TURNING THE CORNER ON HANFORD TANK WASTE CLEANUP – FROM SAFE STORAGE TO CLOSURE

H.L. Boston, E.J. Cruz
U.S. Department of Energy, Office of River Protection
P.O. Box 450, Richland, Washington 99352

S.J. Coleman
Informatics Corporation
1933 Jadwin Ave., Suite 210
Richland, Washington 99352

ABSTRACT

The U.S. Department of Energy (DOE), Office of River Protection (ORP) is leading the River Protection Project (RPP) which is responsible for the disposition of 204,000 cubic meters (54 million gallons) of high-level radioactive waste that have accumulated in large underground tanks at the Hanford Site since 1944.

ORP continues to make good progress on improving the capability to treat Hanford tank waste. Design of the waste vitrification facilities is proceeding well and construction will begin within the next year. Progress is also being made in reducing risk to the worker and the environment from the waste currently stored in the tank farms. Removal of liquids from single-shell tanks (SSTs) is on schedule and we will begin removing solids (salt cake) from a tank (241-U-107) in 2002.

There is a sound technical foundation for the waste vitrification facilities. These initial facilities will be capable of treating (vitrifying) the bulk of Hanford tank waste and are the cornerstone of the clean-up strategy. ORP recognizes that as the near-term work is performed, it is vital that there be an equally strong and defensible plan for completing the mission.

ORP is proceeding on a three-pronged approach for moving the mission forward. First, ORP will continue to work aggressively to complete the waste vitrification facilities. ORP intends to provide the most capable and robust facilities to maximize the amount of waste treated by these initial facilities by 2028 (regulatory commitment for completion of waste treatment). Second, and in parallel with completing the waste vitrification facilities, ORP is beginning to consider how best to match the hazard of the waste to the disposal strategy. The final piece of our strategy is to continue to move forward with actions to reduce risk in the tank farms and complete cleanup.

The goal of these efforts is to keep the RPP on a success path for completing cleanup of Hanford tank waste. While all parties are aggressively moving forward to provide vitrification facilities with enhanced capabilities, work continues toward a credible plan for completing waste treatment and accelerating risk reduction. In all of these efforts two principles are paramount; 1) all actions are focused on protecting worker health and the environment and complying with laws and regulations, and 2) open discussion, involvement, and cooperation of regulators and stakeholders is fundamental to any decision making.

INTRODUCTION

The Office of River Protection (ORP) continues to make good progress on improving the capability to treat Hanford tank waste. Design of the waste vitrification facilities is proceeding well and construction will begin within the next year. Progress is also being made in reducing risk to the worker and the environment from the waste currently stored in the tank farms. Removal of liquids from single-shell tanks (SSTs) is on schedule and we will begin removing solids (salt cake) from a tank (241-U-107) in 2002.

There is a sound technical foundation for the waste vitrification facilities. These initial facilities will be capable of treating (vitrifying) the bulk of Hanford tank waste and are the cornerstone of the clean-up strategy. ORP recognizes that as the near-term work is performed, it is vital that there be an equally strong and defensible plan for completing the mission.

ORP is proceeding on a three-pronged approach for moving the mission forward. First, ORP will continue to work aggressively to complete the waste vitrification facilities. It intends to provide the most capable and robust facilities to maximize the amount of waste treated by these initial facilities by 2028 (regulatory commitment for completion of waste treatment). Second, and in parallel with completing the waste vitrification facilities, ORP is beginning to consider how best to match the hazard of the waste to the disposal strategy. The final piece of our strategy is to continue to move forward with actions to reduce risk in the tank farms and complete cleanup.

This paper discusses some of the recent successes in the three areas that the ORP River Protection Project (RPP) has to date and some of the planning underway.

ONGOING ACTIVITIES TO COMPLETE THE VITRIFICATION FACILITY

Current Waste Treatment Plant (WTP) activities include design, flowsheet research and technology demonstration, permitting, and obtaining the requisite approvals to initiate construction (1). The most exciting news is that the site development work initiated on October 2001, is well underway and progressing well. In October, the limited construction authorization request (LCAR) was approved and site responsibility transferred to the WTP contractor. Procurements for bulk civil materials, temporary facilities, and miscellaneous construction equipment are underway. The facility flowsheet and material balance and operational research assessment contract deliverables were completed and issued.

ORP and its contractors continue to pursue opportunities to optimize the facility to the best value for the government and the taxpayers.

HOW BEST TO TREAT THE WASTE NOT PROCESSED BY THE INITIAL PLAN

It is already known that the waste in the Hanford tank farms varies greatly in character. That is, the waste in some tanks is much more hazardous/dangerous than in other tanks. The most hazardous/dangerous waste will be the first waste turned into glass by the initial facilities. As even more is learned about the character of the waste in each tank, ORP can determine whether vitrification is required to protect worker health and the environment, and comply with regulations. Vitrification is a robust treatment process that produces a very high quality waste form and is the cornerstone of our strategy; however, it also requires costly facilities. There may be other technologies capable of treating some of the less hazardous/-dangerous waste, thereby, producing immobilized waste that meets requirements for protection of health and the environment, but at a lower cost. Such alternatives might include existing technologies like cement waste forms, glass-like products from "steam reforming," and immobilization with polymers. ORP might also consider in place treatment for some tanks (e.g., in-situ vitrification). If alternative technologies can treat waste sufficiently to protect the worker and the environment, and do so at reduced cost, then the use of such alternatives could reduce the cost and schedule for overall waste treatment. If, as alternative treatment technologies are considered, ORP is not confident that they can successfully treat waste to an extent that protects worker health and the environment, then vitrification is still available to complete the job. Reducing costs and accelerating the program are the best ways to assure we are positioned for long-term success, and ORP has an obligation to evaluate potential alternatives. ORP is opening the discussion and evaluation of alternatives now so that there will be a clear path to move aggressively to complete the Hanford tank waste cleanup.

Tank Waste Description

Hanford's tank waste inventory includes the following:

- Saltcake is a crust of salt material that typically resides on the uppermost layer of the tank. Saltcake is formed when tank waste that has been concentrated by evaporation is returned to a tank and cools. As the temperature of the concentrated solution decreases, the crystallized salts form. Saltcakes vary in consistency from wet sand to concrete.

- Supernatant liquids reside either above or within saltcakes (if they are present) and typically contain concentrated and/or saturated solutions of nitrates, nitrite phosphates, carbonates salts of sodium, and other chemicals and contain a relatively small amount of suspended small diameter solids.

- Slurries are a mixture of solid particles, either of salt-like or sludge constituents suspended in liquid.

- Sludges are thick and dense combinations of liquids and solids. The liquid fraction of sludge is called "interstitial liquid" and is usually similar to the supernatant liquid. The solid fraction is mostly insoluble metal hydroxides and oxides and metal phosphates precipitated when the acidic waste from fuel reprocessing was neutralized with alkali.

- In addition, some miscellaneous items have been added [e.g., diatomaceous earth, cement] and some hardware items were abandoned in tanks. The later items range from small hand tools to pump assemblies.

- Approximately 35% of the waste [by volume, by weight, or by radionuclide content] resides in the double-shell tanks (DSTs) and 65 % resides in the SSTs.

Table I contains a summary of the tank waste inventory. Wastes vary significantly between tanks, a result of a complex history of plutonium recovery, recovery of uranium for recycle and waste management activities. Unfortunately, the limited set of historical information on waste composition and variability does not meet current data requirement needs. Hanford has an extensive characterization and data reconstruction program to supply this vital information. Wastes in the tanks are not homogeneous. The solids have often been described has being pseudo-pancake-like in nature, and particularly in the SSTs, represent materials from many different processing campaigns (2, 3)

Table I. Summary of Tank Waste.

Inventory	Double-Shell Tanks	Single-Shell Tanks
Total, m^3 (gal)	72,000 (19,000,000)	128,000 (34,000,000)
Average density, kg/m^3 (lb/in^3)	1500 (0.0542)	1600 (0.0578)
Chemicals, kg (tons)	50,000 (55,000)	173,000 (190,000)
Water, m^3 (gal) (drainable/non-drainable)	59,000 (15,600,000)	36,000 (9,400,000)
Radioactivity, TBq (Ci)	3 (80,000,000)	4 (110,000,000)
NOTES: 1. Data are rounded numbers and estimates provided for informational purposes only (3). 2. More detailed and current data are available on the Tank Waste Information Network System (TWINS). .		

The progress has been developed, specifically for those constituents relevant to safety, to identify the inventory for the initial quantity of wastes to be processed, thereby assuring that the inventory is well understood. However, uncertainty in the tank inventory will continue to be a key component of risk in determining the best technical approach to complete the balance of mission.

ONGOING ACTIVITIES TO REDUCE RISK IN THE TANK FARMS

At this time, there is some space available in the 28 newer DSTs. These tanks comply with regulations for storing waste and are actively in use. Where space permits, waste from SSTs can be removed and transferred to DSTs for safe storage prior to treatment. Removal of liquids is currently underway and removal of solids from SSTs will begin in early 2002. Waste removal from SSTs is important because it places the waste in tanks that are not likely to leak to the environment and, because once empty, workers will not have to perform surveillances and maintain the old SSTs. This reduction of risk to workers and the environment is an important element of the strategy. In addition to tanks from which waste is retrieved, a number of SSTs currently have very little waste. Where the quantity and character of waste in an SST allows, ORP should proceed to close that SST. Before ORP can begin to close an SST, there must confidence that any residual waste in the tank is small enough as not to pose a significant threat to human health and the environment. ORP is prepared to remove residual waste as needed prior to closure. For some tanks, however, waste heels and residuals may be closed in place.

Hanford Tanks

These tanks are constructed of reinforced concrete with either one [SST] or two [DST] carbon steel liners. Most tanks are 23 meters (75 feet) in diameter with a capacity of 1893 cubic meters (m^3) or 500,000 gallons to 3785 m^3 (1 million gallons). Approximately 3785 m^3 (1 million gallons) of waste have leaked from 67 of the 149 older SSTs. No waste has leaked from the 28 newer DSTs. The structural integrity of the tanks varies since the SSTs are up to 57 years old and the DSTs are approaching design life. The in-tank environment includes thermal, chemical, and radiation hazards and physical obstacles; therefore, in-tank equipment must be designed to survive this challenging environment. The tanks are grouped into 18 "farms" spread across the 200 East and 200 West Areas of the Hanford Site. Developing and operating the infrastructure necessary to retrieve the waste while operating the tank farms and WTP is a substantial challenge.

Safe Interim Storage

Storage of the waste requires the management of 149 SSTs and 28 DSTs located on the Hanford Central Plateau. The tanks are grouped into eighteen tank farms and include transfer systems, ventilation, and instrumentation among their supporting systems. Key storage activities include continued removal of pumpable liquids from the SSTs, tank waste characterization, tank integrity inspections, and inventory management.

To substantially reduce the threat of release of liquid to the environment, an activity is underway to interim stabilize the waste in the tanks by removing pumpable liquids from the SSTs, which is scheduled to conclude in 2004. To date, the effort has interim stabilized 129 tanks (4)

Maintaining the integrity of the DSTs is critical to the success of the mission. DSTs are used to receive waste from the SSTs and to prepare feed for delivery to the WTP. The Double-Shell Tank Integrity Program (DSTIP) is actively managing the integrity of the DSTs on three fronts: chemistry control, corrosion mitigation, and integrity assessments. Specific activities for fiscal year 2001 include:

- Chemistry Control — successfully complete the chemical adjustments necessary to protect three tanks, install two new corrosion-monitoring instruments, and implement a new DST Chemistry Sampling Program aimed at generating a tank integrity-lifetime projection baseline for the DSTs.

- Corrosion Mitigation — continues to resolve concerns associated with a potential primary tank leak in tank 241-AY-101, the only DST, which is suspect at present. Recent results include identification of an intrusion pathway for undesired water intrusion onto the tank, establishing a contract to conduct a gas tracer test, and initiating a contract for additional visual inspection and non-destructive testing (NDT) of the low-carbon steel DST annulus.

- Integrity Assessment — Conduct visual inspections of the primary tank and annulus areas and develop technologies that are more cost effective, capable of inspecting the tank faster and more accurately, and capable of reaching a greater area of the tank annulus.

Retrieval

Retrieving the stored waste is a major challenge and is best described separately for SSTs and DSTs.

Approximately 135,000 cubic meters (35 million gallons) of the waste resides in the SSTs, primarily as precipitated salt (saltcake) and insoluble sludge. These tanks have been interim stabilized, to avoid the potential for further leaks, by pumping all but a residual ~50,000 gallons of liquids from the SST waste and transferring that supernate into the DST system. The removal of waste from the SSTs is significantly more difficult due to their potential for leaks, the age of the SST systems, and lack of supporting infrastructure in the SST farms. In addition, the SSTs have a more limited and smaller-diameter set of risers available further complicating their retrieval.

The SST retrieval demonstrations are currently pursuing three different technical approaches. All three approaches are designed to improve upon the traditional past-practice sluicing approach at Hanford by achieving higher retrieval efficiencies and reducing the potential for leaks both in the tanks and in the transfer lines during retrieval. All retrieval actions strive to retrieve all "removable" portions of the waste from the tanks with no leakage. However, there are enough uncertainties in the effectiveness of the technologies, tank wastes, and tank conditions that it is not possible to guarantee a complete and leak free retrieval today.

The three retrieval demonstrations and approaches are:

- Saltcake Retrieval Demonstration (tank 241-S-112) - Low-Volume Density Gradient (LVDG);
- Sludge Retrieval Demonstration (tank 241-C-104) - Confined Sluicing (defined as the localized addition and retrieval of liquids and waste; and
- Tank 241-S-102 - Power fluidic mixing and pumping systems.

The demonstration tanks were selected to define a representative set of tank retrievals to support planning for the balance of mission. Three generic tank groups: saltcake, sludge, and saltcake/sludge were identified. Hanford Site 200 East and 200 West Area geologies differ, so tanks were selected in each. The demonstrations occur in tank farms with and without previous leakage to the environment. An additional consideration in selecting these tanks was their proximity to the DST system. Using SSTs near the DST system requires less new transfer piping and supporting infrastructure. All three tanks are currently designated as "sound." These tanks also contain significant inventories of waste relevant to environmental and worker risk to safer storage in the DST system.

The saltcake waste demonstration tank 241-S-112 (S-112) is using a saltcake dissolution approach. Saltcake dissolution, or LVDG, is a retrieval strategy that carefully matches the addition of water quantities used to dissolve the saltcake and the volume of the resulting salt solution being pumped from the tank. Once the salt solution is pumped from the tank, nozzles will be used to mobilize the insoluble heel. The goal is to retrieve S-112 in conjunction with the interim stabilization of the tank – an acceleration of over one year.

The sludge retrieval demonstration tank, 241-C-104 (C-104) is designed to retrieve tanks where the waste is largely insoluble sludge and/or heels. This demonstration is employing a technique called "confined sluicing." Confined sluicing has been defined as "localized addition and retrieval of liquids and waste." (5). This approach will carefully use a pneumatic assisted vacuum retrieval and conveyance system to mobilize waste in the vicinity of the suction head system. The C-104 Mobile Retrieval System (MRS) uses a mast capable of rotating, elevating, and extending inside the tank to position the intake of the vacuum system. An in-tank vehicle will be used to move waste to the conveyance system intake (6). The conveyance system will transport the waste to the tank surface where a booster pump will enable transfer to the DST system. This technology is expected to be the most complex of the three retrieval technologies and the most costly to deploy. However, it is also the one most likely to be suitable for all waste types and likely to have the smallest volume of free liquid in the tank during retrieval, as well as the least water addition for transfer to the DST system.

The saltcake/sludge combination tank 241-S-102 (S-102) Project is testing power fluidic mixing and pumping systems similar to those used at the Oak Ridge National Laboratory cleanup project. Systems capable of mobilizing and pumping the waste are being tested in various combinations and configurations during 2001 and early 2002. The intent of the testing is to establish the capabilities of the systems and determine which capability is best suited for application at Hanford.

The performance specifications and the overall retrieval sequence for SST retrieval will be based on risk relative to the character of the waste. The transport of contaminants through the soil and tank farm inventories are distinctly different for the C-104 and S-102/S-112 demonstrations. The species contained in the insoluble sludges are significantly less mobile than those in salts and other water-soluble species.

Such risk-based considerations are very important in determining the appropriate investments ORP needs to make in retrieval technologies. Specifically, the relationship between leaks that could occur during retrieval and the actual retrieval efficiency, or percentage of waste removed from the tank vs. leaks that during retrieval, is a critical design consideration. In the case of sludge containing C-104, leaks during retrieval are unlikely to migrate, therefore, pose a relatively lower environmental risk, compared to salt containing tanks (7). Another aspect of risk concerns comparisons when comparing the risk that could result from a future site user digging into a difficult to sluice out heel in a tank remaining after the retrieval vs. that from a maximally retrieved tank. This consideration will be used to make decisions during the retrieval design and operation process to ensure the most effective use of resources towards reducing risk. The retrieval sequence for the SSTs emphasizes retrieval of tanks with higher risk, inclusive of groundwater and airborne pathways and is modified to consider treatment and infrastructure limitations.

DST retrieval systems are designed to support timely delivery of waste to the WTP. These mechanical pump-based systems will include a combination of large mixer pumps to slurry the solids and dissolve soluble components, and transfer pumps to move the waste. A significant effort is underway to upgrade the waste transfer infrastructure and support systems to ensure they are ready for the upcoming waste feed delivery operations. Recently, the tank 241-AZ-101 process test successfully demonstrated the capability of the large mixer pumps for retrieval.

Recently, a contract was awarded to construct the Hanford Cold Test Facility at HAMMER. The Cold Test Facility will be used to develop and demonstrate retrieval systems prior to implementation in the field. Key features of the facility include a full-scale (75' diameter, ~25' working depth) mock tank capable of handling waste simulants and accompanied by flexible "pilot type" support facilities. Construction of the facility is well underway and it is scheduled to be ready for use by the Summer 2002. The facility is located at HAMMER to facilitate its use by others, including possible non-Hanford users.

Since tank waste and tank configurations vary widely, ORP is developing a retrieval technology "toolbox." A given tool or set of tools will be available to address the retrieval challenge of each individual SST or DST on a customized basis.

Treatment of the Tank Waste

Treatment of the waste will be accomplished primarily through the WTP. The WTP will have the capability to pretreat the feed prior to vitrification of the two waste streams to it allow it to meet both on-site [immobilized low activity waste or ILAW] and off-site [IHLW] waste acceptance criteria. The WTP will include processes and operational capabilities to separate the waste into LAW and HLW portions. The goal for the WTP is to allow the waste from the tanks to be separated into soluble and insoluble portions, the later constituting the HLW waste stream. Key radionuclides [radio cesium, radio strontium, the transuranic fraction and technetium, as needed, will be removed from the soluble waste so it can be classified as LAW and immobilized (vitrified) for on-site, near-surface disposal in accord with NRC requirements. The radionuclides removed will be added to the HLW insoluble portion, mixed with glass formers, and vitrified for disposal in an off-site federal geologic repository when it becomes available. In the interim, the sealed and containerized glass product will be stored in the Hanford Canister Storage Building in 200 East Area.

The nominal WTP capacity during Phase 1 will be 30 metric tons of glass per day (MTG/day) of ILAW, 1.5 MTG/day of immobilized high-level waste (IHLW). The WTP also will have expansion capability that will permit doubling its capacity by adding a separate, parallel LAW vitrification facility and a second HLW melter. The HLW vitrification system will be sized such that the capacity can be increased to 6 MTG/day through enhancements to the melters. The WTP is being designed for a 40-year life.

ORP is not focusing on just the WTP to treat the Hanford Tank Farms waste, but is identifying treatment alternatives to deal with the LAW that cost-effectively meet post-disposal risk objectives, such as using polymer and designer grout, steam reforming, etc.

Disposal of Tank Waste

Disposal of the tank farms waste is currently following two paths. Both immobilized products will be in the form of glass monoliths that are created by pouring the molten glass into a container or canister. The initial steel Immobilized Low Activity Waste (ILAW) containers will be disposed of in an onsite trench. The IHLW canisters will be stored on site until it can be shipped off site for disposal in a federal geologic repository. The 600 IHLW canisters in Phase I will be stored in the Canister Storage Building after installing additional storage tubes. Approximately 175,000 cubic meters of ILAW and 14,000 cubic meters of IHLW will be produced from all the tank waste. Current activities include preparation of permit applications for the facilities, and completing final designs for the both the storage facilities for the IHLW products and disposal of ILAW.

It is estimated that about 16,000 m^3 (565,000 ft^3) of ILAW will be generated during the initial quantity with an additional 169,000 m^3 (6 million ft^3) during the balance of mission based on previous contract specifications for treatment of tank waste. ORP is implementing the use of a "remote-handled (RH) trench" as a burial concept (8). If approved by the State of Washington Department of Ecology as treated waste, ILAW packages will be disposed of in a large trench with sloping sides, rather then requiring construction of the more elaborate and costly Resource Conservation and Recovery Act land disposal vaults. The packages would be transferred by tractor-trailer from the WTP to the trench. The ILAW will be being managed in compliance with DOE Order 435.1, Radioactive Waste Management requirements for low-level and mixed low-level waste, following Nuclear Regulatory Commission (NRC) staff concurrence that the ILAW could be considered "incidental waste" (6). This determination allows ORP to dispose of ILAW in near-surface disposal facilities that are not subject to NRC licensing, provided conditions specified in the NRC letter are met. DOE Order 435.1 includes incidental waste classification criteria that are similar to those from the NRC staff. Glass development and testing programs sponsored by ORP and the DOE Office of Science and Technology are underway and are expected to yield results that show practical glass formulations will meet the performance requirements.

With respect to interim storage of IHLW, it is estimated that as many as 1320 canisters could be generated during the initial quantity. The canisters are 0.61 m (2 ft) in diameter x 4.5 m (14.8 ft) tall and hold about 1.15 m^3 (40.6 ft^3) of HLW glass. The first 600 canisters could be produced from 2007 to 2012, and 720 more canisters could be produced by 2018. An additional 10,880 canisters, or about 13 canisters per week, are projected as a reference case for the balance of mission, but estimates vary depending on assumptions (9). The current technical strategy for IHLW interim storage includes retrofitting Vaults 2 and 3 in the Canister Storage Building (CSB), which is currently under construction in the 200 East Area, for interim storage of spent nuclear fuel in multicanister overpacks in Vault 1. The capacity of Vaults 2 and 3 is 880 canisters. The canisters would be transferred by tractor-trailer to the interim storage facility in a shielded transportation cask at a rate of about three to five per week. Depending on the availability of the repository, additional canister storage facilities for the entire output of IHLW canisters could be needed at a cost of approximately $1.8B (in FY 2000 dollars) in addition to a facility for loading canisters into transport casks for shipment by rail to the HLW repository (9).

Preliminary parametric studies of complex-wide storage, shipping, and disposal of both spent nuclear fuel and IHLW show a significant reduction in required canister storage facilities if shipping from Hanford is started in 2010 and production of IHLW canisters is extended beyond the baseline date of 2028.

Tank Farm Closure

Early demonstration of SST closure provides a basis for development of reasonable criteria for closing all tanks and real near-term progress and risk reduction as tanks and tanks farms are closed. The current plan would result in the closure of the first tank in 2014. Clearly there is a need to do better and it is plausible to begin closing tanks in the next few years. Initiating closure actions will have the benefits of:

- Reducing risk to workers, the public and the environment from aging tanks with low volume of waste.
- Achieving near-term operations and long-term retrieval life-cycle cost savings.
- Engaging regulators and stakeholders in open discussion of issues critical to the completion of the mission.
- Collecting and analyzing data and complete demonstration of technologies needed for closure of the remaining tanks.

Some of the SSTs may not require any waste retrieval prior to closure. Other tanks may be suitable for closure following application of inexpensive retrieval methods. By approaching tank closure as demonstration activities, ORP will be able to make progress prior to final clean-up decisions. ORP has high confidence that these near-term demonstration actions will be acceptable for final closure decisions. For example, the volume of waste contained in the four C Tank Farm series tanks is approximately 5 percent of their capacity. The current balance of mission plan includes $112 million for the design, construction, and operation of waste retrieval systems for these tanks. A demonstration project would result in the avoidance of some of these retrieval costs and open the opportunity for closure of other tanks without waste retrieval (past studies indicate that as many as 20 SSTs may contain waste that can be disposed of in-situ while being protective of human health and complying with applicable regulations).

To capitalize on this opportunity, ORP proposes to initiate closure demonstrations on one or more SSTs as soon as possible. Preliminary planning indicates that an aggressive schedule could result in the closure of the first SST as early as 2003-4 with a reasonable degree of confidence.

The tank(s) selected for the demonstration will be those tanks with small residual heels (inventory) such that they can meet risk-based performance requirements. An analysis of risk will be required for leaving the heels in the selected tanks without additional retrieval before the closure demonstration.

Based on the tank selection criteria and the currently available information, tanks C-106 (assuming removal of residual retrieval liquids), AX-104, U-107 (assuming completion of retrieval to the extent practical) and the C Tank Farm series tanks (assuming retrieval of waste from tanks C-203 and C-204) represent the best options for closure demonstration. Prior to final selection of the tanks for closure demonstration a more rigorous tank selection needs to be completed.

SUMMARY

In summary, there is a wealth of visible progress at RPP. New technologies are moving to the field and construction is well underway on key facilities. Additionally, ORP has made assertive moves to take advantage of opportunities to reduce risk earlier in conjunction with aggressive incentives to reduce costs for both near-term and long-term activities.

The Hanford tank cleanup scale and diversity is a formidable challenge. Hanford fuel reprocessing consisted of five different processes, which lead to a more heterogeneous and complex wastes than the other Sites in the DOE Complex. The tank configurations and extent of leakage, diverse and varying near surface strategraphy, geochemistry, geology, and hydraulic characteristics adds complexity.

ORP recognizes the need to aggressively pursue strategies that are protective of human health and the environment while reducing the cost and duration of cleanup.

Therefore, ORP is also examining other strategies that complement the initial quantity activities including:

- Demonstrating tank closures to resolve key technical and regulatory questions regarding the final disposition of the tanks and tank farms;

- Processing approaches or technologies that could reduce the burden on the WTP and make additional DST space available to SST wastes;

- Examining requirements and constraints that increase the cost or administrative burden of cleanup with little positive impact on risk reduction.

Common to all of these is an emphasis on maintaining and developing a sound technical foundation, built on demonstrated experience employing these strategies and supported by data.

It is critical that ORP be allowed to continue its path towards completing cleanup of Hanford tank waste. While ORP is aggressively moving forward to provide vitrification facilities with enhanced capabilities, it must in parallel work on a credible plan for completing waste treatment and accelerating risk reduction. In all of these efforts two principles are paramount: 1) all actions are focused on protecting worker health and the environment and complying with laws and regulations; and 2) open discussion, involvement, and cooperation of regulators and stakeholders is fundamental to any future decision making.

REFERENCES

1. U.S. Department of Energy, Office of River Protection, Bechtel National, Inc., *Design, Construction, and Commissioning of the Hanford Tank Waste Treatment and Immobilization Plant*, Contract No. DE-AC27-01RV14136, Richland, Washington (2001).

2. Agnew, S. F. 1996. *Hanford Tank Contents and Radionuclide Inventories: HDW Model*, LA-UR-96-858, Rev. 3, Los Alamos National Laboratory, Los Alamos, New Mexico; and

3. Agnew, S. F., 1995, *Hanford Defined Wastes: Chemical and Radionuclide Compositions*, LA-UR-94-2657, Rev. 2, Los Alamos National Laboratory, Los Alamos, New Mexico, 1995.

4. Hanlon, B. M., *Waste Tank Summary Report for Month Ending September 30, 2001*, HNF-EP-0182, Rev. 162 (November 2001)

5. Hanford Federal Facility Agreement and Consent Order 89-10, Rev. 5, Washington State Department of Ecology, U.S. Environmental Protection Agency, and U.S. Department of Energy (December 1998).

6. Letter, C. J. Paperiello, Nuclear Regulatory Commission, to J. Kinzer, Department of Energy, Richland Operations Office, Subject: *Classification of Hanford Low-Activity Tank Waste Fraction* (June 9, 1997).

7. Jacobs, 1999. *Retrieval Performance Evaluation Methodology for the AX Tank Farm*, DOE/RL-98-72, Prepared for U.S. Department of Energy, Prepared by Jacobs Engineering Group Inc., Richland WA, April 1999.

8. Letter, K. R. Shah, Lucas Incorporated, to G. A. Gardner, Lockheed Martin Hanford Corporation, Subject: Contract 00004270, Release 1, *Handle Trench Concept*, Attachment (August 30, 1999).

9. R. B. Calmus, *River Protection Project Immobilized High-Level Waste Interim Storage Plan,* HNF-1751, Rev. 1, p 4-4 (August 1999).