Richland (Hanford) Site
Unaddressed Technology Needs

Decontamination and Decommissioning

Capsule Leak Detection System for WESF (RL-DD01)

WESF is operated as a safe storage facility for a number of double-wall corrosion-resistant metal capsules that contain either cesium chloride or strontium fluoride fuel processing waste. The capsules were distributed to five pool cells and stored underwater since about 1967. Current plans are to continue underwater storage until about 2011 at which time the capsules will be turned over to the High Level Waste disposal Program. Although no significant problems have been experienced, there is the continuing possibility of one or more of these capsules developing a leak and contaminating a pool cell. There is need for an effective monitoring system to quickly identify a leaking capsule such that it can be removed. There is need for an easily deployable technology that will allow for rapid underwater identification of a single leaking capsule (there are approximately 1900 capsules stored in 5 pools). This technology must be operable in a high radiation environment. (The exposure rate of a single submerged cesium capsule, which contains 50 kiloCuries is 200 rems per second at contact and 11 rems per second at 24 inches.)

Contact: Gerry McCormick - BWHC (509) 372-8173, Robbin Duncan - BWHC (509) 373-2229, Paul Roege - BWHC (509) 372-0443; or David Evans - EM-60 (509) 373-9278

Tank Remediation for Building 324 (RL-DD09)

Methods are needed for remediation of residual waste from tanks used for storing high level radioactive liquid waste associated with material processing facilities and hot cells. Remote techniques are needed to remove tank heels or prevention of contamination dispersion upon cutting or disassembly. The residual material ranges from low level to high level material with potential for transuranic waste. Residual material remains in high level radiation waste tanks that were used in materials processing facilities and hot cells. The residual materials are left in the tanks after they have been deactivated. The residues are in the form of liquids, liquid sludges, solids and dispersible material.

Contact: Gerry McCormick - BWHC (509) 372-8173, Robbin Duncan - BWHC (509) 373-2229, Rich Hobart - BWHC (509) 373-2316; or Larry Romine - EM-60 (509) 376-4747

Metal Decontamination and Recycling (RL-DD021)

Current methods of handling contaminated materials don't cost-effectively reduce radioactive waste volumes nor allow for recycle/reuse of metals and equipment. Methods are needed that can cost-effectively decontaminate materials to free-release levels for recycle or reuse. The requirements for the technology include decontaminate pipes and internal components to free-release levels to allow for unrestricted use or recycling; quantitative verification that decontamination levels have been achieved. This includes methods for inspecting equipment and piping internals and other difficult geometries. The cost of decontamination and recycling must be cost competitive with the alternative of sending the materials to the Environmental Restoration Disposal Facility (ERDF). Minimize secondary waste generation and avoid any hazardous/mixed waste generation. Easily deployed. As a minimum, any technology should be applicable to the reuse/recycle of steel and carbon steel.

Contact: Ken Jackson - BHI (509) 372-9295, Jerry McGuire - BHI (509) 373-7253, Stephen Pulsford - BHI (509) 373-1769, Sue Garrett - PNNL (509) 372-4266

Mixed Waste

Remote Treatment of RH-LLMW Debris (e.g. Macroencapsulation for RH Debris) (RL-MW01)

There is a need for development and demonstration of remote treatment systems for remote handled (RH) debris contaminated with low-level mixed waste. Converting existing treatment technologies, such as macroencapsulation, to remote handling mode may require substantial design modification or may not be successful, thus leading to development of system that may need regulatory review and/or approval. The technology must be able to treat remote-handled low-level mixed waste to meet LDR standards, and must have a high degree of reliability and ease of maintenance. The TWRS program is projecting a large volume of long-length equipment that will be removed from the tanks during waste recovery. In addition, the D&D program generated $9.5 m^3$ of RH-LLMW equipment and debris in calendar year (CY) 1995. The future waste streams will include items currently in the tanks as well as new equipment that will be used during waste retrieval dismantling operations. A major portion of these items will be classified as remote-handled debris. Remote treatment processes for this debris have not been demonstrated or developed.

Contact: Larbi Bounini, WMH, (509) 376-4650; Mike Coony, WMH, (509) 376-9774; Wayne Ross, PNNL, (509)372-4684; or Joe Waring, DOE, (509) 373-7687

Remotely Controlled Volume Reduction Techniques for RH-LLMW and RH-TRU/TRUM (RL-MW02)

A remotely controlled robust volume/size reduction system needs to be developed for remote-handled (RH) LLMW and transuranic/mixed-transuranic (TRU/TRUM) items over a wide range of sizes, shapes, weights, materials of construction and types/levels of contamination. This technology will be used to reduce the large void volume associated with debris and with the long-length equipment removed from Hanford's underground waste tanks. Selecting a volume reduction technology from existing technologies such as compaction, metal melting, and shredding, and converting it to remote operation may require substantial development as well as regulatory review and/or approval. Volume reduction capability needs to be provided for RH-LLMW and RH-TRU such as compaction, metal melting or shredding. The system should be highly reliable, and easy to maintain and clean.

Contact: Larbi Bounini, WMH, (509) 376-4650; Mike Coony,WMH, (509) 376-9774; Wayne Ross, PNNL, (509) 372-4684; or Joe Waring, DOE, (509) 373-7687

Remote Characterization to Distinguish TRU from Non-TRU Portions or Sections of Various-Sized Debris (up to 22 meters in length) in a High Beta/Gamma Field (RL-MW03)

A large volume of debris generated from the Hanford tanks remediation activities is expected to be a mixture of TRU and non-TRU contaminated items. Developing a detection capability for TRU waste will allow separation and consolidation of TRU items, parts or sections of long-length equipment from the non-TRU portion. As a consequence, the total processing cost may be reduced since the treatment cost for non-TRU is significantly lower than that TRU processing. In addition, reducing TRU debris volume will help keep the total volume of Hanford TRU waste within the planned disposal capacity at WIPP. The TRU NDA capability must be able to determine TRU contamination levels in a high beta-gamma dose rate environment and remotely handle TRU items over a wide range of sizes, shapes, weights, materials of construction and types and levels of contamination. Debris may include pieces up to 22 meters long. The system must generate high quality data (precise and accurate) to allow identification of TRU items with a high degree of confidence. Near real-time detection capability would be a plus, as it could support segregation during equipment removal/retrieval operations. Much of the equipment and other debris from some facilities has been or may be categorized as RH-TRU waste upon retrieval. It is likely that the total volume of RH-TRU waste from Hanford (including tank waste) may approach the RH capacity at WIPP.

Contact: Larbi Bounini, WMH, (509) 376- 4650; Mike Coony, RFSH, (509) 376-9774; Wayne Ross, PNNL, (509) 372-4684; or Joe Waring, DOE, (509) 373-7687

Remote Decontamination of RH-TRU Debris to Support Reclassification into Non-TRU Category (RL-MW04)

Another approach to the volume reduction of RH-TRU materials is to decontaminate the items and concentrate the TRU materials into a much smaller volume. Selecting a decontamination technology from existing technologies and converting it to remote operation may require substantial development as well as regulatory review and/or approval. Decontamination techniques focusing on radionuclides removal from RH-TRU debris may allow recategorization of the debris into non-TRU waste. In addition, some decontaminated materials may be recycled. The decontamination system for RH-TRU must effectively remove radionuclides from the debris and generate minimal amount of secondary waste preferably in the solid form. Decontamination processes which produce liquid secondary waste streams would be inconsistent with the site-wide effort to eliminate liquid waste. The system/equipment should have a high degree of reliability and must be easy to maintain and clean. A volume of 179m^3 of RH-TRU is currently in storage and an additional 3,467m^3 is forecast. The anticipated sources of RH-TRU are the long-length equipment from Hanford HLW tanks (transfer piping, pumps, jumpers and other ancillary equipment), tank waste disposal program and R&D waste.

Contact: Larbi Bounini, WMH, (509) 376-1009; Mike Coony, RFSH, (509) 376-9774; Wayne Ross, PNNL, (509) 372-4684; or Joe Waring, DOE, (509) 373-7687

Remote Treatment of RH Soils and Other Solid Wastes Contaminated With Organics (RL-MW05)

Technologies need to be developed to treat RH soils and other granular materials contaminated with hazardous organic compounds. Low cost remote thermal or non-thermal treatment methods will be needed to process the wastes to meet the land disposal restrictions (LDR). Adding the remote handling capability to existing or emerging organic treatment technologies will require substantial additional development. The technology must be able to remotely handle and treat RH solids, such as organic contaminated soils and lab packs, to applicable LDR standards. Generation of secondary wastes is discouraged and if unavoidable, the secondary must be minimized and preferably in the solid form. The technology must be readily acceptable by the public and the regulators. The process must have a high degree of reliability and must be easy to maintain and clean. The system design should allow for construction of a mobile treatment unit. Small volumes of homogeneous soils, lab packs and soils with organics are expected. Since the wastes are remote handled and the volumes are low, it is unlikely that there will be a commercial capacity for treatment of the wastes.

Contact: Larbi Bounini, WMH, (509) 376-4650; Wayne Ross, PNNL, (509) 372-4684 or Joe Waring, DOE, (509) 373-7687

Treatment of CH-TRU Liquid Wastes Contaminated With PCBs and Ignitables (RL-MW06)

A Technology needs to be developed to treat organic liquid TRU wastes (mostly hydraulic fluids) to destroy PCBs, remove the ignitable characteristic and safely contain transuranic radionuclides. Adapting existing or emerging thermal or chemical organic destruction technologies to handle TRU wastes may require substantial development. The technology must be able to remove the Ignitable Characteristic from ignitable wastes and must destroy PCBs to 99.9999% destruction efficiency and contain TRU radionuclides. The technology must be readily acceptable by the regulators (as equivalent to incineration) and the public. The WIPP Waste Acceptance Criteria prohibits the disposal of TRU waste that contains either PCBs or ignitable characteristics (D001) and therefore wastes with these characteristics must be processed to remove the PCBs or ignitables prior to packaging and transporting to WIPP. The bulk of these wastes are PCB contaminated hydraulic fluids which were generated in 1989 from the Plutonium Finishing Plant.

Contact: Larbi Bounini, (509) 376-4650; Wayne Ross, PNNL, (509) 372-4684; or Joe Waring, DOE, (509) 373-7687

Subsurface Contaminants

Improved, Real-Time, In-Situ Detection of Strontium-90 in Groundwater (RL-SS09)

Monitoring strontium-90 by discrete sampling is costly and time consuming. In situ monitoring would reduce the labor-intensive process of sampling, handling, and shipping samples for analysis. Purge water production and associated disposal or treatment requirements would be minimized or eliminated. In situ monitoring would also aid in situations where monitoring site access is difficult and costly, or where conditions may pose safety hazards to samplers. In situ measurement in extraction, injection or monitoring wells, well points, or in river substrate would provide real-time monitoring of contaminant concentrations. In combinations of horizontal and vertical profiling, this will provide highly accurate isopleths of contaminant concentrations to aid in fate and transport modeling and construction of remediation systems. The new technology must measure contaminant concentrations in situ in extraction, injection or monitoring wells, well points, or in river substrate. Depth to water table is 60-80 feet with maximum ground water concentrations ranging from 4,000 - 6,000 pCi per liter. Results must be near real-time and output must be transmittable by hardwire or telemetry to standard computer connections for data reduction and processing. In situ strontium-90 detection must be sensitive to less than 8 pCi/L. In situ detectors must be of robust design and capable of operating for long periods without maintenance in the specified environments.

Contact: Kim Koegler, BHI, (509) 372-9294; Jared D. Isaacs, BHI, (509) 372-9162; George C. Henckel III, BHI, (509) 372-9381; or Fred R. Serier DOE, (509) 372-8517; David E. Olson, DOE, (509) 376-7142; M. (Mike) Thompson, DOE, (509) 373-0750

Improved Technologies for Detection/Delineation of Burial Ground Contents and Subsurface Geological Boundaries. (RL-SS10)

Improved technologies are needed for non-intrusive or minimally intrusive methods for identifying burial ground contents and delineating difficult to find waste sites. A large number of burial grounds and liquid waste disposal sites were created during fifty years of defense plutonium production. Documentation of materials that were placed in the burial grounds and exact location of some sites is incomplete. These non-intrusive or minimally intrusive methods are also needed to identify geological boundaries prior to characterization/remediation activities for the 200 Area liquid waste sites. A significant number of the 200 Area's liquid waste disposal sites have been interim stabilized prior to characterization. As a result, 5 to 15 feet of stabilized fill material (either imported fill or material pushed in from the sides of the trenches or ditches) now exists above the original contours of the liquid waste sites. Characterization of these waste sites require a clear delineation of the original contours. Performing this delineation in a non-intrusive manner is needed.

Contact: Kim Koegler, BHI, (509) 372-9294; Greg B. Mitchem (509) 372-9632; Ashur R. Michael, BHI, (509) 372-9074; V. R. (Vern) Dronen, BHI, (509) 372-9096; or Fred R. Serier DOE, (509) 372-8517; Bryan L. Foley, DOE, (509) 376-7087; Owen Robertson, DOE, (509) 373-6295

Cost Effective, In Situ Remediation in the Vadose Zone of One or More of the Following Radionuclides: Uranium, Plutonium, Cesium, Cobalt, or Strontium-90 (RL-SS12)

Numerous contaminated soil sites exist at the Hanford site as a result of liquid effluent discharge to the soil column. Cost effective in situ remediation technologies are required to deal with radioactive contamination. In situ technologies that are more cost effective than the baseline excavation/disposal costs ($105/cubic meter) are needed to treat the top 15 feet of soil. In situ treatment technologies may also be required if soil contamination extends beyond the 15 feet to depths were excavation costs become prohibitive. Primary radionuclides of concern include Uranium, Plutonium, Cesium, Cobalt, and Strontium-90.

Contact: Kim Koegler, BHI, (509) 372-9294; Ashur R. Michael, BHI, (509) 372-9074; V.R. (Vern) Dronen, BHI, (509) 372-9096; or Fred R. Serier DOE, (509) 372-8517; Owen Robertson, DOE, (509) 373-6295

Improved Detection and Segregation of TRU Waste (Debris) (RL-SS18)

Burial grounds in the 200 and 300 Areas received waste contaminated with plutonium and other TRU constituents. Many of these burial grounds will be excavated and disposed on site but waste with more than 100 nCi of TRU contamination per gram of waste does not meet current waste acceptance criteria. Improved methods for detecting and segregating TRU waste are required. Technologies must be able to rapidly detect and segregate TRU contaminants at concentrations greater than 100 nCi per gram of waste on a variety of different waste geometries.

Contact: Kim Koegler, BHI, (509) 372-9294; Ashur R. Michael, BHI, (509) 372-9074; V.R. (Vern) Dronen, BHI, (509) 372-9096; or Fred R. Serier DOE, (509) 372-8517

Improved, Real-Time Field Screening During Excavation for One or More of the Following Radionuclides: Uranium, Plutonium, Cesium, Cobalt , or Strontium-90 (RL-SS14)

Rapid, field screening techniques are needed to direct characterization, delineation, and excavation operations. Field screening techniques for characterization and delineation will assure that high cost, site characterization laboratory analyses are optimized. These techniques will also help assure that operations at excavation sites remove all contaminated material and that excavated materials meet waste acceptance criteria prior to disposal. Primary radioactive contaminants of concern include Uranium, Plutonium, Cesium, Cobalt , and Strontium-90. Detection technologies must be portable, easy to use, produce little or no secondary waste and provide real-time field screening. Detection levels must be comparable to cleanup requirements or levels at which remediation alternative decisions can be made. If possible, the technique should support the eventual elimination of the requirement for sample collection and analysis.

Contact: Kim Koegler, BHI, (509) 372-9294; Ashur R. Michael, BHI, (509) 372-9074; V.R. (Vern) Dronen, BHI, (509) 372-9096; or Fred R. Serier DOE, (509) 372-8517; Owen Robertson, DOE, (509) 373-6295

Tanks — Characterization

Technetium-99 Analysis in Low Level Waste Feed (RL-WT02)

An accurate, robust production laboratory method for the measurement of technetium-99 concentration in Hanford waste tank material is needed. The measurement methodology needs to be tested for consistency of performance between DOE Sites characterizing waste materials (round robin exchange, etc.). This methodology must also be suitable for characterizing soils from the vadose zone which receives any leakage of tank wastes. A methodology is needed which is appropriate for production laboratory use to routinely measure the concentration of technetium-99 in waste tank matrices representing any of the waste classifications considered potential feed sources to the vitrification vendors. An accurate production laboratory method for establishing the technetium-99 concentration in low level waste and vadose zone soils is needed. Technetium-99 concentration is a critical component of feed to the waste vitrification vendors. The absolute accuracy of these analytical results produced at Hanford has been questioned and found to be in disagreement with results produced at another DOE site. Variability of redox potential and interferences present in Hanford tank wastes produces inconsistent performance of sample preparation methods in use. In addition, the method must be applicable to soils which may receive waste material that leak from the tank. Technetium in the +7 oxidation state is known to be mobile in the soil column and therefore the concentration in tank wastes must be known well to estimate long term effects of waste tank leakage during storage or retrieval operations.

Contact: J.R. Prilucik, Rust Federal Services Hanford Co., (509) 373-3830 or James A. Poppiti, (509) 376-4550; fax (509) 376-2002; e-mail: james_a_poppiti@rl.gov and Peter T. Furlong, (509) 372-1738; fax (509) 373-0628; e-mail: peter_t_furlong@rl.gov

Large Volume (3-5 liter) Sludge and Supernate Sampler (RL-WT05)

There is a need to obtain large quantities of material from the tanks for analysis, and testing, to support pre-treatment, safety, and retrieval. The system developed must be capable of removing large volumes (~3-5 L) of sludge, and/or supernate, from the DSTs and the SSTs. This system must be compatible with the current sample casks, and supporting transportation, and sample handling systems at Hanford's 222-S Lab. There is no system available to aid in attaining large volume sludge, and Supernate The largest volume sampler for this active, currently, is the 125 ml Bottle-on - a-string.

Contact: C. E. Hanson (SESC), M. Cremonini (NHC) or Paul R. Hernandez, (509) 376-2209; fax (509) 376-2002; e-mail: paul_r_hernandez@rl.gov

Tanks — Operations

Double-Shell Tank (DST) Corrosion Monitoring (RL-WT06)

Corrosion monitoring of DSTs is currently provided by process knowledge and tank sampling. Tanks found to be within chemistry specification limits are considered to be not at risk for excessive corrosion damage. There have been no direct corrosion monitoring systems for DSTs in use at the Hanford Site. As many as 6 DSTs have recently been identified as low hydroxide (out of corrosion specification). This condition indicates that this system is inadequate to support corrosion control. Tank samples are infrequent and their analysis difficult and expensive. Process knowledge is complicated by waste streams that are exempt from the corrosion control specifications. In-tank, real-time measurement of the corrosive characteristics of the tank wastes is needed to provide an acceptable level of corrosion control information. This need supports TWRS Program Logic.

Contact: James L. Nelson, Glenn L. Edgemon, Lockheed Martin Hanford Corporation or Mark L. Ramsay

Tanks — Process Waste

Advanced Methods for Achieving Low-Level Waste (LLW) Volume Minimization (RL-WT012)

There is a need to minimize the volume of the low-level waste. This is both prudent from an overall cost standpoint as well as a requirement when dealing with any RCRA waste. More specifically, there is a need to develop and demonstrate a concept for significant reduction in the volume of low level waste. Currently, the amount of tank waste is so large that enormous quantities of immobilized low activity waste will be generated and require appropriate low level waste disposal. By removal of essentially non radioactive constituents from the waste by innovative chemical processes, the volume of low level waste requiring disposal can be significantly reduced.

Contact: Rudy Carreon or Peter Furlong, (509) 372-1738; fax (509) 373-0628; e-mail: peter_t_furlong@rl.gov or Catherine S, Louie (509)376-6834; e-mail: catherine_s_louie@rl.gov

Identification and Management of Problem Constituents for High-Level Waste (HLW) Vitrification (RL-WT010)

Currently, HLW glasses are formulated to assure that little or no insoluble phases exist in the HLW melter. Insoluble phases are caused by such problem constituents as chrome minerals, spinels, and noble metals. An alternative method for handling problem constituents in HLW glasses is needed. The volume of HLW glass that will be produced from the sludges at Hanford is dependent on the ability to solubilize or dilute problem constituents that make up a very small fraction of the overall waste. Minimizing the impact of the problem constituents is important for formulating a strategy and staging the wastes to be treated during the Phase II privatization effort. Diluting the problem constituents usually involves blending of waste types and/or increasing the volume of glass waste forms. Alternatively, separations of problem constituents is an option. All of these alternatives are expensive. Information is needed on the technical viability of producing HLW glasses with insoluble phases. Information such as settling rates and rheological properties is needed for insoluble phases to determine if the phases will settle in a HLW melter and, if so, whether the settled sludge can be discharged through a bottom drain or by other means. Information is also needed to determine the impact of the insoluble phases on the durability of the waste form. Ultimately, new HLW glass formulations can be produced that reduce the overall glass volume for various waste types and reduce the blending requirements at Hanford. Based on the results of this study, the cost and risk of producing waste forms with insoluble phases will have to be compared with other options such as blending or diluting to determine the best path forward. This information is needed to formulate a strategy for the Phase II privatization effort at Hanford. This includes waste blending requirements for the DOE, waste volume minimization requirements for the Contractors, and overall contracting strategy.

Contact: Rudy Carreon or Peter T. Furlong, (509) 372-1738; fax (509) 373-0628; e-mail: peter_t_furlong@rl.gov or Catherine S. Louie (509)376-6834.

Secondary Products Acceptance Inspection and Test Methods (RL-WT021)

Chemical and radiochemical analytical techniques must be demonstrated to have the required sensitivity, precision, and accuracy to characterize the composition and radionuclide content of the entrained solids, ^{137}Cs ,^{99}Tc, ^{90}Sr, and TRU waste products. Techniques to verify that the solutions and slurries can be safely transported via cask or pipeline. Non-destructive techniques are needed to confirm that separated ^{137}Cs waste product and its container meet the specifications for those materials. Demonstrate destructive and non-destructive examination techniques and chemical and radiochemical analysis techniques for inspecting and testing expected secondary waste products. Techniques must have the required sensitivity, precision, and accuracy to make decisions regarding the acceptability of the products. Techniques must have reliability for application in production type environment.

Contact: J. H. Westsik, Jr., Pacific Northwest National Laboratory (509) 376-5986; fax (509) 376-0166; e-mail: jh_westsik@pnl.gov or Peter T. Furlong, (509) 372-1738; fax (509) 373-0628; e-mail: peter_t_furlong@rl.gov or Philip E. LaMont, (509) 376-6117; fax (509) 372-1350; e-mail: philip_e_lamont@rl.gov

Representative Sampling and Associated Analysis to Support Operations and Disposal (RL-WT018)

There is a need to develop and demonstrate a concept for taking representative samples and associated rapid analysis of feeds which are to be staged for cross site transfer or are to be staged as feed for the Privatization Contractors. Feed for Privatization Phase I immobilization demonstrations must be shown to be within the RFP feed envelope A, B, and C specifications. To accomplish this, the intermediate waste feed staging tank contents must be sampled while being mixed for transfer to the Private Contractors feed staging tank. A variable depth sampling system is needed that can be operated in conjunction with the active mixing system to certify that the tank contents meet the specified waste envelopes. A representative, and preferably also rapid, sampling and analysis system has to be developed and demonstrated so that feeds to the cross site transfer line and to both the LLW and HLW Privatization Contractors can be staged successfully with a minimum impact on tank space. Current grab samplers consisting of "bottle-on-a-string" are used for slurry/supernate sampling. This system of sampling has been found to be cross contaminated with material from higher elevations above the desired sample depth as it is withdrawn from the tank. Although this cross contamination is proportional, it could skew the sample results. Also, this method cannot be performed during active mixing system operation, therefore allowing time for in-tank stratification to re-established before the sampling can be performed. The sampling is a manual operation performed thorough an existing riser using a portable "glove bag" for containment control that has potential for personal contamination and exposure. With HanfordÕs existing capabilities it takes weeks or even months to sample and analyze a tank. Representative sampling involving potentially non homogeneous waste feed is definitely needed. Quicker sample/analytical responses will provide more flexibility to the tank system. ***Possible concept:*** On-line sampling and analysis could satisfy this need. AEA has developed the capability of obtaining representative samples of slurries of waste with a fluidics sampling pump, and this concept is being adapted for Savannah River Site waste tank use. If this device were combined with on-line analytical methods, this need could be satisfied.

Contact: J.D. Galbraith, P. W. Gibbons (NHC), D.G. Baide (LHMC) for sampler; Roger Gilchrist (PNNL) for sampler manifold; John S. Hartman (PNNL) for Laser Ablation/Mass Spectrometer; and Privatization: Peter T. Furlong, (509) 372-1738; fax (509) 373-0628; e-mail: peter_t_furlong@rl.gov; Retrieval: Bruce L. Nicoll, (509) 376-6006; fax (509) 372-1350; e-mail: bruce_l_nicoll@rl.gov

ILAW Product Acceptance Inspection and Test Methods (RL-WT019)

The United States Department of Energy (DOE), Richland Operations Office (RL) is proceeding with a two-phased approach to privatize the treatment and immobilization of HanfordÕs low-activity and high-level wastes currently in storage in underground tanks. DOE will provide the tank wastes to the private contractors who will treat and immobilize the wastes and then return the final products to DOE for storage and final disposal. DOE will pay the private contractors for each waste package received that meets the product specifications. Acceptance of the immobilized wastes will be based on a combination of private contractor activities to qualify, verify, document, and certify the product and DOE activities to audit, review, inspect, and test the processes and products. The immobilization contractors will provide to DOE the immobilized low-activity waste (ILAW) and immobilized high-level waste (IHLW) products in sealed containers, process and product grab samples, and the appropriate product certification which may include pertinent process data. The DOE may conduct non-destructive testing of the sealed immobilized waste containers and destructive and non-destructive testing of the process and product samples. Specific parameters of interest may include chemical composition of the waste forms, fillers, and containers phase composition radiochemical composition thermal history and surface temperature waste form volume and void space waste form and container weight container dimensions including wall thickness effectiveness of container closure or seal (leak tightness) presence of prohibited materials including free liquids and explosive, pyrophoric or combustible materials dose rate surface contamination waste form homogeneity waste form release rates. The IHLW product is expected to be a glass waste form in a 61-cm diameter by 3- to 5-m long cylindrical stainless steel canister. The ILAW is expected to be a glass, ceramic, or metal waste form in a 1.2 m x 1.2 m x 1.8 m rectangular metal box. Generally, the inspection and test methods should not require opening or otherwise breaching the seal of the waste form containers. The appropriate sampling and analysis strategies should provide the basis for making statistically based statements with respect to the confidence with which the products meet specifications. The inspection and test methods must be shown to be relevant to the expected performance parameters of the ILAW and IHLW. Techniques must have the required sensitivity, precision, and accuracy to make decisions regarding the acceptability of the products. Techniques must have reliability for application in production type environment.

Contact: J. H. Westsik, Jr., Pacific Northwest National Laboratory (509) 376-5986; fax (509) 376-0166; e-mail: jh_westsik@pnl.gov or Philip E. LaMont, (509) 376-6117; fax (509) 372-1350; e-mail: philip_e_lamont@rl.gov

Prediction of Solid Phase Formation in Hanford Tank Waste Solutions (RL-WTXX.D)

Information is needed on the solubility of various components in the complex solid and liquid matrices of the Hanford tank wastes. This information is needed to predict when solids will precipitate or when gels will form in retrieval, wash, and leach solutions, and to supplement empirical water wash and caustic leach data from enhanced sludge wash testing of Hanford tank sludge and saltcake samples. Much information is available from past solubility chemistry work at Hanford and from other DOE sites. Available information needs to be compiled for easier use, missing data need to be identified, and work performed to supply the missing data. The information will be used to support the planning for and performance of the Hanford tank waste remediation. This remediation involves pretreating almost 150,000 m^3 of sludge and saltcake solids and 60,000 m^3 of supernatants from 177 waste tanks (Hanlon 1996). Solids and gels are known to form in the Hanford tank wastes when the solution ionic strength is decreased. Transfer lines have been plugged when solids or gels inadvertently formed. Knowledge of the solubility envelope for the waste is necessary to avoid unwanted precipitation or gel formation in supernatants. Sludge washing and leaching performance and saltcake dissolution evaluations are based on empirical data extrapolated from individual tanks to groups of tanks based on waste types. Improvements in processing efficiency are expected if the wash, leach, and dissolution processes are based on an understanding of the dissolution thermodynamics and kinetics rather than just empirical data. Water usage and makeup chemical addition can also be reduced which together with the improvement in efficiency can reduce the amount of HLW glass produced.

Contact: Steve Schaus, Randy Kirkbride or Peter T. Furlong, (509) 372-1738;
fax (509) 373-0628; e-mail: peter_t_furlong@rl.gov

Tanks — Retrieval

Establish Retrieval Performance Evaluation Criteria [Retr-1] (RL-WT023)

Several discrete technology needs must be satisfied to support decisions for tank closure alternatives. These needs include improvements to equipment and methods for tank heel removal, conditioning of wastes to slurries acceptable for transport, techniques to measure the residual waste volume following retrieval efforts, methods to capture samples of waste that are not directly below the riser, and methods to map contaminants in the vadose zone. These needs are expanded in the following paragraphs:

Vadose Zone Contaminants Distribution: Alternative technologies to conventional core drilling for characterization of the vadose zone that are fast, economical and minimize intrusion to the vadose zone are needed. These technologies should: 1) quantify (i.e., 3-D map) the extent of contaminants leaked to the tank backfill material and vadose zone in tank farms; ;and 2) obtain soil samples at selected depths for confirmatory laboratory analysis. The technology must be capable to detect metal pipes and obstructions. The sampled soil column must be sealed (i.e., grouted) to eliminate any potential pathway for contaminant leakage to the aquifer. Technology to verify the quantity and extent of contaminants leaked to the vadose zone in tank farms will reduce the uncertainty associated with estimates of radionuclide and chemical inventory, which are vital input data to the performance assessment model(s) proposed for tank farms closure.

SST Retrieval Equipment/System Development: Performance and cost data comparing alternate and enhanced retrieval methods to the performance baseline of past-practice sluicing is needed. Data will be applied to the selection of retrieval systems for 1)Tank C-106 Heel Removal, 2) M&I retrieval of SSTs during Privatization Phase I, 3) ISSTRS concept design technical input to the Privatization Phase II specification (TPA Milestone M-45-04A) and 5) performance assessment for SST closure. Supports maintaining core competency by providing expertise in the application of retrieval tools, regardless of the implementor.

Waste Conditioning for Tank Heel Transfer: The affects of the physical and chemical properties of waste on pipeline transfer, interim storage and subsequent transfer to pretreatment processed needs to be better understood so that waste conditioning requirements can be determined before any Single Shell Tank hard heels (including the tank 106-C heel) can be safely and efficiently transferred to a storage tank for later processing.

Methods For Waste Heel Volume Determination Including Thickness and Profile: Methods are needed to accurately determine the volume of residual waste in a tank for use in a tank closure assessment. Surface profile and heel thickness are needed to determine waste volume in tanks with unknown tank bottom flatness.

Sampling Methods For Residual Heels — Off Riser Axis: Methods are needed to sample the residual waste in a tank for use in establishing retrieval performance evaluation criteria. Conventional sampling methods can prove ineffective due to little or no waste being located directly below the access riser. In addition, enough locations in the tank need to be sampled to show adequate characterization of residual waste for use in tank specific performance assessment work.

Contact: R.W. Root (HTI Project Manager), P.W. Gibbons, E.A. Fredenburg (NHC); D.G. Baide (LMHC); or Bruce L. Nicoll, (509) 376-6006; fax (509) 372-1350; e-mail: bruce_l_nicoll@rl.gov

Tanks — Storage and Disposal

Contaminant Mobility Beneath Tank Farms and TRU Soil Column Disposal Sites (RL-WTXX.L)

Tank farm leak sites and TRU soil column disposal sites are the two most significant vadose sources of potential groundwater contamination at the Hanford Site. Assessment of contaminant mobility of these sources requires site-specific information.

Tank Farms: Recent borehole spectral gamma data at the Hanford Site indicate that cesium-137 has migrated deeper than previously expected at both the SX and BX tank farms. Groundwater data for several tank farm waste management areas also suggest that pathways through the vadose zone exist and could impact groundwater quality. These observation suggest that fundamental assumptions about contaminant mobility that support single shell tank cleanup options and schedules may be incorrect, a finding echoed by a recent peer review and the National Academy of Sciences. The transport mechanisms and pathways involved are of concern since other waste components not detectable by spectral gamma logging (e.g., plutonium, technetium-99, strontium-90, chromate, nitrate) may also have migrated farther than anticipated and could still be moving. Revised conceptual models coupled with supplemental geophysical and sorption (mobility) data, are needed to quantify and understand the evolution of the present distribution of contaminants and evaluate the potential mobility of the individual contaminants under all "leave or retrieve" options.

Soil Column Disposal Sites (PFP Cribs): Similar needs exist for PFP soil column disposal sites that received large quantities (~20,000 Ci) of transuranics in both a highly acidic aqueous phase and as an organic complex dissolved in an organic phase (carbon tetrachloride). The total contaminated soil volume beneath the PFP cribs is about 1,000,000 cubic meters and may extend to a depth of 40 m or more below ground surface. Some TRU may have migrated deep in the vadose zone in association with the DNAPL. The cost to package, handle and dispose of this volume of TRU (or near TRU) waste (> 100 nCi/g) could easily exceed 1 billion dollars. Excavation and personnel safety related costs would be in addition. Thus stabilization in place, to the extent possible, would be a significant cost savings. Be that as it may, evaluation of either leave or retrieve options will require detailed knowledge of the sorptive status (degree of natural soil "fixation") of the deeply distributed plutonium and americium beneath PFP cribs and trenches.

Contact: V.G. Johnson (PNNL), R.J. Serne (PNNL), M. Fayer (PNNL) or David Shafer (DOE-RL)/David Myers (IT); Mike Thompson (DOE-RL)/Karl Fecht, Tony Knepp (BHI)

Glass Monolith Surface Area (RL-WT030)

The contaminant release rate from glasses is proportional to the surface area reachable by moving moisture. As glass cools it experiences internal stresses and strains which may cause the glass to crack and hence increase the surface area on the glass. External stresses (for example, those caused by earthquakes) could also increase surface area. Iddition, cracks may expose imperfections in waste form (internal gas pockets, nucleation sites, devitrification regions) which may cause increased contaminant release rates. Relatively little is known about the long-term behavior of such cracks. Yet the total contaminant release must be known (or at least estimated) for thousands of years. Status of technology for measurement and aging not known.

Contact: Fred Mann, Fluor Daniel Northwest; (509)376-5728; fax: (509)376-1293; email: frederick_m_mann@rl.gov or v92515@fep0.rl.gov or Phil LaMont, RL/TWRS; (509)376-6117; fax:(509)372-1350; philip_e_lamont@rl.gov