SOLICITATION FOR AN AT-TANK ANALYSIS SYSTEM

TECHNOLOGY DESCRIPTION

The objective of the at-tank analysis project is to produce a field-ready sample analysis system located at the tank site (i.e., “at tank”) as an integral part of the nested, fixed-depth fluidic sampling system, which is being developed under a separate contract. This “at-tank analysis” system must be able to ascertain when the mixing in the tank has reached a steady-state condition by measuring a minimal, but sufficient, number of physical, chemical, and radiological properties of tank wastes in real time. A second but equally important objective for the at-tank analysis system is to quantitatively measure the weight-percent of suspended solids in the 0 - 2 weight-percent range. These measurements will be used to determine when to take liter-size samples of radioactive waste for laboratory analysis and to support decisions on which fraction of the supernatant is within technical specifications for decanting and transfer. Samples will be obtainable from multiple fixed depths.

Laboratory analyses of highly radioactive mixed waste are very expensive, expose personnel and equipment to radiation, and require considerable time and expertise to perform. Therefore, one must ensure that all samples collected are representative of the entire tank contents and that all results are contractually and technically acceptable. The present sampling method is the use of sample bottles lowered into a tank on a string. This method is unsatisfactory because the depth of sampling cannot be adequately controlled and sampling cannot take place during mixing.

The staging tank contents must also reach a steady state as quickly as possible because delays by the U.S. Department of Energy (DOE) in transferring waste to the Privatization Contractor could mean monetary penalties as large as $1 million per day.

TECHNOLOGY NEED

Under the Hanford Site Tank Waste Remediation System (TWRS) privatization strategy, the DOE requires the Project Hanford Management Contract (PHMC) Team to supply tank wastes to the Privatization Contractor for separation/treatment and immobilization (vitrification). Three low-activity waste (LAW) envelopes represent the range of types of liquid wastes in the large underground waste-storage tanks at the Hanford Site. The PHMC Team also is expected to supply a high-level waste (HLW) envelope, which is an aqueous slurry of insoluble suspended solids (sludge).

Ideally, the staging tank for the processing of waste should achieve a state of complete homogenization of liquid and solid components before and during acquisition of all contract-verifying samples. However, no rapid, at-tank method exists to determine if sufficient mixing has been achieved and if it is a steady state or cyclical process. In addition, a rapid, at-tank determination of suspended particle concentration is desired. If the contract specification limit for suspended solids is exceeded, it may be necessary to allow the tank to settle or to take corrective action. This action could lead to costly delays in transferring the waste.

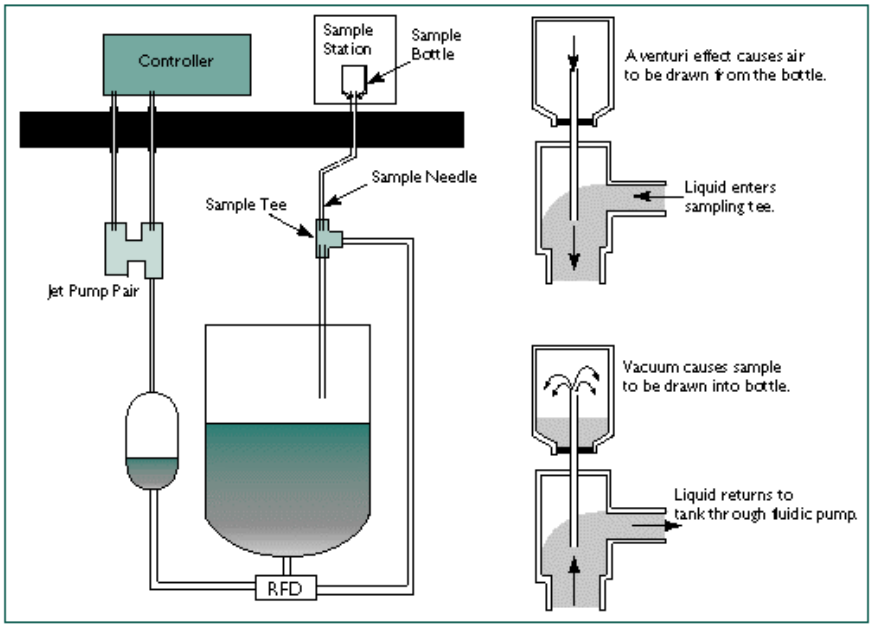
Therefore, development of an at-tank analysis system to determine completion of mixing and particle concentration is necessary. At-tank analysis is a formidable task because the waste is highly radioactive and caustic and it contains near-saturated levels of dissolved species that can crystallize or precipitate. In addition, the actual form of chemicals and the relative distribution of those forms in the waste are not well understood (e.g., a chemical species can exist as a neutral molecule, an ionized molecule, a molecular complex, etc.).

Site Technology Coordination Group (STCG) needs are identified as:

RL-WT09 - Representative Sampling and Associated Analysis to Support Operations and Disposal - To develop and demonstrate a concept for taking representative samples and associated rapid analysis of

feeds that 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 sampled before transfer to the Privatization Contractor. The samples must be representative of the tank contents. To accomplish this, the intermediate waste feed staging tank contents must be sampled while being mixed for transfer to the Private Contractor's feed staging tank. A variable depth sampling system is needed that can be operated in conjunction with the active mixing system to take representative samples and certify the tank contents. The certified tank contents will be needed either for acceptance of the feed by the Privatization Contractor or as a means to determine the additional compensation that the Privatization Contractor will receive.

ID-2.1.26 - Nested Array Fluidic Sampler for Tank Solution Characterization - A method for sampling waste from waste tanks at the Idaho Nuclear Engineering and Technology Center (INTEC) Tank Farm Facility to fully characterize the waste stored in the tanks, and which meets the Resource Conservation and Recovery Act (RCRA) requirements for representative sampling and minimization of sample degradation during sampling. Currently, the waste is transferred from the tank farm tank to a tank at the New Waste Calcining Facility via a steam jet or airlift, sparged, and then sampled via a sampler that uses an air jet to pull liquid through a sample bottle. The existing sampler system and sample transport system is also designed for small 15ml sample bottles, while up to a liter of sample is needed for some U.S. Environmental Protection Agency (EPA) analyses. There is currently concern with the representiveness of the sample and loss of volatile organics during jet/airlift transfer, sparging, and sampling. The State of Idaho recently requested that permitting of facilities at INTEC be accelerated, and waste characterization is needed before permitting of the facilities.



The reverse-flow divertor pump draws liquid from the tank and sends it through the sample tee. As liquid passes the end of the sampling needle and returns to the tank, a venturi effect draws air out of the sampling bottle, creating a vacuum in the bottle. When the delivery pulse from the pump ends, the liquid velocity past the sample needle decreases. At some point, the vacuum exceeds the venturi effect, the flow of liquid is reversed, and some liquid is drawn up into the sample bottle. Eventually, the flow ceases, the vacuum breaks, and the system is ready for another cycle.

Fluidic Sampling System that will pump sample to At-Tank Analysis System

TECHNOLOGY BENEFITS

Development of the at-tank analysis system is expected to provide the following benefits:

- Greatly reduced waiting time for sample analysis.
- Avoidance of potential penalties for late delivery of feed to the Privatization Contractor.
- Reduction of exposure of personnel to radioactive samples.
- Minimization of the transport of radioactive samples.
- Minimization of the need to dispose of radioactive samples after assay is complete.

TECHNOLOGY CAPABILITIES/LIMITATIONS

The primary application for at-tank analysis is deployment with a fluidic sampling system on tanks that will be used to blend and stage waste feed streams as part of the remediation of high-level waste at Hanford and the Idaho National Engineering and Environmental Laboratory (INEEL). The system is expected to determine when steady-state mixing is achieved. Additional physical and chemical properties will be determined in real time.

The at-tank analysis system will only be deployed on tanks equipped with fluidic or other types of sampling devices and only on tanks used for blending staging in the waste remediation process. However, extensive waste remediation will be required for a long period of time so that use and deployment of the system should extend over many years.

COLLABORATION/TECHNOLOGY TRANSFER

This technology development project is a highly collaborative endeavor involving Characterization, Monitoring, and Sensor Technology - Crosscutting Program (CMST-CP), the Tanks Focus Area (TFA), the Hanford TWRS program, the Robotics Crosscutting Program, the International Program, and the Federal Energy Technology Center (FETC) program. The TWRS program will provide program management. The CMST-CP will support design, procurement, proof-of-principle testing, and integration of at-tank analytical instrumentation into the nested, fixed-depth fluidic sampler hardware. Input from the Robotics Crosscutting Program will be used to complete sampler system design review and preliminary hazard assessment. DOE Office of Environmental Management (EM-50) International Program will support completion of proof-of-principal testing and the Outline Design of the nested, fixed-depth sampler and tank interface hardware. DOE Office of Waste Management (EM-30) co-funding with EM-50 funds will be used to support project management activities (reporting and cost/budget tracking/variance analysis) and provide technical oversight. TFA funding will support program management and updates of the AEA Technology Test Plan, Level 2 Component Specifications, the deployment strategy, the hazard assessment, and the review report on the nested, fixed-depth fluidic sampler hardware that will supply sample material to the at-tank analytical instrumentation. FETC will manage the procurement of an industrial contract to design and fabricate the at-tank analysis system.

ACCOMPLISHMENTS AND ONGOING WORK

A Request for Proposal call was issued in February 1999 by FETC to obtain a contractor to design and fabricate the At-Tank Analysis System. Contract award is expected by the summer of 1999. Preliminary design work will be done during the remainder of FY 1999.

TECHNICAL TASK PLAN (TTP) INFORMATION

TTP No./Title: FT09C211 - At-Tank Sampling

CONTACTS

Ron Staubly
Principal Investigator
U.S. Department of Energy
Federal Energy Technology Center
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507 -0880
304-285-4991 fax: -4403
ron.staubly@fetc.doe.gov

Robert Schreiber
Technical Program Officer
U.S. Department of Energy
Federal Energy Technology Center
3610 Collins Ferry Road
P.O. Box 880
Morgantown, WV 26507 -0880
304-285-4127 fax: -4292
rschre@fetc.doe.gov