

Monthly Research Progress

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Task 1 Support of Oak Ridge Site Closure

Characterization of Corrosion for Closure of Oak Ridge Research Reactor

Due to lack of funds for the 2007 federal fiscal year, the Oak Ridge collaborators were unable to provide the support required to enable deployment into the Oak Ridge Research Reactor (ORRR) pool.

Task 2 Support of Hanford Single Shell Tank Waste Disposition

In-tank/At-Tank Characterization for Closure of Hanford Waste Tanks

Stereovision. Progress on the stereovision effort was significantly slowed during October by the unexpected departure of the graduate student working on this effort. The retroactive rescission of CA07 funds in May have prevented replacement of the graduate student. Lack of manpower significantly limits progress on this and other efforts. A literature review of recent advances in stereovision techniques has begun.

Fourier Transform Profilometry. An update on ICET's efforts to evaluate the performance of Fourier Transform Profilometry (FTP) under simulated Hanford waste tank conditions was reported at the Savannah River/Hanford/Idaho Technical Exchange, held in Atlanta, GA.

Based upon Hanford's interest to utilize higher-resolution camera for tank deployments in the future, ICET began a survey of commercially available digital cameras that (1) can fit within a less than four-inch diameter probe and (2) are capable of remote, computer control. The effect of JPEG compression upon image quality and FTP measurement reliability were examined. In order to reduce measurement error by reducing background fluctuations in flat areas, a Hanning window procedure was incorporated into the FTP image analysis software. Since regions of bare tank bottom ("zero height") may be separated by distances greater than a single image, ICET began investigating procedures for how to best propagate height across stitched image boundaries to minimize measurement uncertainty

Process Chemistry and Operations Planning for Hanford Waste Alternatives

A paper, along with a poster, entitled "DOE Chemistry Studies," was presented at the DOE Savannah River/Hanford/Idaho Technical Exchange held on October 9-11 in Atlanta. The paper concentrated on the current workscope and included results on the transfer of the ICET V7DBLSLTDB to the mixed solvent electrolyte formalism being subcontracted to OLI Systems Inc. status of the neural network efforts, evaluation of the DWPF Batch 5 caustic leaching plans for SRS, and evaluation of the gibbsite to boehmite transition. The poster described previous efforts in the development of V7DBLSLTDB, simulations and comparisons of salt cake dissolution experiments, and previous efforts associated with phosphate plug formation and remediation.

A second paper was given at the 15th Symposium on Separation Science and Technology for Energy Applications, held in Gatlinburg, TN October 21-26, 2007. This work was aimed at the gibbsite to boehmite transition and an accompanying manuscript was submitted to the journal Separation Science and Technology.

Task 3 Disposition of Idaho HLW Calcine

Support of the CH2M-WG Idaho Calcine Disposition Project

Because the proper strength from the 34% formulation could not be reached, a formulation with the lower waste loading was run. Below is the recipe. Nine samples were picked, and the first set will be tested for compressive strength next month.

| | | |
|-------------------|-------|--------|
| 20% Waste Loading | | |
| Fly ash | 37.7 | pounds |
| Slag | 37.7 | pounds |
| Portland Cement | 37.7 | pounds |
| Simulant | 56.7 | pounds |
| Water | 102.0 | pounds |
| Sodium Sulfide | 3.3 | pounds |
| total | 275.0 | pounds |

Task 4 Support of SRS Salt Disposition and Other SRS Alternatives

Modeling and Experimental Support for High-level SRS Waste Disposition

Details of the presentations made at the DOE Savannah River/Hanford/Idaho Technical Exchange held on October 9-11 in Atlanta are given in the Hanford waste chemistry report (Task 2.2). While in Atlanta, a meeting with Harry Harmon (PNNL) was held on the issues associated with solids formation in simulants developed for testing of the salt waste processing facility (SWPF) at SRS. An evaluation of the behavior of the simulants using ESP modeling has begun and additional chemicals have been ordered to prepare the simulants. The formation of additional solids following the initial preparation and subsequent filtering of the simulant indicates that some slow kinetics or variations in temperature, leading to saturation and subsequent solids precipitation may be occurring. Efforts are in progress to develop a test plan for current and FY'08 efforts associated with solids re-precipitation.

Process Improvements for the Defense Waste Processing Facility (DWPF): On-line Analysis

The International Scientific Committee (ISC) of Laser Induced Breakdown Spectroscopy (LIBS) has decided to start a North American Symposium on LIBS (NASLIBS). The first NASLIBS will be organized by the Institute for Clean Energy Technology ICET on October 8-10th, 2007 in New Orleans. Dr. Singh is the Chairman of the FIRST (inaugural) NASLIBS symposium. The objective of this symposium is to bring together experts and young researchers in the field, specialists from analytical laboratories, and engineers from the industry concerned with applications and instruments development. NASLIBS2007 Symposium had over 100 participants from the USA and other countries. The papers presented during the NASLIBS-2007 Symposium will be considered for publication in a feature issue of the Applied Optics, Optical Society of America, devoted to the symposium. ICET LIBS group presented three poster papers during this Symposium.

*Process Improvements for the Defense Waste Processing Facility (DWPF):
Improvement of Waste Throughput*

Experiments examining the thermal behavior of the various frit/waste simulant combinations using Differential Scanning Calorimetry (DSC) and Thermogravimetric and Differential Thermal Analysis (TGA/DTA) have been inconclusive and have been discontinued. A report providing the various results will be issued as a final report next month.

*Process Improvements for the Defense Waste Processing Facility (DWPF): Melter
Monitoring*

Awaiting feedback from SRNL on the performance of delivered port adaptor and port window assembly during the CEF test runs.

Task 5 DOE Headquarters Support

DOE HQ Road Map

ICET researchers took part in continued discussions carried out in the formulation of a set of priorities emerging from EM-21 work group conference calls and the workshop held in Salt Lake City, UT during September. This included discussions at the Technology Exchange in Atlanta, GA where ICET was represented by Drs. David Monts, Laura Smith, Jeff Lindner, Rebecca Toghiani, and Charles Waggoner. The ICET 2008 proposed scope of work was submitted to the EM Consolidated Business Center and to DOE Headquarters during the month of October.

Workshop on Heavy Metal Phytoremediation

This workshop has been rescheduled tentatively for early summer 2008; we will report progress next year.

HEPA and Regenerable Filter Performance Assurance

In October, preparations were made to begin the "autopsy" of filters loaded with KCl during the ICET media velocity study. A method to disassemble, with minimal disturbance, the 12"x12"x11.5" HEPA filters was devised. Following that, a labeling system was adopted and physical measurements were made, with respect to filter cake density, to determine the optimum media area required for meaningful gravimetric analysis of the loaded. A method to clean the loaded media was devised, as well as a method to produce consistent results with respect to media drying time.

*Bio-availability Studies of Mercury and Other Heavy Metal Contaminants in
Ecosystems of Selected DOE Sites*

A collaboration with New York City University for testing the feasibility of application of newly developed mercury specific resin to remediate mercury

contaminated soils has started. A series of contaminated Oak Ridge soils were sent to New York City University. The soils included those contaminated with mercury nitrate, mercury chloride, and mercury sulfide at various levels.

Results will probably be reported in Soil Science Society of America International Conference.

Phytoremediation and Long-Term Monitoring of Selected Heavy Metal and Radionuclide Contaminants

Another round of phytoremediation experiments was started. Two fern species, Boston fern and Chinese brake fern, were grown with aged Oak Ridge soil contaminated by various concentrations of different mercury compounds (HgS, HgCl₂, HgNO₃ etc.) Soils from each treatment group were re-mixed and sampled prior to the current experiment.

Task 6 Technology Development

Development of New Technologies for DOE Site Applications

Major efforts have been focused on preparing the data for a presentation at FACSS '07 (The Federation of Analytical Chemistry and Spectroscopy Societies 2007, Memphis, TN). With minor discrepancies in the wavelength output of the optical parameter oscillator (OPO) system, the wavelength scans are relatively reproducible. An interesting phenomenon has been observed and several explanations are being systematically explored. Upon returning from FACSS, the OPO laser began experiencing significant stability issues.

The characterization of the system's performance focused on measuring CO₂ and its mixture. The purpose of the measurement was to test the capability of measuring multiple species simultaneously. For example, most tank vapors contain a wide variety of compounds, the system being developed in this project must be able to characterize multiple important tank-associated species simultaneously (or close to simultaneously). The individual measurements of carbon dioxide and methane have been conducted in previous months; however, the goal of the test conducted during this month was to quantify the time needed to switch from measuring one species to measuring another. It took about 33 seconds for the current system to switch from one species to another. It is noted that this 33-seconds period does not include the time needed to allow a user to change the system operating parameters. This parameter setting time depends on the skillfulness of the user; it usually takes less than a minute.

Development of Fiber Optical Sensor Technologies for DOE Site Applications

DOE reduced the FY 07 funding from \$5M to \$4M dollars for the Institute for Clean Energy Technology. With the reduction in funding, MSU management had to

make hard decisions as to which tasks to continue. After a thorough examination of several factors it was determined that Task 6.2 Optical Sensors would be removed from the scope of work. This information has been conveyed to DOE

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