste retrieval and closure. In addition, groundwater contaminated by releases from the SSTs is considered part of the SST TSD facility for closure purposes. SST system closure requires addressing groundwater contaminated by releases from the SSTs.

The current planning for SST system closure is based on developing closure plans and closing the tank farms pursuant to WAC 173-303-610 and -640. As such, processes for completing closure activities typically will be defined in accordance with these regulations. Approval of WMA action plans and component closure activity plans will be accomplished through modification of the Site-Wide Permit. Potentially, implementation of certain conditions could require modifications to the HFFACO.

Section 6.3 of the HFFACO action plan provides in part:

> *The TSD units containing mixed waste will normally be closed with consideration of all hazardous substances, which includes radioactive constituents.*

The SST system closure plan will address all waste constituents that could potentially affect human health and/or the environment.

Section 6.3.2 of the HFFACO action plan provides in part:

> *The process to close any unit as a land disposal unit will be carried out in accordance with all applicable requirements described at 173-303 WAC. In order to avoid duplication under CERCLA for mixed waste, the radionuclide component of the waste will be addressed as part of the closure action.*

Article I of the HFFACO provides in part:

> *As stated in Section 1006 of RCRA, nothing in this Agreement shall be construed to require DOE to take any action pursuant to RCRA which is inconsistent with the requirements of the Atomic Energy Act of 1954, as amended.*

1.4.3 Applicability of the *Atomic Energy Act of 1954*

The AEA, as amended, provides fundamental jurisdictional authority to DOE and the U.S. Nuclear Regulatory Commission over governmental and commercial use of nuclear materials. The AEA ensures proper management, production, possession, and use of radioactive materials. Where information regarding treatment, management, and disposal of the radioactive source, byproduct material, and/or special nuclear portions of mixed waste (as defined by the AEA, as amended) has been incorporated into this plan, it is not incorporated for the purpose of regulating such portions under Ecology's authority pursuant to RCRA or the HWMA.

1.4.4 *National Environmental Policy Act* and *Washington State Environmental Policy Act* Applicability

In the Tank Waste Remediation System environmental impact statement (EIS) ROD (62 *Federal Register* [FR] 8693, February 26, 1997), DOE committed to complete appropriate NEPA analysis to support decisions regarding remediation of Hanford Site tanks, ancillary equipment, and contaminated soils. Further NEPA analysis is required before formally selecting and implementing an overall closure path for the SST farms. DOE anticipates completion of an EIS analyzing SST system-wide closure issues in calendar year 2004. Ecology is a cooperating agency for this EIS. Data gathering activities, including demonstration projects, are ongoing to provide information for future NEPA analyses that will allow decision-makers to select specific closure methodologies. If needed, DOE will prepare additional NEPA analyses to consider environmental effects of any future actions not completely analyzed in the EIS.

The *Washington State Environmental Policy Act* (SEPA, RCW 43.21C) is intended to ensure that environmental values are considered during decision-making by state and local agencies. SEPA requires decision-making agencies like Ecology to conduct an evaluation of proposals in accordance with WAC 197-11 to determine the potential significance of impacts to the environment and public health. In lieu of preparing a separate SEPA EIS, the state may adopt a NEPA EIS if certain requirements in WAC 197-11-610(3) are met, or cooperate with a federal agency that is preparing an EIS. As a cooperating agency, the State may participate in a range of activities associated with the preparation of an EIS including co-authoring a document, providing input to development of alternatives, or similar actions[3]. DOE will complete and submit an environmental checklist for any proposed system closure action requiring SEPA review.

Both NEPA and SEPA apply to courses of action and decisions on closure of the SST system. The NEPA process provides essential environmental information to aid DOE in determining its course of action for closure. SEPA provides similar information to Ecology for that agency's decisions on approving or conditioning permits.

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[3] WAC 197-11-610. A NEPA document (Environmental Assessment or Environmental Impact Statement) may be adopted or incorporated by reference.

2.0 GROUNDWATER MONITORING

Groundwater is one of several media monitored for compliance with DOE Orders by the Hanford groundwater monitoring project (PNNL-13080). Groundwater in the vicinity of the SSTs is monitored to determine whether activities associated with the SSTs have affected groundwater quality in the uppermost aquifer.

DOE monitors groundwater at the Hanford Site to fulfill a variety of state and federal regulations, including the AEA, RCRA, CERCLA, and WAC regulations. The facility environmental monitoring program routinely monitors groundwater near facilities that have potential to discharge, or have discharged, stored, or disposed of radioactive or hazardous contaminants.

Groundwater monitoring requirements for all units subject to RCRA operating, closure/ postclosure, or corrective action requirements will be included in the Hanford Site-Wide Permit pursuant to WAC 173-303-645 (for land-based regulated units) and WAC 173-303-646 (for RCRA past-practice units). To date, permit conditions have not been developed for all RCRA land-based regulated units listed in Appendix B or RCRA past-practice units listed in Appendix C of the HFFACO. As operating closure/postclosure and corrective action conditions are developed pursuant to the HFFACO Milestone M-20 schedule, however, associated groundwater monitoring requirements will be based on satisfaction of the cited regulatory requirements. It is anticipated that each SST WMA will remain consistent with interim-status standards for groundwater monitoring, and each WMA will shift into postclosure monitoring when closure actions are completed. WMA postclosure monitoring requirements will be developed on a WMA-by-WMA basis and will be integrated with the requirements for regional past-practice, operating, and closure/postclosure units.

Present WMA groundwater monitoring (pre-WMA closure) is based on RCRA/HWMA interim-status standards that are described in 40 CFR 265 Subpart F and incorporated by reference into WAC 173-303, as well as on HFFACO Milestones, particularly the M-24-00 series. 40 CFR 265.91 provides the basic physical monitoring requirement.

Site-specific characteristics determine monitoring needs. Where appropriate, future groundwater monitoring programs will be designed and implemented consistent with WAC 173-303-645. For sites with multiple sources of groundwater pollutants, extensive groundwater pollution, or other unique site problems, groundwater monitoring programs could require more extensive information than is specified in WAC 173-303-645. Monitoring for radionuclides will be in accordance with DOE Orders dealing with radiation protection of the public and the environment and radioactive waste management requirements.

2.1 GROUNDWATER MONITORING AND CORRECTIVE MEASURES FOR THE SST SYSTEM

Groundwater monitoring for SSTs is a complex undertaking that is partially managed under HFFACO Milestones M-24 and M-45. SSTs are considered noncompliant tank systems with documented releases to the environment which must continue to be used to manage waste for an extended period of time pending retrieval and closure. Groundwater monitoring at the SSTs supports numerous environmental and regulatory data needs, including evaluating the sources of groundwater and vadose contamination, the fate and transport of existing and potential future releases, the aquifer characteristics, and the long-term risk for purposes of developing closure performance standards and postclosure care.

RCRA-related groundwater monitoring wells are generally located on the periphery of the WMA fenceline that represents the point of compliance. In some instances, isolated WMA components outside the fenceline may require integration with closure actions conducted for other groundwater operable units or other regional closure activities. General closure performance standards stated in WAC 173-303-610 nevertheless apply throughout all media actually or potentially affected by releases from tank system operations. For example, releases to groundwater that have migrated past the WMA fenceline are subject to closure authority and performance standards.

2.1.1 Program Status of SST System Groundwater Monitoring

The primary objectives of RCRA groundwater monitoring are to comply with regulatory requirements and agreements, to assess potential impact on groundwater quality, and to identify near-term corrective measures, if feasible, for the protection of human health and the environment. As presently performed in accordance with 40 CFR 265 Subpart F (which was incorporated, by reference, into WAC 173-303-400), SST RCRA interim-status facilities are monitored according to one of three levels:

- Background monitoring – Background monitoring is the initial program entered into during RCRA groundwater monitoring. In this program, background levels for groundwater quality and indicator parameters are established. Background concentrations for these values are statistically derived after at least four quarters (one year) of groundwater sample collection. Initial background monitoring programs are completed for all SST WMAs.

- Indicator evaluation – In the indicator evaluation program, concentrations for groundwater parameters in downgradient wells are compared to initial background concentrations. If statistically significant increases are noted, additional groundwater samples are collected to evaluate the data. If results of the additional samples verify the concentration increase, then the regulatory agencies must be notified that the facility may be affecting groundwater quality.

- Groundwater quality assessment – The assessment program is initiated when the indicator evaluation program determines that the facility may be affecting groundwater. The assessment program is implemented to determine the rate and extent of contaminant migration and the concentration of hazardous waste in the groundwater.

Table 2-1 summarizes the regulatory program currently implemented (as of fiscal year 2001) at each SST WMA. In addition, Table 2-1 summarizes the indicator and site-specific sampling parameters at each WMA (PNNL-13788).

Groundwater monitoring is evaluated as collected to determine such parameters as groundwater flow direction and chemistry to assure the adequacy of the groundwater monitoring network. Groundwater monitoring data is reported annually in the Hanford Site groundwater monitoring report.

Table 2-1. Summary of SST WMA Regulatory Program Status and Groundwater Sampling Parameters[a].

WMA	RCRA Program (FY01)	Sampling Frequency	Contaminant Indicator Parameters[a]	Site-Specific Parameters[a]
A-AX	Indicator-Evaluation	Semi-annually	pH, specific conductance, total organic carbon, total organic halides	alkalinity, anions, metals, phenols, turbidity, technetium-99, tritium, uranium
B-BX-BY	Assessment	Quarterly to Annually	pH, specific conductance, total organic carbon, total organic halides	alkalinity, anions, cyanide, metals, turbidity, total dissolved solids, iodine-129, strontium-90, technetium-99, tritium, uranium
C	Indicator-Evaluation	Semi-annually	pH, specific conductance, total organic carbon, total organic halides	alkalinity, anions, cyanide, metals, phenols, turbidity, technetium-99, tritium, uranium
S-SX	Assessment	Quarterly	pH, specific conductance	alkalinity, anions, metals, turbidity, total dissolved solids, hexavalent chromium, strontium-90, technetium-99, tritium, uranium
T	Assessment	Quarterly to Semi-annually	pH, specific conductance	alkalinity, anions, metals, turbidity, volatile organic compounds, iodine-129, strontium-90, technetium-99, tritium
TX-TY	Assessment	Quarterly	pH, specific conductance	alkalinity, anions, metals, turbidity, volatile organic compounds, iodine-129, strontium-90, technetium-99, tritium
U	Assessment	Quarterly	pH, specific conductance	alkalinity, anions, metals, volatile organic compounds, technetium-99, tritium

FY01 = fiscal year 2001

2.1.2 Groundwater Monitoring During Closure and Postclosure Periods

During the time that WMA component closure activities are underway and until WMA closure actions are achieved, groundwater monitoring will be conducted according to current approved groundwater monitoring plans or future modifications to those plans as implemented. It is recognized that groundwater monitoring may support numerous environmental and regulatory data needs. Groundwater monitoring will be coordinated with these activities, CERCLA remediation, and other site-wide activities as feasible. In addition, monitoring wells deemed no longer useful (for regulatory purposes or because of a declining water table) will be decommissioned as necessary. As WMA closures are completed, a postclosure groundwater monitoring plan will be developed for approval by Ecology and incorporation by reference into the Site-Wide Permit. This postclosure groundwater monitoring plan will integrate with the groundwater monitoring approach developed pursuant to the Central Plateau regional closure strategy. A compliance schedule for development of a postclosure groundwater monitoring plan should be developed in accordance with the relative timeline shown on Figure 1-4. The central plateau regional groundwater monitoring and WMA postclosure groundwater monitoring will be transitioned into monitoring conducted for a long-term stewardship program.

3.0 SST CLOSURE PERFORMANCE STANDARDS

WAC 173-303-610 sets forth primary state requirements for closure and postclosure of dangerous waste TSD facilities such as the SST system, referencing additional standards in WAC 173-303-640 (8) specific to closure of tank systems. DOE will close the SST system in compliance with applicable performance standards set out or referenced in WAC 173-303-610 (2). This section of the closure plan discusses how DOE will meet these standards.

WAC 173-303-610 (2)(a) contains generalized standards to ensure the functionality of closure systems, the protection of human health and the environment, and the promotion of restoration of land. Subsections 3.1 through 3.3 discuss how DOE will meet these requirements. The three general closure performance standards are paraphrased as follows:

1. Minimize the need for further maintenance (Section 3.1)

2. 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 run-off, or dangerous waste decomposition products to the ground, surface water, groundwater, or the atmosphere (Section 3.2)

3. Return the land to the appearance and use of surrounding land areas to the degree possible given the nature of the previous dangerous waste activity (Section 3.3).

WAC 173-303-610(2)(b) contains specific standards for waste removal or decontamination. Additionally, WAC 173-303-610(2)(b) references WAC 173-303-640(8). Subsection 3.4 discusses how DOE will address the specific removal or decontamination standards contained in WAC 173-303-610(2)(b) and WAC 173-303-640(8).

In addition, other sections of the Framework Plan describe in further detail how compliance with closure performance standards will be achieved. These include:

- Section 4.0 describes DOE's approach to assessing risk associated with SST system closure. Risk assessment is integral to meeting the second general closure performance standard described above.

- Section 5.0 describes DOE's approach to characterizing residual wastes. Waste characterization is also integral to meeting the second general closure performance standard described above.

- Section 1.3 to this plan discusses the potential for integrating SST system closure activities with closure and remedial actions planned for the Central Plateau, presenting a relative timeline for key events leading to and following after SST system closure. The collective actions described in Section 1.3 will contribute to and ultimately complete compliance with the closure performance standards of WAC 173-303-610(2) and -640(8).

3.1 MINIMIZE NEED FOR FURTHER MAINTENANCE

WAC 173-303-610 provides in part:

> (2) Closure performance standard. The owner or operator must close the facility in a manner that:
>
> (a)(i) Minimizes the need for further maintenance;…

Closure activities planned for the SST tank farms will be designed to minimize the maintenance required after closure of individual WMAs and the SST system. Closure activities will include removing waste from tanks and ancillary equipment, minimizing the potential for spills and leaks, characterizing residuals and contaminated media, isolating and stabilizing any remaining wastes in tanks or ancillary equipment, evaluating and implementing closure options for environmental media, and constructing engineered surface barriers where necessary. DOE will focus primarily on the following to meet this general performance standard:

- Waste removal to reduce consequences of any maintenance issues,
- Low-maintenance approaches to directly enhance containment of any residual wastes, and
- Other low-maintenance protective measures to reduce the potential for infiltration or intrusion.

DOE will remove waste from SSTs to the extent technically possible in accordance with retrieval goals established in HFFACO Milestone M-45-00 and Appendix H. DOE will retrieve wastes from other structures and equipment, remove or decontaminate contaminated structures and equipment, treat and decontaminate media, enhance containment of any remaining wastes, and isolate structures and equipment to the extent practicable to meet requirements.

DOE will employ various approaches for ancillary equipment and any other structures, either singly or in combination. Depending on effectiveness and practicability (including evaluation of worker exposure versus long-term risk reduction benefit), DOE will remove waste to the extent practicable, decontaminate equipment and structures, and/or remove and dispose of equipment and structures. Actions for different system components will be specified in WMA closure action plans and component closure activity plans. Also, depending on effectiveness and practicability, DOE will treat contaminated environmental media, including soil and groundwater and will dispose of contaminants and, as needed, contaminated soil. Goals for stabilization of any below-grade system components remaining after waste retrieval include minimizing the potential for long-term subsidence and settlement of the tank farm surface. Final closure activities will be described in WMA closure action plan submittals.

Following removal or decontamination actions, if dangerous waste or dangerous waste constituents remain to the extent that closure consistent with landfills is required, DOE will implement protective low-maintenance measures to minimize the potential for inadvertent intrusion into remaining contaminants. DOE will isolate tanks and similar below-grade structures and fill them with layers of cementitious grout* or similar material to reduce the potential for water infiltration and contaminant mobility. These layers will also fill void spaces, provide barrier stability, and protect against inadvertent intrusion. DOE will isolate and stabilize the remaining below-grade ancillary components and structures.

As necessary, DOE will install engineered surface barriers at WMAs and other locations to minimize water infiltration into remaining structures and equipment, soil, and groundwater. Barriers will meet or exceed RCRA requirements, will require little or no maintenance, are expected to have no substantial subsidence issues, and will be designed to remain effective for hundreds of years. DOE will also employ institutional controls and markers to minimize the potential for inadvertent intrusion by humans.

DOE has not yet developed final barrier or marker designs for the Hanford site. Consequently, DOE has not established definitive monitoring and maintenance activities. Site programs are ongoing to test and improve the design of prototype barriers and to design markers. Information gained from these programs will be used to define specific SST barrier and marker designs and monitoring and maintenance activities. As designs and monitoring and maintenance activities are finalized, these final designs will be included in the appropriate WMA closure action plans submitted for Ecology approval.

The overall objective of barrier design is to develop a highly protective surface barrier system using natural materials, providing long-term isolation of wastes, requiring minimal maintenance, and exceeding RCRA cover design requirements. The primary function of a surface barrier is to contain waste in place by minimizing 1) the infiltration of precipitation into contaminated soil or debris, thereby minimizing the driving force for downward migration of contaminants; 2) the migration of windblown dust originating from contaminated surface soils; and 3) the potential for direct exposure of inadvertent intruders to contamination. Barriers will be designed to minimize the potential for intrusion and destructive effects by plants and burrowing animals that could reduce potential for limiting infiltration. Decommissioning of all wells that may be buried by the barrier will be required (WAC 173-160-460).

The objective of marker design is to provide a clearly and simply understood warning to a person of any cultural background at any time in the foreseeable future of the potential dangers remaining from past activities involving the SST system.

Initial removal or decontamination, and, as needed, containment, isolation, and stabilization measures will be taken on a component-by-component basis and described in component closure activity plans. Removal or decontamination, and, as needed, containment, isolation, and stabilization will be completed by the time of WMA closures. Barriers will be installed as appropriate after WMA field closure actions and WMA soil remediation are completed, and in a manner that does not inhibit groundwater remediation.

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* See Preface in SST System Closure Plan (RPP-13774).

Effectiveness of measures to minimize the need for further facility maintenance can be assessed by facility monitoring and inspections and by groundwater and vadose zone monitoring.

3.2 PROTECT HUMAN HEALTH AND THE ENVIRONMENT

WAC 173-303-610 provides in part:

> *(2) Closure performance standard. The owner or operator must close the facility in a manner that:*
>
> *(a)(ii) Controls, minimizes or eliminates to the extent necessary to protect human health and the environment, post-closure escape of dangerous waste, dangerous constituents, leachate, contaminated run-off, or dangerous waste decomposition products to the ground, surface water, ground water, or the atmosphere; and…*

Many of the measures described above in Section 3.1 to achieve compliance with WAC 173-303-610(2)(a)(i) will also have the consequence of ensuring compliance with WAC 173-303-610(2)(a)(ii). These previously described measures, together with additional measures discussed below, will minimize or eliminate, to the extent necessary to protect human health and the environment, any post-closure escape of dangerous waste, dangerous constituents, leachate, contaminated run-off, or dangerous waste decomposition products to the ground, surface water, groundwater, or the atmosphere.

Specific measures DOE will take to reduce or eliminate the potential for postclosure escape of any residual wastes after closure of individual WMAs and the SST system will include:

- Retrieval of waste from SSTs. According to HFFACO Milestone M-45-00, waste shall be retrieved from single-shell tanks to the limits of the technology (or technologies) selected. As much waste as technically possible will be retrieved, with remaining residuals of no more than 360 ft^3 for 100-series tanks and 30 ft^3 for 200-series tanks. If the retrieval goal is not met for a specific tank, DOE will request an exception to the criteria in the manner specified in Appendix H of the HFFACO. A risk assessment will be performed on any remaining residuals to ascertain their contribution to risks to human health and the environment using methods described in Attachment C-1 to this plan, or other methods as may be defined in future modifications to this plan.

- Development of DQOs for residual waste sampling and analysis to ensure appropriate characterization data are collected to support the tank component closure activities. (A detailed discussion regarding SST system characterization methodology is contained in Section 5.0.)

- Subsequent storage of retrieved SST waste in double-shell tanks (DST), treatment at waste treatment plant (WTP) or alternative facility (see Section 3.2.2), and disposal in a deep geologic repository

- Employment of risk analyses to evaluate risk to human health and the environment from any residual contaminants. (A detailed discussion regarding SST system risk assessment methodology is contained in Section 4.0.)

- Application of the following measures to ancillary equipment and structures, singly or in combination, depending on effectiveness and practicability:

  – Removal or decontamination of ancillary equipment and structures

  – Sealing in place

  – Disposal of debris in an environmentally protective manner

- Isolation and stabilization of SSTs and other remaining below-grade equipment and enhanced containment of residual wastes in those tanks and other equipment

- Removal/decontamination, treatment, or containment of contaminated soil as needed to achieve protection of human health and the environment, depending on effectiveness and practicability that will meet the standards of RCRA as an ARAR

- Removal/decontamination, treatment, or containment of contaminated groundwater as needed to achieve protection of human health and the environment, depending on effectiveness and practicability and periodic sampling of these wells for identified constituents as included in the postclosure monitoring plan

- Installation of engineered barriers that meet or exceed RCRA criteria

- Installation of groundwater monitoring equipment to meet postclosure monitoring goals

- Inspection and maintenance procedures to ensure the effectiveness of these protective measures.

Most actions will be taken on a component-by-component basis and described in WMA closure action plans and component closure activity plans. Barriers will be installed as appropriate after WMA field closure actions and WMA soil remediation are completed, and in a manner that does not preclude possible future groundwater remediation activities.

Effectiveness of measures to protect human health and the environment will be assessed by facility monitoring and inspections and by groundwater and vadose zone monitoring.

3.2.1 Methodologies for Protecting Human Health and the Environment

DOE will describe methodologies to accomplish these tasks and specify particular actions for individual system components in WMA closure action plans, component closure activity plans, and this revision of the Framework Plan or subsequent modifications.

3.2.1.1 Meeting SST Retrieval Criteria. In accordance with HFFACO Milestone M-45-00 criteria, DOE will retrieve waste from SSTs to the extent technically possible. The volume of any waste residuals will not exceed 360 ft^3 in 100-series tanks and will not exceed 30 ft^3 in 200 series tanks unless DOE requests and obtains approval of individual tank exceptions to the volume criteria. DOE must measure in-tank residual waste volumes in accordance with HFFACO Appendix H procedures as set forth below, and must request and obtain any exceptions to volume criteria from Ecology and EPA in accordance with Appendix H.

To implement Appendix H and ensure compliance with M-45-00 requirements, DOE will:

- Conduct in-tank surveying, including visual inspection techniques, to measure the waste inventory in each SST before retrieval,
- Conduct retrieval operations in accordance with approaches described in closure plans,
- Conduct in-tank surveying, including visual inspection techniques, to calculate the residual waste inventory after retrieval,
- Obtain one or more samples from residual waste in accordance with DQOs and sampling and analysis plans,
- Evaluate the residual volume against M-45-00 retrieval criteria, and
- Notify regulatory agencies if the residual complies with M-45-00 criteria, and move toward final approval of closure activities for the affected system component.

If evaluation of the residual volume shows that retrieval criteria have not been met, DOE will either attempt additional retrieval strategies or, if it believes that these criteria are not achievable for a specific tank, submit an Appendix H Attachment 2 request for an exception to EPA and Ecology. Any exception request will describe:

- The reason or reasons DOE does not believe the criteria can be met
- If possible, a schedule for meeting retrieval criteria using existing technology
- Any future technologies that could meet the criteria, including schedule and cost of implementing such technologies
- The volume, chemical characteristics, and radiological characteristics of the waste residual
- Expected impacts to human health and the environment from leaving the residual in place
- Any additional information requested by the regulatory agencies.

If Ecology and EPA approve the exception request, DOE will move to implement approved closure activities for the component. If the regulatory agencies deny the request, DOE will attempt to retrieve wastes or initiate dispute resolution.

3.2.1.2 Component Closure Activities for Tanks. Closure activities for the individual tanks in WMAs will occur in three major steps 1) tank waste retrieval, 2) tank stabilization, and 3) physical and administrative isolation of the tank. Tank stabilization and isolation will be required regardless of whether removal or decontamination in accordance with WAC 173-303-610(2)(b) and -640(8) is achieved by retrieval actions. For individual tanks, each step will be described in component closure activity plans.

Section 3.2.1.1 above describes DOE's approach to meeting HFFACO Milestone M-45-00 retrieval criteria. Once retrieval criteria are met and Ecology determines that risks associated with remaining contaminants are acceptable, each tank will be stabilized in accordance with Ecology approved component closure activity plans. Tank stabilization may consist of adding fill into the retrieved tanks. Stabilization activities may differ from tank to tank depending primarily on the volume and characteristics of the residual waste remaining after retrieval and the integrity of the tank.

Physical and administrative isolation of the tanks will occur before and after the tank retrieval and tank stabilization activities. Physical isolation refers to filling and/or capping of pipelines, drains, ducting, or other openings into the tank structure as needed, depending on effectiveness and practicability. Physical isolation will occur progressively as individual tanks near final stabilization. Administrative isolation controls tank access through procedural actions. Both physical and administrative isolation measures are intended to prevent infiltration of water or inadvertent reintroduction of waste and/or grout[*] into a partially stabilized or stabilized tank.

Determinations regarding the timing of isolation actions will be made on a tank-by-tank basis with consideration given to specific circumstances of individual tanks and the status of surrounding SST components. Component closure activity plans will include detailed information on isolation steps for individual SSTs. To prevent intrusion of waste or other liquids into retrieved tanks, isolation activities may be most optimally taken at individual tanks before Ecology approval of component closure activity plans, DOE may send letter reports to Ecology specifying near-term isolation actions to be taken and requesting Ecology's concurrence or permission to proceed with actions at appropriate times.

3.2.1.3 Component Closure Activities for Ancillary Equipment. Ancillary equipment refers to steel, concrete, electrical, and other components, both internal and external to the tank, including pipelines, conduit, pits, diversion boxes, ventilation systems, electrical/service connections, tank risers, pumps, measuring equipment (such as liquid level detection systems, thermocouples), shield plugs, and dip legs. A listing of ancillary equipment associated with the SST system is included in Addendum 1.

There are uncertainties associated with the level of contamination contained in ancillary equipment and with potential difficulties in accessing buried equipment. DQOs will be developed to ensure appropriate characterization data are collected to support the ancillary equipment component closure activities. Disposition of in-tank ancillary equipment (such as in-

[*] See Preface in *SST System Closure Plan* (RPP-13774).

tank measuring equipment and tank risers) will be described in the respective tank component closure activity plans. In-tank ancillary equipment will be dispositioned as debris during the tank closure activity. Disposition of ex-tank ancillary equipment (such as pipelines, diversion boxes) will be described in either an ancillary equipment component closure activity plan or other alternate decision documentation such as a corrective measures study or ROD (interim and final) upon approval through incorporation into the SST system chapter of the Site-Wide Permit. Additionally, for closure actions, including SST retrieval, where ancillary equipment is connected/attached, DOE must describe with sufficient detail how anticipated ancillary equipment or tank retrieval/closure actions will not preclude future retrieval/closure actions.

3.2.1.4 Fill and Stabilization for Below-Grade System Components. DOE will implement protective measures to minimize the potential for environmental or human intrusion to increase the potential for mobility and escape of any residual wastes into environmental media. DOE will fill tanks and similar structures with layers of cementitious grout* or similar material as prescribed by the approved plans to reduce the potential for water infiltration and contaminant mobility as well as provide protection against human or ecological intrusion. Grout* will fill void spaces, thereby avoiding subsidence, providing structural stability to prevent settlement of the tank dome, promoting barrier stability, and increasing protection against inadvertent intrusion. Stabilization activities may differ from tank to tank depending primarily on the volume and characteristics of the residual waste remaining after retrieval and the integrity of the tank.

Stabilization of any remaining below grade components following waste retrieval will be designed to immobilize any remaining waste residue, minimize contaminant transport, and avoid long-term subsidence and settlement of the tank farm surface.

3.2.1.5 Component Closure Activities for Soil. The two primary steps in the soil component closure activities are 1) characterizing the nature, extent, and mobility of the contamination in the soil column; and 2) performing necessary corrective actions. Characterization of soils involves an assessment of known and suspected contamination. DQOs are being developed to ensure appropriate characterization data are collected to support the soil component closure activities. Characterization information is used to assess the relative risk associated with the soil component.

A corrective measures analysis based on the risk assessment will be conducted to define appropriate remediation methodologies. Following this analysis, the corrective measures alternative(s) will be implemented.

Soil characterization and corrective measures for the WMAs are being performed using the RFI/CMS process as outlined in DOE/RL-99-36 and associated addenda (HNF-5085, RPP-6072, RPP-7578, and RPP-16608). Figure 3-1 depicts the major activities associated with the RFI/CMS process. The figure also shows the associated document for each of the completed activities and the associated milestone and date for activities in progress. While the scope of the

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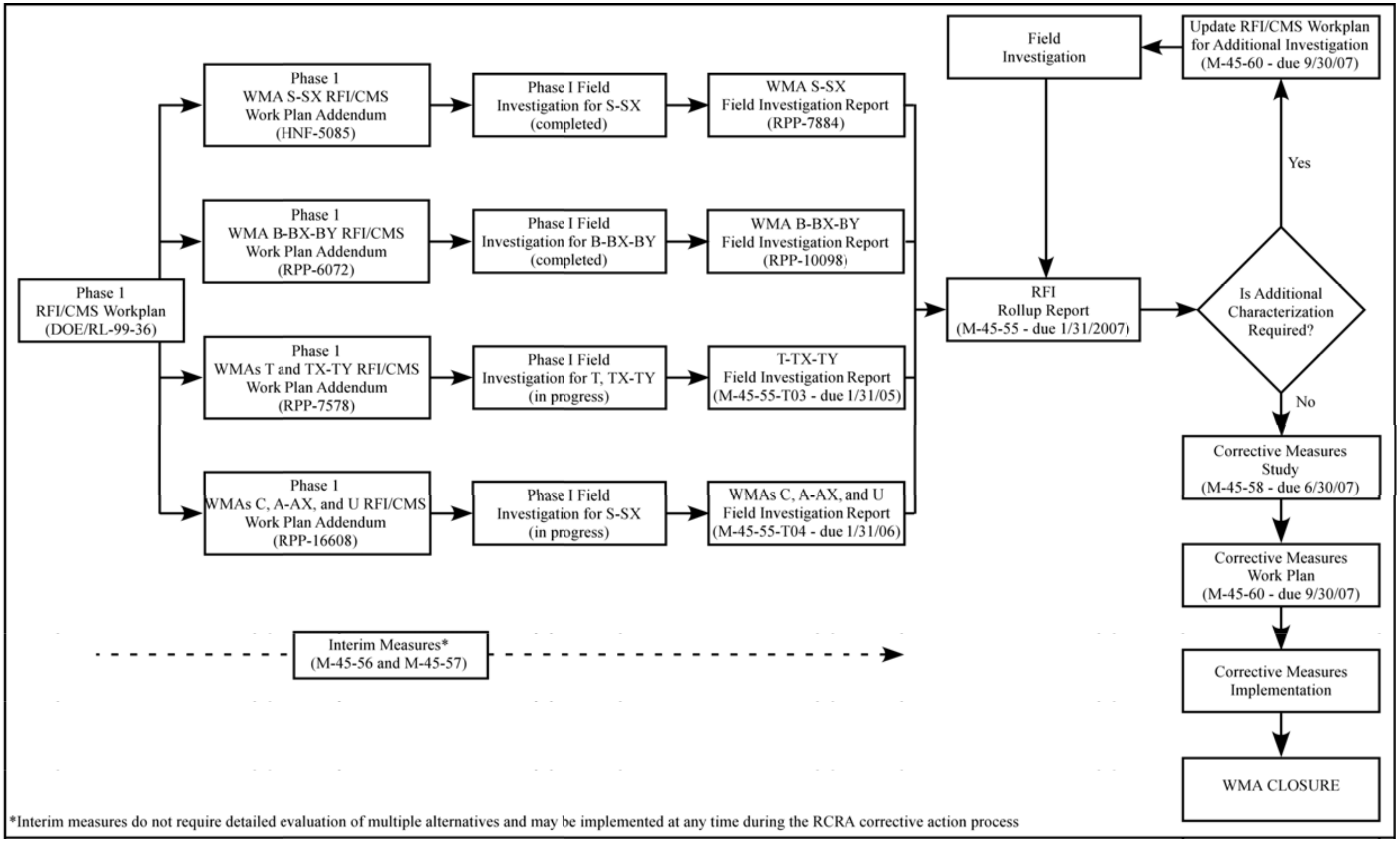
* See Preface in *SST System Closure Plan* (RPP-13774).

original RFI/CMS master work plan (DOE/RL-99-36) was not intended to support closure-related decisions, the process allows for an update to the work plan to allow for additional field investigation to support closure requirements.

Soil characterization and corrective measures activities for all WMAs will be integrated as appropriate with ancillary equipment and groundwater component closure activities and with the Ecology, EPA, and DOE Central Plateau regional closure strategies currently under development. Coordination of these integration actions will be implemented through the *SST System Implementation Plan* or component closure plans.

Figure 3-1. Major Activities Associated with the RFI/CMS Process.



3.2.1.6 Component Closure Activities for Groundwater. The two primary steps in the groundwater closure activities are characterizing the nature and extent of contamination, and performing necessary corrective measures. Characterization of groundwater will involve an assessment of groundwater conditions based on monitoring data and supplemental groundwater data obtained through field investigations. DQOs will be developed to ensure appropriate characterization data are collected to support subsequent groundwater component closure activities. Groundwater characterization will be conducted as a groundwater component closure activity under either WMA closure actions or corrective actions, and may be coordinated with other component closure activities. Characterization information will be used to assess the relative risk associated with the groundwater component. Based on the risk assessment, a corrective measures study will be conducted to define appropriate corrective actions.

If it is determined that groundwater corrective actions are necessary, groundwater remediation may be performed pursuant to a CERCLA ROD (interim and final) developed for the associated groundwater operable unit. Permit condition II.Y.2.c recognizes the overlap between the RCRA closure/postclosure requirements and corrective actions. Though closure and corrective action should achieve similar environmental outcomes, condition II.Y.2.c anticipates that the RCRA closure process will be the principal regulatory mechanism for dealing with environmental releases. Groundwater monitoring and response actions are integrated within the context of HFFACO Milestones M-24 and M-45 and, as feasible, will be integrated with the Central Plateau regional closure strategy.

3.2.1.7 Engineered Surface Barriers and Markers. Should removal or decontamination of dangerous waste constituents not be achievable at the WMA, the proposed contingent final remedy for the respective WMAs is the installation of an engineered surface barrier. DOE will install engineered surface barriers (also called “covers” in this document) at WMAs and potentially at other locations to minimize water infiltration. DOE barrier designs will also function to prevent intrusion by human and ecological receptors, limit wind and water erosion, and attenuate radiation from covered contaminants. Barriers will meet or exceed RCRA requirements, will require little or no maintenance, and will be designed to remain effective for hundreds of years.

Site-specific evaluations will be done to ensure that surface barrier designs are appropriate for specific WMA characteristics. Approved designs will ultimately be incorporated into the Site-Wide Permit.

When an engineered surface barrier has been installed, the barrier and surrounding disturbed area will be revegetated to enhance evapotranspiration, limit erosion, and blend the area into the surrounding landscape of the Central Plateau. Performance monitoring will ensure the surface barrier is performing as designed. Monitoring will include visual inspection and will be supplemented with groundwater sampling. DOE will also employ institutional controls and markers to minimize the potential for intrusion by humans.

Long-term effectiveness of surface barriers in the Central Plateau depends on maintaining each barrier throughout the natural attenuation of contaminants to prevent exposure to potential receptors. Maintenance activities would include erosion repairs and possible vegetation maintenance. Subsidence is not considered a major factor in maintenance activities for Central Plateau waste site barriers.

For calculation of risk estimates associated with SST components, the design life of the engineered surface barrier (closure cover) is currently assumed to be 500 years. For purposes of computing risk estimates, the performance of that barrier and its ability to restrict infiltration into the closed system is assumed to degrade by approximately a factor of 10 at the end of the 500-year design life.

3.2.2 Treatment, Storage, and Disposal of Retrieved Wastes

DOE will treat, store, and dispose of waste retrieved from the SST system in permitted facilities. Treatment and relevant storage activities will be conducted on the Hanford Site. Disposal will be accomplished at onsite or offsite locations, depending on the nature of the waste and availability of facilities. Figure 3-2 illustrates primary elements of DOE's approach to treatment, storage, and disposal of wastes to be retrieved. Waste already retrieved and stored in the DST system will also be treated and disposed of in the manner shown in the figure.

DOE will move waste from the SST system to onsite treatment or storage facilities using permanent transfer lines or temporary overground transfer lines. Leak detection, monitoring and mitigation (LDMM) techniques are under development and will be demonstrated during the course of retrieval operations as a means to evaluate potential loss of fluids associated with retrieval and to implement mitigative actions if necessary. Retrieval functions and requirements documents will be prepared to guide retrieval operations. Strategies for LDMM will be included.

Wastes transferred to TSD facilities from the SST system may consist of HLW, low activity waste (LAW), and TRU wastes, all as mixed wastes. The following lists the intentions for subsequent TSD transfer of these waste types to date:

- The majority of retrieved HLW will be stored in DST and/or other permitted facilities. HLW wastes will then be pretreated and vitrified in WTP facilities, and packaged for disposal in a permitted geologic repository.

- Retrieved LAW will also be stored in DST and/or other permitted facilities or may be sent directly to supplemental processing facilities for pretreatment if needed, treatment and immobilization, and disposal in a permitted immobilized LAW (ILAW) disposal facility. LAW stored in DST or other permitted facilities may receive pretreatment at WTP facilities before being sent to supplemental processing facilities for treatment, immobilization, and eventual disposal.

- Retrieved TRU wastes may be sent directly to TRU processing facilities. There the waste will be treated and packaged for eventual disposal at a permitted facility.

Contaminated soil may be generated during WMA closure actions. The disposal site for soil will likely be the Low-Level Burial Grounds (LLBG) mixed waste trenches unless soil remediation is done under CERCLA. If CERCLA is the statutory authority for soil remediation, then the Environmental Restoration Disposal Facility (ERDF) may be used. However, soil remediation is expected to occur as part of RCRA correction action or TSD closure, thus the LLBG would be the appropriate disposal unit. One exception could be soil remediation outside of the WMAs which may be remediated through the CERCLA process and referenced in the Site-Wide Permit.

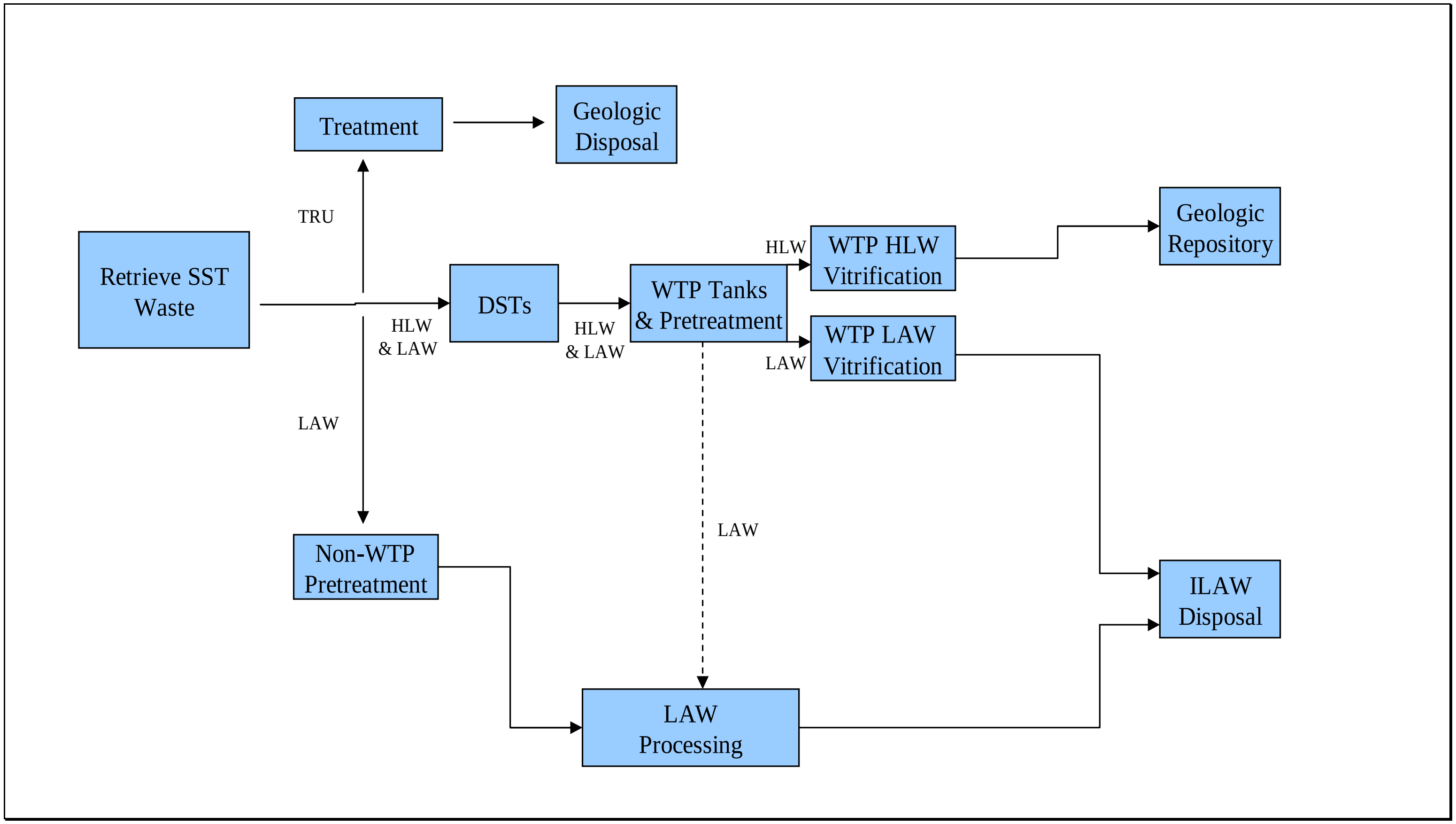


Figure 3-2. Treatment, Storage, and Disposal of Retrieved SST Waste.

3.3 RETURN LAND TO APPEARANCE OF SURROUNDING LAND AREAS

WAC 173-303-610 provides in part:

(2) Closure performance standard. The owner or operator must close the facility in a manner that:

(a)(iii) Returns the land to the appearance and use of surrounding land areas to the degree possible given the nature of the previous dangerous waste activity…

After closure of the SST system, appearance and use of the land will be consistent with future uses in the 200 Areas. Future uses are expected to be determined in accordance with existing decisions, commitments, and recommendations, and the continuing need for waste management.

The future designation of the 200 Areas Central Plateau geographic area in the vicinity of the SSTs is assumed to be industrial-exclusive[4]. This is consistent with the ROD for the Hanford Comprehensive Land-Use EIS (DOE/EIS-0222-F). Industrial-exclusive land use is defined as an area suitable and desirable for TSD of hazardous, dangerous, radioactive, nonradioactive wastes, and related activities. This land use was determined in the ROD to last for a period of 50 years from the time of the EIS through duration of DOE's mission at Hanford.

An industrial-exclusive land-use designation will allow for continued waste management operations within the Central Plateau geographic area consistent with RODs following past NEPA analyses, and commitments or requirements established through RCRA or CERCLA decision processes. Designating the 200 Areas Central Plateau as industrial-exclusive is also consistent with the 1992 Future Site Uses Working Group recommendations (FSUWG 1992) and current DOE management practice.

As part of its obligations under WAC 173-303-610(2)(a)(iii) to return the land to the appearance and use of surrounding areas, the DOE will evaluate administrative, engineering, and legal measures that are necessary to protect public health and the environment in the future. Institutional controls that are robust and layered and that rely heavily on passive measures will reduce the potential for future adverse impacts on the environment and diminish public exposure to SST waste contaminants through the air, the soil, and the groundwater. The Parties to the HHFACO may evaluate the Comprehensive Land-Use Plan (CLUP) future land use industrial-exclusive designation during the establishment of the appropriate institutional controls.

A period of 100 years post-remedy completion is considered as a reasonable time frame for assuming active institutional controls at closure sites. The EPA in 40 CFR 191 and Nuclear Regulatory Commission in 10 CFR 61 consider 100 years to be the reasonable period of time for active institutional controls. However, longer time periods can be considered. It is also

[4] "Industrial-exclusive" means that uses of the land would be restricted to industrial purposes. Other uses (e.g., residential, commercial, or recreational) would be prohibited.

conservatively assumed that a period of 50 years of active waste management in the Central Plateau will occur. Therefore, it is assumed that after a period of 150 years, active institutional controls may not be fully protective and future land use must be conservatively estimated beyond this timeframe. However, passive institutional controls, such as physical barriers, have design lives beyond this timeframe that will allow protection to the inadvertent intruder. Other passive control mechanisms such as permanent markers and communicating the existence and location of waste will also be key for control of human intrusion and should extend the timeframe for protection. Decisions by DOE, Ecology, and EPA regarding future land use will ultimately be required to close the SST system.

3.3.1 Specific Approach to Restoration

Returning the land to the appearance of surrounding areas will be handled on a larger, long-term scale. DOE will plan and implement habitat and topographical restoration actions consistent with Central Plateau land use and its duty to maintain ongoing protective and remedial measures and institutional controls.

Actions associated with restoration activities include the following:

- Design and implement practicable restoration measures consistent with restoration goals and estimates of future land use,
- Preserve achieved closure states of SST components,
- Avoid impairing the functionality of ongoing monitoring and remediation and of engineered and natural barriers, and
- Monitor and inspect restoration activities and restored areas.

Restoration activities will occur as part of closure and postclosure implementation, after final decisions are made on installing barriers. Restoration activities must be conducted in the context of ongoing long-term protective, remedial and restrictive activities and in the context of past activities involving the SST system.

3.4 REMOVAL OR DECONTAMINATION STANDARDS

In addition to standards stated in terms of general functionality, protection, and restoration, the SST closure action must comply with specific criteria for waste removal or decontamination, meet closure and postclosure requirements consistent with WAC 173-303-610(2)(b) standards applicable to closure of all dangerous waste facilities, WAC 173-303-640(8) standards applicable to closure of tank systems and landfill standards (WAC 173-303-665(6)), if applicable. Generated waste will be treated, as necessary, to comply with LDR requirements prior to land disposal. DOE will submit petitions for variances from these standards where necessary, such as any residuals and debris unable to be retrieved from SST.

3.4.1 General Removal or Decontamination Standards for All Facilities

WAC 173-303-610(2)(b) provides:

> *(b) Where the closure requirements of this section, or of WAC 173-303-630(10), 173-303-640(8), 173-303-650(6), 173-303-655(6), 173-303-655(8), 173-303-660(9), 173-303-665(6), 173-303-670(8), 173-303-680 (2) through (4), or 40 CFR 264.1102 (incorporated by reference at WAC 173-303-695) call for the removal or decontamination of dangerous wastes, waste residues, or equipment, bases, liners, soils or other materials containing or contaminated with dangerous wastes or waste residue, then such removal or decontamination must assure that the levels of dangerous waste or dangerous waste constituents or residues do not exceed:*
>
> *(i) For soils, ground water, surface water, and air, the numeric cleanup levels calculated using residential exposure assumptions according to the Model Toxics Control Act Regulations, chapter 173-340 WAC as now or hereafter amended. Primarily, these will be numeric cleanup levels calculated according to MTCA Method B, although MTCA Method A may be used as appropriate, see WAC 173-340-700 through 173-340-760, excluding WAC 173-340-745; and*
>
> *(ii) For all structures, equipment, bases, liners, etc., clean closure standards will be set by the department on a case-by-case basis in accordance with the closure performance standards of WAC 173-303-610 (2)(a)(ii) and in a manner that minimizes or eliminates post-closure escape of dangerous waste constituents.*

DOE will perform waste removal or decontamination activities in accordance with all applicable regulations. DOE will assess the alternative to clean up soil and groundwater associated with the SST system pursuant to WAC 173-303-610(2)(b)(i). Such assessment will be documented through a corrective action RFI/CMS upon approval through incorporation into the Site-wide permit or as part of a component closure activity plan. Should this assessment conclude that removal or decontamination to levels calculated according to MTCA Method B is not practicable in accordance with WAC 173-303-640(8)(b), the performance of closure and postclosure care in accordance with WAC 173-303-665(6) requirements that apply to landfills will be required.

DOE will attempt to achieve removal or decontamination standards on all SST system tanks and ancillary equipment in accordance with WAC 173-303-610(2)(b)(ii). According to this requirement, such removal or decontamination must assure that levels of dangerous waste or dangerous waste constituents or residues do not exceed those established by Ecology on a case-by-case basis and in accordance with the closure performance standard of WAC 173-303-610(2)(a)(ii) for controlling, minimizing, or eliminating postclosure escape of dangerous waste constituents to the environment. These levels are identified as clean closure standards. Ecology clean closure guidance (Ecology F-HTWR-94-144) states that clean closure decontamination levels for metal tanks are generally considered to be met upon meeting the performance treatment standards contained in 40 CFR 268.45, Table 1 (debris rule treatment standards).

Retrieval activities will remove waste from the tanks to the extent technically possible in accordance with HFFACO Milestone M-45-00 and Appendix H and to meet clean closure standards. However, it is unlikely that clean closure decontamination standards based on Ecology F-HTWR-94-144 clean closure guidance can be achieved for SST. In addition, it is unlikely that tank closure activities can practicably meet removal standards to the extent that the entire tank would be removed. However, in meeting the HFFACO Milestone M-45-00 requirements, removal or decontamination of dangerous wastes and dangerous waste residues will be required to be sufficient to ensure that closure will proceed in a manner that minimizes or eliminates postclosure escape of dangerous waste constituents in accordance with WAC 173-303-610(2)(b)(ii).

3.4.2 Waste Removal or Decontamination Standard for Tank Systems

WAC 173-303-640(8) provides:

(8) Closure and post-closure care.

(a) At closure of a tank system, the owner or operator must remove or decontaminate all waste residues, contaminated containment system components (liners, etc.), contaminated soils, and structures and equipment contaminated with waste, and manage them as dangerous waste, unless WAC 173-303-070 (2)(a) applies. The closure plan, closure activities, cost estimates for closure, and financial responsibility for tank systems must meet all of the requirements specified in WAC 173-303-610 and 173-303-620.

(b) If the owner or operator demonstrates that not all contaminated soils can be practicably removed or decontaminated as required in (a) of this subsection, then the owner or operator must close the tank system and perform post-closure care in accordance with the closure and post-closure care requirements that apply to landfills (see WAC 173-303-665(6)). In addition, for the purposes of closure, post-closure, and financial responsibility, such a tank system is then considered to be a landfill, and the owner or operator must meet all of the requirements for landfills specified in WAC 173-303-610 and 173-303-620.

(c) If an owner or operator has a tank system that does not have secondary containment that meets the requirements of subsection (4)(b) through (f) of this section and is not exempt from the secondary containment requirements in accordance with subsection (4)(g) of this section, then:

(i) The closure plan for the tank system must include both a plan for complying with (a) of this subsection and a contingent plan for complying with (b) of this subsection.

(ii) *A contingent post-closure plan for complying with (b) of this subsection must be prepared and submitted as part of the permit application.*

(iii) *The cost estimates calculated for closure and post-closure care must reflect the costs of complying with the contingent closure plan and the contingent post-closure plan, if those costs are greater than the costs of complying with the closure plan prepared for the expected closure under (a) of this subsection.*

(iv) *Financial assurance must be based on the cost estimates in (c)(iii) of this subsection.*

(v) *For the purposes of the contingent closure and post-closure plans, such a tank system is considered to be a landfill, and the contingent plans must meet all of the closure, postclosure, and financial responsibility requirements for landfills under this chapter (WAC 173-303-610 and 173-303-620).*

As indicated in Section 3.4.1, DOE will attempt to achieve removal or decontamination standards on all SST system tanks and ancillary equipment; however, this may not be achievable. In that event, DOE will demonstrate why it cannot practicably remove contaminants to these standards, and will then close the WMA and perform closure and postclosure care in accordance with landfill closure and postclosure requirements set forth in WAC 173-303-665(6) and with landfill requirements contained in WAC 173-303-610.

The SST system was not built with or modified to and does not include secondary containment that meets the standards of WAC 173-303-640(4)(b) through (f). Because of the lack of secondary containment, DOE will submit WMA closure action plans and component closure activity plans that meet both WAC 173-303-640(8)(a) removal and decontamination requirements and the WAC 173-303-640(8)(b) requirements to perform closure and postclosure care in accordance with WAC 173-303-665(6) landfill closure and postclosure requirements and WAC 173-303-610 landfill requirements in the event that landfill closure is required.

Ecology will review the WMA closure action plans, and will approve either tank system clean closure activities or landfill closure activities, depending on the level of removal or decontamination DOE achieves for the components within the WMA. In accordance with Ecology's approval, DOE will conduct either a tank system closure or a landfill closure with appropriate postclosure care at the WMA.

WMAs will become dangerous waste disposal units upon closure as landfills. Postclosure plans will describe postclosure activities at all portions of the SST system closed as landfills.

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4.0 SST SYSTEM RISK EVALUATION

The Washington Dangerous Waste Regulations (WAC 173-303) require that a risk assessment be performed to demonstrate that a permitted facility meets risk-based standards at closure. Under its AEA authority, DOE requires that all activities that could result in the release of radioactivity be assessed for the potential short-term risk to the occupational workforce and the general public (10 CFR 835; DOE Order 5400.1; DOE Order 5400.5; DOE O 440.1A). As low as reasonably achievable guidelines and radiological dose limits have been established under the AEA.

DOE will perform a risk evaluation to analyze whether SST system closure conditions are protective of human health and the environment. The Ecological Risk Assessment (ERA) shall be completed as part of the Tank Farm Feasibility Study and at WMA closure. Methods have been established to assess the impacts of potential releases of radioactivity. Risk also can occur from exposure to nonradioactive contaminants during and following waste retrieval and closure. DOE, EPA, and Ecology are developing a decision-making process that considers risk as well as the limits of technology (e.g., cost benefit analysis per Appendix H of HFFACO) in establishing waste retrieval system requirements and allowable residual waste volumes following retrieval.

The WMA closure risk assessment only evaluates the sources within the WMA. The results of WMA closure risk assessments will be given to the Site-Wide Assessment Program to be integrated with other site risk assessment activities. The Site-Wide Assessment Program uses the tool System Assessment Capability (*An Initial Assessment of Hanford Impact Performed with the System Assessment Capability*, [PNNL-14027]) to examine the risk of the WMA relative to other waste disposal sites, both liquid and solid, through the use of comparable exposure scenarios and incorporation into the site-wide composite analysis. The results of the site-wide composite analysis for both radionuclides and non-radionuclides are due out in late 2004 (radionuclides) and early 2005 (non-radionuclides).

Sections 4.0 and 5.0, respectively, provide a detailed description of DOE's methodology for evaluating SST system risk and a statement of DOE's approach to sampling and characterization of wastes that underlies the risk analysis.

The clean closure option risk assessment is being evaluated as part of the *Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, WA* which expected to be published in 2004. It is anticipated that the clean closure option (e.g., excavating and removing all 149 SSTs, along with contaminated soil and disposing of this material) will not be feasible for the SSTs and that the WMAs that contain the SSTs will be closed as landfills. Therefore, the risk assessment presented in the closure plan only examines the landfill option. If the EIS indicates that clean closure is feasible, the risk assessment in the closure plan will be updated to reflect a clean closure option.

Closure of the SST system requires that long-term and short-term human health risks and long-term ecological risks be evaluated. However, at this time only the long- and short- term human health risks are being evaluated. The ERA is postponed until WMA closure for the following reasons:

- Presently, the tank farms are managed in a way to eliminate, to the extent possible, the intrusion of plants and animals into the facilities.
- Ecological impacts will be much more impacted by engineered features (for example, surface barriers) than the present day conditions.
- Additionally, an ERA is presently being prepared for the 200 Area Plateau by the Groundwater Protection Project. The DQO for 200 Area Plateau's ERA is scheduled to be issued March 19, 2004 with the ERA being published in fiscal year 2006. The ERA conducted for WMA closure will be consistent with what is being agreed to by Ecology, EPA, and DOE for ERA for the 200 Area Plateau.

Estimates of risks must be comprehensive, quantitative, and compared to performance standards. The risk assessment for groundwater and long-term risk exposure will be conducted in a manner consistent with the approach to risk assessment described in the *Phase I RCRA Facility Investigation/Corrective Measures Study Work Plan for Single-Shell Tank Waste Management Areas* (DOE/RL-99-36). Short-term risk exposure will be assessed using an approach consistent with that used for the *Environmental Impact Statement for Retrieval, Treatment, and Disposal of Tank Waste and Closure of Single-Shell Tanks at the Hanford Site, Richland, WA -- Worker and Public Safety Data Package* (DOE/ORP-2003-03), documented safety analysis, or other appropriate existing safety documentation.

4.1 PURPOSE AND BACKGROUND

The purpose of this section is to present the strategy to conduct an SST system risk assessment that supports the ultimate closure of the system, including decisions regarding retrieval of waste and assessment of system closure conditions. Specific activities include the evaluation of risk impacts of the following tank features:

- Existing conditions
- Retrieval of wastes
- Partial retrieval of wastes
- Engineered and chemical mitigation methods
- Emplacement of selected fill material
- Performance of closure conditions, including final covers.

The risk assessment strategy for the SST system will be implemented by preparing comprehensive assessments of each WMA. By preparing risk assessments at the WMA level, risk contribution from individual source terms (tanks, past leaks/spills, and ancillary equipment) can be examined either at an individual source term level or within the perspective of the entire WMA. Area-wide risk assessments will be integrated with the system assessment capability (PNNL-14027) to provide the site-wide composite analysis as required by DOE O 435.1[5] and CERCLA. The initial assessment will be performed based on the best information available and subsequently refined by incorporating the results of new field and engineering data, as the closure program matures. An iterative approach, documented in *Contents of Risk Assessments to Support the Retrieval and Closure of Tanks for the Washington State Department of Ecology* (RPP-14284), will allow the level of uncertainty in risk estimates to be progressively reduced as closure activities move from single tank actions to closure of single WMAs to eventual closure of the complete SST system. These iterative assessments will be integrated with data gathering efforts of the following Hanford Site programs:

- Vadose zone characterization program
- ILAW program
- RCRA groundwater monitoring program
- Improvements in the SST farm best basis inventory
- CERCLA remediation program.

Multiple performance criteria (maximum contaminant level [MCL] for non-radionuclides, MCL Derived Constituent Concentration for radionuclides, incremental lifetime cancer risk [ILCR], hazard index [HI], and radiological dose) will be evaluated at locations from WMA fencelines to the Columbia River for informational purposes and to provide comparability with past studies. As work progresses, it is expected that the number and locations will be refined in a manner that ensures protection of human health and environment. Risk projections will support evaluation of regulatory requirements (e.g., WAC 173-303), DOE Orders (e.g., DOE O 435.1[6]), and other pertinent guidance.

4.2 RISK ASSESSMENT SCOPE AND OBJECTIVES

The scope and objectives of risk assessment activities are described in the following subsections.

4.2.1 Risk Assessment Scope

The scope of the closure risk assessment consists of quantitative estimates of short- and long-term risks related to closure activities and anticipated final conditions of the SST system.

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[5] DOE M 435.1-1 Chapter IV D(4)

[6] DOE O 435.1 Change 1: 8-28-01

To describe the risk contribution of individual source terms (individual tanks, ancillary equipment, etc.), long-term risk estimates will be placed in the context of potential risk contributions from all sources within individual WMAs. Baseline assumptions will be made for source inventories and conditions within each WMA for which specific information is not available.

The need to perform risk assessment activities is identified in the HFFACO, dangerous waste TSD closure requirements (WAC 173-303), and supporting guidance (Ecology 94-111). Additional risk assessment requirements are defined in DOE O 435.1[7] and CERCLA. DOE will perform SST system risk assessments in a manner that is consistent with and can provide information required by, the various governing regulations and orders. If additional requirements are identified during the closure process, they will be evaluated and incorporated as appropriate.

The SST system risk assessment will be compiled from WMA-specific risk assessments. The WMA risk assessments will be prepared for individual WMAs or groups of contiguous WMAs. Grouping of WMAs for risk assessment will depend largely on apparent continuity of geologic and hydrologic conditions that allows fate and transport simulations to represent a selected WMA grouping. The following WMA risk assessments are anticipated:

- WMA A/AX
- WMA B/BX/BY
- WMA C (preliminary risk assessment completed spring 2003)
- WMA S/SX
- WMA T
- WMA TX/TY
- WMA U

The results of the WMA risk assessments will be published in the closure plans for the respective WMAs and attached to this SST system closure plan.

For each WMA, the following source terms will be identified and included as appropriate:

1. Residual waste in tanks
2. Residual waste in ancillary equipment (waste transfer piping, catch tanks, vault tanks, diversion boxes, etc.)

[7] DOE M 435.1-1, Chapter IV D(4)

3. Past unplanned releases of waste (past tank leaks, past leaks/spills from pipes and other ancillary equipment)

4. Retrieval leaks occurring during retrieval of waste from tanks or other source terms. Hypothetical retrieval leaks will be used when the risk assessment is performed before retrieval. Following retrieval, leak monitoring data will be used to estimate the volume of the retrieval leak and associated risk from the leak.

5. Past intentional discharges to the ground within WMAs.

Other important elements of the SST system closure that will be evaluated in the risk assessment include the following:

1. The physical and chemical nature of residual wastes (comprehensive contents, solubility, etc.).

2. Potential performance of alternative tank fill, i.e., defense-in-depth barriers.

3. Potential performance of final covers/caps.

4.2.2 Risk Assessment Objectives

The general objectives of the SST system human health risk assessment are as follows:

1. Establish an approach and methodology for risk assessment that will be implemented consistently across the entire SST system and updated as new information becomes available.

2. Identify short-term risks and accident scenarios related to tank closure activities that may produce unacceptable risks to site workers or the public. These scenarios will be consistent with the tank closure EIS and will be used to ensure that adequate controls are implemented to mitigate the risks.

3. Provide quantitative estimates of long-term human health risk associated with the activities related to SST closure and final conditions of the SST system.

4. Provide sufficient quality and quantity of long-term human health risk estimates in a format that supports the decisions required by the applicable regulations.

5. Provide risk assessment information in sufficient level of detail and resolution to support closure management decisions for individual source terms as well as WMAs and the SST system as a whole.

Similar objectives shall be developed for the ERA conducted before closure of the WMA.

4.3 SST SYSTEM LONG-TERM RISK ASSESSMENT APPROACH

Long-term risk assessment is based on estimation of the potential for contaminants present within the SST system WMAs to migrate through the vadose zone, resulting in contamination of underlying groundwater. Subsequent exposure to or consumption of this contaminated groundwater by hypothetical future receptors may result in exposure to radioactive, toxic, and/or carcinogenic contaminants with resultant human health risks. The long-term risk related to transport of contaminants to groundwater exposure points will be evaluated for each WMA using the general approach described in the following subsections.

Additional long-term risks may be posed by the potential for future site intruders to penetrate the closed tank farm and be subsequently exposed to residual contamination in the tank(s) and subsurface soil. To prevent intrusion and direct contact of contaminants of concern, a modified RCRA Subtitle C barrier shall be placed over the WMA. This barrier has a design life of 500 years (*Focused Feasibility Study of Engineered Barriers for the Waste Management Units in the 200 Areas* [DOE/RL-93-033]) and is designed to prevent both bio-intrusion and human intrusion. Before the final design of the barrier, an analysis of intruder risk will be evaluated.

Long-term risk related to WMA closure is driven by potential for exposure to contaminated soil and groundwater. Long-term risks will be estimated using a combination of numerical and analytical solutions to describe the migration of contaminants from the source areas, through the vadose zone, and through the aquifer to selected groundwater exposure points. Numerical models used for this activity will be selected from models previously evaluated and shown to be applicable and appropriate for use in the identified cases. Modeling inputs will be defined prior to beginning the simulations and will be reviewed for appropriateness. Input parameters will be selected and prepared using the following priority of source: 1) site-specific measured values, 2) measured values from similar sites, 3) best estimates based on site or process knowledge and observations, and 4) information based on literature.

4.3.1 Define Performance Objectives

Formulation of the performance objectives against which project activities will be evaluated is central to the development of a long-term risk analysis. The primary performance objective is that the SST system closure conditions are protective of human health and the environment (the ERA will be completed before the closure of the WMA) on both short- and long-term bases. Relevant performance objectives may be defined by RCRA, CERCLA, HWMA, *Clean Water Act*, *Safe Drinking Water Act*, and the AEA. A comprehensive review of the pertinent regulations has been performed to develop a suite of performance objectives applicable to evaluation of the effectiveness and compliance of SST system closure activities. This information has been published in *Performance Objectives for Tank Farm Closure Risk Assessments* (RPP-14283) and is incorporated in this closure plan by reference. Additional details of selected individual risk-based metrics are presented below in Section 4.4.2.

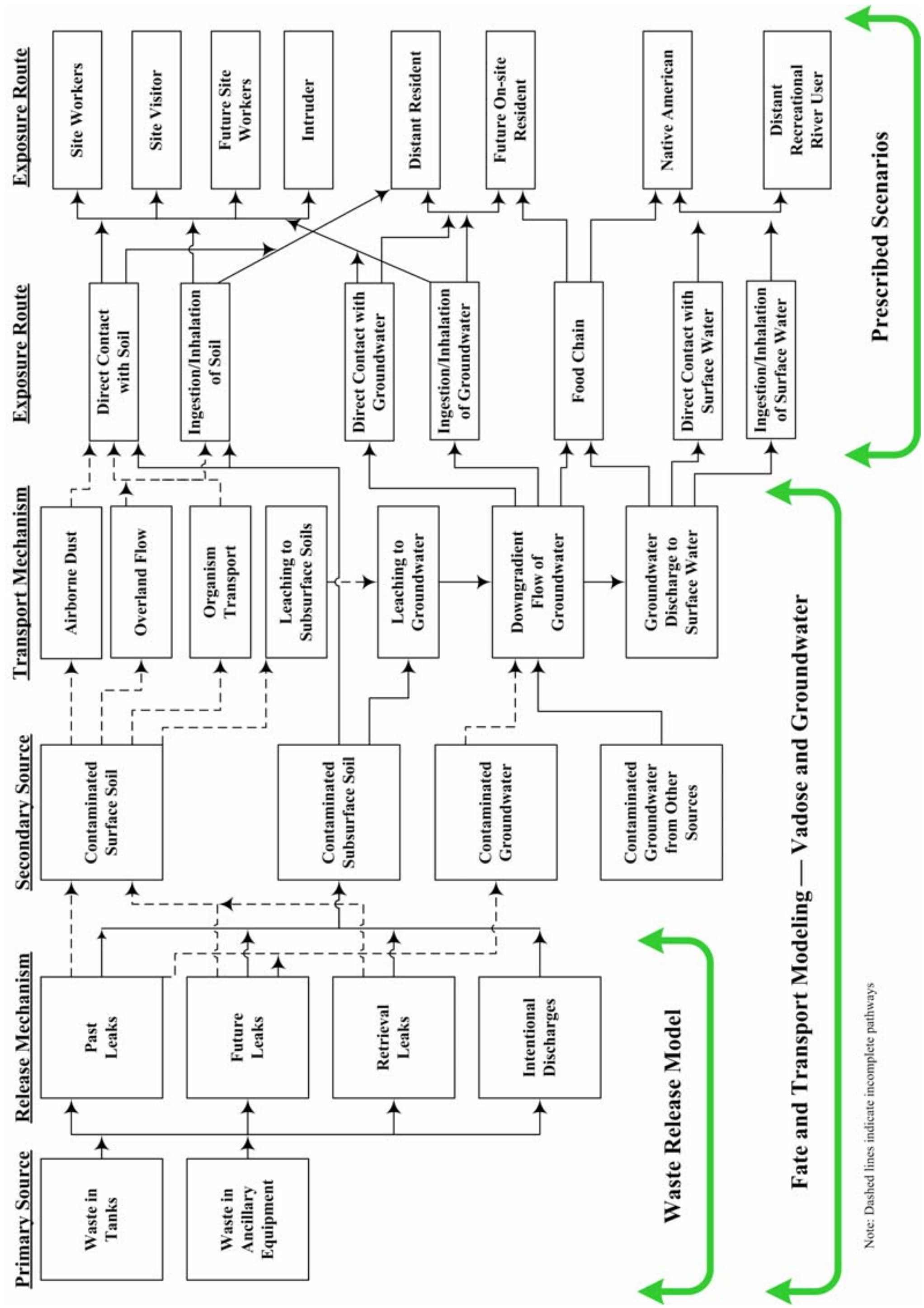
4.3.2 Define the Conceptual Exposure Model

The conceptual exposure model for Hanford tank farms is described in DOE/RL-99-36. Based on the referenced exposure model, a site-specific exposure model will be prepared and documented in an interim report. This exposure model will identify the specific primary and secondary sources that will be considered (an inventory data package shall be prepared for each WMA which identifies the contaminants-of-potential-concern and their inventory and concentrations), the contaminant release and transport mechanisms, contaminated media, and exposure routes. Sources to be considered for this effort will include the following:

- Residual waste in SSTs
- Residual waste in ancillary equipment
- Past leaks and previous unplanned releases
- Past intentional discharges of waste to the ground within WMAs
- Hypothetical leaks during waste retrieval

The preliminary conceptual exposure model for SST system closure is illustrated in Figure 4-1. A similar figure will be developed for the ERA at WMA closure.

1 Figure 4-1. SST System Closure Risk Assessment Conceptual Site Model.



2

The conceptual exposure model also will include the following aspects of the risk assessment, consistent with DOE/RL-99-36:

1. Identification of anticipated future land use scenarios including discussion of how the risk assessment scenarios fit into the "core and buffer" zones identified by Ecology, EPA, and DOE. All of the SST WMAs fall within the 200 Areas' Central Plateau area that has been identified as the "core" area. The anticipated land use scenario for the SST WMAs is exclusive industrial use from the present through 50 years after closure of the last WMA. Full institutional control is assumed to be in place during this period. For the period beyond 150 years post-closure, long-term risks related to a variety of land use scenarios will be evaluated for comparative purposes.

2. Definition of receptor scenarios that will be evaluated for this risk assessment, including a residential farmer scenario among the scenarios selected. A variety of hypothetical human health receptor scenarios have been identified for comparative purposes. These include the following:

   - Industrial worker with exposures via groundwater
   - Residential receptor with exposures via groundwater or surface water
   - Agricultural receptor with exposures via groundwater or surface water
   - Recreational receptor with exposures via groundwater or surface water
   - Native American receptor with exposures via groundwater or surface water

   These receptors have been identified for evaluation of ILCR, HI, and radiological dose (effective dose equivalent [EDE]). The industrial worker is identified as the selected receptor for assessing long-term risk during the postclosure period when institutional control is assumed to be in place. Terrestrial and aquatic receptors will be evaluated during the ERA.

   Additionally, DOE O 435.1 requires three additional hypothetical receptor scenarios be evaluated for radiological dose to support dose-related decisions. These receptors are as follows:

   - A two-part waste site intruder scenario involving an acute dose to a hypothetical well driller who inadvertently penetrates a tank and brings up contaminated drill cuttings. Then an onsite resident subsequently spreads the drill cuttings over a homestead site and lives on the contaminated site receiving a chronic dose.
   - A complex receptor called the All-Pathways Farmer who receives radiological doses from a variety of exposure pathways.
   - A complex Native American receptor who receives radiological doses from a variety of exposure pathways.

All of the preceding receptor scenarios are described in detail in *Exposure Scenarios and Unit Dose Factors for the Hanford Tank Waste Performance Assessment* (HNF-SD-WM-TI-707).

3. Identification of contaminants of concern for which contribution to long-term risk will be calculated. Contaminants of concern will be identified through evaluation of relative contribution to performance metrics from individual constituents. Relative effects of all identified waste constituents will be evaluated. Final selection of contaminants of concern for each WMA will not be made until sampling and analysis of post-retrieval tank residuals and residual vadose contamination are complete. The preliminary baseline WMA risk assessments prepared prior to full characterization will include the following constituents at a minimum:

   - Technetium-99 (assumed to be present as the pertechnetate ion with a distribution coefficient (K_d) = 0)
   - Iodine-129 (assumed to be present as the iodide ion with K_d = 0)
   - Chromium (assumed to be present as ionic hexavalent chromium with K_d = 0)
   - Nitrate and nitrite (assumed to be present as the ions with K_d = 0)
   - Uranium (assumed to be present as $uranium^{VI}$ with K_d = 0.6)

   Based on previous fate and transport simulation efforts at Hanford, the constituents above are expected to account for the majority of long-term impacts to groundwater and a table will be prepared showing the relative contribution of these contaminants to a particular risk metric. Following sampling after retrieval, the impacts of the constituents listed in the approved DQO will be evaluated. For example, for C-106, there are 114 primary constituents and 134 secondary constituents listed in the DQO. Other constituents may be added to preliminary baseline risk assessment depending on WMA-specific inventory information.

4. Identification of the parameters that will be used to assess the estimated long-term risks (such as carcinogenic and noncarcinogenic risk and radiological dose criteria, and numerical regulatory standards [MCL]). The following primary risk-based performance objectives for WMA-related constituents are given in *Performance Objectives for Tank Farm Closure Risk Assessments* (RPP-14283) (see aforementioned document for additional risk assessment performance objectives):

   - Incremental lifetime cancer risk less than 1.0×10^{-5}.
   - Noncarcinogenic HI less than 1.0.
   - No exceedence of drinking water standards (MCLs) for individual constituents (this includes the MCL Derived Constituent Concentration ["C4" concentration] for individual beta/photon emitting radionuclides).

- No exceedence of DOE drinking water dose limit of 4 mrem/yr EDE for beta/photon emitters in water.
- No exceedence of DOE drinking water limit of 15 pCi/L alpha emitters.
- No exceedence of ambient surface water quality standards at the Columbia River.
- No exceedence of WAC 173-340 standards for direct contact.

5. Selection of receptor locations for long-term groundwater exposure assessment, including the WMA fenceline as a point of calculation. Three hypothetical receptor locations have been identified for calculation of preliminary groundwater concentration and resulting risk metric estimates. These locations are as follows:
   - The downgradient WMA fenceline, using a fenceline average concentration calculation.
   - The nearest downgradient boundary of the 200 Areas' exclusion zone.
   - The nearest downgradient point of potential groundwater discharge into the Columbia River.
6. Specification of the time frame for the risk assessment and supporting fate and transport simulations. The fate and transport simulations and resulting risk metric estimates will be limited to a simulation period extending from the present to a maximum of 10,000 years in the future. 10,000 years is the period of time recommended by the EPA for long-term risk assessments involving nuclear waste (10 or 40 CFR 144 and 191). Simulations extended beyond 1,000 years in the future present substantial and increasing uncertainty in estimation of land use and climatic and geologic conditions. Simulations beyond 10,000 years are deemed not to be credible.

4.3.3 Define the Site Conceptual Model for Physical Characteristics and Potential Contaminant Transport

A data package (i.e., *Modeling Data Package for an Initial Assessment of Closure for C-Tank Farm* [RPP-13310]) containing the detailed conceptual physical model of the site will be prepared for each WMA. The conceptual model describes the physical (e.g., hydrologic, stratigraphic, and placement) characteristics of the site. This conceptual model will also describe the physical interrelationships between the potential contaminant sources and the physical setting of the site and will become the basis for the fate and transport simulations. The model will be based on existing knowledge of site-specific conditions to the extent practical. Boundary conditions will be identified for use in transport simulations. The conceptual model will be constructed in a manner that supports extrapolation of fate and transport simulation results to all identified sources within a WMA and will be documented for each WMA in a data package.

Also documented in the data package are the codes to be used and the modeling approach for both the vadose zone and underlying aquifer.

The following elements will be defined for each WMA conceptual model:

- Site-specific vadose and aquifer stratigraphy extending from the ground surface to the selected exposure points
- Location of the contaminant sources
- Contaminant release scenarios that describe the manner in which the individual constituents in the selected source materials (tank residuals, past leaks, ancillary equipment residuals, and retrieval leaks) are assumed to enter the contaminant transport system (solubility limits, duration of release)
- A mechanism to reflect potentially variable effectiveness of engineered surface barriers at controlling infiltration through the site
- A mechanism to reflect the variability in hydraulic characteristics of alternative tank fill materials.

4.3.4 Identify and Catalog the Input Values for Fate and Transport Simulations

Values, or, where appropriate, ranges of values, will be identified for the site hydrologic properties (soil density, porosity, hydraulic conductivity, infiltration rates) and for the physical and chemical properties of the radioactive and nonradioactive constituents (solubility, half-life, distribution coefficient). These values will be derived from a literature search and discussions with local subject matter experts to derive values from previous work under similar conditions and, where possible, from empirical data derived from measurements of site-specific materials. In the event that the current state of knowledge regarding input values yields a substantial range of values for specific parameters, a strategy for quantifying the uncertainty in long-term risk related to the uncertain parameters will be prepared. In the absence of a body of information sufficient to determine the distribution of an observed range of input values, professional judgment will be applied to identify representative values.

4.3.5 Identify Relevant Closure Management Variables and Decisions

Tank closure management alternatives will be identified for analysis of their effects on long-term risk. These alternatives will be selected for specific sensitivity analyses to quantify their impacts on risk. The closure management alternatives to be considered for sensitivity analysis include the following:

- Retrieval efficacy/residual waste volume

- Tank fill effects on infiltration and attenuation of waste constituents
- Final cover's efficacy at reducing infiltration of precipitation through the site.

These alternatives and variables will be specified and included in the WMA-specific documentation.

4.3.6 Implement the Risk Assessment Simulations

The long-term risk assessment simulations will be conducted in a sequential manner using a combination of deterministic and stochastic simulation techniques, as appropriate. This sequential approach will provide a sound basis for the following determinations:

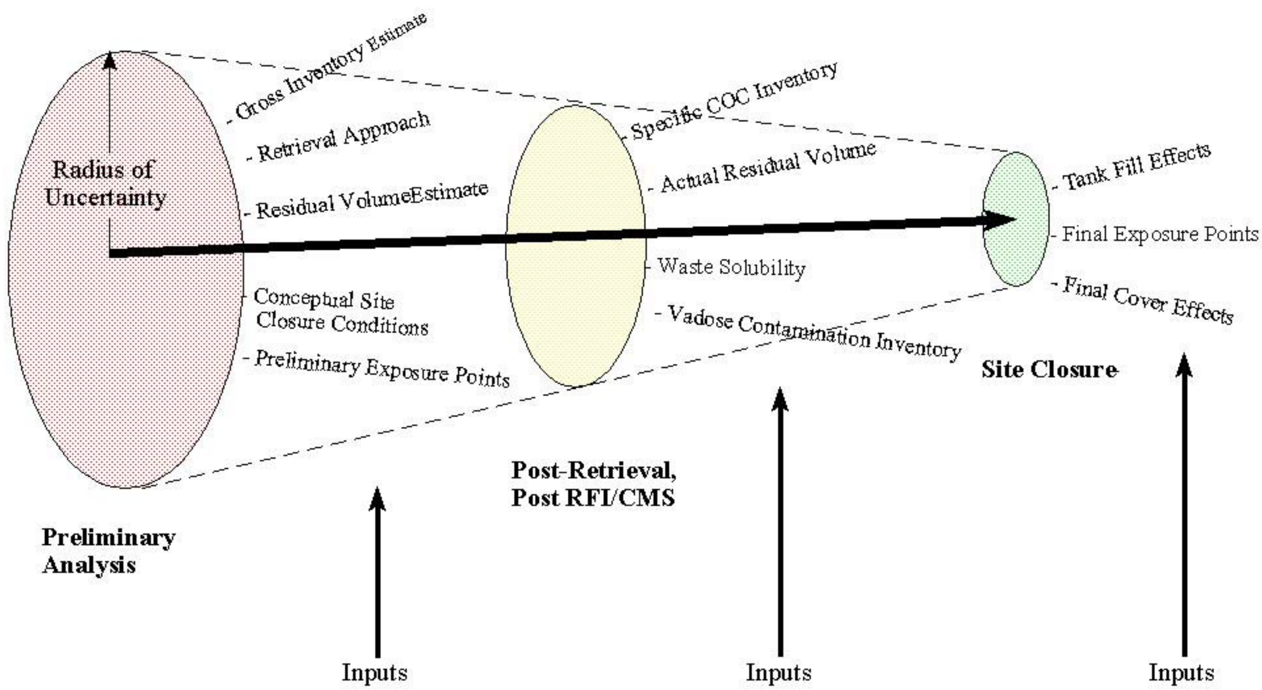
- Demonstrate risks related to expected closure conditions for each WMA.
- Identify variables to which risk estimates are highly sensitive.
- Quantify risk uncertainty related to the sensitive variables, with particular focus on sensitive closure management variables.
- Quantify risk estimate uncertainty resulting from cumulative effects of nonsensitive variables.

Graphical and tabulated risk estimate results will be presented. The objective of the risk estimate result presentation is as follows:

- Clearly indicate the resultant risk(s) and the criterion to which it is compared.
- Clearly indicate the input variable set that generated the resultant risks.
- Clearly indicate the efficacy and appropriateness of selected closure alternatives.

Additionally, the analysis of sensitivity and uncertainty will be used to identify closure data needs and support definition of data collection requirements. Iterative computation of quantitative risk estimates as new data are developed will reduce uncertainty in the estimates. The general effect of data collection and iteration of risk estimates is shown in Figure 4-2, with the uncertainty section in Addendum C-1 providing quantitative analysis showing this process for WMA C.

Figure 4-2. Conceptual Uncertainty Reduction through Data Collection and Iterative Risk Estimation.



4.4 SHORT-TERM WORKER AND GENERAL PUBLIC RISK ASSESSMENT APPROACH

Short-term risks are those risks posed by exposure of site workers and members of the public to contaminants during implementation of site closure activities and the effects of accident scenarios. Radiological short-term risk assessment approach information presented in this section is for information purposes only, in accordance with DOE’s authority under the AEA. The hazards associated with these activities include 1) potential occupational hazards resulting in physical trauma, 2) radiological exposure resulting in latent cancer fatalities, 3) chemical exposure from accidents (HI), and 4) chemical hazards from routine exposure (HI). Initiating events that could result in hazardous health effects may include natural phenomena, human error, component failure, and spontaneous reactions. Health risks during normal conditions include anticipated exposure to radiation and chemical fields and radiological and chemical releases to the atmosphere during normal retrieval activities. The following subsections present additional specific information regarding these approaches.

Worker and general public exposure scenarios will be developed for tank closure activities. These scenarios will be designed to accurately represent the types of exposure that are expected based on selected tank closure alternatives. Various options for tank filling following waste retrieval will be evaluated. Tank filling will present potential exposures to workers and the general public.

Because the short-term risks will be encountered in the near future while the site is under physical and administrative control of DOE, it can be reasonably anticipated that the tank closure activities will be conducted in a manner that maintains exposure to tank wastes as low as reasonably achievable through the use of engineered controls and protective equipment. It is assumed that after final closure of the tanks, short-term risk will be fully mitigated. The engineered controls necessary to maintain as low as reasonably achievable conditions as required by the AEA during closure activities may not be cost-effective and could impact retrieval actions.

4.4.1 Occupational Injuries, Illnesses, and Fatalities

The number of injuries, illnesses, and fatalities resulting from closure activities is calculated based on the most currently available incidence rates that would be applicable to the activities. The number of injuries, illnesses, and fatalities from construction or operations is calculated by multiplying the total person-years required to support the activity by the incidence rates.

4.4.2 Radiological Risk from Accidents Involving Mixed Wastes

The radiological risk is expressed as the number of latent cancer fatalities resulting from accidents in which people are exposed to radiation fields or radiological constituents released to the atmosphere. The probability of the accident occurring also is evaluated. The methodology used to identify and quantify the radiological risk from mixed-waste accidents is performed using the steps described as follows. These analyses are conducted in accordance with DOE's authority under the AEA.

Step 1. **Accident Identification.** Potential hazards associated with retrieval activities are identified from existing preliminary hazards analyses and other safety documents. The hazards will be reported in a tabular format showing, for each accident, the barriers within the facility that prevent or mitigate the consequences of the accident, a rough estimate of the magnitude of consequences of the accident assuming that the listed preventive barriers fail, and the estimated likelihood of the accident occurring.

Step 2. **Accident Strategy Selection.** The accident with the highest risk is screened for further analysis to determine, as accurately as possible, the consequences and probability of occurrence. The risk of a given accident is the product of the consequences of the accident and the estimated likelihood of the event occurring. Screening for the highest risk accidents follows the same methodology as outlined in the *Preparation Guide for U.S. Department of Energy Nonreactor Nuclear Facility Safety Analysis Reports*, Section 3.3.2.3.5 (DOE-STD-3009-94). Accident frequencies are based on published safety hazard documents, for example *Tank Farm Final Safety Analysis Report* (HNF-SD-WM-SAR-067).

Step 3. **Accident Sequence Quantification.** The frequency of occurrence of the selected accidents is taken from referenced documents where available. Where accident frequencies are not available, they are estimated.

Step 4. **Source-Term Development.** The source term is the respirable fraction of inventory from which the receptor dose is calculated. The source term is developed based on the inventory that could potentially be released to the environment from an accident. The major reduction factors that control the source term are considered in the evaluation. The reduction factors include airborne release fractions, airborne release rates, and respirable fractions. Use of the reduction factors will be dependent on the nature of the accident (i.e., energy of accident at impact, waste form, and effectiveness of mitigating barriers). Direct exposure to radiation under mixed-waste accident conditions also is evaluated. Direct exposure is the direct beta and gamma radiation dose rate to a receptor. Exposure due to ingestion would be negligible compared to inhalation and is not analyzed.

Step 5. **Atmospheric Dispersion Coefficients (X/Q).** The X/Q values are generated using the GXQ computer code in the *GXQ Program Users Guide* (WHC-SD-GN-SWD-3002) following the methodology outlined in the *Atmospheric Dispersion Models for Potential Accident Consequence Assessment at Nuclear Power Plants* as referenced in the Nuclear Regulatory Commission Regulatory Guide 1.145 (NUREG 1.145). The meteorological data used by GXQ are in the form of joint frequency tables. The joint frequency data are taken from data collected at the Hanford Site meteorology tower in the 200 Areas. The X/Q values are used in equations to calculate the mixed-waste radiological dose experienced by the noninvolved and involved worker and general public receptors as a result of inhaling radioactive materials (ingestion will also be included for the general public receptor dose).

Step 6. **Receptor Determination.** Potential health effects from radiological exposures from mixed waste are estimated for three population subsets and maximally exposed individuals in those populations. The dose to a receptor depends on the location of the receptor relative to the point of release of the radioactive material from mixed waste. The involved workers are those involved in the proposed action and physically performing work at the facility. They are assumed to be in the center of a 10-m (33.0-ft) radius hemisphere where the airborne released material has spread instantaneously and uniformly. The noninvolved workers would be on the Hanford Site but not involved in the action. They are assumed to extend from

100 m (330 ft) out to the Hanford Site boundary. The general public is assumed to be located at the site boundary to a distance of 80 km (50 mi) from the point of release. The Hanford Site boundary used in the analysis is the adjusted site boundary that excludes areas designated as the Hanford Reach National Monument. These areas include the north slope of the Hanford Reach of the Columbia River. The site boundaries are as follows:

- North: Columbia River, 0.4 km (0.25 mi) south of the south river bank
- East: Columbia River, 0.4 km (0.25 mi) west of the west river bank
- South: A line running west from the Columbia River, just north of the Washington Public Power Supply System leased area, through the Wye Barricade to Highway 240
- West: Highway 240 and Highway 24.

Step 7. **Radiological Dose Assessment.** The inventory involved in each accident is evaluated to determine the activity concentrations. The activity concentrations are converted to unit liter dose factors. The GENII computer code (PNL-6584) is used to generate a single inhalation liter dose factor for each composite source term for a 50-year dose commitment period. The receptor doses are given in terms of committed effective dose equivalents. The unit inhalation dose factors are used along with the appropriate atmospheric dispersion coefficient, breathing rates and the source term to determine the radiological dose to the involved and noninvolved worker and general public receptors.

Step 8. **Latent Cancer Fatality (LCF) Risk Development.** The likelihood that a dose of radiation from mixed waste would result in a fatal cancer at some future time is calculated by multiplying the receptor dose by a dose-to-risk conversion factor. Conversion factors are predictions of health effects from radiation exposure. The dose-to-risk conversion factors used for estimating latent cancer fatalities from low doses of radiological exposure and from high doses are consistent with those taken from *Recommendations of the International Commissions on Radiological Protection* (ICRP 1991). They are summarized as follows:

- **Involved worker and noninvolved worker:** 4.0×10^{-4} LCF/rem for low doses less than 20 rem and 8.0×10^{-4} LCF/rem for doses greater than or equal to 20 rem.
- **General public:** 5.0×10^{-4} LCF/rem for low doses less than 20 rem and 1.0×10^{-3} LCF/rem for doses greater than or equal to 20 rem. The dose-to-risk conversion factors for the general public accounts for the presence of children.

4.4.3 Chemical Exposure from Accidents

The chemical inventory used for this assessment is made up of two components, the organic chemicals and the inorganic chemicals. The emission rates for organic chemicals are taken from *Organic Vapor Source Term for Tanks 241-C-201, 241-C-202, 241-C-203, and 241-C-204 During Waste Retrieval Operations*, RPP-14841. The emission rates for inorganic chemicals are taken from *Exposure Scenarios and Unit Dose Factors for the Hanford Tank Waste Performance Assessment*, HNF-SD-WM-TI-707. Potential acute hazards associated with exposure to concentrations of postulated accidental chemical releases were evaluated using a screening-level approach for the receptors. This involves directly comparing calculated exposure point concentrations of chemicals to a set of air concentration screening criteria, known as emergency response planning guidelines (ERPG). The ERPGs, as developed by the American Industrial Hygiene Association, are specific levels of chemical contaminants in air designed to be protective of acute adverse health impacts for the general population. ERPGs are the maximum airborne concentration below which it is believed that nearly all individuals could be exposed for up to one hour without experiencing or developing the following effects:

- ERPG 1 - Mild transient adverse health effects or perceiving a clearly defined objectionable odor
- ERPG 2 - Irreversible or other serious health effects, or symptoms that could impair ability to take protective action
- ERPG 3 - Irreversible or life-threatening health effects could result from exposures exceeding one hour.

In the event that an ERPG value does not exist, DOE requires the use of Threshold Emergency Exposure Limit (TEEL) values. Like the ERPGs, there are multiple levels of TEELs as follows:

TEEL-0 The threshold concentration below which most people will experience no appreciable risk of health effects.

TEEL-1 The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing other than mild transient adverse health effects or perceiving a clearly defined objectionable odor.

TEEL-2 The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action.

TEEL-3 The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing life-threatening health effects.

Cumulative hazards or the acute hazard index (HI) for toxic and corrosive/irritant chemical classes were evaluated using the following equation.

$$HI = \sum \frac{C_{chemical}}{ERPG_{chemical}} \qquad (4\text{-}1)$$

where:

HI is the cumulative hazard index for acute exposure

$C_{chemical}$ is the concentration at the exposure point of each chemical (mg/m^3)

$ERPG_{chemical}$ is the ERPG (or TEEL if no ERPG available) for each chemical (mg/m^3).

A cumulative HI is calculated for each ERPG/TEEL level (1, 2, and 3). If the HI is greater than 1.0, this indicates that the acute hazard guidelines for a mixture of chemicals has been exceeded and the chemical mixture may pose a potential acute health impact. The potential impact is described in the level definition shown above. To be consistent with previous tank farm worker risk assessments and DOE guidance, TEELs and ERPGs were chosen as the hierarchy approach versus other hierarchy approaches used in the WTP risk assessment on-site.

Determining the accidents to be used in the strategies, the source term, atmospheric dispersion coefficients, and the receptor location followed the same methodology as that applied to radiological risk from accidents described in Section 4.4.2.

4.4.4 Radiological Latent Cancer Fatalities Risk from Routine Exposure

The involved worker exposure is a combination of exposure from inhalation and direct radiation. Involved worker dose rates are estimated based on time, distance, and shielding considerations associated with the various tasks. Noninvolved workers and general public exposure are estimated by determining the expected routine radiological releases during retrieval and closure. Exposure to the noninvolved worker is assumed to be from inhalation and external radiation from the plume continuously throughout the year and from deposition of radionuclides on the ground. The exposure pathways for the general public are assumed to be inhalation, external exposure from submersion in a plume, and ingestion of contaminated farm products. The receptors are in the same location and the same population size as defined in Section 4.4.2 for radiological accidents. The GENII computer code is used to calculate the dose based on X/Qs generated by GXQ. The latent cancer fatality is then calculated by multiplying the receptor dose by a dose-to-risk conversion factor from ICRP (1991) defined in Section 4.4.2 for radiological accidents.

4.4.5 Chemical Hazards from Routine Exposure

The chemical inventory used for this assessment is made up of two components, the organic chemicals and the inorganic chemicals. The emission rates for organic chemicals are taken from RPP-14841. The emission rates for inorganic chemicals are taken from HNF-SD-WM-TI-707.

To estimate the potential noncarcinogenic effects from exposure to multiple chemicals, the HI approach was used consistent to EPA methodology that was used in DOE/EIS-0189 and DOE/RL-98-72. The HI is defined as the summation of the inhalation HQ (chemical concentration divided by the reference concentration [RfC] for that chemical). This HI was calculated as follows:

$$HI = \sum \frac{C_{chemical}}{RfC_{chemical}} \tag{4-2}$$

where:

HI is the cumulative hazard index for acute exposure

$C_{chemical}$ is the concentration at the exposure point of each chemical (mg/m^3)

$RfC_{chemical}$ is the reference concentration of the chemical from the EPA IRIS database (mg/m^3).

A total HI less than or equal to 1.0 is indicative of acceptable levels of exposure.

4.5 ECOLOGICAL ASSESSMENT

The Hanford HLW tank farms, including the SST system, have been used for storage of high-level radioactive mixed waste since the mid-1940s. During this time, the tank farms have been managed in a manner intended to eliminate, to the extent possible, the intrusion of plants and wildlife into the facilities. An ecological assessment of the SST system and its WMAs is required for closure pursuant to WAC 173-340-7490.

It is anticipated that a two-phased approach shall be used to evaluate the ecological risk related to tank farm closure. The first phase would be a biological survey of the tank farms, followed by ecological mitigation planning associated with individual component closure actions. The second phase would be an ecological risk assessment of the effects of the closure activities and the postclosure conditions. These activities are discussed further in the following paragraphs.

The biological survey of tank farms would consist of a thorough on-the-ground examination of each WMA, including any area outside the existing WMA footprint. This survey will include adjacent areas that may be disturbed and reshaped during construction of the final engineered surface barrier and neighboring areas that may serve as habitat for potential receptors. The need and frequency of the biological surveys will be dependent upon the results from the 200 Area ERA that is being conducted by the Groundwater Protection Project.

The product of this survey would be a catalog of flora and fauna residing in and around the WMAs and a conceptual model that identifies all source terms, exposure pathways, and receptors. The catalog should identify those species identified as state or federal threatened or endangered species and will focus on representative receptor species.

The ecological risk assessment would be conducted following the biological survey. The effects of the planned WMA closure activities (such as the construction of the engineered surface barrier) on both affected threatened/endangered species as well as representative species will be assessed. A food chain evaluation shall also be made as part of the ecological risk assessment.

The end state of the closure (activity completed and final engineered surface barrier in place) will be assessed for potential ecological effects. This assessment will include local effects based on studies and observations made of ecological effects of the full-size prototype engineered surface barrier located in the 200 East Area. Additional ecological risk effect estimates will include comparison of estimated groundwater discharge impacts to applicable acute and chronic surface water quality criteria.

The results of the ecological risk assessment will be documented in the final closure report for the WMA(s).

4.6 RISK ASSESSMENT COMMUNICATION

Information will be shared among DOE, implementing contractors and subcontractors, regulators, and stakeholders regarding the elements of the risk assessment and inputs to the simulations. Effective communication of these concepts will be conducive to developing understanding of the process and lead to successful preparation of supporting documentation. The following information will be published as supporting data packages for the overall SST system risk assessment:

- *Performance Objectives for Tank Farm Closure Risk Assessments* (RPP-14283)
- *Exposure Scenarios and Unit Dose Factors for the Hanford Tank Waste Performance Assessment* (HNF-SD-TI-707).

These data packages will provide general information that will be applied to all WMAs in the system. In addition to the system-wide data packages, at least two additional data packages will be published for each WMA, as follows:

- A modeling input data package for each WMA that describes the unique geology/hydrology of the WMA as well as identifying WMA-specific inputs to the contaminant fate and transport simulations.
- A WMA-specific inventory data package, which will include the best-basis inventory and facilitating assumptions for the volume and constituent contents of source terms identified for the WMA (tank residuals, ancillary equipment residuals, past leaks, retrieval leaks, intentional discharges).

Together, these four data packages will form the basis for each WMA risk assessment. Following the risk assessment analysis for each WMA, a summary risk assessment document will be prepared for each WMA describing the results.

The data packages listed above focus on the human health risk. Similar data packages, if necessary, shall be developed for the ERA, which will be performed be a WMA can be closed.

WMA risk assessments will be updated when substantial new input data are generated. Examples of activities that may initiate risk assessment update include:

- Completion of waste retrieval from individual WMA components and generation of component-specific waste volume and residual waste characteristic data

- Completion of characterization of vadose zone and groundwater contaminant inventories (e.g., RFI/CMS)

- Completion of design for final tank fill and/or final WMA closure conditions (e.g., cover or cap designs).

An independent merit review board will evaluate the SST closure risk assessment methodology inputs and results. Results of the review will be documented in a report.

4.7 DATA AND INFORMATION REQUIREMENTS

Risk assessments are iterative in nature and improve as data gaps are filled. The risk assessment is updated as data gaps are filled to reflect a greater understanding of the system. This process begins with using existing data and supplementing known data gaps with assumptions. For this risk assessment, although current site-specific data needed were incomplete, enough relevant data from other sources were available that specific assumptions were made to satisfy the data gaps.

When made, these assumptions tended to be on the conservative side. As the risk assessment process continues, the conservative assumptions are replaced with site-specific data. In this case, sampling of residual waste following retrieval would provide the best residual waste inventory estimates.

The data gaps identified during the course of this analysis are given in Table 4-1. Included in this table are the following:

- **Information type** can be either data (measurable quantity) or analysis (derived)

- **Impacts** identifies what item in the analysis would change with additional information

- **Knowledge level** is based on professional judgment after reviewing available literature

- **Data collection feasibility** is based on professional judgment on the ease of collecting the data
- **Ranking** is based on professional judgment on how important this data is to the analysis
- **Path Forward** describes how the identified data gap should be addressed
- **Limitations** describe how the data gap is being addressed in this analysis.

Table 4-1. Data Gaps and Priorities (3 Pages)

Title	Information Type	Impacts	Knowledge Level	Data Collection Feasibility	Ranking	Path Forward	Limitations
Inventory estimates	Data and analysis	Peak concentrations and arrival times for breakthrough curves from various sources	Medium	Medium	1	Tank residual waste scheduled to be sampled following retrieval and the risk assessment will be updated.	Limited availability and uncertain quality for ancillary equipment and piping systems' inventory estimates.
Residual waste release models	Data and analysis	Peak concentrations and arrival times for breakthrough curves due to residual wastes	Low	High	1	Characterize residual tank wastes; obtain empirical data on their release behavior especially for stabilized (grouted*) and for solubility-driven waste forms. Waste constituent studies started on sludge from Tank AY-102(sludge originally from Tank C-106). Results indicate the release of technetium to water is much slower than previously believed. Additional characterization underway to better understand technetium release from the waste to develop a realistic release model. More realistic release models are also being developed for the other COC	In the absence of characterization data for release models, conservative values are being used for diffusion coefficients for stabilized (grouted*) tank wastes. Considerable uncertainty exists also with the solubility-dominated release model used in this assessment.
Retrieval leak volumes	Data	Peak concentrations and arrival times for retrieval leaks	Low	Not known	1	Evaluate current leak detection monitoring methods during retrieval operations.	Leak volumes used in this assessment are data used in past analyses.

* See Preface in *SST System Closure Plan* (RPP-13774).

Table 4-1. Data Gaps and Priorities (3 Pages)

Title	Information Type	Impacts	Knowledge Level	Data Collection Feasibility	Ranking	Path Forward	Limitations
Composition of leaked retrieval tank wastes	Data and analysis	Peak concentrations and arrival times for retrieval leaks	Low	Medium	1	Evaluate data collected during retrieval operations.	No data on composition available at this time and values used in this assessment are assumptions.
Two-dimensional versus three-dimensional modeling	Analysis	Peak concentrations and arrival times for breakthrough curves from various sources	Medium	High	1	Perform STOMP simulations for both two- and three-dimensional setup of the tank farm flow domain and evaluate the approach being used to account for the third dimension.	An untested approach is presently being used to account for the third dimension.
Hydraulic and transport parameters for unconfined aquifer	Data	Breakthrough curves from various sources at the proposed core zone boundary and Columbia River	Medium	Medium	1	RCRA Drilling just to the north of the WMA C fenceline is scheduled to penetrate the unconfined aquifer and the hydraulic conductivity of the aquifer will be evaluated.	Parameters being used in the initial assessment are believed to be conservative.
Short-term risk assessment closure accident scenarios	Analysis	Changes short-term risk for accident scenarios	Medium	High	1	Perform safety analysis for closure activities.	Uses retrieval accident scenarios as a bounding case.
Pre-closure (current) recharge estimates	Data	Peak concentrations and arrival times for breakthrough curves due to past and retrieval leaks	Medium	Medium	2	Review recently collected infiltration data for BX tank farm, and evaluate applicability for C farm conditions.	Data are derived from other sources and not a site-specific measurement.
Post-closure (barrier) recharge estimates	Data	Peak concentrations and arrival times for breakthrough curves due to residual wastes	High	Medium	2	Review multi-year infiltration data collected for 200-BP-1 prototype barrier, and evaluate applicability for C farm RCRA barrier.	Use available data after review.

Table 4-1. Data Gaps and Priorities (3 Pages)

Title	Information Type	Impacts	Knowledge Level	Data Collection Feasibility	Ranking	Path Forward	Limitations
Hydrologic properties of vadose zone units	Data	Peak concentrations and arrival times for breakthrough curves from various sources	Medium	Medium	3	Measure properties of site-specific soils.	Must extrapolate small scale (i.e., laboratory measurements) to large-scale estimates.
Existing vadose zone contamination	Data and analysis	Peak concentrations and arrival times for past leaks and unplanned releases	Low	Medium	2	Continue evaluating spectral gamma logging data as part of a FIR for WMA C.	Extrapolating local measurements to the entire vadose zone introduces uncertainty. Spectral data do not include long-lived mobile contaminants. Data are mostly from vertical point sources.

BBI = best-basis inventory
COC = constituent of concern
FIR = field investigation report
RCRA = *Resource Conservation and Recovery Act of 1976*
WMA = waste management area

Ranking gathering information rated 1 should be the highest priority, while gathering information for a ranking 3 would have a low priority

5.0 CHARACTERIZATION OF SST SYSTEM FOR CLOSURE

This section describes the general approach for characterizing components within the SST System for the purposes of closure. According to Condition II.D.1 of the Site-Wide Permit, all waste analyses are to be conducted in accordance with a written waste analysis plan (WAP), or sampling and analysis plan (SAP). Operating TSD units that receive waste are required to have a WAP; however, closing TSD units, and units in post-closure, are required to have a SAP and, if necessary, a WAP.

A WAP associated with the SST System for closing components is not considered to be necessary at this time. The purpose of a WAP is to confirm the owner/operator's knowledge about a dangerous waste before storage, treatment, or disposal of the waste (WAC 173-303-300(1)). For closing SST components, receipt of dangerous waste for storage will not occur with the possible exception of future introduction of DST supernatant liquids in some SSTs for retrieval purposes. Should this need arise in the future, the requirements of a WAP will be met for that specific activity in conjunction with retrieval actions. Similarly, treatment of waste within a closing SST system component is not contemplated at this time nor are SST System components intended to be used for receipt of waste for the purposes of disposal.

SAPs will be generated to support sampling activities for closure. A data quality objectives (DQO) process will be used to ensure agreement between Ecology and DOE on the appropriate sampling and analysis requirements for closure purposes. The SAP incorporates the results of the DQO process.

Waste profiles are developed for wastes generated during tank retrieval operations. These profiles ensure that "generated" wastes are properly characterized for the purposes of safe storage or treatment at the receiving facility (e.g., Double-Shell Tank Systems). The DST System WAP (WHC-SD-WM-EV-053, as amended, *DST System Waste Analysis Plan*, Appendix A) describes the process for ensuring that waste from the SST System is properly characterized prior to transfer to the DST System.

DOE will conduct characterization of soil, tank system, and ancillary equipment and measurements of any residual left in tanks in support of closure. Tank and ancillary equipment characterization will provide data and information on the composition and amounts (volume) of any waste remaining in the tanks and in related ancillary equipment. DOE will conduct tank closure characterization at the WMA level and component level.

The primary goals of tank characterization are to provide data to:

1) Identify and implement measures to protect workers, the general public, and the environment,

2) Determine the volume of waste remaining at the completion of waste retrieval activities,

3) Provide a defensible estimate of the constituents remaining in the tank at closure,

4) Reduce uncertainty in inventories of contaminants of concern used in risk assessments, and,

5) Provide samples and analysis to refine conceptual models of contaminant release mechanisms and release rates as used in risk assessment calculations.

Additional goals include providing tank waste for purposes such as laboratory testing to assess performance of sequestering agents and tank fill materials).

The characterization process will start with a single SST (C-106) and then continue for the remaining tanks. Characterization will be also conducted for soil, tank systems, and ancillary equipment at the tank farm or WMA level and details (e.g., crosswalk to DQO and/ or SAP) will be included in the appropriate WMA closure action plan, component closure activity plan and/or corrective action documentation. Groundwater characterization is expected to occur as part of the remedial investigation/ feasibility study process under CERCLA.

5.1 RELIABILITY AND ACCEPTANCE OF CHARACTERIZATION METHODS AND RESULTS

To achieve the goals listed above, characterization methods and results must be reliable and regulatorily acceptable. To ensure reliability and acceptance, Ecology and DOE have been developing DQOs. The DQOs establish agreed and consistent procedures and criteria for conducting sampling and analysis and for residual waste measurements. For example, tank DQOs will determine:

- Volume measurement techniques to be used
- Type of media to be sampled
- Sample collection methodologies
- Number of samples to be collected
- Analytical methods to determine composition
- Data quality requirements for the composition data.

The DQO process will aid in determining when other data or information is needed and how that data will be collected.

Key sampling and analysis results will be summarized and made available to Ecology. Sampling and analysis results pertinent to closure actions will also be summarized in WMA closure action plans and subsequent updates to those plans.

6.0 PLANNING AND SCHEDULING SST CLOSURE ACTIONS

The HFFACO M-45-00 milestone series contains requirements for two new documents that will serve to plan and develop schedule activities required to close the SST system: 1) the *Single-Shell Tank System Closure Plan*, the present document and 2) the *SST System Implementation Plan*. Section 1.3 of the Framework Plan presents the relative timing of major activities required for closure of the SST system. Closure actions must be scheduled/approved through the closure plan and/or the HFFACO and incorporated by reference. As of the initial submittal of the plan, very few of these activities have been planned and scheduled, other than at a conceptual level.

The HFFACO is an agreed-to mechanism for scheduling closure actions. These actions, including retrievals, will be incorporated by reference in the SST closure plan permit and will be subject to SST closure plan requirements.

HFFACO Milestone M-45-06-T20A requires the *SST System Implementation Plan* to cover actions and strategies in the following major work areas:

- Waste retrieval
- Operable units characterization
- Technologies development to support closure
- Risk assessments
- Groundwater monitoring strategies.

Refinement of major work areas is to be developed in a joint Ecology/DOE workshop. Upon completion of the joint Ecology/DOE workshop, refinement of the scope of the implementation plan will have occurred. The essential function of the *SST System Implementation Plan* is as a planning tool for development of strategies, approaches, methods, and schedules for closing the SST system in a manner that both satisfies applicable requirements and coordinates resources and regulatory processes.

The HFFACO establishes a high-level schedule for overall SST system closure activities. The milestones that have been negotiated in the HFFACO provide a structure for developing detailed plans that specify activities and requirements for SST system closure. Table 6-1 identifies HFFACO milestones associated with closure of the SST system.

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System.
(15 pages)

M-45-00 LEAD AGENCY: ECOLOGY	COMPLETE CLOSURE OF ALL SINGLE SHELL TANK FARMS. CLOSURE WILL FOLLOW RETRIEVAL OF AS MUCH TANK WASTE AS TECHNICALLY POSSIBLE, WITH TANK WASTE RESIDUES NOT TO EXCEED 360 CUBIC FEET (CU. FT.) IN EACH OF THE 100 SERIES TANKS, 30 CU. FT. IN EACH OF THE 200 SERIES TANKS, OR THE LIMIT OF WASTE RETRIEVAL TECHNOLOGY CAPABILITY, WHICHEVER IS LESS. IF THE DOE BELIEVES THAT WASTE RETRIEVAL TO THESE LEVELS IS NOT POSSIBLE FOR A TANK, THEN DOE WILL SUBMIT A DETAILED EXPLANATION TO EPA AND ECOLOGY EXPLAINING WHY THESE LEVELS CANNOT BE ACHIEVED, AND SPECIFYING THE QUANTITIES OF WASTE THAT THE DOE PROPOSES TO LEAVE IN THE TANK. THE REQUEST WILL BE APPROVED OR DISAPPROVED BY EPA AND ECOLOGY ON A TANK-BY-TANK BASIS. PROCEDURES FOR MODIFYING THE RETRIEVAL CRITERIA LISTED ABOVE, AND FOR PROCESSING REQUESTS FOR EXCEPTIONS TO THE CRITERIA ARE OUTLINED IN APPENDIX H TO THE AGREEMENT. FOLLOWING COMPLETION OF RETRIEVAL, SIX OPERABLE UNITS (TANK FARMS), AS DESCRIBED IN APPENDIX C (200-BP-7, 200-PO-3, 200-RO-4, 200-TP-5, 200-TP-6, 200-UP-3), WILL BE REMEDIATED IN ACCORDANCE WITH THE APPROVED CLOSURE PLANS. FINAL CLOSURE OF THE OPERABLE UNITS (TANK FARMS) SHALL BE DEFINED AS REGULATORY APPROVAL OF COMPLETION OF CLOSURE ACTIONS AND COMMENCEMENT OF POST-CLOSURE ACTIONS. FOR THE PURPOSES OF THIS AGREEMENT ALL UNITS LOCATED WITHIN THE BOUNDARY OF EACH TANK FARM WILL BE CLOSED IN ACCORDANCE WITH WAC 173-303-610. THIS INCLUDES CONTAMINATED SOIL AND ANCILLARY EQUIPMENT THAT WERE PREVIOUSLY DESIGNATED AS RCRA PAST PRACTICE UNITS. ADOPTING THIS APPROACH WILL ENSURE EFFICIENT USE OF FUNDING AND WILL REDUCE POTENTIAL DUPLICATION OF EFFORT VIA APPLICATION OF DIFFERENT REGULATORY REQUIREMENTS: WAC 173-303-610 FOR CLOSURE OF THE TSD UNITS AND RCRA SECTION 3004(U) FOR REMEDIATION OF RCRA PAST PRACTICE UNITS. ALL PARTIES RECOGNIZE THAT THE RECLASSIFICATION OF PREVIOUSLY IDENTIFIED RCRA PAST PRACTICE UNITS TO ANCILLARY EQUIPMENT ASSOCIATED WITH THE TSD UNIT IS STRICTLY FOR APPLICATION OF A CONSISTENT CLOSURE APPROACH. UPGRADES TO PREVIOUSLY CLASSIFIED RCRA PAST PRACTICE UNITS TO ACHIEVE COMPLIANCE WITH RCRA OR DANGEROUS WASTE INTERIM STATUS TECHNICAL STANDARDS FOR TANK SYSTEMS (I.E., SECONDARY CONTAINMENT, INTEGRITY ASSESSMENTS, ETC.) WILL NOT BE MANDATED AS A RESULT OF THIS ACTION. HOWEVER, ANY EQUIPMENT MODIFIED OR REPLACED WILL MEET INTERIM STATUS STANDARDS. IN EVALUATING CLOSURE OPTIONS FOR SINGLE-SHELL TANKS, CONTAMINATED SOIL, AND ANCILLARY EQUIPMENT, ECOLOGY AND EPA WILL CONSIDER COST, TECHNICAL PRACTICABILITY, AND POTENTIAL EXPOSURE TO RADIATION. CLOSURE OF ALL UNITS WITHIN THE BOUNDARY OF A GIVEN TANK FARM WILL BE ADDRESSED IN A CLOSURE PLAN FOR THE SINGLE-SHELL TANKS. COMPLIANCE WITH THE WORK SCHEDULES SET FORTH IN THIS M-45 SERIES IS DEFINED AS THE PERFORMANCE OF SUFFICIENT WORK TO ASSURE WITH REASONABLE CERTAINTY THAT DOE WILL ACCOMPLISH SERIES M-45 MAJOR AND INTERIM MILESTONE REQUIREMENTS.	9/30/2024

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System. (15 pages)

	DOE INTERNAL WORK SCHEDULES (E.G., DOE APPROVED SCHEDULE BASELINES) AND ASSOCIATED WORK DIRECTIVES AND AUTHORIZATIONS SHALL BE CONSISTENT WITH THE REQUIREMENTS OF THIS AGREEMENT. MODIFICATION OF DOE CONTRACTOR BASELINE(S) AND ISSUANCE OF ASSOCIATED DOE WORK DIRECTIVES AND/OR AUTHORIZATIONS THAT ARE NOT CONSISTENT WITH AGREEMENT REQUIREMENTS SHALL NOT BE FINALIZED PRIOR TO APPROVAL OF AN AGREEMENT CHANGE REQUEST SUBMITTED PURSUANT TO AGREEMENT ACTION PLAN SECTION 12.0. COMPLETION OF THIS MAJOR MILESTONE REQUIRES THE COMPLETION OF THE WORK SCOPE IN ALL PRECEEDING MILESTONES AND TARGET DATES, UNLESS OTHERWISE AGREED TO BY THE PARTIES.	
M-045-00B	COMPLETE "NEAR TERM" SST WASTE RETRIEVAL ACTIVITIES. UNTIL THE WASTE TREATMENT COMPLEX IS OPERATIONAL, THE AMOUNT OF DST SPACE AVAILABLE TO RECEIVE SST WASTE IS LIMITED. THE NEAR TERM FOCUS FOR SST WASTE RETRIEVAL WILL INCLUDE MAXIMIZING THE TRANSFER OF CONTAMINANTS OF CONCERN (LONGLIVED, MOBILE RADIONUCLIDES) INTO THE DST SYSTEM. WORK UNDER THIS MILESTONE ALSO INCLUDES COMPLETION OF ONE "LIMITS OF TECHNOLOGY" RETRIEVAL DEMONSTRATION, INITIATION OF A SECOND "LIMITS OF TECHNOLOGY" RETRIEVAL DEMONSTRATION, AND RETRIEVAL OF SUFFICIENT SST WASTE CONTAINING NO LESS THAN 800 CURIES OF CONTAMINANTS OF CONCERN AND OCCUPYING A MINIMUM OF 2 MILLION GALLONS OF DST SPACE (PER DOE BEST-BASIS INVENTORY DATA, 8/01/2000). "LIMITS OF TECHNOLOGY" RETRIEVAL DEMONSTRATIONS WILL SEEK TO IMPROVE UPON PAST PRACTICE SLUICING (PPS) BASELINE TECHNOLOGY INCLUDING BUT NOT LIMITED TO RETRIEVAL EFFICIENCY, LEAK LOSS DURING RETRIEVAL, AND LEAK DETECTION MITIGATION AND MONITORING (LDMM). PROCEDURES FOR MODIFYING THE RETRIEVAL CRITERIA LISTED WITHIN THE ASSOCIATED MILESTONES, AND FOR PROCESSING REQUESTS FOR EXCEPTIONS TO THE CRITERIA ARE OUTLINED IN A NEW APPENDIX "H" TO THE AGREEMENT.	09/30/2006

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System.
(15 pages)

M-045-00C	COMPLETE RENEGOTIATION OF SECOND PHASE (I.E., 9/30/2006 THROUGH 9/30/2015) SST WASTE RETRIEVAL ACTIVITIES. THESE NEGOTIATIONS SHALL TAKE INTO ACCOUNT VARIABLES SUCH AS WORK IN PROGRESS, E.G., DOE'S TANK WASTE TREATMENT COMPLEX ACQUISITION INITIATIVE AND ENVIRONMENTAL AND HUMAN HEALTH RISKS ASSOCIATED WITH RELEASES FROM DOE's SSTs. NEGOTIATIONS SHALL BE DESIGNED TO ESTABLISH A SUFFICIENT NUMBER OF AGREEMENT MILESTONES AND TARGET DATES TO EFFECTIVELY DRIVE EACH PHASE OF WORK INCLUDING BUT NOT LIMITED TO: 1.) WASTE RETRIEVAL TECHNOLOGY DEVELOPMENT, 2.) RETRIEVAL PERFORMANCE EVALUATIONS, 3.) LEAK DETECTION, MONITORING, AND MITIGATION, 4.) SELECTION OF SST RETRIEVAL SEQUENCE, 5.) DESIGN, CONSTRUCTION AND OPERATION OF SST WASTE RETRIEVAL SYSTEMS, AND 6.) CLOSURE PLANNING AND CLOSURE PLAN DEVELOPMENT. DOE, AND DOE's CONTRACTOR(S) WILL RETRIEVE AND TRANSFER SST WASTES INTO THE DST SYSTEM AS SOON AS SPACE IS MADE AVAILABLE, ALLOWING DST SPACE FOR TREATMENT PLANT FEED STAGING AND SAFETY ISSUE RESOLUTION. TRANSFER OF SST WASTE WILL BE MADE ONCE SUFFICIENT DST SYSTEM SPACE IS AVAILABLE TO ALLOW A TRANSFER OF AN OPERATIONALLY PRACTICABLE VOLUME OF WASTE. SST WASTE WILL BE RETRIEVED ON A PRIORITY BASIS WITH THE GOALS OF REDUCING ENVIRONMENTAL RISK AND TREATMENT PROCESS OPTIMIZATION. DOE AND ECOLOGY WILL AGREE ON THE CRITERIA TO DETERMINE ENVIRONMENTAL RISK REDUCTION. NOTE: THESE NEGOTIATIONS WILL ALSO CONSIDER THE NEED FOR ADDITIONAL COMPLIANT STORAGE SPACE.	02/28/2004
M-45-00D	COMPLETE RENEGOTIATION OF THE REMAINDER OF THE SST WASTE RETRIEVAL AND CLOSURE PROGRAM. THESE NEGOTIATIONS WILL ESTABLISH REGULATORY REQUIREMENTS FOR THE REMAINDER OF THE SST WASTE RETRIEVAL AND CLOSURE PROGRAM (THROUGH COMPLETION OF CLOSURE AT ALL SINGLE SHELL TANK FARMS). NEGOTIATIONS WILL INCLUDE MODIFICATION AS MAY BE NECESSARY OF COMPLETION DATES FOR SST WASTE RETRIEVAL AND SST FARM CLOSURE BASED ON EXPERIENCE GAINED FROM SST AND DST WASTE RETRIEVAL WORK COMPLETED, CORRECTIVE ACTIONS, PHASE I TREATMENT COMPLEX OPERATIONS, PHASE II TREATMENT PLANNING, KNOWN AND LIKELY VADOSE ZONE AND GROUNDWATER IMPACTS, AND OTHER AVAILABLE ENVIRONMENTAL IMPACT INFORMATION. DOE, AND DOE's CONTRACTOR(S) WILL RETRIEVE AND TRANSFER SST WASTES INTO THE DST SYSTEM AS SOON AS SPACE IS MADE AVAILABLE, ALLOWING DST SPACE FOR TREATMENT PLANT FEED STAGING AND SAFETY ISSUE RESOLUTION. TRANSFER OF SST WASTE WILL BE MADE ONCE SUFFICIENT DST SYSTEM SPACE IS AVAILABLE TO ALLOW A TRANSFER OF AN OPERATIONALLY PRACTICABLE VOLUME OF WASTE. SST WASTE WILL BE RETRIEVED ON A PRIORITY BASIS WITH THE GOALS OF REDUCING ENVIRONMENTAL RISK AND TREATMENT PROCESS OPTIMIZATION. DOE AND ECOLOGY WILL AGREE ON THE CRITERIA TO DETERMINE ENVIRONMENTAL RISK REDUCTION.	6/30/2011

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System. (15 pages)

M-045-02L	SUBMIT ANNUAL UPDATES TO SST RETRIEVAL SEQUENCE DOCUMENT. THIS PROVIDES FOR AN ANNUAL UPDATE OF A SST RETRIEVAL SEQUENCE DOCUMENT THAT WILL DEFINE THE TANK RETRIEVAL SEQUENCE, SELECTION CRITERIA AND, RATIONALE, REFERENCE RETRIEVAL METHOD(S) FOR EACH TANK, AND THE ESTIMATED RETRIEVAL SCHEDULES. THE RETRIEVAL SEQUENCE DOCUMENT WILL DETAIL RETRIEVAL METHODOLOGIES TO BE EMPLOYED AND ESTIMATED WASTE VOLUMES TO BE GENERATED DURING RETRIEVAL (TO BE TRANSFERRED TO THE DST's OR OTHER AVAILABLE SAFE STORAGE). THE REPORT WILL ALSO DETAIL TANK SELECTION RATIONALE BASED ON THE PRIMARY OBJECTIVE OF MAXIMIZING RISK REDUCTION THROUGH THE RETRIEVAL OF MOBILE, LONG-LIVED RADIONUCLIDES OR POTENTIAL AIRBORNE CONTAMINANTS AND PRINCIPLE NON RADIOLOGICAL HAZARDOUS CONSTITUENTS IN A MANNER WHICH IS SENSITIVE TO WASTE TREATMENT FACILITY REQUIREMENTS AND INFRASTRUCTURE CONSTRAINTS. THE SEQUENCING WILL ALSO TAKE IN CONSIDERATION DOUBLE-SHELL TANK (DST) SPACE AND DST WASTE COMPATABILITY WHEN SELECTING THE SST RETRIEVAL SEQUENCE. THE ANNUAL UPDATES WILL BE SUBMITTED TO ECOLOGY FOR APPROVAL AS AGREEMENT PRIMARY DOCUMENTS.	09/30/2003
M-045-02M	SUBMIT ANNUAL UPDATE OF SST RETRIEVAL SEQUENCE DOCUMENT. (SEE TEXT OF M-45-02L FOR FURTHER DETAILS). 09/30/2004	
M-045-02N	SUBMIT ANNUAL UPDATE OF SST RETRIEVAL SEQUENCE DOCUMENT. (SEE TEXT OF M-45-02L FOR FURTHER DETAILS). 09/30/2004	09/30/2005
M-045-02O	SUBMIT ANNUAL UPDATE OF SST RETRIEVAL SEQUENCE DOCUMENT. (SEE TEXT OF M-45-02L FOR FURTHER DETAILS).	09/30/2006
M-045-02P	SUBMIT ANNUAL UPDATE OF SST RETRIEVAL SEQUENCE DOCUMENT. (SEE TEXT OF M-45-02L FOR FURTHER DETAILS).	09/30/2007 AND ANNUALLY THEREAFTER
M-045-03C	COMPLETE FULL SCALE SALTCAKE WASTE RETRIEVAL TECHNOLOGY DEMONSTRATION AT SINGLE-SHELL TANK S-112. WASTE SHALL BE RETRIEVED TO THE DST SYSTEM TO THE LIMITS OF THE TECHNOLOGY (OR TECHNOLOGIES) SELECTED. SELECTED SALTCAKE RETRIEVAL TECHNOLOGY (OR TECHNOLOGIES) MUST SEEK TO IMPROVE UPON THE PAST-PRACTICE SLUICING BASELINE IN THE AREAS OF EXPECTED RETRIEVAL EFFICIENCY, LEAK LOSS POTENTIAL, AND SUITABILITY FOR USE IN POTENTIALLY LEAKING TANKS. THIS DEMONSTRATION SHALL ALSO INCLUDE THE INSTALLATION AND IMPLEMENTATION OF FULL SCALE LEAK DETECTION, MONITORING, AND MITIGATION (LDMM) TECHNOLOGIES. THE PARTIES RECOGNIZE AND AGREE THAT THIS ACTION IS FOR DEMONSTRATION AND INITIAL WASTE RETRIEVAL PURPOSES. COMPLETION OF THIS DEMONSTRATION SHALL BE BY WRITTEN APPROVAL OF DOE AND ECOLOGY.	09/30/2005
M-045-03D	COMPLETE S-112 SALTCAKE WASTE RETRIEVAL TECHNOLOGY DEMONSTRATION DESIGN (TO INCLUDE ALL PHYSICAL SYSTEMS INCLUDING DESIGN AND OPERATING STRATEGIES NECESSARY FOR LEAK DETECTION MONITORING AND MITIGATION (LDMM)). DESIGN WILL BE CONSIDERED COMPLETE WHEN 90% OF THE DESIGN HAS BEEN APPROVED FOR FABRICATION AND/OR CONSTRUCTION.	05/31/2003

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System. (15 pages)

M-045-03E	COMPLETE S-112 SALTCAKE WASTE RETRIEVAL TECHNOLOGY DEMONSTRATION CONSTRUCTION (TO INCLUDE ALL PHYSICAL SYSTEMS INCLUDING THOSE NECESSARY FOR LEAK DETECTION MONITORING AND MITIGATION). CONSTRUCTION WILL BE CONSIDERED COMPLETE WHEN ALL PROCESS EQUIPMENT IS INSTALLED AND ACCEPTANCE TESTS ARE COMPLETED.	09/30/2004
M-045-03F	COMPLETE FULL SCALE SLUDGE/HARD HEEL, CONFINED SLUICING AND ROBOTIC TECHNOLOGIES, WASTE RETRIEVAL DEMONSTRATION AT TANK C-104. WASTE SHALL BE RETRIEVED TO THE DST SYSTEM TO THE LIMITS OF THE TECHNOLOGY (OR TECHNOLOGIES) SELECTED. SELECTED SLUDGE/HARD HEEL TECHNOLOGY (OR TECHNOLOGIES) MUST SEEK TO IMPROVE UPON THE PAST-PRACTICE SLUICING BASELINE IN THE AREAS OF EXPECTED RETRIEVAL EFFICIENCY, LEAK LOSS POTENTIAL, AND SUITABILITY FOR USE IN POTENTIALLY LEAKING TANKS. CONFINED SLUICING IS DEFINED AS THE LOCALIZED ADDITION AND RETRIEVAL OF LIQUIDS AND WASTE. THIS DEMONSTRATION SHALL ALSO INCLUDE THE INSTALLATION AND IMPLEMENTATION OF FULL SCALE LEAK DETECTION, MONITORING, AND MITIGATION (LDMM) TECHNOLOGIES. THE PARTIES RECOGNIZE AND AGREE THAT THIS ACTION IS FOR DEMONSTRATION AND INITIAL WASTE RETRIEVAL PURPOSES. COMPLETION OF THIS DEMONSTRATION SHALL BE BY APPROVAL OF DOE AND ECOLOGY. GOALS OF THIS DEMONSTRATION SHALL INCLUDE THE RETRIEVAL TO SAFE STORAGE OF APPROXIMATELY 89 KG OF PLUTONIUM WHICH REPRESENTS APPROXIMATELY 17% OF THE TOTAL PLUTONIUM INVENTORY WITHIN THE SST SYSTEM), AND 99% OF TANK CONTENTS BY VOLUME (PER DOE'S BEST-BASIS INVENTORY DATA OF 8/01/2000).	09/30/2007
M-045-03G	COMPLETE C-104 SLUDGE/HARD HEEL, CONFINED SLUICING AND ROBOTIC TECHNOLOGIES, WASTE RETRIEVAL COLD DEMONSTRATION. THIS FULL SCALE DEMONSTRATION WILL BE SUFFICIENT TO SUPPORT FINAL DESIGN AND TESTING OF ALL EQUIPMENT, INCLUDING THE LDMM APPROACH USED IN THE ACTUAL SYSTEM. THE DEMONSTRATION MUST ESTABLISH THE PERFORMANCE OF THE EQUIPMENT SPECIFIED IN THE FUNCTIONS AND REQUIREMENTS DOCUMENT. A LETTER REPORT WILL BE SUBMITTED TO ECOLOGY TO DOCUMENT THE RESULTS OF THE COLD DEMONSTRATION.	06/30/2004
M-045-03H	COMPLETE C-104 SLUDGE/HARD HEEL, CONFINED SLUICING AND ROBOTIC TECHNOLOGIES, WASTE RETRIEVAL DEMONSTRATION DESIGN (TO INCLUDE ALL PHYSICAL SYSTEMS INCLUDING DESIGN AND OPERATING STRATEGIES NECESSARY FOR LEAK DETECTION MONITORING AND MITIGATION (LDMM)). DESIGN WILL BE CONSIDERED COMPLETE WHEN 90% OF THE DESIGN HAS BEEN APPROVED FOR FABRICATION AND/OR CONSTRUCTION.	09/30/2004
M-045-03I	COMPLETE C-104 SLUDGE/HARD HEEL, CONFINED SLUICING AND ROBOTIC TECHNOLOGIES, WASTE RETRIEVAL DEMONSTRATION CONSTRUCTION (TO INCLUDE ALL PHYSICAL SYSTEMS INCLUDING THOSE NECESSARY FOR LEAK DETECTION MONITORING AND MITIGATION). CONSTRUCTION WILL BE CONSIDERED COMPLETE WHEN ALL PROCESS EQUIPMENT IS INSTALLED AND ACCEPTANCE TESTS ARE COMPLETED.	09/30/2006

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System.
(15 pages)

M-045-05	RETRIEVE WASTE FROM ALL REMAINING SINGLE-SHELL TANKS. COMPLETE WASTE RETRIEVAL FROM ALL REMAINING SINGLE-SHELL TANKS. RETRIEVAL STANDARDS AND COMPLETION DEFINITIONS ARE PROVIDED UNDER THE MAJOR MILESTONE. THE SCHEDULE REFLECTS RETRIEVAL ACTIVITIES ON A FARM-BY-FARM BASIS. IT ALSO ALLOWS FLEXIBILITY TO RETRIEVE TANKS FROM VARIOUS FARMS IF DESIRED TO SUPPORT SAFETY ISSUE RESOLUTION, PRETREATMENT OR DISPOSAL FEED REQUIREMENTS, OR OTHER PRIORITIES.	09/30/2018
M-045-05-T05	INITIATE TANK RETRIEVAL FROM FIVE ADDITIONAL SINGLE-SHELL TANKS.	09/30/2007
M-045-05-T06	INITIATE TANK RETRIEVAL FROM FIVE ADDITIONAL SINGLE-SHELL TANKS.	09/30/2008
M-045-05-T07	INITIATE TANK RETRIEVAL FROM SEVEN ADDITIONAL SINGLE-SHELL TANKS.	09/30/2009
M-045-05-T08	INITIATE TANK RETRIEVAL FROM EIGHT ADDITIONAL SINGLE-SHELL TANKS.	09/30/2010
M-045-05-T09	INITIATE TANK RETRIEVAL FROM TEN ADDITIONAL SINGLE-SHELL TANKS.	09/30/2011
M-045-05-T10	INITIATE TANK RETRIEVAL FROM 12 ADDITIONAL SINGLE-SHELL TANKS.	09/30/2012
M-045-05-T11	INITIATE TANK RETRIEVAL FROM 14 ADDITIONAL SINGLE-SHELL TANKS.	09/30/2013
M-045-05-T12	INITIATE TANK RETRIEVAL FROM 17 ADDITIONAL SINGLE-SHELL TANKS.	09/30/2014
M-045-05-T13	INITIATE TANK RETRIEVAL FROM 20 ADDITIONAL SINGLE-SHELL TANKS.	09/30/2015
M-045-05-T14	INITIATE TANK RETRIEVAL FROM 20 ADDITIONAL SINGLE-SHELL TANKS.	09/30/2016
M-045-05-T15	INITIATE TANK RETRIEVAL FROM 20 ADDITIONAL SINGLE-SHELL TANKS.	09/30/2017

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System. (15 pages)

M-45-05-T17	SUBMIT S-105, S-106, AND S-103 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION FUNCTIONS AND REQUIREMENTS DOCUMENT. THIS DOCUMENT WILL ESTABLISH DEMONSTRATION SYSTEM SPECIFICATIONS (INCLUDING LDMM SYSTEM SPECIFICATIONS) AND WILL ALSO INCLUDE A SCOPING LEVEL RETRIEVAL PERFORMANCE EVALUATION (RPE) FOR EACH TANK. THE FUNCTIONS AND REQUIREMENTS DOCUMENT AND ITS ASSOCIATED RPE SHALL ALSO PROVIDE, AS A SEPARATE EVALUATION FOR EACH OF THE THREE TANKS, ENVIRONMENTAL AND HUMAN HEALTH RISK EVALUATION DATA/INFORMATION ASSOCIATED WITH ESTIMATED WASTE VOLUMES TO BE RETRIEVED, THE MAXIMUM VOLUME WHICH COULD LEAK DURING RETRIEVAL, AND RISK FROM RESIDUAL WASTE. THIS DOCUMENT WILL DETAIL KNOWN AND ESTIMATED RADIONUCLIDE CONTAMINATION AND CONTAMINANT MIGRATION WITHIN THE VADOSE ZONE AS BASES OF CALCULATION. LDMM AND RPE DOCUMENTATION PROVIDED WILL BE ADEQUATE TO ALLOW ECOLOGY TO ASSESS THE ADEQUACY OF THE DEMONSTRATION SYSTEMS. THIS DOCUMENT WILL INCORPORATE LESSONS LEARNED, INCLUDING LDMM, RETRIEVAL, INSTRUMENTATION, AND OPERATIONAL EXPERIENCE FROM PREVIOUS DOE AND INDUSTRY RELATED RETRIEVAL PROJECTS. THE RETRIEVAL FUNCTIONS AND REQUIREMENTS DOCUMENT WILL DOCUMENT ALL PERTINENT RETRIEVAL AND CLOSURE REQUIREMENTS, E.G., THOSE SPECIFIC TO THE EXTENT OF RETRIEVAL NECESSARY TO ALLOW CLOSURE. DOE WILL SUBMIT ITS LDMM STRATEGY AS PART OF THE FUNCTIONS AND REQUIREMENTS DOCUMENT, PRIOR TO INITIATION OF DESIGN. THIS DOCUMENT WILL BE SUBMITTED FOR ECOLOGY APPROVAL AS AN AGREEMENT PRIMARY DOCUMENT. THIS FUNCTIONS AND REQUIREMENTS DOCUMENT WILL BE SUBMITTED IN A TIMELY FASHION SO THAT PROJECT CRITICAL PATH IS NOT AFFECTED, AND SO AS TO ALLOW ADEQUATE TIME FOR DOE AND ECOLOGY REVIEW, REVISION, AND APPROVAL.	4/30/2005
M-045-05A	COMPLETE INITIAL WASTE RETRIEVAL FROM TANK S-102. THE S-102 INITIAL WASTE RETRIEVAL TECHNOLOGY (OR TECHNOLOGIES) WILL BE SELECTED BASED ON THE PRINCIPLE CRITERIA OF MAXIMIZING THE RETRIEVAL OF MOBILE, LONG-LIVED RADIOISOTOPES AND NON-RADIOLOGICAL HAZARDOUS CONSTITUENTS. THE PARTIES RECOGNIZE AND AGREE THAT THIS ACTION IS FOR INITIAL WASTE RETRIEVAL PURPOSES. COMPLETION OF THIS INITIAL RETRIEVAL SHALL BE BY APPROVAL OF DOE AND ECOLOGY. GOALS OF THIS INITIAL WASTE RETRIEVAL PROJECT SHALL INCLUDE THE RETRIEVAL TO SAFE STORAGE OF APPROXIMATELY 490 CURIES OF MOBILE, LONG-LIVED RADIOISOTOPES AND 99% OF TANK CONTENTS BY VOLUME (PER DOE BEST-BASIS INVENTORY DATA, 8/01/2000). COMPLETION OF S-102 INITIAL WASTE RETRIEVAL IS SUBJECT TO SAFE STORAGE SPACE AVAILABILITY CONSISTENT WITH M-45-00B.	09/30/2006
M-045-05B	COMPLETE S-102 INITIAL RETRIEVAL PROJECT DESIGN (TO INCLUDE ALL PHYSICAL SYSTEMS INCLUDING DESIGN AND OPERATING STRATEGIES NECESSARY FOR LEAK DETECTION MONITORING AND MITIGATION (LDMM). THE DESIGN WILL BE CONSIDERED COMPLETE WHEN 90% OF THE DESIGN HAS BEEN APPROVED FOR FABRICATION AND/OR CONSTRUCTION.	03/31/2004

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System.
(15 pages)

M-045-05C	COMPLETE S-102 INITIAL WASTE RETRIEVAL PROJECT CONSTRUCTION (TO INCLUDE ALL PHYSICAL SYSTEMS INCLUDING THOSE NECESSARY FOR LEAK DETECTION MONITORING AND MITIGATION). CONSTRUCTION WILL BE CONSIDERED COMPLETE WHEN ALL PROCESS EQUIPMENT IS INSTALLED AND ACCEPTANCE TESTS ARE COMPLETED.	11/30/2005
M-45-05E	COMPLETE S-105, S-106, AND S-103 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT DESIGN (TO INCLUDE ALL PHYSICAL SYSTEMS INCLUDING DESIGN AND OPERATING STRATEGIES NECESSARY FOR LEAK DETECTION MONITORING AND MITIGATION (LDMM) FOR EACH TANK). THE DESIGN WILL BE CONSIDERED COMPLETE WHEN 90% OF THE DESIGN HAS BEEN APPROVED FOR FABRICATION AND/OR CONSTRUCTION.	6/30/2007
M-45-05F	COMPLETE S-105, S-106, AND S-103 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT CONSTRUCTION (TO INCLUDE ALL PHYSICAL SYSTEMS INCLUDING THOSE NECESSARY FOR LEAK DETECTION MONITORING AND MITIGATION). CONSTRUCTION WILL BE CONSIDERED COMPLETE WHEN ALL PROCESS EQUIPMENT IS INSTALLED AND ACCEPTANCE TESTS ARE COMPLETED.	9/30/2008
M-45-05G-T01	COMPLETE S-105, S-106, AND S-103 WASTE RETRIEVAL. WASTE SHALL BE RETRIEVED TO THE DST SYSTEM TO THE LIMITS OF THE TECHNOLOGY (OR TECHNOLOGIES) SELECTED. RETRIEVAL SHALL RETRIEVE AS MUCH WASTE AS TECHNICALLY POSSIBLE, WITH A REMAINING RESIDUAL OF NO MORE THAN 360 CUBIC FEET (CU. FT.).	10/31/2009
M-45-05H	INTERIM COMPLETION OF TANK C-106 SST WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT. THE C-106 SST WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT WILL BE CONSIDERED INTERIM COMPLETE WHEN THE FOLLOWING CRITERIA HAVE BEEN MET: 1. FULL SCALE WASTE RETRIEVAL HAS BEEN COMPLETED IN ACCORDANCE WITH APPLICABLE REGULATORY REQUIREMENTS INCLUDING WASHINGTON'S HAZARDOUS WASTE MANAGEMENT ACT AND REQUIREMENTS SET BY THIS AGREEMENT (DOE WILL DOCUMENT PROJECT DATA AND RESULTS IN A WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT REPORT). 2. REMAINING WASTES HAVE BEEN ADEQUATELY CHARACTERIZED, AND A RISK ASSESSMENT, APPROVED BY ECOLOGY, HAS BEEN COMPLETED FOR RESIDUALS THAT REMAIN IN THE TANK. 3. THE C-106 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN HAS BEEN SUBMITTED BY DOE AND APPROVED BY ECOLOGY, I.E., INCORPORATED INTO THE SITE-WIDE PERMIT. 4. IF APPROPRIATE, DOE HAS REQUESTED, AND ECOLOGY HAS APPROVED, AN EXCEPTION TO WASTE RETRIEVAL CRITERIA PURSUANT TO AGREEMENT APPENDIX H.	4/30/2004
M-45-05J-T01	COMPLETE C-106 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT DESIGN (TO INCLUDE ALL PHYSICAL SYSTEMS INCLUDING DESIGN AND OPERATING STRATEGIES NECESSARY FOR LEAK DETECTION MONITORING AND MITIGATION (LDMM)). THE DESIGN WILL BE CONSIDERED COMPLETE WHEN 90% OF THE DESIGN HAS BEEN APPROVED FOR FABRICATION AND/OR CONSTRUCTION.	4/30/2003

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System. (15 pages)

M-45-05K-T01	COMPLETE C-106 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT CONSTRUCTION (TO INCLUDE ALL PHYSICAL SYSTEMS INCLUDING THOSE NECESSARY FOR LEAK DETECTION MONITORING AND MITIGATION). CONSTRUCTION WILL BE CONSIDERED COMPLETE WHEN ALL EQUIPMENT IS INSTALLED AND ACCEPTANCE TESTS ARE COMPLETED.	9/30/2003
M-45-05L-T01	COMPLETE FULL SCALE C-106 WASTE RETRIEVAL. WASTE SHALL BE RETRIEVED TO THE DST SYSTEM TO THE LIMITS OF THE TECHNOLOGY (OR TECHNOLOGIES) SELECTED. RETRIEVAL SHALL RETRIEVE AS MUCH WASTE AS TECHNICALLY POSSIBLE, WITH A REMAINING RESIDUAL OF NO MORE THAN 360 CUBIC FEET (CU. FT.).	11/1/2003
M-45-05M-T01	SUBMIT C-106 WASTE RETRIEVAL RESULTS, ANALYSIS OF RESIDUAL WASTE(S), AND (IF APPROPRIATE) REQUEST FOR EXCEPTION TO THE CRITERIA PURSUANT TO AGREEMENT APPENDIX H.	2/27/2004
M-45-05N-T01	FINAL COMPLETION OF TANK C-106 SST RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT. COMPLETION OF THE TANK C-106 RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT IS DEFINED AS THE COMPLETION OF NECESSARY FIELD PROJECT ACTIONS REQUIRED BY THE APPROVED C-106 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN.	12/31/2004
M-45-06	COMPLETE CLOSURE OF ALL SINGLE-SHELL TANK FARMS IN ACCORDANCE WITH APPROVED CLOSURE/POST CLOSURE PLAN(S).	9/30/2024
M-45-06-T03	INITIATE CLOSURE ACTIONS ON AN OPERABLE UNIT OR TANK FARM BASIS. CLOSURE SHALL FOLLOW COMPLETION OF THE RETRIEVAL ACTIONS UNDER PROPOSED MILESTONE M-45-05. CLOSURE WILL BE DEFINED IN AN APPROVED CLOSURE PLAN FOR THE DEMONSTRATION FARM. FINAL CLOSURE IS DEFINED AS REGULATORY APPROVAL OF COMPLETION OF CLOSURE ACTIONS.	3/31/2012
M-45-06-T04	COMPLETE CLOSURE ACTIONS ON ONE OPERABLE UNIT OR TANK FARM.	3/31/2014
M-45-06-T20A	SUBMIT SST SYSTEM IMPLEMENTATION PLAN IN SUPPORT OF RETRIEVAL AND CLOSURE ACTIVITIES. MAJOR WORK AREAS COVERED IN THE IMPLEMENTATION PLAN WILL INCLUDE WASTE RETRIEVAL OPERABLE UNITS CHARACTERIZATION, TECHNOLOGIES DEVELOPMENT TO SUPPORT CLOSURE, RISK ASSESSMENTS, AND GROUNDWATER MONITORING STRATEGIES. (REFINEMENT OF THE MAJOR WORK AREAS WILL BE DEVELOPED IN A JOINT ECOLOGY/DOE WORKSHOP.) DOE’s SST SYSTEM IMPLEMENTATION PLAN UPDATE WILL BE SUBMITTED TO ECOLOGY AS A PRIMARY DOCUMENT.	6/30/2004
M-45-06-T20B	SUBMIT SST SYSTEM IMPLEMENTATION PLAN IN SUPPORT OF RETRIEVAL AND CLOSURE ACTIVITIES. MAJOR WORK AREAS COVERED IN THE IMPLEMENTATION PLAN WILL INCLUDE WASTE RETRIEVAL OPERABLE UNITS CHARACTERIZATION, TECHNOLOGIES DEVELOPMENT TO SUPPORT CLOSURE, RISK ASSESSMENTS, AND GROUNDWATER MONITORING STRATEGIES. (REFINEMENT OF THE MAJOR WORK AREAS WILL BE DEVELOPED IN A JOINT ECOLOGY/DOE WORKSHOP.) DOE’s SST SYSTEM IMPLEMENTATION PLAN UPDATE WILL BE SUBMITTED TO ECOLOGY AS A PRIMARY DOCUMENT.	6/30/2006

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System.
(15 pages)

M-45-06-T20C	SUBMIT SST SYSTEM IMPLEMENTATION PLAN IN SUPPORT OF RETRIEVAL AND CLOSURE ACTIVITIES. MAJOR WORK AREAS COVERED IN THE IMPLEMENTATION PLAN WILL INCLUDE WASTE RETRIEVAL OPERABLE UNITS CHARACTERIZATION, TECHNOLOGIES DEVELOPMENT TO SUPPORT CLOSURE, RISK ASSESSMENTS, AND GROUNDWATER MONITORING STRATEGIES. (REFINEMENT OF THE MAJOR WORK AREAS WILL BE DEVELOPED IN A JOINT ECOLOGY/DOE WORKSHOP.) DOE's SST SYSTEM IMPLEMENTATION PLAN UPDATE WILL BE SUBMITTED TO ECOLOGY AS A PRIMARY DOCUMENT.	6/30/2008 (AND EVERY 2 YEARS THEREAFTER)
M-45-06A	SUBMIT A CERTIFIED (FRAMEWORK) SST SYSTEM CLOSURE PLAN AND C-106 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN, AS AN APPLICATION FOR A MODIFICATION TO THE HANFORD SITE-WIDE HAZARDOUS WASTE FACILITY PERMIT TO ECOLOGY. THIS SUBMITTAL WILL INCLUDE ALL REQUIRED CLOSURE PLAN ELEMENTS. ADDITIONALLY, THIS SUBMITTAL WILL INCLUDE THE FOLLOWING: 1. CHARACTERIZATION APPROACH FOR RESIDUAL WASTES. THIS APPROACH WILL SUPPORT DECISIONS REGARDING THE COMPLIANCE OF THE RESIDUAL WASTE WITH APPLICABLE REGULATORY REQUIREMENTS (INCLUDING BUT NOT LIMITED TO: CHARACTERIZATION NEEDS, WORK REQUIREMENTS, WORK SCHEDULES, AND CONTAMINANTS OF CONCERN FOR; RISK ASSESSMENT, LAND DISPOSAL RESTRICTION (LDR), AND THE WASHINGTON STATE HAZARDOUS WASTE MANAGEMENT ACT). 2. A RISK ASSESSMENT METHODOLOGY INCLUSIVE OF THE ASSUMPTIONS, APPROACH, CONCEPTUAL MODEL, AND METRICS (E.G., POINT OF COMPLIANCE, RECEPTOR SCENARIOS). THE CHARACTERIZATION REQUIREMENTS AND RISK ASSESSMENT METHODOLOGY WILL BE JOINTLY DEVELOPED BY DOE AND ECOLOGY PRIOR TO THE SUBMITTAL.	12/19/2002
M-45-06B	SUBMIT A CERTIFIED (FRAMEWORK) SST SYSTEM CLOSURE PLAN MODIFICATION AND S-112 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN, AS AN APPLICATION FOR A MODIFICATION TO THE HANFORD SITE-WIDE HAZARDOUS WASTE FACILITY PERMIT TO ECOLOGY. THIS SUBMITTAL WILL INCLUDE ALL REQUIRED CLOSURE PLAN ELEMENTS. ADDITIONALLY, THIS SUBMITTAL WILL INCLUDE THE FOLLOWING: 1. CHARACTERIZATION APPROACH FOR RESIDUAL WASTES. THIS APPROACH WILL SUPPORT DECISIONS REGARDING THE COMPLIANCE OF THE RESIDUAL WASTE WITH APPLICABLE REGULATORY REQUIREMENTS (INCLUDING BUT NOT LIMITED TO: CHARACTERIZATION NEEDS, WORK REQUIREMENTS, WORK SCHEDULES, AND CONTAMINANTS OF CONCERN FOR; RISK ASSESSMENT, LAND DISPOSAL RESTRICTION (LDR), AND THE WASHINGTON STATE HAZARDOUS WASTE MANAGEMENT ACT). 2. A RISK ASSESSMENT METHODOLOGY INCLUSIVE OF THE ASSUMPTIONS, APPROACH, CONCEPTUAL MODEL, AND METRICS (E.G., POINT OF COMPLIANCE, RECEPTOR SCENARIOS). THE CHARACTERIZATION REQUIREMENTS AND RISK ASSESSMENT METHODOLOGY WILL BE JOINTLY DEVELOPED BY DOE AND ECOLOGY PRIOR TO THE SUBMITTAL.	3/31/2005

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System. (15 pages)

M-45-06C	SUBMIT A CERTIFIED (FRAMEWORK) SST SYSTEM CLOSURE PLAN MODIFICATION AND S-102 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN, AS AN APPLICATION FOR A MODIFICATION TO THE HANFORD SITE-WIDE HAZARDOUS WASTE FACILITY PERMIT TO ECOLOGY. THIS SUBMITTAL WILL INCLUDE ALL REQUIRED CLOSURE PLAN ELEMENTS. ADDITIONALLY, THIS SUBMITTAL WILL INCLUDE THE FOLLOWING: 1. CHARACTERIZATION APPROACH FOR RESIDUAL WASTES. THIS APPROACH WILL SUPPORT DECISIONS REGARDING THE COMPLIANCE OF THE RESIDUAL WASTE WITH APPLICABLE REGULATORY REQUIREMENTS (INCLUDING BUT NOT LIMITED TO: CHARACTERIZATION NEEDS, WORK REQUIREMENTS, WORK SCHEDULES, AND CONTAMINANTS OF CONCERN FOR; RISK ASSESSMENT, LAND DISPOSAL RESTRICTION (LDR), AND THE WASHINGTON STATE HAZARDOUS WASTE MANAGEMENT ACT). 2. A RISK ASSESSMENT METHODOLOGY INCLUSIVE OF THE ASSUMPTIONS, APPROACH, CONCEPTUAL MODEL, AND METRICS (E.G., PONIT OF COMPLIANCE, RECEPTOR SCENERIOS). THE CHARACTERIZATION REQUIREMENTS AND RISK ASSESSMENT METHODOLOGY WILL BE JOINTLY DEVELOPED BY DOE AND ECOLOGY PRIOR TO THE SUBMITTAL.	3/31/2006
M-45-06D	SUBMIT A CERTIFIED (FRAMEWORK) SST SYSTEM CLOSURE PLAN MODIFICATION AND C-104 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN, AS AN APPLICATION FOR A MODIFICATION TO THE HANFORD SITE-WIDE HAZARDOUS WASTE FACILITY PERMIT TO ECOLOGY. THIS SUBMITTAL WILL INCLUDE ALL REQUIRED CLOSURE PLAN ELEMENTS. ADDITIONALLY, THIS SUBMITTAL WILL INCLUDE THE FOLLOWING: 1. CHARACTERIZATION APPROACH FOR RESIDUAL WASTES. THIS APPROACH WILL SUPPORT DECISIONS REGARDING THE COMPLIANCE OF THE RESIDUAL WASTE WITH APPLICABLE REGULATORY REQUIREMENTS (INCLUDING BUT NOT LIMITED TO: CHARACTERIZATION NEEDS, WORK REQUIREMENTS, WORK SCHEDULES, AND CONTAMINANTS OF CONCERN FOR; RISK ASSESSMENT, LAND DISPOSAL RESTRICTION (LDR), AND THE WASHINGTON STATE HAZARDOUS WASTE MANAGEMENT ACT). 2. A RISK ASSESSMENT METHODOLOGY INCLUSIVE OF THE ASSUMPTIONS, APPROACH, CONCEPTUAL MODEL, AND METRICS (E.G., POINT OF COMPLIANCE, RECEPTOR SCENARIOS). THE CHARACTERIZATION REQUIREMENTS AND RISK ASSESSMENT METHODOLOGY WILL BE JOINTLY DEVELOPED BY DOE AND ECOLOGY PRIOR TO THE SUBMITTAL.	6/30/2007

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System. (15 pages)

M-45-06E	SUBMIT A CERTIFIED (FRAMEWORK) SST SYSTEM CLOSURE PLAN MODIFICATION FOR TANKS S-105, S-106, AND S-103 CLOSURE DEMONSTRATION PLAN, AS AN APPLICATION FOR A MODIFICATION TO THE HANFORD SITE-WIDE HAZARDOUS WASTE FACILITY PERMIT TO ECOLOGY. THIS SUBMITTAL WILL INCLUDE ALL REQUIRED CLOSURE PLAN ELEMENTS, AND PROVIDE A SEPARATE STAND ALONE EVALUATION FOR EACH TANK. ADDITIONALLY, THIS SUBMITTAL WILL INCLUDE THE FOLLOWING: 1. CHARACTERIZATION APPROACH FOR RESIDUAL WASTES IN S-105, S-106, AND S-103. THIS APPROACH WILL SUPPORT DECISIONS REGARDING THE COMPLIANCE OF THE RESIDUAL WASTE WITH APPLICABLE REGULATORY REQUIREMENTS (INCLUDING BUT NOT LIMITED TO: CHARACTERIZATION NEEDS, WORK REQUIREMENTS, WORK SCHEDULES, AND CONTAMINANTS OF CONCERN FOR; RISK ASSESSMENT, LAND DISPOSAL RESTRICTION (LDR), AND THE WASHINGTON STATE HAZARDOUS WASTE MANAGEMENT ACT). 2. A RISK ASSESSMENT METHODOLOGY FOR TANKS S-105, S-106, AND S-103, INCLUSIVE OF THE ASSUMPTIONS, APPROACH, CONCEPTUAL MODEL, AND METRICS (E.G., POINT OF COMPLIANCE, RECEPTOR SCENARIOS). THE CHARACTERIZATION REQUIREMENTS AND RISK ASSESSMENT METHODOLOGY WILL BE JOINTLY DEVELOPED BY DOE AND ECOLOGY PRIOR TO THE SUBMITTAL.	12/31/2008
M-45-13	INTERIM COMPLETION OF TANK S-112 SST WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT. THE S-112 SST WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT WILL BE CONSIDERED INTERIM COMPLETE WHEN THE FOLLOWING CRITERIA HAVE BEEN MET: 1. FULL SCALE WASTE RETRIEVAL HAS BEEN COMPLETED IN ACCORDANCE WITH APPLICABLE REGULATORY REQUIREMENTS INCLUDING WASHINGTON'S HAZARDOUS WASTE MANAGEMENT ACT, REQUIREMENTS SET BY THIS AGREEMENT, AND THE APPROVED S-112 SALTCAKE WASTE RETRIEVAL TECHNOLOGY FUNCTIONS AND REQUIREMENTS DOCUMENT (DOE WILL DOCUMENT PROJECT DATA AND RESULTS IN A WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT REPORT). 2. REMAINING WASTES HAVE BEEN ADEQUATELY CHARACTERIZED, AND A RISK ASSESSMENT, APPROVED BY ECOLOGY, HAS BEEN COMPLETED FOR RESIDUALS THAT REMAIN IN THE TANK. 3. THE S-112 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN HAS BEEN SUBMITTED BY DOE AND APPROVED BY ECOLOGY, I.E., INCORPORATED INTO THE SITE-WIDE PERMIT. 4. IF APPROPRIATE, DOE HAS REQUESTED, AND ECOLOGY HAS APPROVED AN EXCEPTION TO WASTE RETRIEVAL CRITERIA PURSUANT TO AGREEMENT APPENDIX H.	6/30/2006
M-45-13-T01	FINAL COMPLETION OF TANK S-112 SST RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT. COMPLETION OF THE TANK S-112 RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT IS DEFINED AS THE COMPLETION OF NECESSARY FIELD PROJECT ACTIONS REQUIRED BY THE APPROVED S-112 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN.	6/30/2007

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System.
(15 pages)

M-45-14	INTERIM COMPLETION OF TANK C-104 SST WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT. THE C-104 SST WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT WILL BE CONSIDERED INTERIM COMPLETE WHEN THE FOLLOWING CRITERIA HAVE BEEN MET: 1. FULL SCALE WASTE RETRIEVAL HAS BEEN COMPLETED IN ACCORDANCE WITH APPLICABLE REGULATORY REQUIREMENTS INCLUDING WASHINGTON'S HAZARDOUS WASTE MANAGEMENT ACT, REQUIREMENTS SET BY THIS AGREEMENT, AND THE APPROVED C-104 SLUDGE/HARD HEEL, CONTAINED SLUICING AND ROBOTIC TECHNOLOGIES WASTE RETRIEVAL FUNCTIONS AND REQUIREMENTS DOCUMENT (DOE WILL DOCUMENT PROJECT DATA AND RESULTS IN A WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT REPORT). 2. REMAINING WASTES HAVE BEEN ADEQUATELY CHARACTERIZED, AND A RISK ASSESSMENT, APPROVED BY ECOLOGY, HAS BEEN COMPLETED FOR RESIDUALS THAT REMAIN IN THE TANK. 3. THE C-104 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN HAS BEEN SUBMITTED BY DOE AND APPROVED BY ECOLOGY, I.E., INCORPORATED INTO THE SITE-WIDE PERMIT. 4. IF APPROPRIATE, DOE HAS REQUESTED, AND ECOLOGY HAS APPROVED AN EXCEPTION TO WASTE RETRIEVAL CRITERIA PURSUANT TO AGREEMENT APPENDIX H.	6/30/2008
M-45-14-T01	FINAL COMPLETION OF TANK C-104 SST RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT. COMPLETION OF THE TANK C-104 RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT IS DEFINED AS THE COMPLETION OF NECESSARY FIELD PROJECT ACTIONS REQUIRED BY THE APPROVED C-104 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN.	6/3/2009

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System. (15 pages)

M-45-15	INTERIM COMPLETION OF TANK S-102 SST WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT. THE S-102 SST WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT WILL BE CONSIDERED INTERIM COMPLETE WHEN THE FOLLOWING CRITERIA HAVE BEEN MET: 1. FULL SCALE WASTE RETRIEVAL HAS BEEN COMPLETED IN ACCORDANCE WITH APPLICABLE REGULATORY REQUIREMENTS INCLUDING WASHINGTON'S HAZARDOUS WASTE MANAGEMENT ACT, REQUIREMENTS SET BY THIS AGREEMENT, AND THE APPROVED S-102 INITIAL WASTE RETRIEVAL FUNCTIONS AND REQUIREMENTS DOCUMENT (DOE WILL DOCUMENT PROJECT DATA AND RESULTS IN A WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT REPORT). 2. REMAINING WASTES HAVE BEEN ADEQUATELY CHARACTERIZED, AND A RISK ASSESSMENT, APPROVED BY ECOLOGY, HAS BEEN COMPLETED FOR RESIDUALS THAT REMAIN IN THE TANK. 3. THE S-102 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN HAS BEEN SUBMITTED BY DOE AND APPROVED BY ECOLOGY, I.E., INCORPORATED INTO THE SITE-WIDE PERMIT. 4. IF APPROPRIATE, DOE HAS REQUESTED, AND ECOLOGY HAS APPROVED AN EXCEPTION TO WASTE RETRIEVAL CRITERIA PURSUANT TO AGREEMENT APPENDIX H.	6/30/2007
M-45-15-T01	FINAL COMPLETION OF TANK S-102 SST RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT. COMPLETION OF THE TANK S-102 RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT IS DEFINED AS THE COMPLETION OF NECESSARY FIELD PROJECT ACTIONS REQUIRED BY THE APPROVED S-102 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN.	6/30/2008

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System.
(15 pages)

M-45-16	INTERIM COMPLETION OF TANK S-105, S-106, AND S-103 SST WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT. THE S-105, S-106, AND S-103 SST WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT WILL BE CONSIDERED INTERIM COMPLETE WHEN THE FOLLOWING CRITERIA HAVE BEEN MET AND DOCUMENTED FOR EACH OF THE TANKS: 1. FULL SCALE WASTE RETRIEVAL HAS BEEN COMPLETED IN ACCORDANCE WITH APPLICABLE REGULATORY REQUIREMENTS INCLUDING WASHINGTON'S HAZARDOUS WASTE MANAGEMENT ACT, REQUIREMENTS SET BY THIS AGREEMENT, AND THE APPROVED S-105, S-106, AND S-103 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION FUNCTIONS AND REQUIREMENTS DOCUMENT (DOE WILL DOCUMENT PROJECT DATA AND RESULTS IN A WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT REPORT). 2. REMAINING WASTES HAVE BEEN ADEQUATELY CHARACTERIZED, AND A RISK ASSESSMENT, APPROVED BY ECOLOGY, HAS BEEN COMPLETED FOR RESIDUALS THAT REMAIN IN THE TANK. 3. THE S-105, S-106, AND S-103 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN HAS BEEN SUBMITTED BY DOE AND APPROVED BY ECOLOGY, I.E., INCORPORATED INTO THE SITE-WIDE PERMIT. 4. IF APPROPRIATE, DOE HAS REQUESTED, AND ECOLOGY HAS APPROVED, AN EXCEPTION TO WASTE RETRIEVAL CRITERIA PURSUANT TO AGREEMENT APPENDIX H. A REQUEST MAY BE MADE FOR EACH AND/OR ALL TANKS.	7/31/2010
M-45-16-T01	FINAL COMPLETION OF TANK S-105, S-106, AND S-103 SST RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT. COMPLETION OF THE TANK S-105, S-106, AND S-103 RETRIEVAL AND CLOSURE DEMONSTRATION PROJECT IS DEFINED AS THE COMPLETION OF NECESSARY FIELD PROJECT ACTIONS REQUIRED BY THE APPROVED S-105, S-106, AND S-103 WASTE RETRIEVAL AND CLOSURE DEMONSTRATION PLAN.	7/31/2011
M-045-55	SUBMIT TO ECOLOGY FOR REVIEW AND APPROVAL AS AN AGREEMENT PRIMARY DOCUMENT A PHASE 1 RFI REPORT INTEGRATING RESULTS OF DATA GATHERING ACTIVITIES AND EVALUATIONS FOR WMAS S-SX, T, TX-TY, AND B-BX-BY, AND RELATED ACTIVITIES, INCLUDING GROUNDWATER MONITORING AND IMPACTS ASSESSMENT USING HANFORD SITE GROUNDWATER MODELS, WITH CONCLUSIONS AND RECOMMENDATIONS.	02/28/2004
M-045-55-T03	SUBMIT TO ECOLOGY FOR REVIEW AND COMMENT AS AN AGREEMENT SECONDARY DOCUMENT A FIELD INVESTIGATION REPORT PURSUANT TO THE SITE-SPECIFIC SST WMA PHASE 1 RFI/CMS WORK PLAN ADDENDA FOR WMA T AND WMA TX-TY.	01/31/2005

Table 6-1. HFFACO Milestones[a] Associated with Closure of the SST System.
(15 pages)

M-045-56	COMPLETE IMPLEMENTATION OF AGREED-TO INTERIM MEASURES. SPECIFIC INTERIM MEASURES WILL BE IMPLEMENTED PURSUANT TO AGREEMENT COMMITMENTS (E.G., SEE INTERIM MILESTONE M-45-57). INTERIM MEASURES MAY ALSO BE REQUIRED BY ECOLOGY, PROPOSED BY DOE IN THE SST WMA RFI REPORT (M-45-55) (OR ENGINEERING STUDIES INCLUDING THAT ADDRESSED IN TARGET MILESTONE M-45-56-T01), OR ESTABLISHED BY AGREEMENT OF THE PARTIES AT ANY TIME DURING THE CORRECTIVE ACTION PROCESS. ALSO SEE TABLE 1 OF AGREEMENT CHANGE CONTROL FORM #M-45-98-03. ECOLOGY AND DOE AGREE, AT A MINIMUM, TO MEET YEARLY (BY JULY OR AS NEEDED TO SUPPORT ANNUAL BUDGETING) FOR THE SPECIFIC PURPOSE OF ASSESSING THE ADEQUACY OF INFORMATION, AND THE NEED FOR THE ESTABLISHMENT OF ADDITIONAL AGREEMENT INTERIM MEASURES. ADDITIONAL AGREEMENT INTERIM MEASURES SHALL BE DOCUMENTED THROUGH ESTABLISHMENT OF INTERIM MILESTONES AND ASSOCIATED TARGET DATES AS AGREED NECESSARY BY THE PARTIES.	To Be Determined
M-045-58	SUBMIT TO ECOLOGY FOR REVIEW AND APPROVAL AS AN AGREEMENT PRIMARY DOCUMENT A CORRECTIVE MEASURES STUDY FOR INTERIM CORRECTIVE MEASURES (PENDING RESULTS AND CONCLUSIONS IN THE PHASE 1 RFI REPORT-MILESTONE M-45-55 OR SUBSEQUENT RFI REPORTS).	To Be Determined
M-045-59	CONTROL SURFACE WATER INFILTRATION PATHWAYS AS NEEDED TO CONTROL OR SIGNIFICANTLY REDUCE THE LIKELIHOOD OF MIGRATION OF SUBSURFACE CONTAMINATION TO GROUNDWATER AT THE SST WMAS (PENDING THE CMS REPORT, MILESTONE M-45-58, AND IMPLEMENTATION OF OTHER INTERIM CORRECTIVE MEASURES. DECISIONS ON CONTROLLING SURFACE WATER INFILTRATION PATHWAYS WILL BE MADE BY EVALUATING THE ROLE OF SURFACE WATER INFILTRATION AND THE TRANSPORT OF SUBSURFACE CONTAMINATION TO GROUNDWATER. BASED ON THE CORRECTIVE MEASURES STUDY (M-45- 58) INTERIM SURFACE BARRIERS AND/OR OTHER INFILTRATION CONTROLS MAY BE REQUIRED.	To Be Determined
M-045-60	SUBMIT TO ECOLOGY FOR REVIEW AND APPROVAL AS AN AGREEMENT PRIMARY DOCUMENT DOE'S RFI/CMS WORK PLAN FOR SST WMAS. THIS RFI/CMS WORK PLAN SHALL DOCUMENT THE ADDITIONAL INTERIM MEASURES AND FURTHER INVESTIGATIONS NEEDED FOR DECISIONS ON RETRIEVAL, CLOSURE, AND CORRECTIVE MEASURES FOR THE SST WMAS.	SIX MONTHS FOLLOWING RFI REPORT APPROVAL

[a] Appendix D to the HFFACO Action Plan

7.0 CERTIFICATION OF CLOSURE, SURVEY PLAT, AND NOTICE IN DEED

After DOE completes closure activities at each WMA included in the SST system closure, DOE will submit to Ecology, by registered mail, a certification that the WMA has been closed according to the specifications in the approved WMA closure action plan. The certification will be signed by DOE and an independent registered Professional Engineer registered in the State of Washington (WAC 173-303-610(6)). Not later than the date of submission of the certification of closure of the WMA, DOE will provide a survey plat to Benton County indicating the location and dimensions of the closed dangerous waste units with respect to permanently surveyed benchmarks. The survey plat will be prepared and certified by a Professional Land Surveyor. After final closure, the survey plat of the WMA will be submitted to Benton County and Ecology (WAC 173-303-610(9-10). Closure certification will also be conducted at the SST system level.

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8.0 POSTCLOSURE PLAN

Postclosure care is required for TSD units after closure if waste has been left in place. Following completion of waste retrieval, completion of tank and ancillary equipment stabilization activities, and construction of a surface barrier, each WMA will enter a postclosure care period during which surface barrier inspection, barrier maintenance and performance monitoring, administrative controls, and groundwater monitoring will be implemented. These activities may be integrated with the Hanford Site long-term stewardship program and Central Plateau closure strategies.

Postclosure will be performed on a WMA-by-WMA basis. Each postclosure plan will be incorporated into Chapter VI of the Site-Wide Permit through a permit modification. DOE will submit a postclosure plan for the entire SST system to take effect after final system closure actions are complete to comply with the postclosure requirements in WAC 173-303-610(7), -610(8), -610(9), -610(10), and -665(6)(b).

Appropriate measures will be implemented upon closure of each component within a WMA to protect both the integrity of the component closure prior to installation of the engineered surface barrier, and to protect human health and the environment from exposure.

8.1 INSTITUTIONAL CONTROLS

Following completion of final closure activities and construction of a surface barrier, DOE will place each WMA in a period of administrative control during which monitoring and maintenance activities will take place.

As noted, DOE anticipates that components of the SST system may require land disposal. Landfill closure standards require that institutional controls be in place to protect human health and the environment. Institutional controls generally include all non-engineered restrictions on activities, access, or exposure to land, groundwater, surface water, waste, and waste disposal areas or media. Institutional controls may be temporary or permanent restrictions or requirements. The main institutional control types include 1) access controls, 2) land and groundwater controls, 3) performance assessment and reporting of controls, and 4) permanent markers and distributed records that pass on information regarding the nature and location of hazards to future generations.

DOE will develop specific institutional controls as a part of each closure plan and integrate these controls with similar institutional controls for the Hanford Site and other 200 Area waste sites. Specific information regarding marking, signs, and/or monuments has not been developed to date for SST WMAs. DOE has authorized programs to develop a site-wide institutional controls plan to provide for the implementation and maintenance of institutional controls including the placing of marking, signs, and/or monuments at the Hanford Site to protect human health and the environment. DOE will specifically integrate the planning, development, and implementation of institutional controls for SST system closure with appropriate elements of the site-wide institutional controls plan.

8.2 GROUNDWATER MONITORING

During the time from the closure of the first component of a WMA through final closure of that entire WMA, groundwater monitoring will continue according to the approved groundwater monitoring plan for that WMA, which is described in its WMA closure action plan. After this period, groundwater monitoring requirements may be redefined relative to the 200 East Area and 200 Area West SST system boundaries or to the entire SST system.

8.3 INSPECTION AND MAINTENANCE

An inspection schedule is required as part of postclosure care of land disposal units (WAC 173-303-610(7)) including tanks that are land disposed, if any (WAC 173-303-665(6)). An inspection schedule will be developed for postclosure of each closed component prior to final closure of each WMA and then for each WMA and the SST system after their respective final closures. Activities will include inspecting engineered surface barriers after final closure. Surface barrier inspections will monitor vegetation conditions, signs of intrusion, and run-on/run-off control. Maintenance will be performed if problems are discovered during inspections.

8.4 CERTIFICATION OF POSTCLOSURE PERFORMANCE

No later than 60 days after completion of the established postclosure care period for each WMA and the entire SST system, DOE will submit by registered mail a certification that the postclosure period for the WMA (or the SST system, as appropriate) was performed according to the specifications in the approved postclosure plan. The certification will be signed by DOE and an independent Registered Professional Engineer.

9.0 REFERENCES

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10 CFR 835, "Occupational Radiation Protection," *Code of Federal Regulations*, as amended.

40 CFR 61, "National Emission Standards for Hazardous Air Pollutants," *Code of Federal Regulations*, as amended.

40 CFR 144, "Underground Injection Control," *Code of Federal Regulations*, as amended.

40 CFR 191, "Environmental Radiation Protection Standards for Management and Disposal of Spent Nuclear Fuel, High-level, and Transuranic Radioactive Wastes.", *Code of Federal Regulations,* as amended.

40 CFR 265, Subpart F, "Interim Status Standards for Owners and Operators of Hazardous Waste Treatment, Storage, and Disposal Facilities: Groundwater Monitoring," *Code of Federal Regulations*, as amended.

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