

# **SUBSURFACE CONTAMINANTS**

## **PLUMES**

### **EXPEDITED SITE CHARACTERIZATION**

**TTP #:** *SRI-6-C2-21*

#### **CONE PENETROMETER SENSOR TESTING AND EVALUATION**

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Principal Investigator: Carol Eddy-Dilek, Westinghouse River Company, 513-529-3218

#### **Project Objectives:**

The work to be completed is focused on evaluation and/or deployment of the Cone Penetrometer Toolbox (CPT) approach for Dense Non-Aqueous Phase Liquids (DNAPL) characterization.

- Task A: Site Characterization of the Interagency DNAPL Consortium (IDC) Site: The IDC is a joint U.S. Environmental Protection Agency (EPA), U.S. Department of Defense (DoD), National Aeronautics and Space Administration (NASA), and U.S. Department of Energy (DOE) program that is focused on evaluation of innovative technologies for DNAPL remediation. The IDC will complete an evaluation of three DNAPL remediation technologies (Six Phase Heating, Steam Stripping, and Chemical Oxidation) in shallow permeable sediments at the Cape Canaveral Air Station in Fiscal Year (FY) 2000. Activities in FY 2001 will focus on identification and characterization of a new evaluation site in a more complex geohydrologic setting such as fractured rock. Funding from this task will be used to do preliminary characterization of the selected site.
- Task B: Characterization to Support Density Balance Mobilization Evaluation at Dover Air Force Base (AFB): Currently two fundamentally different approaches (tracer tests, depth discrete measurements) have been applied to characterization and performance monitoring at DNAPL contaminated sites. Both of these approaches have inherent limitations and strengths and either may be preferable dependent on site or contaminant characteristics. A side-by-side rigorous testing of the methods has not been done to date to determine the appropriate niches and limitations of each of these methods. Joe Rossabi was invited by Ron Falta of Clemson University to deploy the DNAPL characterization toolbox in conjunction with a EPA-sponsored density balanced mobilization test at the DNAPL test cell located at the Dover AFB that was scheduled for June 2001. This test cell is used for DNAPL remediation tests and is artificially contaminated with DNAPL.
- Task C: Development and Deployment of the CPT: The Membrane Interface Probe (MIP) is a probe that was developed by a commercial vendor (GeoProbe) for use with smaller diameter GeoProbe rods. The sensor uses a diffusion membrane and is the only currently available tool for in-situ measurement of high concentration dissolved phase contamination

and DNAPL. It is especially useful for site screening purposes to locate unidentified DNAPL source areas. The MIP was first demonstrated at the Savannah River Site (SRS) in FY 1999 in the AM area where the sensor performed well. The field testing of the MIP at several sites including SRS shows that the response of the MIP is dependent on the properties of the subsurface probe zone as well as the amount of target contaminant in that zone. Work in FY 2001 on this task will focus on developing laboratory and field experiments to better understand the dynamic operation of the MIP. We hope to understand the performance of the MIP in different applications such that it can be used to provide a semi-quantitative vertical profile of Volatile Organic Compounds (VOCs) and DNAPL in the subsurface.

- Phase-Out Activities: A Closeout Plan is being developed to close out this task in the next FY. One of the activities proposed as part of the close out is to develop a compendium of CPT methods of environmental site characterization that includes a history of the Site Characterization and Analysis Penetrometer System (SCAPS) program and documents the significant accomplishments. The success of this group was cited in the National Academy of Sciences (NAS) evaluation of the Environmental Management (EM) Program. The compendium would be an interagency effort with involvement from the DoD (Navy, Army Corps of Engineers, Air Force) and EPA will be issued either as a book or a special issue of a technical journal. Initial planning for the close-out documentation will be done at the SCAPS Users Meeting. Steve Lieberman of the Space and Weapons Research (SPAWAR) will coordinate contributions by the DoD.

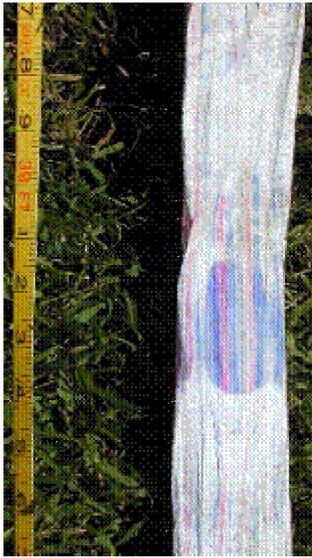
**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Perform Field Work at Dover AFB	06/30/01	06/30/01

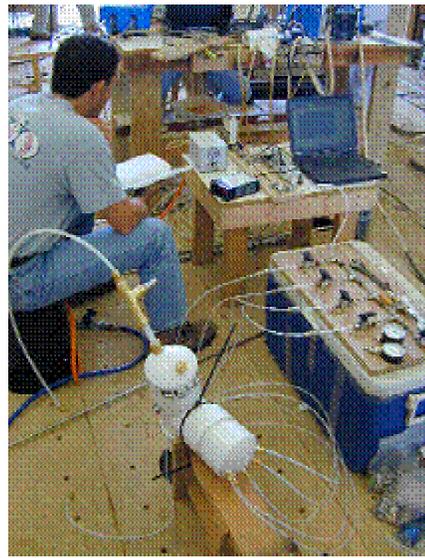
**Accomplishments and Technical Progress:**

- TASK B:
  - ▶ DNAPL characterization using the Ribbon Non-Aqueous Phase Liquids Sampler (RNS) and pore entry pressure studies were conducted at a DNAPL test cell at Dover AFB in June and July of 2001. The RNS were used to map the location of DNAPL in the test cell after flooding with DNAPL. Five RNSs were deployed in existing wells and mapped discrete layers of DNAPL in the saturated zone.
  - ▶ DNAPL pore entry pressure studies were also conducted in three wells in the test cell. The tests used a custom Flexible Liner Underground Technologies (FLUTE) membrane with five pressure ports located one foot apart. Air pressure on each port was increased until flow occurred which is the pore entry pressure of a non-wetting fluid. The pressure was then increased and pressure and flow were measured to determine the permeability of the sediments at each port. This is the first time pore entry pressure measurements have been attempted in-situ. The final documentation on this study will be completed when the results of partitioning tracer tests are received.
- TASK C:
  - ▶ Results of these studies of the MIP completed by researchers at Georgia Tech showed that the thermal influence under air dry soil conditions was much less than 10cm outward from the MIP. These data can also be used to estimate thermal soil properties (thermal

conductivity) and heat transport due to moisture movement. Their experiments also show that the primary mode of VOC transfer through the membrane is by Knudsen diffusion, which is driven by the vapor pressure of VOC compound exterior to the membrane. Heating the membrane serves to increase the vapor pressure and reduce VOC residence time within the membrane. The theoretical temperature at which maximum VOC flux occurs is near 200°C. However, controlled laboratory and field tests yielded better recovery at operational temperatures between 40 and 80°C. It is recommended that the membrane be heated with a proportional power supply with the feedback temperature set-point between the limits of 40 and 80°C during optimal operation of the MIP.



**A RNS recovered at Dover Air Force Base.**



**Joe Rossabi collected pressure data at the site.**

**Plans for the Next Quarter:**

- Data analysis and report preparation will continue.
- An American Society of Mechanical Engineers (ASME) review is planned for November 5, 2001.

**TTP #: FT0-8-C2-62**

**SITE CHARACTERIZATION TECHNOLOGY INTEGRATION AND SUPPORT**

Principal Investigator: Paul Wang, Concurrent Technologies Corporation, 412-577-2648

Point-of-Contact: Ron Staubly, National Energy Technology Laboratory, 304-285-4991

**Project Objectives:**

This project is to provide a center of expertise in alternative characterization and monitoring solutions to help reduce cost and schedule of groundwater and soil cleanup at U.S. Department of Energy (DOE) sites. The project scope involves providing technical and technology integration support to the Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP) as well as providing technical assistance to DOE sites. Task activities will be guided by the Site Technology Coordinating Group (STCG) needs documentation and site "Accelerating Cleanup: Paths to Closure" Plans, specifically in reference to site project baseline summary activities and critical closure paths/events. Specific activities will include (1) serving as the CMST-CP technical point of contact (Liaison) to the Subsurface Contaminants Focus Area (SCFA) and other programs listed above, and providing these programs with expert review of proposals and projects; (2) assessing development status of technologies from all these programs; (3) linking the Principal Investigators (PIs) with site users and vice versa; and (4) keeping the CMST-CP program and its customers informed about the availability, applicability, strengths, and limitations of technology development efforts.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Assist in Technology Gap Analysis and Documentation of Response to STCG Needs	04/30/01	04/30/01
2	Prepare Draft Innovative Technology Summary Report (ITSR) on Topic to be Determined	07/15/01	08/01/01

**Updates:** The draft ITSR for the *Adaptive Sampling & Analysis Program (ASAP) Technology* has been completed.

**Accomplishments and Technical Progress:**

- As CMST-CP/SCFA Liaison, Paul Wang, participated in the Albuquerque Needs Workshop SCFA Breakout. In follow-up, he provided input for needs responses generated from the Workshop. These responses will eventually become the FY 2002 formal needs responses for the Integrated Planning, Accountability, and Budgeting System-Internet System (IPABS-IS).
- At the request of Janis Romo, CMST-CP Task Manager, provided an explanatory note for the overdue Milestone A1-02 for Technical Task Plan No. NV0-1-C2-22: Instrument waster monitoring system at a DOE site, due June 30, 2001.
- As reported last quarter, the Long-Term Monitoring (LTM) Sensor/Analytical Methods Workshop was held June 13-15, 2001, in Orlando, Florida, in support of the SCFA. Dr.

Caroline Purdy, formerly of CTC, and the Workshop moderators are continuing work on the final report, which is expected to be issued in September 2001. This meeting report will contain: the basic and applied LTM Needs Statements with specific contaminants and other LTM requests noted for each statement; a separate listing of commercially available detection technologies for organics, metals, and radionuclides; summaries from all the Breakout Sessions; copies of the Workshop presentations; copies of the filled out evaluation sheets; and a section entitled "Other Opinions" from Workshop participants in addition to the consensus strategies and potential solutions for LTM sensors of the future.

- In response to a request from Richard Carlson of Ground Truth Environmental, provided him with information on how to obtain point-of-contact information for individual Site Technology Coordination Group (STCG) needs.
- Tiffany Zachry of CTC continued work on the draft redesigned CMST-CP Website with other team members of the task.

**Plans for the Next Quarter:**

- Activities in support of the SCFA will be coordinated and level-of-support work requested by the CMST-CP Management Team will be provided.

## **FIELD ANALYSIS**

**TTP #: SRI-7-C2-21**

### ***DEVELOPMENT AND DEPLOYMENT OF INNOVATIVE DENSE NON-AQUEOUS PHASE LIQUIDS CHARACTERIZATION METHODS***

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Principal Investigator: Joe Rossabi, Savannah River Technology Center, 803-725-5220

**Project Objectives:**

This project has sought to develop and field test innovative technologies for subsurface Dense Non-Aqueous Phase Liquids (DNAPL) characterization. Currently, we are focusing on the development and enhancement of one of the most successful characterization technologies to date, the Ribbon Non-Aqueous Phase Liquids Sampler (RNS). The RNS was developed in a collaboration between Savannah River Technology Center (SRTC) and FLUTe Ltd. The RNS uses a hydrophobic sorbent membrane with an impregnated dye that is deployed using everting flexible liner technology. The dye's color is expressed when Non-Aqueous Phase Liquid (NAPL) contacts the membrane in the subsurface. When the membrane is brought to the surface, the depth and location of the NAPL is determined. The first objective for this Fiscal Year (FY) is to select, lab test, and deploy a replacement DNAPL dye for Sudan IV which has been recently identified as a suspected mutagen. The other main objective is to deploy the RNS at suspected DNAPL sites in fractured rock geology.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Identify Partner to Develop New Dyes	11/30/00	11/30/00
<i>Updates:</i> Dr. R. C. Aspland from Clemson University, Textile Sciences Department, will partner.			
2	Deploy RNS at Fractured Rock Site	08/31/01	
<i>Updates:</i> Deployment will be at Smithville, Ontario, site			

**Accomplishments and Technical Progress:**

- Field work using the RNS with the new dyes occurred this quarter. The new dyes were tested in Cone Penetrometer Technology boreholes at the A-14 site of the Savannah River Site (SRS). DNAPL was identified at several depths using the RNS. A second RNS was deployed in the same borehole immediately after the first and similar spots (wrt location and density) were identified on the second RNS. In addition to the spots identified in visible light, additional smaller spots potentially indicating DNAPL were detected under observation with an ultraviolet light. Two of the new dyes used on the RNS have color changes in both the visible and UV spectra when exposed to organic solvents. The American Society of Mechanical Engineers (ASME) reviewed this project and the evaluation was favorable. The SRS DNAPL characterization course was presented to an audience of approximately 100 at the Interstate Technology and Regulatory Cooperation (ITRC) meeting in Trenton, New Jersey, in this quarter. Some non-technical issues have arisen for planned DNAPL characterization work in Canada. We hope to resolve these soon and deploy the RNS at a fractured rock site there.

**Plans for Next Quarter:**

- Deploy RNS at fractured rock site (Smithville, Ontario).

# CONTAMINANT DETERMINATION and MIGRATION

**TTP #: RL3-5-C2-23**

## JOINT COORDINATING COMMITTEE FOR ENVIRONMENTAL RESTORATION AND MANAGEMENT CONTAMINANT TRANSPORT STUDIES

Principal Investigators: Signe K. Wurstner, Pacific Northwest National Laboratory, 509-372-6115  
Michael G. Foley, Pacific Northwest National Laboratory, 509-372-4671

### **Project Objectives:**

Perform detailed geochemical and contaminant-transport analyses of the historic groundwater plumes from Lake Karachay at the Mayak Site and an injection plume at the Tomsk Site in the West Siberian Basin using all available information sources, including direct interactions with Russian scientists and visits to the sites to benefit the U.S. Department of Energy(DOE)/Environmental Management (EM) efforts in the U.S. by providing unique assessments of scale effects in contaminant migration available from no other source.

### **Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Complete Fiscal Year (FY) 2001 Project Report	09/30/01	

### **Accomplishments and Technical Progress:**

- The principal effort in July was preparation for and conduct of the July Modeling Workshop with the Russians and performing follow-up work afterwards. In addition, the short-form Technical Task Plan (TTP) for FY 2002 was submitted.
- The principal effort in August was continuation of development of the transport model for the Mayak site.
- The principal efforts in September were completion of the preliminary transport model and completion of the Year-End Final Report to meet Milestone 1.

# LANDFILLS

## POST-CLOSURE MONITORING

**TTP #: AL2-8-C2-21**

### ALTERNATIVE LANDFILL COVER DEMONSTRATION

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Principal Investigator: Stephen Dwyer, Sandia National Laboratories-Albuquerque,  
505-844-0595

#### **Project Objectives:**

The Alternative Landfill Cover Demonstration (ALCD) is a large-scale field test at Sandia National Laboratories (SNL), located on Kirtland Air Force Base (AFB) in Albuquerque, New Mexico. Construction and instrumentation is complete, and the ALCD is now in the performance-monitoring phase.

The stated objectives of the ALCD are to:

- Demonstrate the construction and cost of cover design alternatives.
- Measure the performance of the design alternatives for a minimum five-year post-construction period using water balance and ancillary data as the primary evaluation method.
- Validate predictive models for evaluating long-term performance of the cover designs.
- Document the results through presentations, reports, and peer-reviewed publications.

The test covers are constructed side-by-side for comparison based on their performance, cost, and ease of construction. The focus of this project is to provide the necessary tools (i.e., cost, construction, and performance data) to the public and regulatory agencies so that design engineers will have better regulatory acceptable alternatives to the conventional cover designs.

Continuous water balance and meteorological data is currently being obtained. It will be actively collected for a minimum five-year, post-construction period. In addition, periodic measurements of vegetation cover, biomass, leaf area index, and species composition are being taken.

#### **Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Water Balance Data Report	08/30/01	08/30/01
2	Numerical Modeling Report	08/30/01	08/30/01
3	Vegetation Characterization Data Report	08/30/01	08/30/01

**Accomplishments and Technical Progress:**

- All milestones were completed on time and submitted via e-mail. Data is still being collected to be included in the Final Data Report due at the end of Fiscal Year (FY) 2002. Submitted a report summarizing all water balance data collected to date at the ALCD. Submitted a second report outlining predictive numerical modeling of the six landfill covers tested in the ALCD. Used the same weather and soil data as that collected in the field. Finally, submitted a report summarizing all data on the vegetation characteristics of the six different landfill covers with their respective surface treatments.
- Recently assisted the Navajo Nation and Tohono O'dham Nation deploy several landfill covers based on technology tested in the ALCD. The Principal Investigator (PI) is also writing an alternative design guidance document for the U.S. Environmental Protection Agency (EPA) Region 9 Office to assist with the deployment of alternative covers based on concepts tested in the ALCD.
- Los Alamos National Laboratory (LANL) and Rocky Flats (RF) have used data produced from the ALCD to back design concepts for landfill closures at their respective sites.

**Plans for the Next Quarter:**

- Continue to collect water balance data at the ALCD site. This next FY will be the ALCD's closeout year.

# HIGH LEVEL WASTE TANKS

## SAFE STORAGE

**TTP #: CH1-0-C2-11**

### **CENTER FOR NONDESTRUCTIVE EVALUATION SAFETY**

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Principal Investigator: Brian Larson, Center for Nondestructive Evaluation/Ames Laboratory,  
515-294-8158  
Bruce Thompson, Center for Nondestructive Evaluation/Ames  
Laboratory, 515-294-8152

#### **Project Objectives:**

Hanford, Idaho National Engineering and Environmental Laboratory (INEEL), Savannah River Site (SRS), West Valley (WV), and Oak Ridge (OR) share a common need to assess and confirm the integrity of their aging High-Level Waste (HLW) storage tanks. Nondestructive Evaluation (NDE) methods are commonly used to collect data on the conditions of materials and structures. The sites will benefit from an activity that promotes collaboration and information sharing relative to NDE issues. The Center for NDE (CNDE) has an extensive history in working with industry on collaborative projects that solve difficult problems. CNDE will initiate a collaborative activity that involves the five main HLW storage facilities. CNDE will assist the sites in solving NDE related technical issues by (1) coordinating both inter- and intra-site information and technology exchange, and (2) providing NDE related technical support and review.

#### **Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Issue a Summary Report on the Site Assessment of NDE for Tank Integrity Inspection	01/31/01	02/28/01
2	Issue a Year-End Report of Activities	09/30/01	10/16/01
3	Conduct Multi-Site Tank Integrity Inspection Workshop and Technology Exchange	12/30/00	11/01/00
4	Issue a Report on the Results of the NDE Workshop and Technology Exchange	03/01/01	02/28/01
5	Issue a Final Report on HLW Tank Inspection and Repair Technologies	09/30/01	10/17/01

### **Accomplishments and Technical Progress:**

- CONFERENCE CALLS:
  - ▶ On August 21, 2001, a conference call was held to discuss tank repair technologies. Participating were representatives from CNDE, Hanford, SRS, and Tanks Focus Area (TFA). It appeared that there was a good opportunity for the sites to share Lessons Learned in this area. This topic will be on the Agenda of the 2<sup>nd</sup> Tank Integrity Workshop.
  - ▶ A conference call to discuss NDE for concrete structures associated with Single-Shell Tanks (SST) was held on September 10, 2001.
  - ▶ The third Quarterly Coordination Conference Call, organized and hosted by CNDE, was held on September 20, 2001. Representatives of HLW storage sites participated along with representatives from TFA, Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP), CNDE, and Defense Nuclear Facilities Safety Board (DNFSB). This call provided an opportunity for site personnel to share information and to coordinate future collaborative activities. Conference call notes were distributed to participants and other interested parties on October 8, 2001.
- CNDE STAFF ADDITION - A new addition to the concrete NDE team has been identified. Dr. Kejin Wang has recently joined the Civil and Construction Engineering Department at Iowa State University (ISU), with credentials including a Ph.D. from Berkeley and post-doctoral studies at Northwestern. She has interests in NDE of concrete and will bring a perspective that complements the measurement expertise of CNDE.
- QUANTITATIVE NONDESTRUCTIVE EVALUATION (QNDE) MEETING - Ron Roberts, Sam Wormley, David Rehbein, Brian Larson, and Bruce Thompson attended the Review of Progress in QNDE Meeting, held in Bowdoin, Maine, the week of July 30, 2001. Many interactions occurred that support the tank integrity program. Of particular note, is the work reported by Roberts and Pacific Northwest National Laboratory (PNNL) researchers (A. Pardini and A. Diaz) regarding the development of a computer-based analysis to guide the application of Tandom Synthetic Aperture Focusing Technique (TSAFT) to the inspection of the knuckle region of the Double-Shell Tanks (DSTs). Theoretical predictions were presented that appeared to be in excellent qualitative agreement with the experimental observations. (The paper, "A Model for High Frequency Guided Wave Inspection of Curved Shells," by R. Roberts, A. Pardini, and A. Diaz is available upon request from CNDE [lpoore@cnde.iastate.edu]). Work towards making a quantitative comparison is now in progress. Wormley attended a number of sessions on Infrastructure NDE, which included work on ultrasonic interrogation of concrete. Rehbein made a number of contacts regarding Guided Wave NDE. Particularly noteworthy, were discussions with the group of Professor Peter Cawley of Imperial College in London, England. Cawley has been a leader in the application of guided waves to NDE in the petroleum industry in the United Kingdom and many of these techniques should be considered for tank walls and transfer piping. The groundwork was laid for future collaborative efforts.
- LITERATURE REFERENCES - An initial set of references was provided to the TFA website personnel for posting. These references were obtained using various search engines for the keywords "tank inspection" and "pipeline inspection." TFA plans to make the test of all posted references available through their website although it will be necessary to resolve copyright issues with some journal publishers prior to publication of complete articles.

- TANK INTEGRITY WORKSHOP - CNDE contracted to hold the 2<sup>nd</sup> Tank Integrity Workshop on November 13-15, 2001, at the La Quinta Inn & Suites Northwest Tech Center, in Las Vegas, Nevada. A draft agenda for the meeting was prepared and discussed with TFA, CMST-CP, and CNDE representatives.
- TECHNICAL INFORMATION EXCHANGE (TIE) QUARTERLY - An article describing the CNDE program for TFA was submitted for publication in a forthcoming issue of the *TIE Quarterly*.
- WASTE MANAGEMENT 2002 MEETING - Two papers were submitted for presentation at the next Waste Management Meeting in Tucson, Arizona. One by Alers and Rehbein, described Electro-Magnetic Acoustic Transducer (EMAT) applications to HLW tanks and the other by Thompson, Bastiaans, and Terry, described how CNDE was working with TFA and CMST-CP to help apply NDE at HLW tanks. In October, the conference organizers, who had more good submissions than could be accommodated within the time allotted to their sessions, requested that the two papers be combined into one. The authors accepted that recommendation.
- ASSISTING PNNL WITH THEIR EFFORT TO DEVELOPMENT A TECHNIQUE TO INSPECT THE LOWER KNUCKLE REGION OF DSTs - PNNL has developed a technique (TSAFT) that has been shown in the laboratory to have promise for the inspection of the lower knuckle region of DSTs, a region expected to be under great stress. However, the physical interpretation of the flaw signal is complicated. A need currently exists for a rigorous physical explanation of the origins of the components of the signal.

CNDE staff traveled to the Hanford site in April to discuss CNDE's assistance to PNNL in their development of TSAFT. CNDE proposed using its computer modeling capabilities to evaluate the sensitivity of the current system, identify sources of error, and suggest possible improvements. As a result of this meeting, a proposal to use computer modeling techniques to improve the understanding of TSAFT measurements, particularly to understand the physical processes leading to complex wave forms when the technique is applied to curved tank sections, was finalized and approved by TFA in May.

Work during the latter part of the Fiscal Year (FY) has focused on developing a computer model to predict flaw signals in the curved tank shell geometry and concentrated on establishing appropriate modeling approaches and computational algorithms.

In this quarter, the computer model was used to predict the measurement response in specific test cases of TSAFT ultrasonic tank inspection to assess performance. These tests revealed conditions under which the algorithm had difficulties, associated with prediction of ultrasonic field amplitudes in regions of field focusing in the curved shell geometry. The problems are associated with the mathematical failure of elementary ray theory in these regions. An algorithm based on a more rigorous mathematical analysis of field amplitudes was implemented earlier this year for treating these special cases, based on certain assumptions of the ray field geometry. The problems being encountered now are due to those few cases where these assumptions do not hold. An alternative approach to handling computations near points of focusing was examined and upcoming work will assess the pros and cons of this alternative approach.

A draft report that describes the CNDE work done in collaboration with PNNL on TSAFT has been prepared. When all of the comments are resolved, a final report will be released.

- **DEVELOPING A TECHNIQUE FOR ASSESSING THE INTEGRITY OF THE CONCRETE DOMES OF THE TANKS** - Several of the sites currently rely on dome deflection surveys to detect changes in the conditions of the concrete. A system that provides more forewarning of problems is desired. Low-frequency ultrasonic evaluation techniques are being considered for this application.

A draft work statement for assessing the integrity of the concrete domes of the HLW storage tanks was completed in April. Low-frequency ultrasonic techniques were considered for this application and several meetings held to discuss possible approaches to this task. Estimation of the bulk modulus of concrete using ultrasound involves coupling ultrasound into the concrete and making accurate measurements of sound velocity.

CNDE will make use of a correlation technique involving direct-sequence spread spectrum ultrasonics to measure the bulk modulus of large concrete structures and thereby gauge concrete structural integrity. This study will be done using a small concrete slab with simulated risers and will measure the effects of probe registration and probe couplant. The study will also compare direct coupling within the risers to an indirect coupling on the outside of the risers (simulating above-ground coupling).

In this quarter, the laboratory apparatus for this task was repaired and calibrated by the manufacturer. The co-developer of direct-sequence spread spectrum ultrasonics, Professor Steve Russell (ISU), joined the project to work with his co-developer, Sam Wormley, the CNDE Principal Investigator (PI).

- **EVALUATING THE USE OF EMATs TO MAKE THICKNESS MEASUREMENTS OF TANK WALLS** - The tank integrity work focuses on attempts to apply and adapt existing EMAT technology to the evaluation of tank wall thinning and corrosion. A vendor (Sonic Sensors) was identified as a source of knowledge and equipment for this purpose. During July, a trip was made to the vendor's site for the purpose of familiarization and training with EMAT equipment and planning of a future trip to the Hanford site for a demonstration of the vendor's technology.

Samples containing simulated flaws similar to those of interest to HLW tank NDE practitioners were manufactured at the Ames Laboratory. These samples included both generalized wall thinning and isolated pitting, as well as, a combination of the flaw types.

The samples were tested in Ames using equipment similar to the vendor's, as well as, using the vendor's portable set. The equipment was demonstrated at the Hanford site using the vendor's portable equipment in the last week of September.

Dave Rehbein (Ames Lab) and Ron Alers (Sonic Sensors) spent September 25-27, 2001, at the Hanford site and PNNL for the purpose of demonstrating the potential of EMAT generated Lamb waves for inspection of the primary tank wall of the waste storage. A meeting with the NDE team headed by Jerry Posakony was held at PNNL on the afternoon of September 25, 2001, for the purpose of acquainting them with EMAT technology and to receive their advice and guidance for the demonstration to site personnel. A technical presentation was made after which interested members of the team participated in a hands-on demonstration of the EMAT equipment provided by Ron Alers. The samples to be used for the demonstration were unavailable, but other plate samples were made available by the Posakony team for examination during this meeting. These samples were subsequently also used for the Hanford site personnel demonstration.

The advice received from Mr. Posakony was extremely valuable and confirmed our initial supposition, namely that this demonstration should focus on the potential use of

EMATs and guides waves as a search tool for location of areas containing defects that would then be quantitatively characterized by more precise Unilateerial Tolerance (UT) methods.

The demonstration with the Hanford site personnel was conducted September 27, 2001. The primary attendees were David Becker and Ed Fredenburg (CH2M Hill), Wes Nelson (Cogema Engineering), and Mike Terry (TFA) who stayed with us the entire day with other personnel from the various contractors, PNNL, TFA, and U.S. Department of Energy (DOE) present at various times. The schedule consisted of a background technical presentation describing EMAT technology followed by a description and demonstration of the hardware and software.

Real-time scans for detection of the defects from the simulated samples manufactured at Ames was performed. These measurements demonstrated that changes in transit time in the case of wall thinning and signal amplitude for the isolated pitting serve as indicators of the presence of defects.

The 0.375" plate samples obtained from PNNL were then scanned. The surface of these samples was degraded with adherent rust scale. No characterization of the surfaces had been performed but the surface condition was such as to render conventional UT difficult without prior cleaning of the surface. The assertion was made by one of the site personnel that these surfaces were "representative" of those encountered in an actual tank. The first of these samples contained a machined depression of approximately 4-5 inch diameter with a depth of 30% of the plate thickness. The maximum transducer separation obtainable for this sample was only about 15". With the close spacing and thus high sensitivity, the flaw indication from this defect was quite dramatic. The second plate contained grinding marks of approximately 2" diameter of depths estimated to range from under 5% of the thickness to a maximum of 15%. The smaller size made these defect indications not as dramatic but still clearly visible in the transit time. Overall, the demonstration was favorably received.

A preliminary examination of the lower knuckle area of a DST mock-up was also conducted during the demonstration. This examination concentrated on the location of simulated crack-like flaws present in the lower half of the knuckle. For these scans, SH waves were used with the transmitter and receiver close together and flaw signals detected that were reflected from the various slots. Identification of the pattern of the flaw locations was accomplished with the stipulation that location of the flaws was known in advance. No sizing was attempted although theoretically that is possible.

Subsequent discussions indicated a high level of interest from site personnel and generated a prioritized list of potential applications. This list reflects primarily the thoughts of Ed Fredenburg and Dave Becker with input from Wes Nelson. The items shown as numbers 2 and 3 actually are of equal priority but are quite far below item 1 in priority.

1. Search and locate tool for identification of suspect areas to be examined later by higher resolution, more quantitative UT techniques. This would allow a larger area to be searched for flaws than is now economically feasible. Currently two 15-inch wide strips spanning the full height of the tank are scanned taking approximately 10 working days. If a high-speed tool for locating defect areas were available, the full 20-foot section accessible through a single riser could be searched for the most critical defects.
2. Investigation of the amount of "Beach Line" corrosion in those tanks where a stable liquid-vapor interfaces level had been maintained for a period of several years.

3. Characterization of those areas where “concrete splatter” requires extensive (and expensive) surface cleaning before inspection with conventional UT techniques is possible.
4. Examination of the lower knuckle area for confirmation or replacement of the TSAFT technique as a method of sizing cracks in the lower knuckle.

Subsequent to the demonstration, a conference call with personnel from TFA, Hanford, and SRS was held on September 27, 2001. Personnel involved included Dave Rehbein, Mike Terry, Bruce Wiersma, and John Elder from SRS, Ed Fredenburg, Dave Becker, Wes Nelson, and others from Hanford. Technical issues were discussed and then followed by questions and observations and comments from the Hanford personnel who observed the demonstration. Positive interest was generated at SRS based on the comments from Hanford.

- REMOTELY CHARACTERIZING THE MICRO-STRUCTURE OF THE STEEL LINERS OF TANKS AT SRS - The tanks at SRS were manufactured from a type of steel that can have significant variation in carbon content. Systems that can remotely and nondestructively determine the carbon content are wanted but believed to be impractical. However, a system that provides useful information about the micro-structure of the material is possible. CNDE proposed making measurements on several heats of material to determine if a correlation could be found between ultrasonic or electromagnetic properties and fracture toughness. SRS made samples available for CNDE measurements, and in August, magnetic testing of three samples from each of the two heats of steel from SRS was accomplished. The data were sent to Andy Duncan (SRS) on August 17, 2001. Good separation in the remanence, min and max H, remanence point, and max permeability was found between the different heats. The preliminary results look encouraging and testing of additional heats seems warranted.

**Plans for the Next Quarter:**

- WORKSHOP - The 2<sup>nd</sup> Tank Integrity Workshop will take place on November 13-15, 2001, at the La Quinta Inn & Suites Northwest Tech Center in Las Vegas, Nevada. Meeting notes, primarily available in CD format, will be prepared and distributed to attendees and other interested parties.
- WASTE MANAGEMENT 2002 MEETING - A paper describing the conference presentation will be submitted to the session chairman for peer review.
- CONFERENCE CALLS - The regular Quarterly Conference Call will be scheduled for early December. Other calls will be scheduled on an as-needed basis to discuss technical and programmatic issues.
- DEVELOPING A TECHNIQUE FOR ASSESSING THE INTEGRITY OF THE CONCRETE DOMES OF THE TANKS - Steve Russell and Sam Wormley plan to deliver analysis of Concrete Velocity measurements using direct-sequence spread spectrum ultrasonics (accuracy measures, limitations, and applicability in estimation of concrete modulus) in December of 2001 and to participate in an upcoming workshop on NDE measurements of concrete scheduled for the early Spring of 2002.
- EVALUATING THE USE OF EMATs TO MAKE THICKNESS MEASUREMENTS OF TANK WALLS - The September demonstration of EMATs at Hanford was very positively received and discussions will take place in the quarter to outline the path forward towards testing on real-world tanks at Hanford in FY 2002.

- **REMOTELY CHARACTERIZING THE MICRO-STRUCTURE OF THE STEEL LINERS AT SRS** - The positive initial findings that the Magnescope can “type” different heats of steel will be discussed at the November workshop with the site representatives and the FY 2002 work to continue these studies will be determined.
- **ASSISTING PNNL WITH THEIR EFFORT TO DEVELOP A TECHNIQUE TO INSPECT THE LOWER KNUCKLE REGION OF DSTs** - The PNNL/CNDE team will issue a report describing FY 2001 progress and defining the work to be accomplished in FY 2002. The team will also collaborate on a research paper on this topic that will be submitted to a peer-reviewed journal for publication.
- **NDE OF CONCRETE WALLS AND DOME OF AN SST** - A new subtask was added to the Technical Task Plan (TTP) directing work in this project for FY 2002. Original plans were to organize a workshop early in the second quarter of FY 2002 to scope out the current NDE technologies that could be applied to this measurement task. However, the continuing resolution, which restricts funding to FY 2001 levels, may cause delays in starting this task and push the workshop later into the FY.

# WASTE RETRIEVAL

**TTP #: FT0-0-C2-11**

***CHARACTERIZATION, MONITORING, AND SENSOR TECHNOLOGY-CROSSCUTTING PROGRAM UNIVERSITY PROGRAMS (FLORIDA INTERNATIONAL UNIVERSITY) [CENTER OF EXPERTISE FOR TANK SLURRY MONITORING]***

Principal Investigator: Anindra Mazumdar, Florida International University, 305-348-2348  
Point-of-Contact: Ron Staubly, National Energy Technology Laboratory, 304-285-4991

## **Project Objectives:**

This project will be a multi-year, collaborative effort with ongoing tasks at Hemispheric Center for Environmental Technology (HCET)/Florida International University (FIU), Oak Ridge National Laboratory (ORNL), and Savannah River Site (SRS). This effort will meet the needs of SRS, ORNL, and Hanford to develop effective slurry monitors for retrieval of high-level radioactive tank waste. This project will support finding or developing tank waste slurry monitoring technologies that can be deployed in the near future. Fiscal Year (FY) 2001 scope for this project includes finalizing the design of the prototype, fabricating the monitor and cold test stand, and cold testing the in-tank Dual Coriolis Slurry Monitoring System (DCMS) to meet critical SRS needs for deployment in FY 2002. Collaboration with Hanford contractors and the Office of River Protection will continue to identify opportunities for deployment of a DCMS at Hanford and for other slurry monitors needed.

## **Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Complete Changes to Detailed Design	12/29/00	01/08/01
2	Issue Cold Test Plan for Prototype Dual Coriolis Wt% Solids Monitor	04/30/01	04/30/01
3	Fabricate the Prototype DCMS Assembly and Test Stand	06/29/01	07/13/01

**Updates:** Milestone M3 completion date was changed in consultation with the client. The new completion deadline for M3 is 07/13/01. This is due to delay from pump vendor, Mayno. However, this will not affect the subsequent milestones.

4	Complete Cold Tests on Prototype and Issue Report	09/27/01	
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**Updates:** Completion of this milestone was affected by the delay in the previous milestone. Cold Testing is now scheduled for completion by 12/15/01.

**Accomplishments and Technical Progress:**

- **BENCH-SCALE EXPERIMENTS** - The bench-scale experiments are performed in a system which is exactly the same as the real Dual Coriolis Monitoring System (DCMS) probe, except that it is not in a vertical alignment. The experiments are aimed at providing statistical data on the performance of the system under a range of expected conditions for filtrate density, temperature, and undissolved solid percent of the slurry. The slurry is simulated using Kaolin clay in a water-Na<sub>2</sub>CO<sub>3</sub> system. The slurry is maintained at a constant consistency and temperature in the slurry feed tank. It is pumped through the slurry Coriolis meter using a Moyno progressive cavity pump. The slurry then passes through a Mott crossflow filter and returns to the feed tank. A small part of the slurry is filtered in the Mott crossflow filter, and the filtrate passes through the filtrate Coriolis meter and is returned to the feed tank. Online density measurement of the slurry and the filtrate is used to calculate the undissolved solid weight percent using a simple correlation.

The water-Na<sub>2</sub>CO<sub>3</sub> was incapable of delivering a filtrate density of 1.3g/cc at 20°C due to saturation. To achieve the density of 1.3g/cc at 20°C, a water-NaNO<sub>3</sub> solution was used instead. Note, however, that system performance is independent of the chemical nature of the carrier fluid.

All bench-scale experiments have been completed and the results have been statistically analyzed by Oak Ridge National Laboratory (ORNL). Analysis performed by ORNL and Hemispheric Center for Environmental Technology (HCET) demonstrates a high degree of correlation, without any significant bias, between the measured and reference experiment values. The results provide a high degree of confidence to proceed with the prototype development and full-scale deployment.

- **FIRST PROTOTYPE DCMS** -The large-scale probe must be compact (6-inch diameter to fit an 8-inch riser port) for easy introduction, positioning, and operation in the tank. Hence, the dimensions of the parts are critical. Detailed drawings and specifications for major equipment and control philosophy have been furnished to the Savannah River Site (SRS) on schedule. A pre-Facilities Review and Testing (FRAT) for the prototype DCMS was conducted by SRS and concluded successfully. SRS comments were incorporated and the design was resubmitted and approved. The test protocol for the first prototype DCMS was approved and submitted on schedule.
- **ASSESSMENT OF CURRENT STATUS AND ISSUES** - The large-scale probe was fabricated and erected in a spare elevator shaft. However, the pump did not work due to low clearance problems between the stator and rotor. The pump was disassembled and sent back to the manufacturer (Moyno Pumps) for correction. The pump is currently being expedited and will be received by the end of September 2001. Cold Tests will resume as soon as the pump is received.

**Plans for the Next Quarter:**

- Tests will be resumed as per the Test Plan approved by SRS on receipt of pump. Results will be statistically analyzed to determine the performance of the probe. A cold acceptance criterion will be agreed upon in discussions with SRS and Tanks Focus Area (TFA). International Union of Operating Engineers (IUOE) review will be conducted to develop Technology Safety Data Sheet (TSDS) for the DCMS.

# WASTE SAMPLING/ANALYSIS

**TTP #: NV0-8-C2-31**

## **INTEGRATED RAMAN pOH SENSOR FOR IN-TANK MONITORING**

Principal Investigator: Job Bello, EIC Laboratories, Inc., 781-769-9450

### **Project Objectives:**

The objectives of this project are to design, assemble, and demonstrate an *in-situ* monitor for corrosive species in the U.S. Department of Energy's (DOE) large-scale waste tanks. The goal is to develop a combined chemistry and corrosion probe consisting of a fiber-optic Raman Probe for sensing nitrate, nitrite, and hydroxide concentration and an Electrochemical Noise (EN) sensor for monitoring in-tank corrosion. In Fiscal Year (FY) 2001, EIC Laboratories, Inc. (EIC) will work with the Savannah River Site (SRS) to finalize the design of the deployment platform for the combined Raman/EN sensor that meets SRS specifications. Based on approved platform design by SRS, EIC will then fabricate and deliver the deployment platform along with the probe and associated instrumentation. EIC Laboratories, Inc. will also provide technical assistance to SRS in the Cold Acceptance Testing of the corrosion probe.

### **Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Complete Engineering	01/07/00	06/00
<i>Updates:</i> Engineering drawings were completed and sent to SRS for final approval.			
2	Deliver Raman System and Deployment Platform to SRS	03/31/00	08/01
<i>Updates:</i> Fabrication was delayed by design approval; delivery expected 08/01 after successful Cold Acceptance Test.			
3	Final Contract Closeout Report	09/30/01	
<i>Updates:</i> Report expected 10/01.			

### **Accomplishments and Technical Progress:**

- Cold Acceptance Testing of the Raman/EN corrosion monitor system to qualify it for delivery to the SRS was successfully completed at HiLine Engineering in July-August 2001 following repair and upgrading of system components. The system will be delivered to SRS customer after as-built drawings are completed by HiLine Engineering. SRS personnel will be planning for the deployment of the combined Raman/EN probe system in FY 2002.

- A report by the SRS customer entitled “Laboratory Testing of a Raman-Based Measurement System for the Determination of Important Corrosion Species in Alkaline Salt Solutions,” D. T. Hobbs, WSRC-TR-2001-00129 was issued.
- An abstract has been accepted for a presentation “Raman Analysis of Corrosion Anions in High-Level Waste,” J. M. Bello, EIC Laboratories, Inc.; D. T. Hobbs, Savannah River Technology Center (SRTC) [4577-30] at Photonics Boston 2001 featuring Environmental and Industrial Sensing Symposia, October 28 through November 2, 2001, Boston, Massachusetts, sponsored by SPIE (The International Society for Optical Engineering)
- The Principal Investigator (PI) responded to an inquiry from a West Valley (WV) site representative.
- Information on the Raman spectroscopy probe developed by EIC Laboratories, Inc. can be found on the InPhotonics website <http://www.inphotonics.com>.

**Plans for the Next Quarter:**

- Report work on SPIE conference presentation.
- Complete final project report.

# MIXED WASTE

## OFFGAS & EFFLUENT MONITORING

**TTP #: CHI-7-C2-33**

### ***DEVELOPMENT OF A MULTI-ELEMENT METAL CONTINUOUS EMISSIONS MONITOR FOR COMPLIANCE MONITORING***

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Principal Investigator: David Baldwin, Ames Laboratory, 515-294-2069

#### **Project Objectives:**

The goal of this project is to provide a system capable of monitoring elemental emissions from waste treatment facilities. The purpose of this monitoring system is to provide documentation of regulatory compliance with regard to toxic metal or radioactive emissions. In order to achieve this goal, we have developed a Compact, High-Resolution Spectrometer (CHRS) based on Acousto-Optic Tunable Filter (AOTF) and high-resolution echelle grating technologies. The CHRS is combined with an air-plasma Inductively Coupled Plasma-Atomic Emission Spectrometry (ICPAES) system developed by collaborators at Mississippi State University (MSU). The combined system is capable of compliance monitoring of heavy metal (e.g., Resource Conservation and Recovery Act [RCRA] metals) and actinide (e.g., alpha emitters) contaminants in stack emissions. In Fiscal Year (FY) 2000, innovations include (1) adaptation of the Echelle Spectrometer System for use as a Mercury (Hg) vapor monitor with simultaneous background and interference monitoring, and (2) application of the existing AOTF-echelle Spectrometer System to other emission-based Continuous Emission Monitoring (CEM) techniques. These innovations will improve the speed and reliability for compliance with U.S. Environmental Protection Agency (EPA) maximum achievable control technology CEM regulations at thermal waste treatment facilities. During FY 2001, we will demonstrate these capabilities at user sites and in collaboration with other CEM developers to establish the ability of this technology to aid in the application of CEMs to emissions monitoring. The spectrometer has an advanced user interface capable of easy adaptation to atomic or molecular emission spectrometric applications such as hot cell and nuclear fuel analysis and processing, field analyses in complex matrices, or passive remote sensing. Additional applications are being sought.

#### **Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Complete Test Plan for Validation Test	05/31/01	05/31/01
2	Demonstrate Mercury (Hg) CEM	09/30/01	

**Updates:** The test has been rescheduled to begin 10/07/01, due to schedule conflicts. Revised date for completion: 10/12/01 (a two-week delay due to travel and scheduling conflicts).

**Accomplishments and Technical Progress:**

- Calibrations for simultaneous detection and interference corrections for Hg, SO<sub>2</sub>, and NO<sub>2</sub> completed.
- Valving and automated control of system for continuous automated monitoring of total and elemental Hg completed. Routine includes automated zero-drift correction.
- System crated and shipped to test site.

**Plans for the Next Quarter:**

- Hg CEM field test at the EPA/Environmental Technology Verification (ETV) Rotary Kiln at Research Triangle Park (RTP). The test will be held the week of October 7, 2001. A report will be prepared and submitted once validation data have been received from Reference Method samples collected during the field test.

**TTP #: HQ0-0-C2-31**

***DIOXIN/FURAN FORMATION AND PREVENTION STUDIES***

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Principal Investigator: Ed Rizkalla, U.S. Department of Energy Headquarters, 202-586-9112

**Project Objectives:**

This project provides technical integration of activities to benefit the U.S. Department of Energy (DOE) waste treatment facilities in their need to understand what impact emission regulations will have on their operation and how to comply with those regulations. The project consists of several activities to aid DOE treatment facilities in understanding their needs for effluent control and emission monitoring of Dioxins/Furans (D/F). Technical assistance teams identify potential problem areas and solutions, diagnostic instrumentation, and on-site testing of emission control methodologies. Of particular concern, are sampling, analysis, and monitoring of process effluents to define emissions relative to operating parameters and testing of potential control techniques to determine their ability to address D/F emissions.

Emissions of Polychlorinated Dibenzo-P-Dioxins and Dibenzofurans (PCDD/F) from hazardous waste treatment facilities and incinerators will be more closely regulated under the U.S. Environmental Protection Agency (EPA) Maximum Achievable Control Technology (MACT) standard. Successful application of this task will help sites obtain and maintain operating permits, which will allow DOE's waste treatment facilities to continue to operate and meet various state compliance agreements. The work also enables facilities to develop effluent control systems to meet compliance emission limits.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
	N/A		

**Accomplishments and Technical Progress:**

- Principal Investigator (PI), Brian Gullet (EPA), and his group presented seven papers at an international conference on dioxins, 21<sup>st</sup> International Symposium on Halogenated Environmental Organic Pollutants and Persistent Organic Pollutants (POPs) in Gyeongju, Korea, September 9-14, 2001.

The titles of the talks included:

- ▶ PCDD/F Formation Rates from Fly Ash and Methane Combustion Carbon Sources, B. Gullett, E. Altwicker, E. Wikstrom, and A. Touatius.
- ▶ Use of Indicators for Measuring Real-Time PCDD/F Toxic Equivalency in Combustion Emissions, B. Gullett, J. Dunn, and E. Wikstrom.
- ▶ Correlations between PCDD/F Homologue Concentrations and TEQ Values in Laboratory-, Boiler-, and Practical-Scale Incinerators, F. I i no, T. Takasuga, A. Touati, and B. K. Gullett.
- ▶ Relative Degradation of Chlorinated Dioxins and Furans in Both a Flow Reactor and a Fixed Bed, B. Gullett, A. Touati, E. Wikstrom, and D. Tabor.
- ▶ <http://www.dioxin2001.com/img/programs%20book.pdf>

**Plans for the Next Quarter:**

- Discuss results of activities with related DOE National Energy Technology Laboratory (NETL) Industry & University Programs project investigators, Transuranic Mixed Waste Focus Area (TMFA), and CMST-CP representatives.

**TTP #:**      *NV0-1-MW-31*

***CHARACTERIZATION, MONITORING, AND SENSOR TECHNOLOGY-CROSSCUTTING PROGRAM TECHNICAL EXECUTION - DIAGNOSTIC INSTRUMENTATION AND ANALYSIS LABORATORY AND ALTERNATIVE OXIDATION TECHNOLOGY***

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Principal Investigator: Stephan Weeks, Bechtel Nevada/Special Technologies Laboratory,  
805-681-2262

**Project Objectives:**

This task provides analytical measurement technical expertise for the execution of Transuranic and Mixed Waste Focus Area (TMFA) research products being developed at the Diagnostic Instrumentation and Analysis Laboratory (DIAL) at Mississippi State University (MSU), and to be used for monitoring effluents of Alternative Oxidation Technologies (AOT) being developed for processing Mixed Transuranic (MTRU) and Mixed Low-Level (MLL) wastes.

- Subtask 1: The Principal Investigator (PI) will coordinate activities and communications to enhance measurement technology development and expedite regulatory permitting of TMFA treatment processes for projects being executed at DIAL that support TMFA priorities.
- Subtask 2: A critical review of technologies applicable to monitoring effluents from mixed waste treatment processes that may provide alternatives to incineration will be performed. The PI will work closely with the management and support staff of the TMFA and the

Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP) to select and use appropriate monitors in order to obtain data that will (1) enhance the development of the Alternative Waste Treatment Technologies (AWTT), and (2) enable regulatory permitting. The emphasis will be defining data required by effluent monitoring technologies to support successful Fiscal Year (FY) 2002 demonstrations of selected AWTT.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Letter Report to TMFA: AOT Effluent Monitoring	09/18/01	
<i>Updates:</i> Report will be completed during the first quarter of FY 2002.			
2	Letter Report to TMFA: DIAL	09/30/01	
<i>Updates:</i> Report will be completed during the first quarter of FY 2002.			

**Accomplishments and Technical Progress:**

- Coordinated and supported the testing of a Mercury (Hg) Continuous Emissions Monitoring (CEM) innovative technology at the U.S. Environmental Protection Agency (EPA) Research Triangle Park (RTP) Rotary Kiln Incinerator.
- Participated in the EPA/U.S. Department of Energy (DOE) Memorandum of Understanding (MOU) Technical Working Group (TWG) on High-Efficiency Particulate Air (HEPA) Filter and Performance and Monitoring.
- Participated in the EPA/DOE MOU TWG on alternative Mixed Waste Treatment Technologies.
- Supported DIAL’s preparation for the America Society of Mechanical Engineers (ASME) Technical Peer Review scheduled for October 2-3, 2001, in Boise, Idaho.

**Plans for the Next Quarter:**

- Participate in the TWG HEPA Filter Performance and Monitoring conference calls and activities.
- Participate in TWG AOT Evaluation conference calls and activities.
- Discuss and coordinate projects with DIAL PIs.
- Write Letter Reports.

**TTP #: *OR0-1-MW-31***

***COMPARE MERCURY CONTINUOUS EMISSIONS MONITORS***

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Principal Investigator: James Dunn, Jr., IT Corporation, 865-241-3737

**Project Objectives:**

This task will support the performance evaluation of long-term Continuous Emissions Monitors (CEMs) for Mercury (Hg) at the Toxic Substances Control Act Incinerator (TSCAI). In order for Hg CEMs to be considered for regulatory compliance assurance, acceptable performance

must first be demonstrated. Previous Hg CEM testing in conjunction with a proposal on the U.S. Environmental Protection Agency (EPA) Maximum Achievable Control Technology (MACT) standards for hazardous waste combustors at a commercial cement kiln in 1996-97 was not successful. The emission characteristics of the kiln, specifically the combination of high Particulate Matter (PM), moisture, and acid gases were believed to have contributed to the failure of the tested CEMs. Further testing of a commercial Hg CEM at the TSCAI in 1998 was evaluated according to the proposed EPA Performance Specification 12 (PS12). The CEM exhibited potential at the mixed waste incinerator to meet proposed requirements under liquid feed conditions for Hg concentrations in the range of proposed MACT standards. However, under conditions of incinerating liquids and solids simultaneously, reliable CEM performance was *NOT* demonstrated under the facility's operating conditions and configuration. The data supported the feasibility of Hg CEM at hazardous waste incinerators, however, pointed to additional testing required to satisfy PS12, CEM modifications to handle transient emissions from treating heterogeneous waste streams, further development of calibration standards and methods to meet EPA MACT mercury emission limits, and agreement on site-specific response factors.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
	N/A		

**Accomplishments and Technical Progress:**

- Hg CEMs - A draft Test/Quality Assurance (QA) Plan for field demonstration of Hg CEMs at the TSCAI is being written and will be completed in October 2001. The primary objective is the full-scale field test of Hg CEMs so that results can be used to select monitors for deployment at U.S. Department of Energy (DOE) sites. A secondary objective is to support EPA, industry, and the public in regulatory compliance information gathering, including results that satisfy EPA Environmental Technology Verification (ETV) Phase II program requirements. The testing is currently scheduled to begin in March 2002. The EPA ETV Program sent out an initial inquiry of interest to vendors concerning participation in the Hg CEM testing at TSCAI.
- PARTICULATE MATTER (PM) CEMs - The final report from a previous field evaluation of PM CEMs is in the final stages of editing. The field study evaluated the performance of three commercially available PM CEMs, which were conducted in 1999-2000 at the DOE TSCAI. The performance of the CEMs was evaluated using the requirements in draft EPA Performance Specification 11 (PS11) and Procedure 2.

**Plans for the Next Quarter:**

- Coordinate activities with Florida International University (FIU)/Hemispheric Center for Environmental Technology (HCET) and EPA ETV through Transuranic Mixed Waste Focus Area (TMFA) and Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP).
- Draft Test Plan.
- Query expressions of interest to participate in test program from Hg CEM vendors through a *Commerce Business Daily* (CDB) announcement.
- Initiate Hg CEM instrument selection.

# DISPOSITION OF FACILITIES (D&D)

## FACILITY CHARACTERIZATION

**TTP #:** *FT0-0-C2-51*

### ***SCREENING TO BELOW REGULATORY LIMITS***

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Principal Investigator: Hans Weger, Florida International University, 305-348-6620

Point-of-Contact: Ron Staubly, National Energy Technology Laboratory, 304-285-4991

#### **Project Objectives:**

Many U.S. Department of Energy (DOE) sites have facilities awaiting Deactivation and Decommissioning (D&D). These facilities must be periodically surveyed for radiological contaminants as well as hazardous contamination. Current advances in technology have produced a number of field instruments capable of generating accurate data comparable to laboratory instruments.

This project aims to acquire regulatory acceptance for improved real-time characterization technologies that have shown cost and time savings in Large-Scale Demonstration and Deployment Project (LSDDP) demonstrations or demonstrate same technologies for different applications. In addition, these field instruments could potentially be used to gain regulatory approval for purposes other than free release such as classifying waste category (i.e., Low-Level Waste [LLW], Transuranic [TRU], High-Level Waste [HLW]) in the field. Technology such as the Niton Lead Paint Analyzer would be considered to replace paint sampling and analysis.

Hemispheric Center for Environmental Technology (HCET)/Florida International University (FIU) will work with DOE Deactivation and Decommissioning Focus Area (DDFA), Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP), Environmental Measurements Laboratory (EML), and Interstate Technology Regulatory Corporation (ITRC) to identify and test improved real-time characterization technologies. FIU will (1) review characterization technologies demonstrated in LSDDPs, (2) demonstrate the Niton Lead Paint Analyzer at one DOE site, (3) collect relevant data to satisfy regulators requirements, and (4) develop necessary documentation for regulatory approval of technology.

The implementation of a regulatory accepted field deployable system for free release from a given facility will provide the following benefits: provide an alternative to sample collection and lab analysis, savings in terms of time and cost, and near real-time data to the D&D worker for improved efficiency.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Review of Characterization Technologies Demonstrated in LSDDPs Investigation of Requirement for Regulatory Acceptance Requirements at One DOE Site	05/30/01	05/30/01
2	Demonstration of Niton Lead Paint Analyzer at HCET or a DOE Site	08/31/01	

*Updates:* Milestone has been postponed indefinitely due to potential redirection of project by DDFA.

**Accomplishments and Technical Progress:**

- Initiated review and re-analysis of technologies for selection for this project evaluating dozens of new technologies (during past year) and lessons learned from difficulties in Fiscal Year (FY) 2001.
- Continued development of general acceptance criteria for regulatory compliance of technology application in progress.
- Initial interactions with newly-formed ITRC characterization and monitoring working group.
- A meeting is scheduled with ITRC at their annual meeting in Long Beach, California, November 5-8, 2001, which is expected to provide the direct input by several key people in ITRC that would not be possible in any other way. A new characterization group in ITRC has recently formed and this will be an excellent opportunity to network with them.

**Plans for the Next Quarter:**

- Attend ITRC meeting in November to represent DOE issues on one panel as well as to get input from several key ITRC personnel on this project.
- Continued development of regulatory acceptance criteria for equivalent characterization technology.

**TTP #: FT0-0-C2-52**

**REAL-TIME BERYLLIUM MONITOR FOR SURFACE AND AIR SAMPLES**

Point-of-Contact: Ron Staubly, National Energy Technology Laboratory, 304-285-4991

**Project Objectives:**

This project will develop and field test real-time, field-ready prototype monitor for near-instantaneous detection and measurement of both airborne and surface beryllium contamination. This capability will allow for more effective free release of property, aid the determination of beryllium-contaminated work areas prior to potential worker exposure, and improve worker safety by providing workers with an "alarm" function capable of notifying workers when airborne beryllium is present within the work area.

In the Base Program, the project will commence with a design task to determine the optimal configuration for a field-ready beryllium monitor for making airborne and surface measurements. Once the design has been finalized and approved by the U.S. Department of Energy (DOE), the contractor shall fabricate the prototype beryllium monitor and perform checkout testing in their facilities. A calibration shall then be carried out on the monitor(s) to verify its/their performance prior to field testing. Once the monitor has been successfully calibrated, the contractor shall deliver the monitor to Rocky Flats (RF) and assist the site in performing field tests on the monitor in actual beryllium-contaminated facilities. In the Option, the contractor shall produce a maximum of twelve additional monitors for use at various DOE sites contaminated with beryllium.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Final Conceptual Design Report	02/10/01	02/16/01
2	Prototype Fabrication Complete	07/15/01	09/30/01

*Updates:* System fabrication is essentially complete, but several bugs remain to be resolved. This milestone is now non-critical to the demo schedule as it was pushed back due to scheduling conflicts at Rocky Flats Environmental Technology Site (RFETS). [See discussion below.]

**Accomplishments and Technical Progress:**

- Science and Engineering Associates, Inc. (SEA) continued with the system fabrication and system assembly. SEA has received the circuit board that is designed to provide the timing and triggering for the Laser-Induced Breakdown Spectroscopy (LIBS) sparking, sample movement, and data collection. This circuit board contains an SX programmable microprocessor chip that was programmed according to the laser, robot, and Andor Charge Coupled Device (CCD) detector timing parameters. Upon receipt of the circuit board, it was quickly determined that the system was not functioning properly. SEA determined a number of issues with the laser triggering and timing (both the flash lamp and the Q-switch) that were not represented accurately in the User’s Manual for the laser. In addition, a Radio Frequency (RF) pulse generated by the Q-switch in the laser was propagating back into the circuit board and causing intermittent errors in its performance. Subsequently, the timing and triggering errors were identified, fixed, and the circuit board was isolated from the RF noise pulse. This exercise resulted in several design iterations on the circuit board and SX chip software, along with a return of the laser to the manufacturer to check the internal circuitry of the laser.
- A number of other fabrication and assembly tasks were conducted including:
  - ▶ Assembled the PC-104 computer board. This includes the physical support for the Andor card, the terminal blocks for the various Input/Output (I/O) and relay lines and the hard disk mounting. Tested the relays, digital input lines, and the analog input lines. The relays and digital inputs work fine. SEA is working through a calibration issue with the analog input lines.
  - ▶ The mirror was drilled and mounted in the LIBS column.

- ▶ The instrument pass-thru plate design was modified to accommodate the fiber optic required by the SX circuit isolation and sent out for fabrication.
- ▶ The monitor/keyboard module was sent out for fabrication. All of the hardware that interfaces through the monitor/keyboard, such as the bulkhead fittings for the chiller water, air pump plumbing and electrical, etc. was ordered and received.
- ▶ The drawings for the instrument frame and panels were completed and are out for fabrication.
- ▶ The spent filter disposal unit was returned from the machine shop and it being assembled.
- ▶ The Lower Optics Assembly Wiper (the wiper part of the dust seal between the spark chamber top and the optics assembly) was remade using an aluminum tooling plate. This was necessary because the original material, delrin, exhibited dimensional instability over time and began to warp.
- ▶ The robot grippers were sired for the limit switches and assembled on the robot hand.
- The plan for this quarter was to move the laser system, robot, and sample chamber over to Lovelace Respiratory Research Institute (LRRRI) to perform the final method development tests with the actual hardware in its final configuration. Due to the circuit board issues, this could not be accomplished; therefore, no lab work was conducted. In preparation for the availability of the hardware, numerous beryllium samples were prepared. As of this writing, the equipment is being moved over to LRRRI for testing on beryllium samples.
- SEA has also initiated discussions with RFETS for the site test at Rocky Flats. Alec Cameron of RFETS has been provided some details on the testing and demonstration procedure. The demo date has been pushed back until November or December 2001. A firm date has not been identified, but will depend on the schedule for RFETS resources over the next several months.

# FIELD PROGRAM ACTIVITIES

**TTP #: CH1-0-C2-31**

## ***TECHNICAL INTEGRATION FOR CHARACTERIZATION, MONITORING, AND SENSOR TECHNOLOGY-CROSSCUTTING PROGRAM***

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Principal Investigator: Williams Haas, Ames Laboratory, 515-294-4986

### **Project Objectives:**

This project provides technical integration for the Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP) activities with the Transuranic Mixed Waste Focus Area (TMFA). The Principal Investigator (PI) serves as CMST-CP project facilitator and undertakes other CMST-CP technology integration and technical support tasks as assigned. The PI also reviews proposals, test plans, progress reports, and other documents as assigned, and provides observations and conclusions to CMST-CP management as requested. The principal areas of emphasis are the TMFA, technical support to Industry and University Programs efforts in support of the CMST-CP related needs of the TMFA, TMFA support provided by the Diagnostic Instrumentation and Analysis Laboratory (DIAL) at Mississippi State University (MSU), and the monitoring and control of emissions from mixed waste thermal treatment processes and other treatment processes that may be acceptable alternatives to incineration.

### **Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Date Due</i>	<i>Completion Date</i>
	N/A		

### **Accomplishments and Technical Progress:**

- CMST-CP TECHNICAL SUPPORT TO THE TMFA
  - ▶ BASIC SCIENCE & APPLIED RESEARCH - Continued communication with Roger Scott regarding TMFA Basic Science and Applied Research needs and plans, including the work of the National Academy of Science (NAS)/Nuclear Regulatory Commission (NRC) committee to identify TMFA Basic Science Needs (July 23, 30; August 2; and September 24, 2001).
  - ▶ CONTINUOUS EMISSIONS MONITORING (CEMs) - At the request of Caroline Purdy, provided her with information on the status of current Office of Science and Technology (OST)-funded CEM development efforts (August 14 & 21, 2001). Also at Ms. Purdy's request, provided her with a written summary of the U.S. Environmental Protection Agency (EPA) Maximum Achievable Control Technology (MACT) Rule. The summary was prepared shortly after the Rule was promulgated in 1999 (August 27, 2001). Later provided Ms. Purdy with (1) previously prepared presentation material on the MACT Rule and U.S. Department of Energy (DOE) CEM development activities

and (2) material previously prepared by the CMST-CP team as input to DOE for a U.S. General Accounting Office (GAO) evaluation of emissions monitoring technologies (August 27, 2001). Sent additional information on multi-metals CEM development progress to Ms. Purdy (September 4, 2001).

- ▶ **HIGH-EFFICIENCY PARTICULATE AIR (HEPA) FILTER PERFORMANCE** - Participated in EPA/DOE Memorandum of Understanding (MOU) HEPA Monitoring and Performance Technical Work Group (TWG) conference calls (July 11, 25; August 6, 14; and 27, 2001). The conference call participants have included Bill Owca, DOE/Idaho (ID); Ed Rizkalla and Dan Melamed, Environmental Management (EM)-52; Randy Seeker, Wyman Clark, and Bruce Springsteen, GE Energy & Environmental Research Corp.; Charles Waggoner, Arun Kumar, John Luthe, and John Plodinec, DIAL; David Eaton and Steve Priebe, BWXT; Stephan Weeks, Bechtel Nevada Special Technologies Laboratory (BN/STL); C. C. Lee, EPA; Brian English, ID Department of Environmental Quality; Catherine Massimino, EPA Region 10; Bill Haas, Ames Laboratory; and James Slawski (Defense Programs [DP]-45). The topics addressed included:

1) What Quality Assurance (QA) level is needed. Conclusion: EPA Level 3 - Suitable for support of Engineering and Development but may need to go to Level 2 (suitable for support of Policy decisions, rule-making, regulatory decisions) on certain types of work yet to be identified.

2) Test Plan items yet to be completed. Steve Priebe and David Eaton signed up for some of these.

3) Criteria for American Society of Mechanical Engineers (ASME) Peer Review of the Test Plan. The Peer Review is scheduled for October 2, 2001, in Boise, ID. The Test Plan, Criteria for Evaluation, and list of recommended reviewers are due to American Society of Mechanical Engineers (ASME) 45 days prior to the review.

Sent Charles Waggoner, DIAL, information on EPA Requirements of QA Project Plans, EPA QA/R-5 (EPA/240/B-01/003). EPA developed the QA Project Plan as a tool for project managers and planners to document the type and quality of data needed for environmental decisions and to describe the methods for collecting and assessing those data. The development, review, approval, and implementation of the QA Project Plan are part of EPA's mandatory Quality System. The EPA Quality System requires all organizations to develop and operate management structures and processes to ensure that data used in Agency decisions are of the type and quality needed for their intended use.

This document provides the QA Project Plan requirements for organizations that conduct environmental data operations on behalf of EPA through contracts, financial assistance agreements, and interagency agreements (March 2001, 40 pages) (July 16, 2001).

Provided written review comments and suggestions regarding the draft of Section 4 of the Test Plan to members of the TWG (July 24, 2001).

Sent Stephan Weeks information on several EPA Test/QA Plan documents and Decision Quality Objectives (DQO) documents. The Test/QA Plan documents are from the EPA Environmental Technology Verification (ETV) program (August 7, 2001)

- **CMST-CP TECHNICAL SUPPORT TO OST** - Provided contact information to Stan Wolf, at his request, concerning persons/organizations that have expertise in the measurement of moisture in powders (July 16, 2001).

- LONG-TERM MONITORING (LTM) SENSORS/ANALYTICAL METHODS WORKSHOP - Continued work with Workshop Manager, Caroline Purdy, Concurrent Technology Corporation (CTC), to help produce the Workshop Final Report (July 10, 2001). Also, as requested, provided written evaluation comments concerning the Workshop to Caroline Purdy (July 16, 2001). Reviewed the draft Workshop Report transmitted by Caroline Purdy, and provided her with written comments and suggestions regarding the draft (August 8 & 11, 2001). Reviewed the “final draft” of the Workshop Report transmitted by Caroline Purdy and provided written comments and suggestions to her (September 27, 2001).
- LONG-TERM MONITORING (LTM) SENSORS/ANALYTICAL METHODS WORKSHOP - Continued work with Workshop Manager, Caroline Purdy, Concurrent Technology Corporation (CTC), to help produce the Workshop Final Report (July 10, 2001). Also, as requested, provided written evaluation comments concerning the Workshop to Caroline Purdy (July 16, 2001). Reviewed the draft Workshop Report transmitted by Caroline Purdy, and provided her with written comments and suggestions regarding the draft (August 8 & 11, 2001). Reviewed the “final draft” of the Workshop Report transmitted by Caroline Purdy and provided written comments and suggestions to her (September 27, 2001).
- INNOVATIVE TECHNOLOGY SUMMARY REPORT (ITSR) ON *ADVANCED TENSIO METER FOR VADOSE ZONE MONITORING* - Completed all the changes requested by John Jones, CMST-CP Field Lead, Heather Holmes-Burns, British Nuclear Fuels, Ltd. (BNFL) Savannah River, and Principal Investigators (PIs) Joel Hubbell and Buck Sisson, Idaho National Engineering and Environmental Laboratory (INEEL). Forwarded the resulting draft ITSR to John Jones for Field Office review (August 28, 2001). The plan is to rewrite the Cost Section if/when Holmes-Burns provides appropriate cost data.
- ITSR ON *LASER-INDUCED BREAKDOWN SPECTROSCOPY (LIBS)-BASED CONTINUOUS EMISSIONS MONITORING (CEM) FOR METALS* - Reviewed the draft ITSR on LIBS-Based CEM for Metals prepared by Steve Buckley and David Hahn, and provided written review comments and suggestions to Stephan Weeks, CMST-CP Liaison to the TMFA (September 25, 2001).
- CMST-CP ROAD MAP - As requested, reviewed and provided written suggestions and review comments to Charles Davis, CMST-CP Field Coordinator, and John Jones, CMST-CP Field Lead, for a new draft section of the CMST-CP Road Map (August 31, 2001). Reviewed and provided written comments on the draft Road Map section addressing OST CMST-CP Successes (September 25, 2001).
- CMST-CP TEAM CONFERENCE CALLS - Participated in CMST-CP team conference calls on July 16, 30; August 13, 27; and September 24. Topics addressed included the CMST-CP Road Map document, CMST-CP requirements of the Long-Term Stewardship (LTS) program, highlight reporting, collaboration with the Interstate Technology and Regulatory Cooperation (ITRC), Program Execution Guidance (PEGs), and Technical Task Plans (TTPs), and reports from staff.

**Plans for the Next Quarter:**

- Participate in the CMST-CP Fiscal Year (FY) 2002 Kickoff Meeting November 15, 2001.

- Attend the Industry Partnerships for Environmental Science and Technology Conference at the DOE National Energy Technology Laboratory (NETL) in Morgantown, West Virginia, October 30 through November 1, 2001.
- Complete work on the Advanced Tensiometer ITSR (OST Tech ID #2122).
- Continue to contribute to the completion of the CMST-CP Road Map.

**TTP #: CH1-9-C2-11**

**TECHNICAL SUPPORT AND PROGRAM LIAISON TO TANKS FOCUS AREA**

Principal Investigator: Glenn Bastiaans, Ames Laboratory, 515-294-3298

**Project Objectives:**

This task provides technical support and assistance in field coordination and program support for the Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP). It involves and contributes to identification of technology needs; assessment of technology requirements, capabilities, and limitations; promotion of technology integration; assessment of technology development opportunities; and program planning and implementation. The Principal Investigator (PI) works as a member of the combined U.S. Department of Energy (DOE) Headquarters (HQ) and Field CMST-CP management and implementation team, providing technical and other support, as directed, to the CMST-CP HQ Program Manager and the CMST-CP Field Manager. A primary duty is to provide liaison to the Tanks Focus Area (TFA) for all collaborative technology development and technical oversight activities.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Prepare Draft Strategic Plan	10/30/00	10/27/00
2	Prepare Final Strategic Plan	03/31/01	03/30/01
3	Identify CMST-CP Related Development and Performance Requirements	04/30/01	04/11/01
<i>Updates:</i> Technical response preparation has been completed.			
4	Complete Product Delivery Expectations	05/30/01	07/06/01
<i>Updates:</i> Product delivery expectations preparation in progress.			
5	Prepare Draft Program Execution Guidance (PEG)	06/30/01	06/01/01
<i>Updates:</i> Development plan was completed in collaboration with TFA.			

### **Accomplishments and Technical Progress:**

- TECHNICAL SUPPORT TO CMST-CP AND TFA
  - ▶ SLURRY MONITORS - Periodic conference calls were held with Hemispheric Center for Environmental Technologies (HCET), Savannah River Site (SRS), Oak Ridge National Laboratory (ORNL), and TFA personnel to monitor technical progress. In collaboration with the TFA Characterization Technical Integration Manager (TIM), a visit was made to HCET/Florida International University (FIU) on August 16, 2001, to review progress and to prepare for a technical review now scheduled for November 2001. HCET has solved a pump operation problem and is proceeding with performance testing of the first prototype of a dual Coriolis monitor of suspended solids for deployment at SRS.
  - ▶ RAMAN CORROSION PROBE - Acceptance Testing of the Raman/Electrochemical Noise (EM) Corrosion Monitor system to qualify it for delivery to the SRS was successfully completed in August 2001 following repair and upgrading of system components in July. The CMST-CP portion of this work will be completed with the acceptance of a final report of EIC Laboratories, Inc. that is now expected in October 2001. A Task Change Request (TCR) will be issued to change the final milestone of the Raman probe development project to delivery and completion of the Cold Test. Following completion of as-build drawings, the Raman/EN probe will be delivered to SRS under a separate contract.
  - ▶ NONDESTRUCTIVE EVALUATION FOR TANK SAFETY - A Quarterly Teleconference Call was held with representatives from the DOE sites, Center for Non-Destructive Evaluation (CNDE), TFA, CMST-CP, and the Defense Nuclear Facilities Safety Board (DNFSB). Sites exchanged progress reports and planning was done for the Second Workshop on Tank Structural Integrity Assessment that will be held November 13-15, 2001, in Las Vegas, Nevada. Additional Workshop planning was done with CNDE and TFA staff. In late September, a very successful demonstration of Electro-Mechanical Acoustic Transducer (EMAT) technology for nondestructive evaluation was completed by CNDE at Hanford. The EMAT technology allows efficient surveys of tank walls to be done to detect wall thinning and defects, such as cracks and pits, even though rust and scale may be present on the wall surface. Several samples were successfully evaluated and a high level of interest was expressed by Hanford site personnel. Other DOE site personnel have also expressed initial interest.
  - ▶ WEST VALLEY TANK CHARACTERIZATION - A technical project review was held at the West Valley Demonstration Project (WVDP) by TFA with support of CMST-CP and Robotics personnel. At the review, significant data modeling results were presented in the area of characterization. The CMST-CP Liaison contributed to a report of the technical review that will be released by TFA. Gary Troyer, Fluor Hanford, has issued a final report on the modeling of characterization data to predict the inventory of residual waste in tank 8D-2 at the WVDP.
  - ▶ LIAISON - The TFA Liaison participated in monthly conference calls with TFA Contractor Management and TIMs for planning purposes. Visits were paid to ORNL and the Diagnostic Instrumentation and Analysis Laboratory (DIAL ) at Mississippi State University (MSU). At ORNL, discussions were held with the ORNL Robotics group on potential participation in the development of sludge mapping and level measurement technologies in support of tank waste retrieval. Discussions were also held

with an Environmental Management Science Program (EMSP) PI developing a tank waste characterization technology. At DIAL, discussions were held to enhance research and development work in the areas of high priority TFA needs.

- CMST-CP PROGRAM SUPPORT - The TFA Liaison participated in the CMST-CP conference calls held this quarter. Support was provided for the review of drafts of the report on the Long-Term Monitoring (LTM) Workshop held by CMST-CP and Subsurface Contaminants Focus Area (SCFA). A completed draft of an ITSR on the *Raman Probe for Corrosion Monitoring* was submitted to the CMST-CP program staff for review. Responses were provided to numerous information and document review requests in support of the Road Map generation and other reporting and planning activities of the CMST-CP program.

**Plans for the Next Quarter:**

- Will assist in planning for and participate in the Second Workshop on Tank Structural Integrity to be held November 13-15, 2001, in the Las Vegas, Nevada.
- Will participate in the EMSP Workshop being sponsored by TFA on November 4-5, 2001.
- Will continue to supply CMST-CP management with updated project status, milestone and spending information for the quarterly Business Review, monthly Program Highlights, and other programmatic information.
- Will continue to assist in the preparation of the CMST-CP Road Map.
- Will revise the submission draft of the ITSR on the Raman corrosion probe upon the receipt of review comments.
- Will support the TFA process of Fiscal Year 2002 site needs assessment as requested.
- Will attend the Industry Partnerships for Environmental Science and Technologies Conference and the CMST-CP Kick-Off Meeting scheduled after the conference.

**TTP #: CH2-7-C2-61**

***CHARACTERIZATION, MONITORING, AND SENSOR TECHNOLOGY PROGRAM  
TECHNICAL SUPPORT***

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Principal Investigator: Bruce Friedrich, University of Iowa, 319-626-7947

**Project Objectives:**

Provide technical support and assistance in field coordination for the Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP). Serve as project facilitator for CMST-CP projects assigned by the CMST-CP Field Program Manager. Monitor the technical progress and schedule status, perform an annual on-site review of technical progress, and transmit review reports to the Principal Investigator (PI) and CMST-CP Field Program Manager. Write Innovative Technology Summary Reports (ITSR) for projects assigned by the Field Program Manager.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Prepare Draft ITSR on Topic to be Determined	07/15/01	

*Update:* This milestone was cancelled by Task Change Request (TCR) dated 06/25/01.

**Accomplishments and Technical Progress:**

- All funding for this Technical Task Plan (TTP) was redirected for support of the CMST-CP/ Subsurface Contaminants Focus Area (SCFA) Long-Term Monitoring (LTM) Workshop and subsequent demonstration by TCR dated June 25, 2001.

**TTP #: FT0-0-C2-61*****TECHNICAL AND PROGRAMMATIC SUPPORT TO THE CHARACTERIZATION, MONITORING, AND SENSOR TECHNOLOGY-CROSSCUTTING PROGRAM***

Principal Investigator: David Roelant, Florida International University, 305-348-6625

Point-of-Contact: Ron Staubly, National Energy Technology Laboratory, 304-285-4991

**Project Objectives:**

This project provides program support and expert technical assistance in technical integration and field coordination for the Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP). The activities involve and contribute to identification and assessment of CMST-CP capabilities, limitations, needs, and technology performance requirements; promotion of technology integration, implementation, and commercialization; assessment of technology development opportunities; and program planning and execution. Some specific activities include collecting and inputting data on CMST-CP projects into the Technology Management System (TMS) database and the CMST-CP database, regular updating of technology deployment information, and technical and programmatic support to CMST-CP management. Additionally, Hemispheric Center for Environmental Technologies(HCET)/Florida International University (FIU) will support CMST-CP liaisons with analysis of Site Technology Coordination Group (STCG) needs to help identify performance requirements, whether technology exists for the needs, to capture real technology gaps, and document in a Gap Analysis Report.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Collect Data, Write, and Submit Draft Innovative Technology Summary Report on an Office of Science and Technology (OST) Technology	08/01/01	08/01/01

**Accomplishments and Technical Progress:**

- Worked with Mound, Deactivation and Decommissioning Focus Area (DDFA), and the U.S. Department of Energy (DOE)/OH (Ohio) on designing and providing specifications and

installment methods for long-term monitoring system for Long-Term Stewardship Initiative (LTSI) at Mound facility.

- Provided input and review of various versions of the CMST-CP analysis of the current OST Research and Development (R&D) investment portfolio in characterization and monitoring areas-Gerald Boyd's request.
- Provided input and review of various versions of the CMST-CP Road Map, role in OST programs, and ten-year vision for program.
- Provided updates to Technology Management System (TMS) database on several old technologies and the current Dual Coriolis in-tank technology under development by CMST-CP/Tanks Focus Area (TFA).
- Reviewed and made suggestions for the CMST-CP website update. Reviewed nondestructive assay technology Transuranic Optimization Management System (TOMS) for Transuranic Mixed Waste Focus Area (TMFA) and CMST-CP prior to its deployment for Spent Nuclear Fuel (SNF) at the Savannah River Site (SRS).
- Submitted three abstracts for the 13<sup>th</sup> Technical Information Exchange (TIE) Workshop November 13-15, 2001, in Albuquerque, New Mexico.

**Plans for the Next Quarter:**

- Technical Task Plan (TTP) for Fiscal Year (FY) 2002 is under development for this task. Final scope will depend upon final funding level.

**TTP #: NV0-6-C2-61**

***TECHNICAL INTEGRATION AND CHARACTERIZATION, MONITORING, AND SENSOR TECHNOLOGY-CROSSCUTTING PROGRAM LIAISON FOR TRANSURANIC MIXED WASTE FOCUS AREA***

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Principal Investigator: Stephan Weeks, Special Technologies Laboratory, 805-681-2262

**Project Objectives:**

This project will provide technical integration for Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP) projects associated with the Transuranic Mixed Waste Focus Area (TMFA). The Principal Investigator (PI) will provide technical expertise, leadership, and assessments to facilitate various projects under CMST-CP; respond to TMFA and CMST-CP information requests; conduct technical studies; assist in reports, cost savings, and other designated TMFA and CMST-CP activities, as directed; develop and administer the public and team CMST-CP world wide web (WWW) sites; and champion technologies where applicable. Activities include support in the identification of technology needs; assessment of technology requirements, capabilities, and limitations; prioritization of technology development activities according to the impact of cost savings for U.S. Department of Energy (DOE) sites; issuance of solicitations that seek solutions in the identified high-priority technology deficiency areas; technical monitoring of the progress of projects; program planning and implementation; and promotion of technology deployments to meet DOE site cleanup objectives. Major task activities also include helping to coordinate the CMST-CP input to the TMFA Review meeting.

**Major Milestones:**

No.	Milestone Title	Due Date	Completion Date
1	Letter Report to TMFA	09/30/01	
<p><i>Updates:</i> Report will be completed following the Mercury (Hg) Continuous Emission Monitor field test at U.S. Environmental Protection Agency (EPA) in October.</p>			
2	Prepare Draft Innovative Technology Summary Report (ITSR)	07/15/01	09/30/01
<p><i>Updates:</i> This milestone was cancelled per Task Change Request (TCR) due to change of program emphasis. A <i>Laser-Induced Breakdown Spectroscopy (LIBS) metals Continuous Emissions Monitoring (CEM)</i> ITSR draft will be submitted to CMST-CP Field Office in October.</p>			

**Accomplishments and Technical Progress:**

- BERYLLIUM SURFACE AND AIR MONITOR BASED ON LASER-INDUCED BREAKDOWN SPECTROSCOPY (LIBS) - This task is coordinated through the Deactivation & Decommissioning Focus Area (DDFA). Visited the Science and Engineering Associates, Inc. (SEA) facility and reviewed project progress and data analysis methodology.
- INTEGRATED RAMAN/ELECTRON NOISE PROBES FOR IN-TANK CORROSION MONITORING - This task is coordinated with other Tanks Focus Area (TFA) projects and work performed at Savannah River Site (SRS). The SRS customer completed Cold Acceptance Testing at HiLine Engineering and submitted test report.
- ALBUQUERQUE (AL) 4<sup>TH</sup> ANNUAL ENVIRONMENTAL NEEDS WORKSHOP - Attended the meeting and visited Pantex and Los Alamos National Laboratory (LANL) TVRS facility.
- CMST-CP INTERNET PAGES - Completed new CMST-CP public website design to better support the draft CMST-CP Road Map.
- ITSR ON *LIBS-BASED CEM FOR METALS* - Coordinated and reviewed the draft ITSR on *LIBS-Based CEM for Metals* prepared by Steve Buckley and David Hahn.
- CMST-CP ROAD MAP -Reviewed and provided comments as requested.
- STATUS OF CEM - Provided information on the status of current Office of Science and Technology (OST)-funded CEM development efforts as input to DOE for a U.S. General Accounting Office (GAO) evaluation of emissions monitoring technologies.
- CMST-CP TEAM CONFERENCE CALLS - Participated in CMST-CP team conference calls.
- REMOTE-HANDLED (RH) NONDESTRUCTIVE ANALYSIS (NDA) - NDA Interface Working Group (IWG) Meeting was held July 20, 2001. The meeting focus was RH-Transuranic (TRU) radiological characterization strategies and inventories. The presentations have been posted to the TMFA website.
- NATIONAL ACADEMY OF SCIENCE (NAS) RH WASTE ISOLATION PILOT PLANT (WIPP) MEETING #1 - The NAS began a study to review and evaluate DOE's plans to characterize RH TRU waste to be disposed of at WIPP. The committee met August 1-3, 2001, to gather information for an interim report. A final report is expected Spring/Summer 2002.

- AMERICAN SOCIETY OF MECHANICAL ENGINEERS (ASME) RH WASTE CHARACTERIZATION REVIEW - The ASME and the Institute for Regulatory Science (RSI) organized an independent review of RH Waste Characterization Plan for WIPP during the week of July 30, 2001.
- NONDESTRUCTIVE EXAMINATION (NDE) BY DIGITAL RADIOGRAPHY/COMPUTED TOMOGRAPHY (DR/CT) - The current Hazardous Waste Facility Permit (HWFP) for WIPP requires NDE on 100% of stored waste containers. A report prepared by Carlsbad Field Office (CBFO) titled "Demonstration of Digital Radiography/Computed Tomography as a Quality Control Check on Radiography of Waste Drums for Disposal at WIPP" supports using the noninvasive, high-resolution DR/CT as the primary NDE technology over more invasive techniques such as Visual Examination (VE). The DR/CT methodology was implemented at Argonne National Laboratory (ANL)-E using 20 waste surrogate drums. DR/CT adequately addressed all Quality Control (QC) requirements for radiography in the WIPP HWFP including waste physical form identification, prohibited item identification, confirmation of AK information on Resource Conservation and Recovery Act (RCRA) constituents, procedure compliance with the HWFP, material parameter weight estimation, drum inventory, evaluation of dense items, generation of audio/video records, and inspection of opaque items.
- DEVELOPMENT OF A MULTI-ELEMENT METAL CEM FOR COMPLIANCE MONITORING-ACOUSTO-OPTIC TUNABLE FILTER/ECHELLE SPECTROMETER PROJECT - The field testing of a Hg CEM at EPA Research Triangle Park (RTP) was delayed until October 5-12, 2001. Diagnostic Instrumentation and Analysis Laboratory (DIAL) will assist in the Ontario Hydro Reference Method sampling. A member of the AMES Compact High Resolution Spectrometer (CHRS) group presented a paper, "Nonchemical Conditioning of Simulated Coal Gasification Streams Prior to Real-Time Hg Determinations Using Atomic Absorption," at the Air & Waste Management Association (A&WMA) Speciality Conference on Mercury Emissions: Fate, Effects, and Control, August 21-23, 2001, in Chicago, Illinois. The paper was presented in the Hg Measurement Systems session co-chaired by Jeff Ryan (EPA) and Dennis Laudal (Energy and Environmental Research Center).
- COMPARE Hg CEMS - This task is being coordinated with the EPA Environmental Technology Verification (ETV) program and with work performed through Florida International University (FIU)/Hemispheric Center for Environmental Technology (HCET).
- HIGH-EFFICIENCY PARTICULATE AIR (HEPA) FILTER PERFORMANCE AND MONITORING - Participated in EPA/DOE Memorandum of Understanding (MOU) HEPA Monitoring and Performance Technical Work Group (TWG) conference calls and document reviews. Mississippi State University (MSU)/DIAL personnel completed a Test Plan including sections on "Failure Mode vs. Minimum Detection Limit Testing" and "Source Term Testing." These sections are the drivers for the work to be performed in the section on "Calibration Testing." The Test Plans were discussed along with other materials on the HEPA TWG conference calls. The review criteria and project description and the Test Plan were submitted to the RSI for the ASME Technical Peer Review scheduled for October 2-3, 2001, in Boise, Idaho.

- DIOXIN/FURAN (D/F) FORMATION AND PREVENTION STUDIES - This task is coordinated with SRI "Development of CEM for Dioxin" National Energy Technology Laboratory (NETL) contract DE-AC26-98FT-40370 and work performed at MSE and DIAL. EPA and SRI Principal Investigators (PIs) presented their work at an international conference on dioxins in September. Data analysis showed that compounds of interest were detected and aromatics, including aniline (C<sub>6</sub>H<sub>5</sub>NH<sub>2</sub>) were detected in the flue gas during the D/F CEM Field Test and studies performed collaboratively with SRI, International on June 18-29, 2001. The EPA/SRI team ran tests on a standard Hazardous Air Pollutants (HAPs) gas mixture that contained chlorinated compounds (e.g., di-chlorobenzene) and flue gas constituents from a methane burner.

**Plans for the Next Quarter:**

- Participate in the CMST-CP Fiscal Year (FY) 2002 Kickoff Meeting, November 15, 2001.
- Attend the Industry Partnerships for Environmental Science and Technology Conference at DOE NETL in Morgantown, West Virginia, October 30 through November 1, 2001.
- Submit draft LIBS based CEM for Metals ITSR to CMST-CP Field Office.
- Submit new CMST-CP Field Office website design for review.
- Continue to contribute to the completion of the CMST-CP Road Map.
- Attend NDA Conference.
- Visit DIAL.

**TTP #:** *NV0-9-C2-41*

**TECHNICAL AND PROGRAM SUPPORT FOR NUCLEAR MATERIALS FOCUS AREA**

Principal Investigator: Paul Hurley, Special Technologies Laboratory, 805-681-2472

**Project Objectives:**

This task provides technical and program support for future Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP) related projects in the Nuclear Materials Focus Area (NMFA). The principle role for this task is to serve as the Liaison from CMST-CP to NMFA and provide technical and program support to the NMFA and CMST-CP field and Headquarters (HQ) Program Managers. Other tasks for this project include facilitation for several other CMST-CP related projects.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	NMFA Technology Assessment Report	09/30/01	10/31/01

**Accomplishments and Technical Progress:**

- Attended a meeting in Washington, DC, in July with Stan Wolf, John Tseng, et al, to discuss Multi-Detector Assay System (MDAS)

- Met with Beth Moore, CMST-CP HQ Program Manager, in July to discuss Long-Term Monitoring (LTM) issues.
- Met with Doug Smith and Siraj Khan of U.S. Customs in July to discuss radiation detectors.
- In July, attended a Interagency Working Group (IWG) in Palm Desert to discuss MDAS and Nondestructive Analysis (NDA) projects.
- Attended the SPIE Conference in San Diego, California, in July/August.
- Attended the MDAS Workshop in August at Vanderbilt University in Nashville, Tennessee.
- Attended a Focus Area (FA) Needs Meeting in August in Albuquerque, New Mexico.
- Visited Sandia National Laboratories (SNL) and Los Alamos National Laboratory (LANL) for discussions of NMFA issues with Product Line Managers (PLMs) Marty Molecke and Kevin Ramsey in September.

**Plans for the Next Quarter:**

- Visit Savannah River Site (SRS) to discuss the Site Characterization and Analysis Penetrometer System (SCAPS) program with Carol Eddy-Dilek and the Dense Non-Aqueous Phase Liquids (DNAPL) program with Joe Rossabi.
- Visit SNL to discuss the Alternative Land Cover program with Steve Dwyer.
- Continue to work with the NMFA.

**TTP #: NV0-9-C2-61**

***CHARACTERIZATION, MONITORING, AND SENSOR TECHNOLOGY-CROSSCUTTING PROGRAM TECHNICAL & PROGRAM SUPPORT FIELD COORDINATION***

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Principal Investigator: Charles B. Davis, Professional Analysis Inc./Bechtel Nevada,  
702-295-0541

**Project Objectives:**

The primary objective of this project is to provide overall coordination of the Characterization, Monitoring, and Sensor Technology-Crosscutting Program (CMST-CP). As part of this coordination, responses to requests from Headquarters (HQ) for information, plans, tables, and other documents will be drafted using information obtained from the CMST-CP Team. Management and planning documents will be created as appropriate to assure good program management and document program performance.

**Major Milestones:**

<i>No.</i>	<i>Milestone Title</i>	<i>Due Date</i>	<i>Completion Date</i>
1	Deliver CMST-CP Annual Performance Plan (APP)	12/31/00	Cancelled
<i>Updates:</i> This milestone has been cancelled. It was based on the 07/14/00 draft Office of Science and Technology (OST) Management Plan, which is not required in the final OST Management Plan.			
2	Prepare CMST-CP Technology Summary - Fiscal Year (FY) 2001	08/31/01	Cancelled
<i>Updates:</i> This milestone has been cancelled. Programmatic considerations have given higher priority to the OST CMST-CP Portfolio Analysis and the OST CMST-CP Road Map.			
3	Prepare Draft Innovative Technology Summary Report (ITSR)	07/15/01	Cancelled
<i>Updates:</i> This milestone has been cancelled. Programmatic considerations have given higher priority to the OST CMST-CP Portfolio Analysis and the OST CMST-CP Road Map.			

**Accomplishments and Technical Progress:**

- Submitted ITSR *Induced Fluorescence Sensors for Direct Push Systems* (Tech ID #2237) to CMST-CP Field Program Manager for review; revised ITSR in response to field review comments and submitted to HQ
- Revised April 2, 2001, version of *CMST Science and Technology Development Road Map for OST* in response to review comments and other discussions. New revision is dated September 30, 2001; will go out to Environmental Management (EM) OST programs shortly as strawman for an eventual OST document. This revision incorporates significantly modified treatment of Visible and Important Problems, included graphic presentations in the document body with detailed technical discussions relegated to an Appendix.
- Located and assembled information on proposed Fiscal Year (FY) 2002 budgets and programs in support of the CMST-CP Field Office with regard to CMST-CP Technical Integration and Program Management Technical Task Plans (TTPs), CMST-related technical TTPs, and other TTPs in the CMST-CP area.
- Supported Nevada Operations Office Technical Program Officer (TPO) and Subsurface Contaminants Focus Area (SCFA) in preparation for OST 3<sup>rd</sup> Quarter FY 2001 Business Review.
- Continued editing, reviewing, and submitting ITSRS to HQ and preparing monthly CMST-CP ITSR Status Reports, particularly *Cone Permeameter* (Tech ID #307), *Advanced Tensiometer* (Tech ID #2122), and *Integrated Raman pOH Sensor for In-Tank Corrosion Chemistry Monitoring* (Tech ID #2015).
- Began providing assistance to site personnel in completing Integrated Planning, Accountability, and Budgeting System-Internet System (IPABS-IS)-seeded FY 2000 and FY 2001 Deployment Fact Sheets (DFSs) and in creating Technology Management System (TMS) application records to correspond to all DFSs, pending HQ implementation of promised procedures for linking deployments with OST technologies deployed.

- Participated on OST HQ Exhibit Design Group, OST Communications Working Group, and American Society of Civil Engineers (ASCE) Environmental and Water Resources Institute (EWRI) Long-Term Groundwater Monitoring Working Group. Attended and participated in the annual OST Communications Working Group Workshop in Gaithersburg, Maryland, July 31 through August 1, 2001.
- Continued to provide CMST-CP program coordination with regard to budget, management, planning, and business reporting matters.

**Plans for the Next Quarter:**

- Finalize the September 30, 2001, predecisional draft of the *CMST Science and Technology Development Road Map for OST*, distribute to OST Focus Areas (FAs) and other programs and establish procedure for further development of the document.
- Continue providing input and support to CMST-CP Field Office and other OST programs toward development of FY 2002 programs in CMST-CP Research and Development (R&D).
- Continue editing, reviewing, and submitting ITSRs to HQ and preparing monthly CMST-CP ITSR Status Reports. Review, edit, and/or submit CMST-CP ITSRs to HQ for publication.
- Identify suitable topics for new ITSRs and coordinate production of new ITSRs with FAs and other OST programs; recruit suitable authors for these ITSRs.
- Continue participation on OST HQ Exhibit Design Group, OST Communications Working Group, U.S. Department of Energy (DOE)/U.S. Environmental Protection Agency (EPA) High-Efficiency Particulate Air (HEPA) Technical Working Group (TWG), and ASCE EWRI Long-Term Groundwater Monitoring Work Group. Provide review comments on draft EWRI monograph on Long-Term Groundwater Monitoring Strategies.
- Participate in Technology Information Exchange (TIE) Workshop in Albuquerque, New Mexico, November 13-15, 2001, and side meetings.
- Coordinate and participate in CMST-CP Kickoff Meeting in conjunction with TIE Workshop.
- Develop plan for document to supplant the annual CMST-CP Technology Summary to better support OST's current FA centered structure.
- Continue to champion CMST-CP technologies as appropriate, including maintaining TMS database information on those technologies.