Accelerated Tank Closure Demonstrations at the Hanford Site

Terry L. Sams, Mark J. Riess, Jerry W. Cammann
CH2M HILL Hanford Group, Inc.
P.O. Box 1500, 2440 Stevens Center Place, Richland, WA 99352

Timothy A. Lee
CH2M HILL Hanford, Inc.
3190 George Washington Way, Richland, WA 99352

David Nichols
Columbia Energy & Environmental Services, Inc.
1207 George Washington Way, Suite 22, Richland, WA 99352

ABSTRACT

Among the highest priorities for action under the *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1989a), hereafter referred to as the Tri-Party Agreement, is the retrieval, treatment and disposal of Hanford Site tank waste. Tank waste is recognized as one of the primary threats to the Columbia River and one of the most complex technical challenges. Progress has been made in resolving safety issues, characterizing tank waste and past tank leaks, enhancing double-shell tank waste transfer and operations systems, retrieving single-shell tank waste, deploying waste treatment facilities, and planning for the disposal of immobilized waste product. However, limited progress has been made in developing technologies and providing a sound technical basis for tank system closure. To address this limitation the Accelerated Tank Closure Demonstration Project was created to develop information through technology demonstrations in support of waste retrieval and closure decisions. To complete its mission the Accelerated Tank Closure Demonstration Project has adopted performance objectives that include:

- Protecting human health and the environment
- Minimizing/eliminating potential waste releases to the soil and groundwater
- Preventing water infiltration into the tank
- Maintaining accessibility of surrounding tanks for future closure
- Maintaining tank structural integrity
- Complying with applicable waste retrieval, disposal, and closure regulations
- Maintaining flexibility for final closure options in the future.

This paper provides an overview of the Hanford Site tank waste mission with emphasis on the Accelerated Tank Closure Demonstration Project. Included are discussions of single-shell tank waste retrieval and closure challenges, progress made to date, lessons learned, regulatory approach, data acquisition, near-term retrieval opportunities, schedule, and cost.

INTRODUCTION

In February 2002, the U.S. Department of Energy (DOE) Environmental Management Program released the findings of a comprehensive "Top-To-Bottom Review" outlining key improvement objectives across the DOE complex. The primary objective included a fundamental realignment of Environmental Management Program scope to focus on accelerated risk-based cleanup and closure.

At the Hanford Site, the mission of the U.S. Department of Energy (DOE) Office of River Protection (ORP) River Protection Project (RPP) is to retrieve and treat tank waste and close the tank farms to protect the Columbia River. The Single-Shell Tank (SST) Project mission is to retrieve waste from SSTs and prepare the SST farms for closure in a safe, regulatory compliant and economical manner. In 2002, ORP established the Accelerated Tank Closure Demonstration (ATCD) Project in response to DOE Environmental Management Program objectives and to support the SST Project mission by developing information through technology demonstrations required to support tank waste retrieval and tank closure decisions.

The ATCD Project will apply systems engineering principles to assessment of existing data; characterization of waste; and conduct laboratory studies, cold testing, and hot deployment of engineering options for critical aspects of tank closure. The following are some of the potential technology demonstration and deployment opportunities being evaluated by the ATCD Project:

- In-tank characterization of residual waste.
- Ex-tank characterization of contaminated soil.
- Isolation of the tank from ancillary equipment to prevent liquids from entering the tank.
- Stabilization and immobilization of residual waste.

SST RETRIEVAL AND CLOSURE CHALLENGES

For much of the 1990's the focus of the RPP (formally known as the Tank Waste Remediation System) was on resolving safety issues, characterizing waste, and developing waste treatment capacity. In the late 1990's the signatories of the Tri-Party Agreement (DOE, Ecology, and EPA) concurred that tank waste characterization should shift its focus from safety issue resolution to characterization in support of waste retrieval and treatment.

As the 1990's progressed, DOE acknowledged that much work was needed to (1) demonstrate SST waste retrieval systems; (2) develop technologies to detect, monitor, and mitigate potential retrieval leak losses; and (3) establish the technical basis for closure of tank systems. DOE and Ecology recognized the interrelationship of these aspects of the RPP mission and the need for

DOE to resolve important technical and regulatory issues associated with each. As a result, the following major activities occurred:

- In 1994, the Tri-Party Agreement M-45 Series of milestones were adopted which established:
  - A sequence for SST waste retrieval to support completion of SST waste retrieval by 2018 and closure of all SST farms by 2024.
  - A goal for extent of retrieval required on a tank-by-tank basis to a level of not more 360 cubic feet for large SSTs (100-Series) and 36 cubic feet for smaller SSTs (200-Series).
  - A methodology for determining if the extent of retrieval attained on a tank-by-tank basis was sufficient to support ceasing waste retrieval activities and proceeding with tank closure actions.
  - A requirement to demonstrate alternative retrieval technologies as a means of determining the adequacy of available technologies to meet the retrieval goals and a process for attaining a waiver when an alternative retrieval goal was appropriate on a tank-by-tank basis.
  - A requirement to evaluate leak detection, monitoring, and mitigation technologies and strategies and establish leak loss limits on a tank-by-tank basis.
  - A requirement to prepare a closure plan under the Hazardous Waste Management Act (HWMA) that would be approved in 2006 to support a closure demonstration project in 2012 to 2014.
  - An agreement among the agencies that:
    - Closure decisions would be made under the HWMA.
    - The closure unit would include the entire tank systems (i.e., soils, ancillary equipment, and tanks) within a tank farm or a group of tank farms.
    - When evaluating closure options for SSTs, the regulators will consider cost, technical practicability, and potential exposure to radiation, as well as compliance with applicable regulations.
- In 1996, DOE and Ecology determined (DOE/EIS-0189) that technical uncertainties needed to be resolved before tank farm closure decisions could be made in the following areas:
  - SST waste retrieval effectiveness in meeting the Tri-Party Agreement retrieval goal.

- Past tank leaks and spills and the potential for leak losses during retrieval and/or closure actions.

- Closure technology performance, including surface and subsurface barriers, residual waste immobilization or isolation, and remediation of ancillary equipment and contaminated soils.

- In the associated Record of Decision (62 FR 8693) DOE committed to collect information to reduce technical uncertainty associated with waste retrieval and support future closure decisions.

- In 1996, a Memorandum of Understanding (MOU, 1996) between DOE and Ecology recognized that uncertainties existed with implementing the M-45 milestones relative to:

  - Performance limits of retrieval technologies and removal of residual waste that potentially would not be removed by bulk retrieval technologies.

  - Characterization of residual waste volumes and inventories.

  - Process for establishing tank-by-tank retrieval leak loss limits.

  - Relationship of end-state requirements (i.e., closure performance measures) with retrieval and leak loss requirements.

- In response to the MOU, DOE initiated the Hanford Tanks Initiative. This project operated through 1999 addressing uncertainties identified in the MOU. In 1999, DOE published *Retrieval Performance Evaluation Methodology for the AX Tank Farm* (DOE/RL-98-72) and completed technology evaluation activities under the Hanford Tanks Initiative which determined that:

  - The method established in 1994 to assess the extent of waste retrieval requirements was technically and programmatically feasible to use to make decisions on a tank-by-tank basis.

  - Technologies could be made available to support removal of residual wastes and/or characterization of residual waste in SSTs.

  - Uncertainties in the inventory of tank and ancillary equipment waste and past tank waste leaks required resolution before making final retrieval and closure decisions.

  - A basis for determining the extent of waste retrieval and leak loss limits existed; however, both required additional technology development to provide enhanced understanding of the relationship across the life-cycle of the project.

Presently, retrieval under the Tri-Party Agreement for tank C-106 is scheduled for completion in 2004 and three more tanks are scheduled to complete waste retrieval by 2007 (tanks C-104, S-112, and S-102). Following completion of the technology demonstration phase of the retrieval project four retrieval technologies will have been tested and may be available to support the remaining 145 SST retrieval actions. This pace will challenge RPP systems including:

- DST waste management in support of SST waste retrieval and waste feed delivery to the Waste Treatment Plant.
- Execution of multiple major projects simultaneously.
- Aged physical systems within and among SST and DST farms.

In addition to the challenges posed by waste retrieval from SSTs, from 2014 to 2024 ORP is required to close 12 SST farms – an average of 1 farm closure per year. Completing tank system closure will need to be closely linked to SST waste retrieval. Acceleration of waste treatment and mission completion could complicate the challenge of SST waste retrieval and closure. Under some scenarios up to 140 tanks could be considered for closure by as early as 2018.

To ensure cost effective management of the SST Project in the decade ahead, it is important for DOE to fully understand its functions and requirements for all aspects (i.e., waste retrieval and closure) of the SST Project and to develop laboratory, cold test, and hot test data on waste retrieval and closure technologies planned for deployment in the tank farms early in the mission schedule. This approach to SST waste retrieval and tank system closure is needed to ensure the SST Project is executed based on the following:

- Understanding what is technically possible.
- Protecting human health and the environment.
- Complying with applicable regulations.
- Cost effectively managing tax dollars.

SST SYSTEM PROGRESS TO DATE

In 1999, in response to groundwater monitoring data that indicated past tank releases and spills had migrated to groundwater beneath certain tank farms, DOE and Ecology issued Change Package M-45-98-03 which established:

- Integration of groundwater and vadose zone corrective actions at 8 of 12 SST farms.
- A series of milestones for completion of field investigation reports (FIR) and corrective measures studies (CMS) in tank farms where past tank waste leaks are known or suspected to have already impacted groundwater quality (the tank farms include S, SX, B, BY, BX, T, TX, TY).

- Interim measures required in response to past SST leaks.

- A schedule for field investigations, a basis for corrective measure decisions, and an understanding of the relationship between corrective action investigations, SST waste retrieval, and SST system closure decisions.

The ORP Vadose Zone Characterization Project has completed FIRs in five of the eight tank farms and will complete field studies of the remaining three farms on schedule. The project has also completed interim corrective actions including sealing off unused and/or leaking water lines in all SST farms, implemented run-on and run-off control measures, and sealed unused or deficient drywells. The project is evaluating the feasibility and potential benefits of interim barriers over SST farms to mitigate migration of past tank leaks to groundwater. The project has focused considerable resources on collection and reporting of all available data on past tank leaks and spills, including completion of high-resolution spectral gamma logging of all SST farm drywells.

In 2000, ORP retrieved waste from tank C-106 using hydrologic sluicing to attain a residual waste volume of approximately 6,000 gallons of solids and approximately 20,000 to 40,000 gallons of liquids following deactivation of the retrieval system. The tank C-106 waste retrieval effort provided valuable information regarding design, construction, operation, cost, and schedule for hydraulic sluicing retrieval systems especially within a sound SST with a predominantly sludge waste form.

In 2000, the approval of Tri-Party Agreement Change Request M-45-98-03 modified the schedule for SST waste retrieval project to:

- Meet waste treatment project feed delivery requirements.

- Demonstrate effectiveness of additional low liquid volume retrieval technologies.

- Maximize reduction in risk to the public.

- Establish a technically sound basis for selection of retrieval technologies to be deployed throughout the life-cycle of the retrieval project.

- Integrate leak detection, monitoring, and mitigation with retrieval technology deployment to ensure effective technology deployments.

- Integration of tank system closure planning with retrieval project milestones.

Based on the 2000 agreement ORP has:

- Initiated design and deployment of three alternative waste retrieval demonstration projects to test and deploy in-tank retrieval systems.

- Brought into service a full-scale, cold test facility to allow testing of promising technologies in a non-radiological environment.

- Initiated testing of possible ex-tank leak detection systems to augment available in-tank detection systems.

- Completed a Closure Work Plan (DOE/ORP-2001-18) that identifies the steps that will be taken to move from waste storage to tank system closure:

  - In accordance with the HWMA and Tri-Party Agreement commitments.
  - In a manner that resolves specific data needs in support of interim and final tank system closure decisions.

Several waste retrieval activities are underway to test performance of low-liquid volume retrieval systems. The Waste Management 2003 Symposia paper entitled, "Retrieval of Hanford's Single-Shell Nuclear Waste Tanks Using Technologies Foreign and Domestic," (J. A. Eacker, W. T. Thompson, and P. W. Gibbons) presents a detailed discussion of retrieval technology demonstrations planned and underway at the Hanford Site.

ORP is also evaluating options for accelerating retrieval technology deployments and to schedule waste removal from additional SSTs on an accelerated schedule. These options will be considered within the context of available DST space, progress in completing and the performance of waste treatment capacity, and maximizing reduction of human health risk while supporting waste feed delivery and considering the constraints of tank waste transfer systems.

WASTE RETRIEVAL AND TANK CLOSURE LESSONS LEARNED

In addition to advances made in the past few years in data collection needed to support SST waste retrieval and SST system closure decisions, DOE has learned valuable lessons directly applicable to moving forward with retrieval and closure activities. These lessons have been learned from projects conducted within the tank farms, at other Hanford waste sites, and at other DOE sites with tank waste retrieval and closure challenges.

Lessons Learned from Interim Stabilization/Isolation, Tank C-106 Retrieval, and Waste Treatment Plant Projects indicate that tank waste retrieval projects are technically complex, span a long period of time, and require compliance with multiple approval authorities. As such, tank waste retrieval projects can benefit from:

- Cost-effective technology deployments based on an appropriate foundation of laboratory, cold, and hot testing before full-scale deployment.

- Application of a systems engineering approach to project management that establishes agreed to functions and requirements early in the project to minimize rework and redirection throughout the life-cycle of the project.

- A "learn-as-you-go" approach that places a bias on action, reducing technical uncertainty while maximizing the value of data collected in the early stages of the project to resolve issues.

Lessons learned from other DOE sites have been incorporated into Hanford's tactical and strategic planning. These include tank waste retrieval and closure actions at the Savannah River Site, Oak Ridge National Laboratory, and West Valley Demonstration Project. Each of these sites have deployed retrieval and closure technologies in underground storage tanks containing mixed waste. Much has been learned regarding the implementability, performance, and cost of technologies that may be feasible to deploy at Hanford. Additionally, each site has provided insight into important federal and state regulatory approval processes (e.g., *Atomic Energy Act of 1954*, *National Environmental Policy Act of 1969* [NEPA], *Resource Conservation and Recovery Act of 1976* [RCRA], *Comprehensive Environmental Response, Compensation, and Liability Act of 1980* [CERCLA]). However, the lessons learned from each site must be considered in light of the differences between retrieving and closing tanks at Hanford compared to the other DOE sites. Among these differences are:

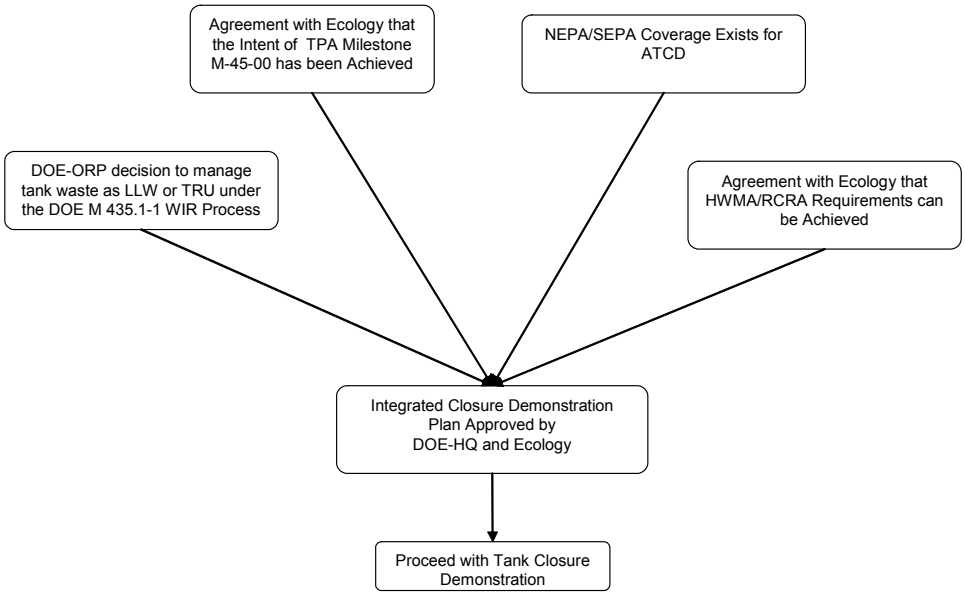
- Specific requirements and agreements with EPA and Ecology regarding the application of RCRA and CERCLA were required due to the unique characteristics of the:
    - Tank farm system.
    - Waste stored in the systems
    - Past releases to the environment.
    - Physical environment.

The lessons learned from ORP, Hanford Site, and other DOE sites are an integral basis for the ATCD Project technical and regulatory approach as described in the following pages.

ATCD PROJECT REGULATORY APPROACH

Closure demonstration activities will establish and demonstrate the technical, regulatory, and administrative aspects of retrieval and closure and provide important data needed to support future actions (e.g., tank system closure decisions under NEPA, the *Atomic Energy Act of 1954*, HWMA, and the Tri-Party Agreement). The demonstration activities will not constitute final closure of a tank system. Compliance with applicable regulations is required. The regulatory approach, shown in the diagram below, has been identified for each of the key regulatory drivers controlling tank waste retrieval and closure technology demonstrations.

The diagram illustrates the multiple regulatory approvals required before ORP proceeds with field deployment of closure technology demonstrations. In all, seven separate approvals are required before ORP can deploy a closure technology demonstration within a tank. Regulatory approvals will be made by ORP, DOE-Headquarters, Ecology, the Washington State Department of Health, and EPA. The logic for the ATCD Project is consistent with the current planning basis for closure of tanks under both DOE Order 435.1 and HWMA. This approach is comparable to the regulatory processes being followed for closure of tanks at the Savannah River Site, West Valley Demonstration Project, and Idaho National Engineering and Environmental Laboratory.



It is understood that the majority of the Hanford tanks do not meet the regulatory requirements that would permit the reuse or unrestricted use of the tanks or tank farms or that would satisfy the waste volumes specified as an interim retrieval goal under the Tri-Party Agreement. Therefore, ORP will need to retrieve additional waste, and/or demonstrate that when the tanks are retrieved and closed (under DOE Order 435.1 and the HWMA) that residual wastes remaining in the tanks (and in surrounding soils and ancillary equipment) will not pose an unacceptable risk to human health and the environment. The current planning baseline for SST system closure would result in a low-level waste disposal facility under DOE Orders and a RCRA landfill under the HWMA (DOE/ORP-2001-18). The following information summarizes the current approach to addressing applicable regulatory processes.

Tri-Party Agreement

Tri-Party Agreement Milestone M-45-00 requires that residual waste in tanks following completion of retrieval operations not exceed 360 cubic feet in 100-Series tanks, 30 cubic feet in 200-Series tanks, or to the limit of the technologies capabilities, whichever is less. Following initial waste retrieval efforts, if the residual volumes exceed these requirements, then the Tri-Party Agreement Appendix H process may be invoked to determine if additional retrieval is required. Request for exemption from additional waste retrieval must be submitted within 120 days following a determination by DOE that:

- Further waste retrieval is not technically possible.
- Unretrieved residual waste, if disposed of in place, would meet closure requirements as defined in the HWMA Closure Plan and in compliance with WAC 173-303-610 considering cost, radiation exposure, and technical practicality.

Ecology then has 60 days to review and approve the requested exemption or specify what, if any, additional waste retrieval is required for the tank. The technical analyses performed to support the waiver request are designed to support both a decision on the need for additional waste retrieval from an SST and the preparation, if necessary, of a request for a waiver from additional retrieval for an SST. The approach to support a decision is to provide an understanding of the technical feasibility, cost, and human health risk associated with performing additional tank waste retrieval. The Appendix H process also requires consultation with the U.S. Nuclear Regulatory Commission regarding the analysis supporting near-surface disposal of waste incidental to reprocessing (WIR).

Hazardous Waste Management Act

ORP must submit a closure plan for incorporation into the Hanford Site-wide Permit to Ecology under the HWMA that meets the site-wide permit provision prior to initiating closure actions on tanks. The plan contains elements of necessary detail to allow Ecology to determine whether the closure performance standards of WAC 173-303-610 will be achieved for tanks to be closed. These elements include:

- Assessment of risk to human health and the environment.
- Description of closure actions and strategies based on a conceptual design (e.g., how the tank will be decontaminated, stabilized, placement of fill material, isolation actions, interim cap design).
- Interim post-closure monitoring and maintenance activities (until final closure of a tank farm or waste management area).

The closure plan will form the basis for a request to modify the Hanford Site-wide Permit. Experience indicates that a permit modification can take from 24 to 72 months. However, opportunities exist to accelerate the process based on recent experience with modification of the permit to incorporate the Waste Treatment Plant.

Radioactive Air Emissions

The Washington State Department of Health has regulatory authority, through the Radiation Air Emissions Program (WAC 246-247), over radioactive airborne emissions from the Hanford Site; including tank farms. Any activities undertaken by the ATCD Project that could increase radioactive airborne emissions must first be approved by the Washington State Department of Health.

National Environmental Policy Act/State Environmental Policy Act

Appropriate NEPA analysis will be prepared to evaluate whether the accelerated closure activity is bounded under the tank farms environmental impact statement (EIS). The closure demonstrations may be within the bounds of previous NEPA analysis. This position has merit in that the actions likely to occur would be undertaken only if they can be demonstrated to be protective of human health and the environment and that they will not restrict the availability of

reasonable alternatives for consideration in a tank closure supplemental EIS or EIS. The ATCD actions would be "interim" actions pending final tank farm closure decisions.

The State Environmental Policy Act (SEPA), the state equivalent of NEPA, requires an evaluation of environmental impacts before making permitting decisions under the HWMA. A SEPA Checklist will be prepared identifying potential impacts of proposed closure activities. Ecology will make a determination if the closure demonstration activity is of significant impact or may delay this determination until later in the tank system closure schedule. If Ecology determines that the proposed action is significant, Ecology may require an EIS or mitigation measures. If the determination by Ecology is that the actions are not significant, no further SEPA review is required and a determination of non-significance can be issued. Ecology may adopt NEPA documentation as being sufficient to support decisions under SEPA.

DOE Order 435.1

A closure plan and associated performance assessments are required to close a tank under DOE Order 435.1. DOE-Headquarters must approve the closure plan before entering the construction phase of a final tank closure. Since the likely pathway for the initial closure demonstrations is an interim action pending final closure of the tank farm, ORP and DOE-Headquarters could develop a basis for the closure plan that would allow for the acceleration of the ATCD Project development and approval process.

An issue of concern is the ability to meet the DOE Order 435.1 WIR requirements. The WIR requirements were established by DOE to address near-surface disposal of separated and immobilized waste (e.g., low-activity immobilized waste from the Waste Treatment Plant) or residual waste in tanks following completion of waste retrieval and residual waste stabilization and isolation. The ATCD Project plan must show that:

- Key radionuclides have been removed to the maximum extent technically or economically practicable.
- The requirements of 10 CFR 61 Subpart C are met.
- Residual wastes meet either the U.S. Nuclear Regulatory Commission Class C limits for low-level waste or alternative requirements.

Although the requirements of DOE M 435.1-1 for tank closure are being implemented at the Hanford Site, DOE has been sued on the DOE M 435.1-1 WIR evaluation determination process. A complaint filed with the U.S. District Court for the District of Idaho (Case No. 01-CV-413 [BLW]) states that the *"incidental waste exemption created under DOE Order 435.1, which reclassifies high-level radioactive waste as low-level radioactive waste according to criteria solely with DOE's discretion, circumvents the extensive congressionally mandated processes for the disposal of high-level radioactive waste."* In the event the Court's forthcoming decision invalidates DOE's use of the WIR process, the ATCD Project schedule will be jeopardized.

ATCD PROJECT DATA ACQUISITION

The critical first step in the ATCD Project is an assessment of available data. A data assessment report will be prepared to compile and assess existing, available technical data, including prior closure engineering studies, and available tank waste and contaminated soil characterization data. Elements of the tank farm system that will be addressed include materials for residual waste stabilization and tank fill, ancillary tank farm equipment, contaminated soil treatment, and surface barriers. Results of prior engineering studies that evaluated and compared alternatives for each of these elements will be summarized.

Much of the data needed to support retrieval and closure decisions can be attained through engineering studies, laboratory and cold testing, and based on lessons learned from similar projects. However, some data can only be developed in a manner that provides confidence through in-tank technology deployments. Specifically, deployments of in-tank technologies are needed to adequately characterize tank and residual waste, develop performance data for retrieval systems, and test the effectiveness of technologies and methods for stabilizing and immobilizing residual waste.

Inventories and concentrations of contaminants in residual waste remaining in tanks and in tank farm soil will be evaluated. This may involve sampling and analysis prior to, during, or following waste retrieval. The data quality objectives (DQO) process will be used as a basis for development of sampling and analysis plans, and conducting sampling and analysis of tank waste to improve the existing baseline for waste inventory projections. Following establishment of final closure criteria, DQOs may be refined, and sampling and analysis plans updated to identify additional waste characterization data needs and sampling approaches.

Based on available data, identified data needs, retrieval and closure requirements, and performance measures, approaches for evaluating and comparing alternative closure technologies will be identified. An alternatives generation analysis will be conducted to identify technologies for in-tank deployment. This alternatives generation analysis will assess technology options based on the ability to comply with applicable requirements and performance measures defined in State and Federal regulations, and cost and exposure to radiation (including worker exposure) which is required under the Tri-Party Agreement.

A Level 2 Specification (RPP-11094) for the ATCD Project has been prepared based on the results of the alternatives generation analysis and closure plan. These will serve as the basis for the preliminary engineering for the ATCD Project. The preliminary design effort may also identify data needs for final design (e.g., materials testing and development).

Before proceeding with detailed engineering, a design activities regulatory approval will be attained. Following approval by external regulators and DOE, detailed engineering and design of closure technology demonstration activities will be completed. The ATCD Project will be managed in accordance with CH2M HILL Hanford Group, Inc. (CH2M HILL) procedures for Minor Projects Volume 13, Section 1.4 (HNF-IP-0842). This includes implementation of systems engineering principles defined in the CH2M HILL Systems Engineering Management

Plan (RPP-MP-618). Design reviews will be conducted in accordance with CH2M HILL procedures Volume 4, Section 4.24 (HNF-IP-0842).

Based on the approved plans, permits, and detailed design closure technology demonstration activities scheduled for deployment in tank farms would be constructed and completed. Following completion of the permitted closure demonstration activities, performance data (e.g., cost, effectiveness in meeting performance objectives, etc.) would be collected and reported regarding each of the demonstration activities to support future closure decisions.

The data needed to determine if a proposal for remediation of a waste site is sufficient to allow the plans to move forward are common among the primary regulatory drivers controlling tank waste retrieval and tank system closure (e.g., NEPA/SEPA, HWMA, DOE Order 435.1, and Tri-Party Agreement). The ATCD Project will target data collection and analysis needed for regulatory decision documents including the following:

- Understanding of waste volume and characteristics.
- Understanding of the physical system and environment.
- Engineering options for waste retrieval and in-place treatment and/or isolation.
- Risk to workers and the public during retrieval and closure activities and risks to post-closure future site users and environmental quality.

In June 2002, ORP submitted a Closure Work Plan (DOE/ORP-2001-18, Rev. 0) in compliance with Tri-Party Agreement Milestone M-45-06-T05. This work plan identified 27 issues that required resolution prior to submittal of a Closure Plan in support of the closure of a tank system under the Tri-Party Agreement. Approximately one-third of the issues were associated with resolution of regulatory uncertainties while the remaining issues were linked to technical challenges that will be addressed through data collection, technology demonstrations, and regulatory documentation under the ATCD Project.

Tank retrieval and tank system closure for all the 149 SSTs and 12 SST farms will follow the decisions, agreements, and lessons learned from the retrieval and closure data collected during waste retrieval and tank closure demonstrations performed under the ATCD Project.

ATCD PROJECT NEAR-TERM RETRIEVAL OPPORTUNITIES

The most promising tank for retrieval and closure demonstration is tank C-106. Tank C-106 was previously retrieved using hydraulic sluicing and has an estimate residual waste volume of approximately 6,000 gallons of sludge and 20,000 to 40,000 gallons of liquids. Deployment of residual waste retrieval technologies, completion of closure technology deployments, and development of regulatory approval documents could be completed on a schedule to support development of a tank system closure NEPA document in 2006. Other tanks within the C farm

pose additional opportunities for closure technology demonstrations due to their low volume of residual waste. These tanks include the smaller 200-Series tanks (4 tanks with 55,000 gallon capacity each).

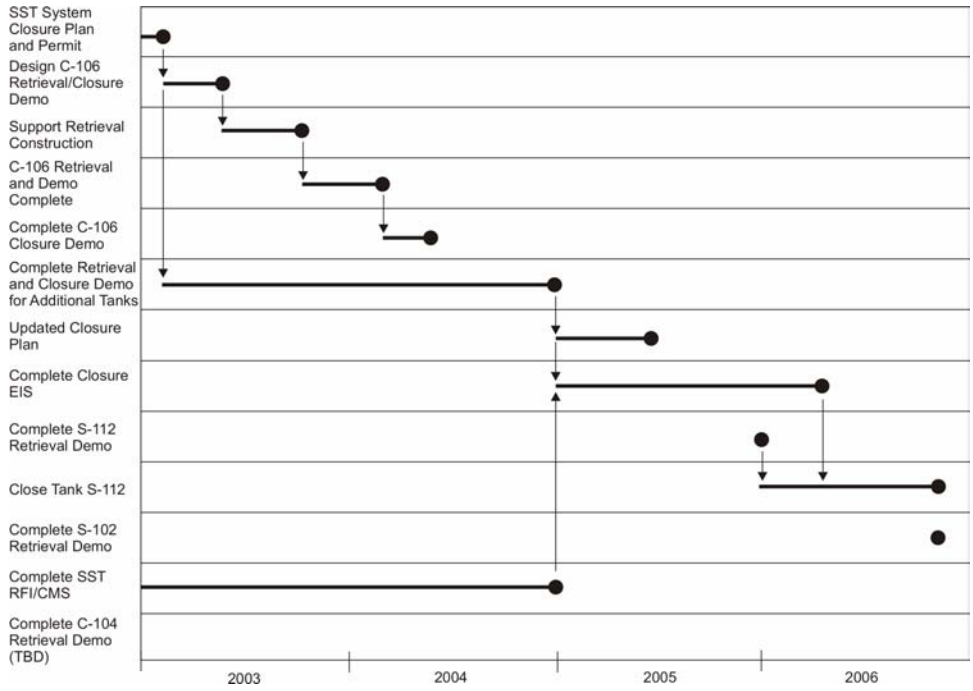
The four 200-Series tanks contain an average of 2,000 gallons of residual waste per tank. The total waste volume (excluding liquids in tank C-106) with tank C-106 and the four 200-series tanks represents less than ~14,000 gallons of the more than 35 million gallons presently stored in SSTs (0.004% of the SST waste volume). These tanks provide a basis for evaluation of application of retrieval and closure technologies in smaller tanks and demonstration of closure technologies could be completed in a manner that supports a full range of closure alternatives for final tank closure decisions under NEPA, HWMA, and DOE orders.

Another advantage of the C-Farm is that tank C-104 is scheduled for retrieval technology demonstration completion in 2007. This would provide an early opportunity for moving a tank to closure following completion of the tank system NEPA document in 2006. Other early opportunities for moving a tank from retrieval to closure include tanks S-112 and S-102.

ATCD – SCHEDULE

Current Tri-Party Agreement milestones anticipate initiating closure demonstration for a tank farm in fiscal year 2012 and completion of activities in fiscal year 2014. Much of the time associated with this baseline is required to prepare the data (e.g., waste characterization) and analysis (e.g., performance assessment) needed to complete regulatory documents (e.g., NEPA EIS and closure plan) and gain approval prior to proceed with closure activities.

The preliminary schedule provides timelines of the major activities and milestones required in completing tank waste retrieval and closure technology demonstration activities. The schedule is based on commitments identified in DOE/RL-2002-47 and includes deployment of retrieval and closure technology demonstrations in tank C-106 and additional low-volume SSTs and completing a Closure Plan and NEPA/SEPA EIS. The schedule and specific activities identified are preliminary and subject to change based on assumptions, the regulatory processes, and approval previously discussed in this paper.



Preliminary ATCD Project Schedule

ATCD – COST

ORP has prepared preliminary cost estimate for the closure demonstration aspects of the ATCD Project. ORP is currently refining its estimate and estimating the cost of retrieval demonstration activities as well as completion of a closure NEPA/SEPA document to support final closure decisions. Past preliminary retrieval technology deployment estimates for low volume tanks similar to tank C-106 have ranged from $12 to $35 million and NEPA EISs generally cost from $5 to $10 million.

SST waste retrieval and tank system closure are a significant cost element in the RPP life-cycle cost estimate. Currently, roughly $12 billion (or nearly 30% of all RPP expenditures through mission completion) is planned to be spent over the next two decades to retrieve waste from SSTs and close SST systems (RPP-12416). This cost estimate does not include the cost of storing waste in SSTs until waste is retrieved or of treating and disposing of the waste removed from the SST system. On a tank-by-tank basis approximately $60-70 million per tank will be spent on retrieval and closure activities. Currently, it requires nearly five years from the time planning and design activities are initiated for retrieval of an SST before retrieval is completed.

The approximately $185 million estimate for the ATCD Project from 2002 to 2006 represents a small fraction of RPP expenditures during the same timeframe. From 2002 to 2006 RPP will spend in excess of $5 billion. Hence the ATCD Project will represent less than 4% of the RPP expenditure.

REFERENCES

10 CFR 61, "Licensing Requirements for Land Disposal of Radioactive Waste," *Code of Federal Regulations*, as amended.

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

62 FR 8693, 1997, "Record of Decision for the Tank Waste Remediation System, Hanford Site, Richland, Washington," *Federal Register*, February 26.

Atomic Energy Act of 1954, 42 USC 2011 et seq., as amended.

Case No. 01-CV-413 (BLW), United States District Court for the District of Idaho, Natural Resources Defense Council, Inc.; Confederated Tribes & Bands of the Yakama Nation, Snake River Alliance, Plaintiffs, v. Spencer Abraham, Secretary, Department of Energy, United States of America.

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

DOE/EIS-0189, 1996, *Final Environmental Impact Statement for the Tank Waste Remediation System*, U.S. Department of Energy and the Washington State Department of Ecology, Washington, D.C.

DOE M 435.1-1, *Radioactive Waste Management Manual*, as amended, U.S. Department of Energy, Washington, D.C.

DOE O 435.1, *Radioactive Waste Management*, as amended, U.S. Department of Energy, Washington, D.C.

DOE/ORP-2001-18, 2002, *Single-Shell Tank System Closure Work Plan*, Rev. 0, U.S. Department of Energy, Office of River Protection, Washington, D.C.

DOE/RL-98-72, 1999, *Retrieval Performance Evaluation Methodology for the AX Tank Farm*, U.S. Department of Energy, Richland Operations Office, Richland, Washington.

DOE/RL-2002-47, 2002, *Performance Management Plan for the Accelerated Cleanup of the Hanford Site*, Predecisional Draft (B), U.S. Department of Energy, Richland Operations Office, Richland, Washington.

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

Ecology, EPA, and DOE, 1989b, *Hanford Federal Facility Agreement and Consent Order Appendix A*, "Action Plan for Implementation of the Hanford Consent Order and Compliance Agreement," 89- 10, Rev. 4, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy, Olympia, Washington.

"Hazardous Waste Management Act," RCW 70.105, *Revised Code of Washington*, as amended.

HNF-IP-0842, 2000, *RPP Administration*, CH2M HILL Hanford Group, Inc., Richland, Washington.

HWTF, 1993, *Final Report, Hanford Tank Waste Task Force*, submitted to Washington State Department of Ecology, U.S. Department of Energy, and U.S. Environmental Protection Agency by the Hanford Waste Task Force, Richland, Washington.

"Model Toxics Control Act," RCW 70.105D, *Revised Code of Washington*, as amended.

MOU, 1996, *Memorandum of Understanding: Required Percent of Waste Retrieval*, U.S. Department of Energy and Washington State Department of Ecology, Richland, Washington.

National Environmental Policy Act of 1969, 42 USC 4321, et seq.

Resource Conservation and Recovery Act of 1976, 42 USC 6901, et seq.

RPP-10525, *Tank Alternative Closure Demonstration Project Management Plan*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-MP-618, 2001, *Systems Engineering Management Plan for the Tank Farm Contractor*, RPP-MP-618, Rev. 0, CH2M HILL Hanford Group, Inc, Richland, Washington.

RPP-11094, 2002, *Tank Closure Fill System for the Accelerated Tank Closure Level 2 Specification*, Rev. 0, CH2M HILL Hanford Group, Inc., Richland, Washington.

RPP-12416, 2002, *River Protection Project Target Baseline,* CH2M HILL Hanford Group, Inc., Richland, Washington.

"State Environmental Policy Act of 1983 (SEPA)," RCW 43.21c, *Revised Code of Washington*, as amended.

WAC 173-303, "Dangerous Waste Regulations," *Washington Administrative Code*, as amended.

WAC 246-247, "Radiation Air Emissions Program," *Washington Administrative Code*, as amended.