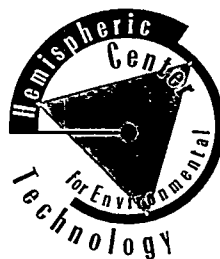


# Mobile Pipe Decontamination and Characterization System



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OSTI

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**305-348-HCET**

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Federal Energy Technology Center  
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**P.O. Box 880**

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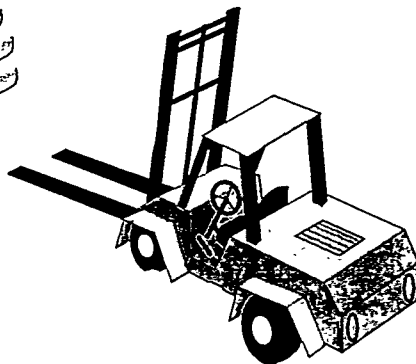
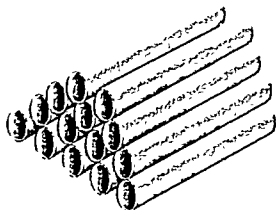
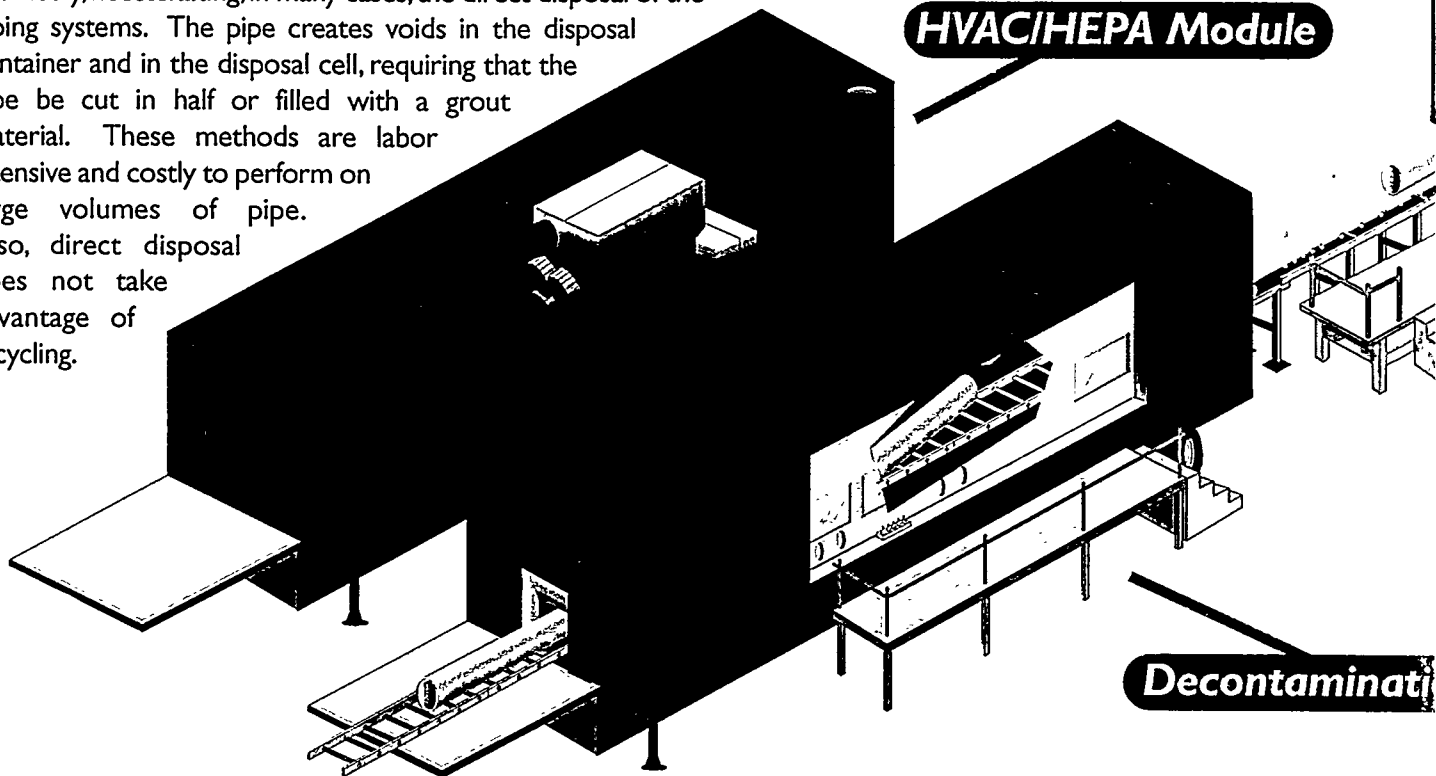
# Problem.

The decontamination and decommissioning of buildings and systems will require the disposition of miles of pipe. This pipe ranges in size, material type, type of contaminants, and coating. The disposition of large bore pipe presents difficulties in the areas of decontamination, characterization, and disposition. The pipe is potentially contaminated internally as well as externally. This situation requires a system capable of decontaminating and characterizing its interior and exterior. Current decontamination and characterization systems are not designed to handle this geometry, necessitating, in many cases, the direct disposal of the piping systems. The pipe creates voids in the disposal container and in the disposal cell, requiring that the pipe be cut in half or filled with a grout material. These methods are labor intensive and costly to perform on large volumes of pipe. Also, direct disposal does not take advantage of recycling.

**Characterization**

**HVAC/HEPA Module**

**Decontamination**



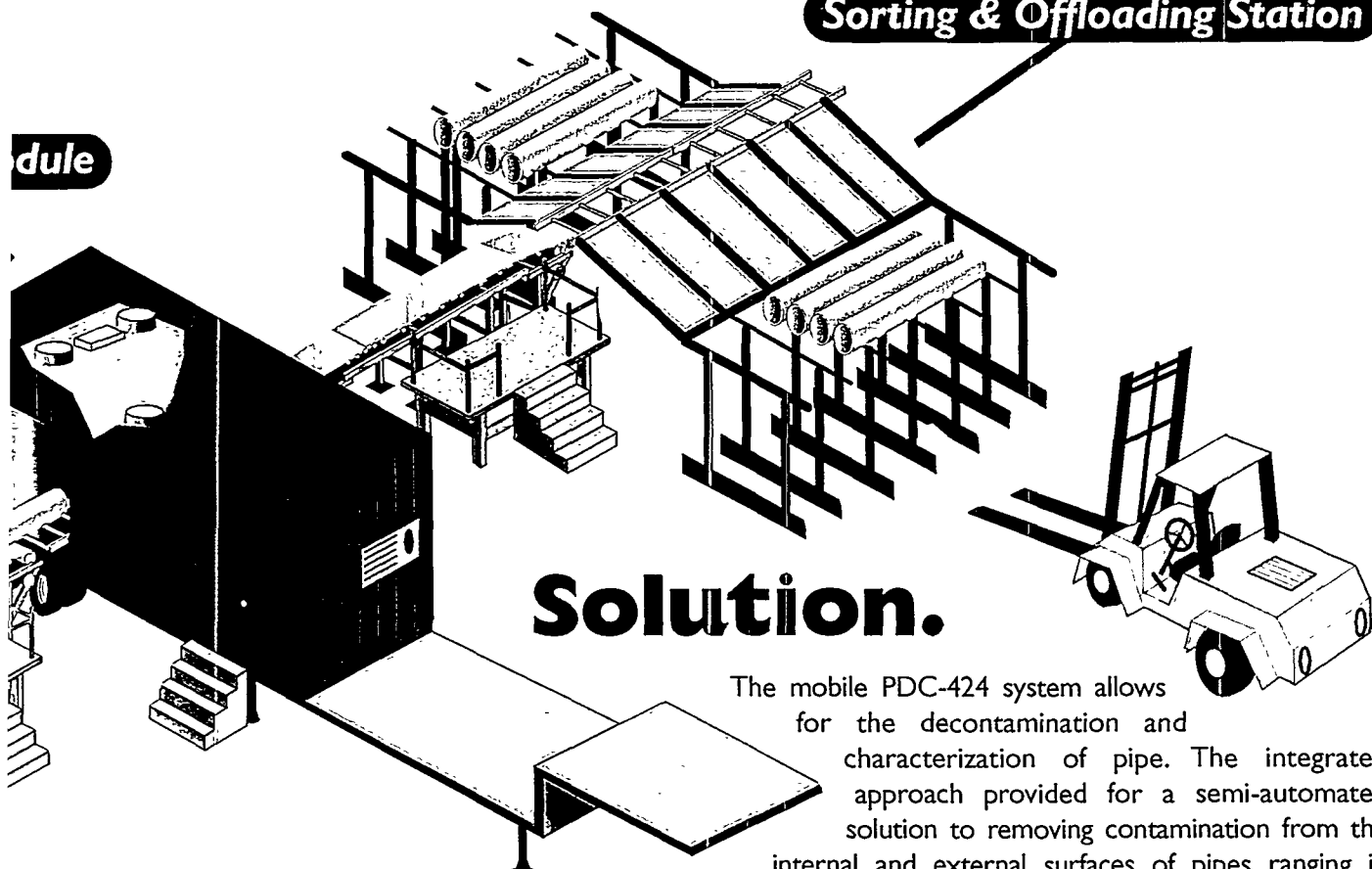
## Mobile Pipe and Characterization

*The development of the Pipe Decontamination effort between Florida International University and the U.S. Department of Energy, Office of Technology's Deactivation and Decommissioning*

**Participating vendors and technology**  
*Canberra Industries • Container Products Corporation*

Module

Sorting & Offloading Station



## Solution.

The mobile PDC-424 system allows for the decontamination and characterization of pipe. The integrated approach provided for a semi-automated solution to removing contamination from the internal and external surfaces of pipes ranging in diameter from 4 to 24 inches and the characterization of pipe to meet

the limits in DOE Order 5400.5 and/or Regulatory Guide 1.86. Other system features include:

- The system is fully self contained and is field mobile.
- Decontamination system uses standard recyclable steel grit as a blasting media.
- Modular design permits multiple arrangements to meet project parameters.
- System is capable of decontaminating and characterizing structural steel as well as pipe.
- Characterization components are proven to be reliable in field applications.

Module

# Decontamination Characterization System

The Decontamination and Characterization System was a collaborative effort of the Hemispheric Center for Environmental Technology, Environmental Management, Office of Science and Technology Focus Area, Federal Energy Technology Center.

Providers:

DeLong Equipment Corporation • DeLong Equipment Corporation



# FIU

FLORIDA INTERNATIONAL UNIVERSITY

*Hope, Knowledge, and Opportunity*

# System Description.

The PDC-424 System consists of two main sub systems and a material handling system. The process design provides for a material flow through the decontamination and characterization systems with minimal operator involvement. Material is loaded on an entrance conveyor, which transfers the material to a centrifugal wheel grit blast system for external surface decontamination. The conveyor then transfers the material to the compressed air driven lance blasting system for internal pipe decontamination. The material is then transferred to the characterization system. The characterization system is capable of meeting DOE Order 5400.5 and Regulatory Guide 1.86 for the unrestricted reuse of reactor and uranium contaminated components. The characterization system is also capable of proving material is not contaminated with transuranic contamination allowing material to be disposed of as low-level radioactive waste. All components are housed in strong tight containers to facilitate transportation of the PDC-424 System from site to site. The decontamination system is equipped with a nuclear grade HEPA ventilation system ensuring operations are performed under a negative pressure. After the completion of the process a material off loading system separates contaminated material from non-contaminated material.

Each sample analyzed by the characterization is assigned a unique identifier, which is permanently marked on the part. This unique identifier references a database, which houses the characterization results. This system provides for a complete data management and tracking system.

## Performance Data.

**Production Rate for 6" diameter pipe:** 180-360 linear feet per hour (depended on contaminant type)

**Waste Production:** Average .25 cubic feet per hour

**Set-up time Between Batches:** 30 minutes

**Secondary Waste Description:** fine metallic powder, spent filters

### System Requirements:

Applicable to Carbon or Stainless Steels

Material must be free of deposits.

Five foot minimum material length.

Ten foot maximum length.

Material processed in batches according to geometry.

Material must be straight and free of obstructions, valves, hangers, etc.

Material must be free of moisture.

**Pipe 4" through 24' in diameter can be processed.**

**Structural steel shapes from 2" to 24" maximum dimension can be processed.**

### For additional information, contact:

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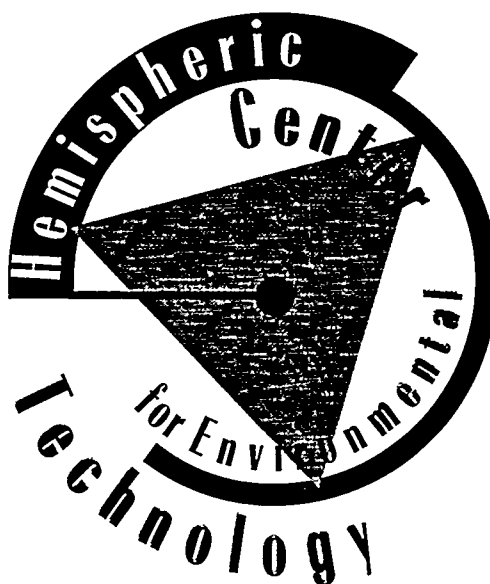
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# HEMISPHERIC CENTER FOR ENVIRONMENTAL TECHNOLOGY

## MONTHLY PROGRESS REPORT

FISCAL YEAR 1999

DE-FG21-95EW55094



JUNE 1999

FIU-HCET Principal Investigator  
Focus Area Technical Lead  
Program Officers

M.A. Ebadian  
Paul Hart  
John Wengle  
Karl-Heinz Frohne

ACQUISITION & ASSISTANCE  
1999 JUL 12 A 10:26  
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## SUMMARY

- To enhance the measurement capability of EICs to alpha spectrometry, measurements at FIU-HCET were performed on different energy alpha sources, and response factors of ST electrets in 960- mL chamber were determined. Earlier, EIC was considered as only a charge-integrating device without spectrometric capability. This is a potentially significant development accomplished by FIU-HCET. It could appreciably lower the current cost of spectral characterization.
- FIU-HCET has been invited to participate in the Operating Engineers' National Hazmat program's assessment of the Mini Mitter, commercially known as the VitalSense™ Telemetric Monitoring System. This evaluation is scheduled for early July 1999. Additional health & safety technology evaluations, in which FIU-HCET will also participate, are also scheduled for later in the summer.
- The Technology Information System (TIS), MISD, and DASD are now complete and accessible through the Internet website <http://www.DandD.org/tis>.



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## I. DEACTIVATION AND DECOMMISSIONING (D&D) FOCUS AREA

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### MONTHLY PROGRESS REPORT

FIU-HCET Principal Investigator	M.A. Ebadian
FIU-HCET D&D Program Manager	Rob Rose
Focus Area Technical Lead	Paul W. Hart
Program Officers	John Wengle
	Karl-Heinz Frohne

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## Deactivation and Decommissioning Technology Assessment Program

Project Number: HCET-1996-D038

### Project objectives

The Deactivation and Decommissioning (D&D) Technology Assessment Program (TAP) was developed to provide detailed, comparable data for environmental technologies and to disseminate this data to D&D professionals in a manner that will facilitate the review and selection of technologies to perform decontamination and decommissioning. The objectives for this project include the following:

- Determine technology needs through review of the Site Technology Coordination Group (STCG) information and other applicable web sites and needs databases.
- Perform a detailed review of industries that perform similar activities as those required in D&D operations to identify additional technologies.
- Define the technology assessment program for characterization and waste management problem sets.
- Define the data management program for characterization, dismantlement, and waste management problem sets.
- Evaluate baseline and innovative technologies under standard test conditions at Florida International University's Hemispheric Center for Environmental Technology (FIU-HCET) and other locations and collect data in the areas of performance, cost, health and safety, operations and maintenance, and primary and secondary waste generation.
- Continue to locate, verify, and incorporate technology performance data from other sources into the multimedia information system.
- Develop the conceptual design for a dismantlement technology decision analysis tool for dismantlement technologies.

### Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
D038-M1	Publication of the Technology Assessment Reports	Completion of 16 technology demonstrations and each summarized in monthly reports within 60 days after the demonstration.	Five technologies evaluated for various applications for a total of eight demonstrations. One technology is scheduled for July. The PPPL demo is scheduled for July.
D038-M2	Test Plan for Characterization Technologies Assessment Program	Characterization Technology Test Plan Approved	Completed 5/24/99 <sup>1</sup>

Milestone No.	Milestone Description	Completion Criteria	Status
D038-M3	Test Plan for Waste Management Technologies Assessment Program	Waste Management Technology Test Plan Approved	Scheduled completion 6/30/99. On hold (see issues section below)
D038-M4	Access to the multimedia information system web-based user interface for dismantlement	Assignment of user name and passwords to DDFA provided distribution list.	Design started 12/7/98. Scheduled completion 10/1/99.
D038-M5	Access to the information system characterization database	Assignment of user name and passwords to DDFA provided distribution list.	Scheduled start 7/6/99. Scheduled completion 10/29/99.
D038-M6	Report on the information system waste management design	Final copy of report sent to DDFA.	Scheduled start 10/1/99. Scheduled completion 10/29/99.
D038-M7	Report on the decision analysis tool for dismantlement design	Final copy of report sent to DDFA.	Scheduled start 7/6/99. Scheduled completion 10/29/99.

1 This date has changed from last month's report. The new date identifies when the test plan received final FIU-HCET internal approval.

### Significant events for this reporting period

- Work is progressing on the technology assessment test facilities for the size reduction of glove boxes and tanks. Designs are in place for a crane system to stand-up the Kynar and Annular tanks once transferred to the modular building to better simulate the in-situ conditions at a DOE facility. Sampling equipment is also being ordered for these demonstrations.
- The evaluation of the ElectroStrip™ technology that was evaluated at FIU-HCET in April 1999 is complete. The Technology Assessment Summary sheet is attached to this monthly report.
- The evaluation report for the Ice Blasting, Inc. technology demonstrated in May 1999 is completed. This report has been sent to the vendor for their review. The Technology Assessment Summary sheet will be incorporated into the July monthly report.
- Demonstration of the En-Vac Robot Blasting System was performed from 6/7/99 – 6/11/99 by MHI Marine Engineering, Ltd. (MHI-ME), a subsidiary of Mitsubishi Heavy Industries, Ltd. The technology successfully performed coating removal from metal and masonry and aggressive removal from a masonry wall and floor.
- FIU-HCET has been invited to participate in the Operating Engineers' National Hazmat program's assessment of the Mini Mitter, commercially known as the VitalSense™ Telemetric Monitoring System. This evaluation is scheduled for early July 1999. Additional health & safety technology evaluations, in which FIU-HCET will also participate, are also scheduled for later in the summer.
- FIU-HCET is working with Fluor Daniel Fernald Site Technology Coordination Group personnel to create a mock-up design for the evaluation of technologies to locate underground piping and drums. This mock-up and the associated technology assessments would be located at the International Union of Operating Engineers (IUOE) facility in Beaver, WV. It is anticipated that evaluations should begin in early fall.



## Accomplishments and technical progress to date

- Under this grant project and earlier technology assessment projects funded from other sources, FIU-HCET assessed over 60 innovative/improved and baseline technologies for decontamination and equipment dismantlement under standardized, non-nuclear testing conditions. Many of the technologies identified for demonstration at FIU-HCET are selected to address the needs identified in the EM-50 Needs Management System (<http://EM-Needs.em.doe.gov/Home/>). As a result of these assessments, directly comparable performance data related to operations and maintenance, primary and secondary waste generation, and health and safety has been compiled. This data has been valuable in assessing whether a technology meets the screening criteria for those DDFA LSDDPs where these technologies are being considered, as well as assisting EM-40 project managers in making decisions on the deployment of innovative technologies. Technology assessment data is managed using a Microsoft Windows-based multimedia information system.
- In FY99, five technologies have been evaluated to date in multiple applications giving a total of eight demonstrations. The technologies evaluated include
  - Bartlett Robotic Climber - Bartlett Services, Inc.
  - Fourier Transform Profilometry – Mississippi State University, DIAL
  - ElectroStrip™ -- EMEC Consultants
  - Ice Blast with Chemical Softener – Ice Blast, Inc.
  - En-Vac Robot Blasting System – MHI Marine Engineering, Ltd.

## Assessment of current status and issues

This project is on schedule. Five technologies have been assessed in FY99, and two additional technologies are scheduled. Test plans for assessing Facility Dismantlement and Facility Characterization technologies have been completed.

The generation of a test plan for Waste Management Technology Assessment has been placed on hold pending a reassessment of the complex-wide needs and on-going development programs to allow for an optimized assessment strategy.

## Plans for the next two months

Activities for the next two months include the following:

- Continue technology search for FY99 demos. Demonstrate at least two technologies, Mini Mitter and diamond-wire cutting at PPPL, by the end of August 1999.
- Finalize the data collected from the Ice Blast and En-Vac technology assessments completed in May and June. Include summaries of each technology in the monthly reports.
- Complete the test plan and mock-up for the Glove Box and Tank size reduction technology assessments and begin scheduling technologies for demonstration.
- Determine a strategy for FIU-HCET to perform Waste Management technology assessments.

*D&D Focus Area*

- Complete the scope of work for performing demonstrations at the IUOE testing facilities in Beaver, WV.
- Complete the design of the multimedia information system for dismantlement and begin programming.

**FIU-HCET Collaborator**

Susan C. Madaris, (305) 348-3727

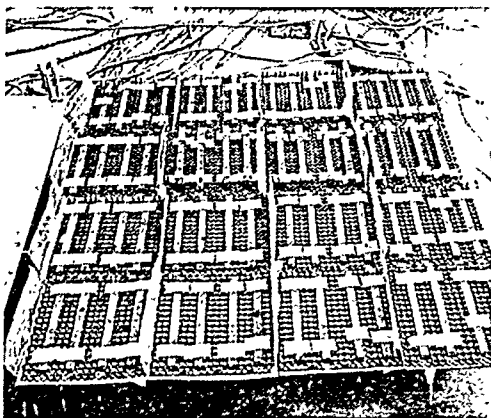
## TECHNOLOGY ASSESSMENT PROGRAM (TAP) Decontamination Technology Assessment Summary

### *ElectroStrip™*

#### DEMONSTRATION OBJECTIVE

The ElectroStrip™ was demonstrated at FIU-HCET in April 1999 by EMEC Corporation. The objective of the demonstration was to remove coatings or rust from carbon steel plates and I-beams.

#### TECHNOLOGY DESCRIPTION



*EMEC Corporation's ElectroStrip™ Technology (A coated plate covered with ElectroPad™).*

The ElectroStrip™ process is designed to remove paint from steel structures. Debonding of the coating is achieved by applying a cathodic current to a painted metal substrate. The environmentally benign electrolyte is contained in a liquid-absorbent material to which a counter electrode is attached. This combination, often with a liner, is applied to the painted metal surface, in the case of steel, with magnets. To initiate current flow, a surface that is not sufficiently deteriorated needs to be scored. After an electrochemical treatment for ½ to 2 hours at a safe voltage of 8 to 10 V, the ElectroPad is removed, and paint fragments are collected. Banks of ElectroPads may cover an area up to 150 square feet and can be run simultaneously. Pads can accommodate various sizes and geometries (e.g., rounded surfaces).

#### RESULTS

During the demonstration, the coated plates and I-beams were scored with a knife before operators manually covered them with ElectroPad. The electrochemical treatment was approximately 1.5 hours for the coated plates and 1 hour for rusted plates, coated I-beams, and rusted I-beams. Operators occasionally sprayed the electrolyte onto the pad during the waiting time.

The technology was successful in removing rust from rusted plates with a production rate of 29 ft<sup>2</sup>/hr. Demonstration for coating removal on the painted plates presented inconsistent results. Paint was completely removed from 1 of the 6 plates and partially removed from the rest. The production rate was approximately 8 ft<sup>2</sup>/hr. The technology was able to remove the majority of the paint and rust from the coated and rusted I-beams with a production rate of 20 and 18 ft<sup>2</sup>/hr, respectively.

The technology required modest equipment setup. No aggressive chemicals were used, and no airborne particles were generated. The technology also had a low noise level.

The technology was designed to remove lead-based alkyd-type coatings. The demonstration suggested that technology was effective on flat surfaces with relatively weak paint, an anti-corrosive paint in this case. It is less effective on irregular shaped surfaces. Operation parameters need to be redefined to achieve good results for epoxy paint removal.

**For additional information about this Decontamination Technology Assessment contact:  
Cindy Zhang, D&D Project Manager, FIU-HCET, (305) 348-6340.**

## Integrated Vertical and Overhead Decontamination System

**Project Number: HCET-1998-D023**

### Project objectives

The overall objective of this project is to fabricate and test an innovative technology for the purpose of characterizing and decontaminating vertical and overhead structures and to transfer this technology to industry for use in reducing the cost to perform decontamination operations. The sub-objectives required to meet the overall objective include the following:

- Design and fabricate a characterization system for overhead and vertical applications.
- Design and fabricate a decontamination system for overhead and vertical applications.
- Integrate and assess the system for commercial application.
- Transfer the system to industry for use throughout the DOE complex.

### Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
D023-M1	Selection of Industrial Partner To design and manufacture decontamination and deployment systems	Selection of a responsible and qualified vendor	Completed. Contract placed with selected vendor on 6/14/99.
D023-M2	Approved Design Specifications for the Decontamination System	Approval of final design specifications for the decontamination system	Scheduled completion 4/6/99. See "Assessment of current status and issues" for explanation.
D023-M3	Fabrication of Decontamination System	Complete fabrication of decontamination system unit	Scheduled completion 7/30/99.
D023-M4	Field Testing of Decontamination System	Completion of testing of decontamination unit at FIU-HCET Test Site	Scheduled completion 8/16/99.
D023-M5	Design Drawings for the Characterization System	Approval of final design specifications for the characterization system	Scheduled completion 6/1/99. See "Assessment of current status and issues" for explanation.
D023-M6	Fabrication of Characterization System	Complete fabrication of characterization system	Scheduled completion 9/30/99.
D023-M7	Testing the Characterization System	Completion of characterization system testing at FIU-HCET	Scheduled completion 10/15/99
D023-M8	Final report on the Decontamination and Characterization System.	Deliver final report to DDFA-determined distribution list	Scheduled completion 11/30/99

### Significant events for this reporting period

- All issues between the selected vendor and FIU have resolved. An award was made to a team composed of Redzone Robotics and Bartlett Services on 6/14/99. A revised schedule will be sent to HCET by Redzone Robotics detailing the projected dates of completion for Titles I, II and III.
- A kick-off meeting will be scheduled at Redzone Robotics headquarters in Pittsburgh, PA. A tentative date of July 1, 1999, has been set.
- Design documentation was prepared for the development of a test area for testing the characterization technology. Copies of this documents were given to HCET's D&D Program Manager and QA Manager. After approval of the design documentation, a formal design review team will be assembled, and a design review meeting will be conducted.
- A conference paper was prepared and submitted for the DD&R conference in Knoxville, TN, coming up in September.
- A presentation was made at FETC's Mid-Year Review held in Morgantown, WV on May 25-27 of this year. The status of the project was presented to FETC and a panel of experts.

### Accomplishments and technical progress to date

- All issues were resolved between vendor and FIU-HCET. The bid was awarded to a team composed of Redzone Robotics and Bartlett Services.
- A contract has been put in place and a kick-off meeting has been tentatively scheduled for July 1, 1999.
- The Invitation to Bid was sent out to vendors on March 8, 1999. The original Bid Opening date was scheduled for March 19, 1999. All qualified vendors requested additional time to adequately respond to the bid. Based on this request, FIU-HCET issued an extension of the Bid Opening date until April 2, 1999.
- Bid Opening was conducted on April 2, 1999. Two bids were received and reviewed. Bid proposals were reviewed for technical content and responsiveness to bid specifications. A letter was sent to one of the vendors on 4/13/99 seeking clarification on issues in their bid response. A letter was received from the vendor on 4/16/99 containing answers to FIU-HCET questions.
- Performance Specification documents that included conceptual designs of the decontamination and deployment systems were sent for review to the FIU-HCET DDFA Program Manager and FIU-HCET Senior Program Manager. Comments received were implemented by the end of January 1999. The reviewed documents and comments have been documented and are available.
- For additional details on accomplishments and technical progress, refer to the Integrated Vertical and Overhead Decontamination System FY98 Year-End Report.

### Assessment of current status and issues

A technology vendor has been selected, and an award was made to a team composed of Redzone Robotics and Bartlett Services. A contract has been put in place and new completion dates for Titles

I, II, and III will be sent to HCET by Redzone Robotics. It is expected that a kick-off meeting will be held at Redzone Robotics' headquarters in Pittsburgh, PA, on July 1, 1999.

M1 and M2 have been delayed because of the procurement and contract issues. Redzone Robotics/Bartlett Services will provide a revised completion schedule. Based on this schedule, completion dates for milestones M1, M2, and M3, and M4 will be assigned. FIU-HCET will notify FETC of these schedule changes. M5 has also been compromised by the delay in M1. A new completion date for this milestone will be assigned after completion of Title I design by Redzone, which should be completed by July 16, 1999.

### **Plans for the next two months**

Activities for the next two months include the following:

- Conduct kick-off meeting at Redzone Robotics.
- Submit new completion dates for milestones to DOE-FETC.
- Complete and approve Title I design for decontamination and platform development.
- Conduct design review process for approval of test site design.
- Start test site development and construction.

### **FIU-HCET Collaborators**

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Man Young Cheung, (305) 348-6653  
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## Large-Scale Demonstration and Deployment Project— Technology Information System (LSDDP-TIS)

**Project Number: HCET-1998-D039**

### Project objectives

Within the DOE complex, there are some 10,000 buildings that require deactivation and decommissioning (D&D). These facilities present an immense array of problems and challenges for D&D project managers who must investigate and screen scores of candidate technologies to select the most appropriate one(s) for their specific remediation problems. The search for candidate technologies can be arduous and involve several sources of varying reliability. The Large-Scale Technology Demonstration and Deployment Project Technology Information System (LSDDP-TIS) will facilitate the search and selection process by providing D&D managers with ready access to an extensive information base of DOE-screened environmental technologies.

The objectives of this project include the following:

- Collect technology information from LSDDP technology screenings and other reliable sources.
- Compile a searchable database to serve as an aid to decision-makers for identifying candidate technologies for future LSDDPs or for addressing specific problems.

### Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
D039-M1	Release 1 of the TIS	User Access to the functional LSDDP-TIS via the Internet	Completed on schedule on 1/4/99.
D039-M2	Information from new LSDDPs incorporated	Screening data from new LSDDPs accessible through TIS	Completed as of 5/30/99 – New data will be incorporated into the TIS as new evaluations are done.
D039-M3	Information on DOE's baseline technologies and FIU-HCET's Technology Assessment Program incorporated	Information on DOE baseline and FIU-HCET-assessed technologies accessible through TIS	Completed as of 5/30/99 – New data will be incorporated into the TIS as new evaluations are done.
D039-M4	Information from DOE databases incorporated	Data from DOE designated databases accessible through TIS	Completed on schedule on 4/30/99
D039-M5	TIS Linked to other D&D Technology Web Sites	Users of TIS provided with hyperlinks to other technology web sites	Completed on schedule on 5/21/99
D039-M6	Final Report	Final report on results of the project delivered to DOE.	Scheduled completion – 10/31/99
D039-M7	DDFA decision on other Media to Access TIS	Users able to access TIS information via other media such as telephone and return fax.	If approved, scheduled for FY00.



### Significant events for this reporting period

- The advanced TIS was showcased at the FETC Mid-year Review in Morgantown, West Virginia, on May 25 and 26 1999, along with the FIU-HCET-developed Multimedia Information System for Decontamination and the Decision Analysis System for Decontamination.
- The TIS, MISD, and DASD are now complete and are accessible through the Internet website <http://www.DandD.org/tis>.

### Accomplishments and technical progress to date

- This project was completed on May 21, 1999. The new name for the Internet website is Technology Information System (TIS).
- Technology screening datasheets from the four new LSDDPs have been collected. All datasheets received to date have been entered into the database.

New LSDDP Sites	# of Technologies Evaluated at LSDDP to Date	# of Datasheets Received at FIU-HCET to Date	# of Datasheets Entered into TIS to Date
Mound Environmental Management Project (MEMP)	63	63	63
Savannah River Site (SRS)	46	46	46
Idaho National Environmental Engineering Laboratory (INEEL)	55	55	55
Los Alamos National Laboratory (LANL)	34	34	34

\* INEEL screened 123 technologies but produced evaluation forms on only 55 of these. The remaining 68 technologies were verbally screened and evaluation forms will not be produced for these.

### Assessment of current status and issues

The system development phase of the project is complete. Datasheets from the four new LSDDPs and HCET TAP are still being collected and entered into the database as technology screenings occur.

### Plans for the next two months

- FIU-HCET will continue to collect technology information from reputable sources. The data will be validated and entered into the TIS database.
- FIU-HCET will produce and deliver to DOE a final report on the results of this project.





## **FIU-HCET Collaborators**

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Robert Tucker, (305) 348-6181

## Ex-Situ Large-Bore Pipe Decontamination and Characterization System

Project Number: HCET-1997-D017

### Project objectives

The deactivation and decommissioning of 10,000 buildings in the U.S. Department of Energy (DOE) complex will require the disposition of miles of pipe. In particular, the disposition of large-bore pipe presents difficulties in the areas of decontamination and characterization. This pipe is potentially contaminated internally as well as externally. This situation requires a system capable of decontaminating and characterizing both the internal and external surfaces of the pipe. Current decontamination and characterization systems are not designed for application to this geometry, necessitating, in many cases, direct disposal of the piping systems. Once disposed of, the pipe often creates voids in the disposal cell, requiring the pipe to be cut in half or filled with a grout material. These methods are labor-intensive and costly to perform on large volumes of pipe. Direct disposal does not take advantage of recycling, which would provide monetary dividends as a result of the disposition of large-bore pipe.

To facilitate the decontamination and characterization of large-bore piping and thereby reduce the volume of piping required for disposal, the following objectives have been established:

- Conduct detailed analysis to document the pipe remediation problem set. (completed FY97)
- Determine potential technologies to solve this remediation problem set. (completed FY97)
- Design and laboratory test potential decontamination and characterization technologies. (completed FY97)
- Fabricate a prototype system. (FY98 and FY99)
- Provide a cost-benefit analysis of the proposed system. (preliminary completed FY98)
- Deploy the system. (FY99 and beyond)

### Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
D017-M1	Title III of the decontamination system complete	The completion of Title III provides for a complete decontamination system ready for a field assessment.	Completed
D017-M2	Field testing of the decontamination system	The decontamination system will be tested to ensure the performance specifications are met. This will be accomplished by witnessing the cleaning of five tons of pipe of various diameters.	Completed

Milestone No.	Milestone Description	Completion Criteria	Status
D017-M3	Close-out of decontamination system	This milestone requires the completion of all required activities, including operation/maintenance procedures. Five people from FIU-HCET will be trained on the operation and maintenance of the system. The completed system will be turned over to FIU-HCET for operation and integration with the characterization system.	Ongoing. Scheduled for completion 7/30/99
D017-M4	Title I of the characterization system complete	FIU-HCET will approve initial design details of the characterization system and the costs associated with the characterization system.	Completed 11/30/98
D017-M5	Title II of the characterization system complete	FIU-HCET will approve initial design details of the characterization system and the costs associated with the characterization system.	Scheduled completion 2/16/99. Actual completion date 2/18/99.
D017-M6	Title III of the characterization system complete	The completion of Title III provides for a complete characterization system ready for a field assessment.	Scheduled completion 7/28/99
D017-M7	Field testing the characterization system	The characterization system will be tested to verify that it meets performance requirements by characterizing five tons of pipe of various sizes and contaminant types.	Scheduled completion 9/14/99
D017-M8	Close-out of characterization system	This milestone requires the completion of all required activities, including operation/maintenance procedures. Five people from FIU-HCET will be trained on the operation and maintenance of the system. The completed system will be turned over to FIU-HCET for operation and integration with the decontamination system.	Scheduled completion 11/30/99**
D017-M9	Final Report on the decontamination and characterization system	Final report detailing the technology assessment process and the design, fabrication, and testing of the system will be completed and issued. The final report will be distributed through the Remedial Action Program Information Center (RAPIC) and the DDFA mailing list database and will be available on the FIU-HCET Home Page.	Scheduled completion 11/30/99
D017-M10	Large-scale field deployment of ex-situ large-bore pipe characterization and decontamination system.	The integrated characterization and decontamination system will be deployed at an environmental restoration site.	Scheduled completion 1/19/00

\*\* This date has been moved forward to allow for a more extensive demonstration to be completed at a commercial site.

### Significant events for this reporting period

- On May 21, a final run-off of the decontamination unit was conducted successfully at Jet Blasting Equipment in Adrian, MI. The entire decontamination system was approved, and it will

be assembled into the decontamination strong tight container. Once this has been accomplished, the entire assembly will be mounted on a flatbed trailer.

- Preliminary scope of work has been drafted for testing and deployment of this unit at Big Rock Point. A service contractor has been identified and procurement issues are being addressed.
- A conveyor system on the characterization system has been installed.
- Construction of the four trailers will start on July 13, 1999. It should be completed by end of July 1999.
- Title I for the material off-loading system was completed and approved by FIU-HCET.

## Accomplishments and technical progress to date

### *Literature Search to Determine Pipe Remediation Problem Set*

Rough order-of-magnitude quantities were obtained from Hanford and Fernald, including 150,000 m<sup>3</sup> of pipe at Hanford and 5,880 m<sup>3</sup> of pipe at Fernald. Obtaining quantities from other DOE operations offices would require a significant level of effort; therefore, FIU-HCET and the Deactivation and Decommissioning Focus Area (DDFA) decided that acquiring the additional information would not be cost-effective and concluded that significant volumes of pipe exist to warrant the continuation of the project.

### *Determine Applicable Regulatory Policies and Procedures*

The list of regulations that govern the fabrication and operation of the pipe decontamination and characterization system was compiled. This list was given to the potential technology vendors to aid in proposal development, design, equipment fabrication, and system evaluation.

### *Review of Decontamination and Characterization Technologies*

The review and collection of data for possible decontamination and characterization options for large-bore pipe are complete. Based on the information reviewed, an initial screening method used for pipe decontamination technologies was developed and implemented. The initial criteria include the technology's ability to meet the required clean, near-white metal surface finish<sup>1</sup> on the interior or exterior of a pipe and the system's potential to be developed into a field mobile system. Seventeen decontamination technologies were evaluated as part of the initial screening process. Of the technologies screened, six technologies were selected for further evaluation; these six were then narrowed to one technology: grit blasting.

The literature survey of technologies capable of characterizing the interior and exterior of large-bore pipe is complete, and the resulting list detailing 21 technologies was prepared.

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<sup>1</sup> "A cleaned, near-white surface, when viewed without magnifications, shall be free of all visible oil, grease, dirt, dust, mill scale, rust, paint and oxides, corrosion products, and other foreign matter, except for staining. Staining shall be limited to no more than 5 percent of each square inch of the surface area and may consist of light shadows, slight streaks, or minor discoloration caused by rust stains, mill scale stains, or previously applied paint stains." (Structural Steel Painting Council, 1991, *Surface Preparation Specifications*, Structural Steel Painting Council, Pittsburgh, PA, pp. 53-56.)

### *Design and Fabricate Decontamination System*

DeLong Equipment Company was selected to design, fabricate, and perform proof of principle testing of the decontamination module. The primary design difficulties involved laying out the system to fit into transportation containers. All critical issues have been resolved, and the system design indicates the performance specifications will be met.

Title I, Title II, and Title III design have been completed. The entire decontamination system is currently being installed inside a specially designed strong tight container. Once this is accomplished, the entire assembled unit will be placed on a flatbed trailer for transportation.

### *Design and Fabricate Characterization System*

Canberra, Inc., was selected as contractor to supply the characterization module. A kick-off meeting was held on August 28, 1998.

## **Assessment of current status and issues**

- The characterization system is on schedule. The current schedule is valid with no major concerns anticipated.
- Title I for the material off-loading system was completed and approved by FIU-HCET.
- Three of the four transportation trailers have been delivered. The fourth trailer will be completed by end of July 1999.
- Canberra's software programming is progressing on schedule. The main electrical control box has been completed and installed in the container.
- Conveyor system for the characterization system has been installed inside the characterization container.
- The computer and printer have been tested and are working well. The cabinet for the computer and NIM has been assembled and is awaiting installation into the container.
- The run-off of the decontamination unit was successfully completed, installation of the decontamination unit inside a strong tight container is under way and expected to be completed by the middle of next month.
- Development of the detectors for the characterization is progressing on schedule. The manufacturing of the germanium detector is of significant schedule risk and therefore will be monitored closely by FIU-HCET.
- All ventilation equipment was installed and operationally checked. Scheduled completion was May 30, 1999.

## **Plans for the next two months**

- Transport the completed decontamination unit to DeLong Equipment in Atlanta and integrate the unit with the vacuum system during July.

- Conduct final decontamination system and ventilation system inspections at DeLong Equipment in Atlanta by early August.

**FIU-HCET Collaborator**

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## In-Situ Pipe Decontamination System

Project Number: HCET-1999-D041

### Project objectives

The deactivation of radiologically contaminated facilities in many cases requires the characterization and decontamination of piping systems. There exists within the Department of Energy (DOE) inventory several thousand miles of piping and ductwork from facilities throughout the United States. The pipelines were used to move several types of contaminated fluids from one area to another within these facilities. The ductwork moved air within the facilities through ventilation systems. In-situ pipe decontamination options are limited; most commercial systems use high-pressure water to clean the pipe internals. High-pressure water generates large volumes of wastewater, which requires treatment, and in many cases is not aggressive enough to remove heavy scale and contaminants.

The goal of this project is to develop a low-cost and efficient system for in-situ decontamination of pipes, which does not release contaminants into the environment or generate secondary waste.

The objectives of the project are the following:

- Determine performance factors for the decontamination system.
- Select the most capable technology for decontaminating in-situ pipes.
- Incorporate an efficient filtration system to prevent release of contaminants or generation of waste.
- Perform technology enhancement/integration to accommodate horizontal, straight, circular, and rectangular piping and ducting sections.
- Perform a cost-benefit analysis.
- Fabricate a prototype system and assess its performance.

### Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
D041-M1	Technology selection complete	Determine optimum technology to deploy considering production rate, decontamination factor, and safety factors	Completed 2/1/99
D041-M2	Design plan complete	Peer review of design plan complete and approved	Scheduled completion 2/23/99. Completed 3/31/99. Delay due to revisions in approval requirements.
D041-M3	Approved design drawings and cost-benefit analysis	Peer review of final design drawings and the cost to complete approved	Scheduled completion 6/11/99. Peer review of the design performed on June 8, 1999. Cost estimate to be completed by end of July 1999.

Milestone No.	Milestone Description	Completion Criteria	Status
D041-M4	Prototype system complete and demonstration test plan developed	Fabricated prototype system ready for tests and demonstration test plan approved	Scheduled completion 10/15/99

### Significant events for this reporting period

- The existing pipe decontamination system was designed for vertical pipes. To extend its applicability to horizontal pipes and to pipes with smooth bends, design drawings for these systems were prepared and approved by the design review committee.

### Accomplishments and technical progress to date

- Candidate technologies for in-situ decontamination of pipes were screened and grit blasting was selected for further development.
- IPDS concept drawings were prepared and approved by the design review committee.
- FIU-HCET is discussing teaming partnerships with national decontamination firms.

### Assessment of current status and issues

This is the first year of a two-year project. The project is currently on track. The milestone 3 concept design for the enhanced capability unit was completed. Fabrication drawing will be completed by end of July 1999, and then a cost estimate of the new system will be developed. No other issues impacting design or deployment have been identified to date.

### Plans for the next two months

- Review piping systems in use at DOE (length, diameter, and type of bends).
- Complete fabrication drawings for the enhanced capability system..
- Perform more tests on the existing pipe decontamination system and improve performance. Evaluate the performance as regards cleaning rates.
- Continue discussion with commercial firms regarding partnering on this project and performing in-situ pipe decontamination.

### FIU-HCET Collaborators

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## Deactivation and Decommissioning Technology Opportunities for Non-Power NRC-Licensed Sites

**Project Number: HCET-1999-D042**

### Project objectives

The Nuclear Regulatory Commission's (NRC) Operator Licensing Tracking System (OLTS) lists approximately 5,000 NRC-licensed operators of nuclear facilities in the United States. At the end of their useful life, power and non-power nuclear facilities must be deactivated and decommissioned. The use of appropriate deactivation and decommissioning (D&D) technologies can enhance the safety, efficiency, and cost-effectiveness of cleanup operations.

Over the next 10 years, approximately 34 NRC-licensed non-power reactors (NPR) will begin the process of deactivation and decommissioning. Project managers at these sites will be faced with the challenge of selecting safe, cost-effective environmental technologies for achieving their remediation goals. FIU-HCET, with its knowledge and expertise in environmental technologies and the D&D process, will accomplish the following:

- Assess the needs of these NRC-licensed non-power reactor sites.
- Identify opportunities for the fielding of technologies that have been proven safe and effective through research, development, and testing sponsored by the DOE's Office of Science and Technology.

### Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
D042-M1	Report on site licensing, decommissioning, and participation information	List of NPRs indicating nature of operation, license expiration date, decommissioning schedule, and willingness of the site to participate in the study.	Originally scheduled for completion February 28, 1999. Delayed due to slow responses to survey. Recommendation to proceed sent to FETC on April 26, 1999.
D042-M2	DOE-FIU-HCET decision to proceed and NPR sites to be studied	Based on level of participation, a decision by DOE and FIU-HCET on whether to proceed with the project.	Recommendation to proceed to Phase II approved by FETC June 18, 1999.
D042-M3	Site needs assessment	Identification of key problem sets facing each NPR scheduled for decommissioning.	Needs assessment survey will be sent to NPR managers on June 25, 1999. The June 30 completion date has been rescheduled to July 30.
D042-M4	Technological solutions	Identification of candidate technologies for addressing problem sets identified in milestone 3.	Scheduled to begin August 1999. July date rescheduled to August due to delays in M3.

Milestone No.	Milestone Description	Completion Criteria	Status
D042-M5	Final report production and distribution	Report summarizing problem sets and potential technological solutions submitted to DOE and upon approval distributed to NPR sites and candidate technology providers.	To be completed before October 31, 1999.

### Significant events for this reporting period

- On June 18, 1999, DOE-FETC concurred with FIU-HCET's recommendation to proceed with Phase II of the project.
- The Needs Identification and Potential Decommissioning Problems Survey was finalized and will be sent to the participating NPRs on June 25, 1999.
- Three NPR sites have been selected for site visits by FIU-HCET personnel. These visits will allow FIU-HCET personnel to better assess site-specific decommissioning needs. The sites will be visited in July 1999.

### Accomplishments and technical progress to date

The project is being executed in two phases.

In Phase I, FIU-HCET contacted site managers at NRC-licensed NPRs to ascertain the nature of their operations, the duration of their operating licenses, and whether they had plans for decommissioning or intended to renew their licenses. In addition, site managers were asked to participate in a follow-up study to assess and identify current and/or future D&D needs at their facilities. Forty-four NPRs were surveyed, of which 36 responded. Among the 36 respondents:

- Eleven were unable to participate in the study.
- Twenty-three have already filed, or plan to file, for extension of their licenses when they expire.
- Twenty-five agreed to participate in the follow-up needs assessment survey. Five of these had immediate needs for D&D technologies. The remaining 20 responded that they would not be undergoing decommissioning in the near future but were interested in participating in the study.
- Based on this high level of interest and participation, on April 26, 1999, FIU-HCET recommended to DOE that Phase II of the project be undertaken. On June 18, 1999, DOE concurred.

To date in Phase II, FIU-HCET has researched and compiled a checklist of potential D&D problems which NPR facilities may face during decommissioning. This list formed the basis of a follow-up survey of participating NPR site managers to more accurately assess their current and future D&D needs. Site visits to the State University of New York in Buffalo, University of Virginia, and University of Washington are planned for July 1999. These visits will provide a better understanding and definition of NPR site clean-up needs.

### **Assessment of current status and issues**

- FIU-HCET is awaiting survey responses from NPR site managers.
- No major issues are foreseen that would hinder completion of this project.

### **Plans for the next two months**

- FIU-HCET has begun working with selected NPRs in defining D&D problem sets, developing technology needs assessments, and identifying feasible technology solutions. In July 1999, FIU-HCET personnel will visit three NPR sites to assess their current and potential decommissioning needs.
- Based on discussions, site visits, and survey results, FIU-HCET will compile an inventory of current and potential problems that NPRs face during decommissioning. Identified problems will be ranked according to frequency of occurrence at sites and urgency assigned by site managers.
- Work will begin on identifying technological solutions to decommissioning problems and developing the decision model that NPR site managers may use to identify feasible technology solutions for their site-specific problems.

### **FIU-HCET Collaborators**

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## Life-Cycle Cost Analysis for Radioactively Contaminated Scrap Metal

Project Number: HCET-1999-D043

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### Project objectives

In September 1996, the Assistant Secretary of the U.S. Department of Energy's Office of Environmental Management (U.S. DOE-EM) issued a challenge to the DOE community that, to the degree that recycling is economically advantageous and protective of worker and public health, radioactively contaminated scrap metal (RSM) presently in storage, or projected to be generated by future EM activities, should be recycled.

Future deactivation and decommissioning (D&D) of the DOE's surplus facilities is expected to generate more than 600,000 tons of metal and 23 million cubic meters of concrete. Already there are more than 400,000 tons of RSM from past D&D activities temporarily stockpiled at DOE sites and pending disposition. There are also large quantities of RSM permanently buried at commercial and DOE-managed low-level waste (LLW) disposal facilities across the country. In total, it is estimated that more than 1,000,000 tons of RSM will be generated from the deactivation and decommissioning of radioactively contaminated facilities at the DOE and in the private sector.

Current waste disposal costing methodologies at DOE-managed waste disposal sites favor direct disposal of RSM in landfills over recycling. Studies commissioned by the DOE have shown that current rates for direct disposal of RSM may be understated. It is perhaps because they do not reflect the total costs associated with the full life-cycle of LLW land disposal. The long-term maintenance and surveillance cost of disposal sites once they have been closed is one issue. A complete life-cycle cost analysis (LCCA) could reflect higher costs for direct disposal and could lead to increased material recycling, resource recovery, and waste minimization, which are key goals of the DOE.

DOE-managed LLW land disposal sites are limited in their capacity. It has been stated that to think that additional sites could be available to contain the projected generation of RSM from D&D activities is unrealistic. This complicates the issue of a "true" cost analysis. Because the issue of capacity is so relevant, insofar as obtaining a comparable "true" cost analysis, this study will take a zero-based approach that should be able to identify all initial costs, operating costs, direct costs, variable costs, closure costs, and value added. The objectives of this project are

- to conduct a DOE-wide survey to collect existing information on the quantities and characteristics of RSM currently in DOE stockpiles, as well as quantities likely to be generated from future D&D of DOE's surplus facilities and buildings.
- to estimate the range of the real costs for direct disposal of DOE-generated RSM. The study is limited to designated low-level waste (LLW) direct disposal facilities selected by FIU-HCET and DOE.

## Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
D043-M1	RSM inventory	A compilation of existing estimates of current and future RSM inventories generated by D&D activities.	Completed: June 15, 1999
D043-M2	Committed waste site managers	A list of waste site managers willing to provide information necessary for developing LCCAs.	Completed: June 15, 1999
D043-M3	Report to DOE on Phase 1 (milestones 1 and 2)	Summary of results of milestones 1 and 2 and recommendation to DOE on RSM disposal facilities to be surveyed.	Completed: June 15, 1999
D043-M4	Decision on RSM disposal sites to be assessed	FIU-HCET and DOE-FETC shall consult and decide whether to proceed to Phase II and select sites to be surveyed.	Due date: July 15, 1999
D043-M5 (deleted)	Documentation of NRC and commercial means of costing RSM disposition	Comparative analysis of costing methodology and factors used by selected sites.	This task has been deleted.
D043-M6 (deleted)	Documentation of DOE means of costing RSM disposition	Procedural outline of DOE's costing methodology, indicating variances with other sites surveyed.	This task has been deleted.
D043-M7	LCCA for direct disposal of RSM	Develop LCCA for direct disposal of RSM at selected disposal sites. LCCAs will be submitted to DOE for review.	This task was revised to exclude LCCAs for disposal means other than direct disposal. Due date: August 31, 1999.
D043-M8 (deleted)	Finalize LCCAs and update DOE handbook	Revised LCCAs incorporating DOE's comments and procedures for LCCA incorporated in DOE handbook.	This task has been deleted.
D043-M9	Final Report	Review comments provided to FIU-HCET by DOE to be incorporated into LCCAs and resubmitted to DOE with final project report	Due date: October 31, 1999

## Significant events for this reporting period

- The project was presented to the D&D Focus Area at the FY99 DDFA Mid-Year Review held at FETC Headquarters in Morgantown, WV. Two of 11 DOE offices responded with inventory information on RSM. A memorandum for *Request for Information* was initially sent on April 26,

1999 with a follow-up E-mail three weeks later. A due date of June 15, 1999, was stipulated for the completion of the inventory. The two sites responding are INEEL and SRS. FIU-HCET has completed all tasks associated with Phase I of the project and will issue the Phase I report at the end of the month.

- Planning activities for Phase II are continuing and will be accelerated. Life-cycle costs for disposal of LLW RSM have been identified for a commercial disposal facility, Envirocare of Utah, Inc. Additional information on DOE LLW disposal facilities has been requested from selected sites via current BPS documents.

### **Accomplishments and technical progress to date**

- In December 1998, FIU-HCET in consultation with Dr. Katherine Yuracko, an expert in life-cycle analysis at the ORNL, identified and defined tasks to complement the life-cycle decision methodology developed by Dr. Yuracko.
- In March 1999, representatives from FIU-HCET, DOE-FETC and NMR reviewed the project's scope of work and objectives. The outcome of the review was that FIU-HCET would focus exclusively on collecting existing information to estimate current and future RSM inventories and on developing an LCCA for estimating the true costs associated with direct disposal of DOE-generated RSM at selected disposal sites. Costs associated with other means of RSM disposal would not be investigated. These changes were endorsed by DOE-FETC and reflected in the Major Milestones table above.
- In April 1999, FIU-HCET prepared and issued a survey questionnaire to 11 DOE sites requesting data on current and future RSM inventories. The survey provided the sites with their specific Internet address for the *Accelerating Cleanup: Paths to Closure Baseline Disposition Maps*. An Excel spreadsheet was included to facilitate data reporting.
- The Nevada Test Site and Envirocare of Utah, Inc., waste disposal sites were designated by the DOE for evaluation. These sites were visited in May 1999 and information on cost elements collected. The visit to Envirocare provided information on cost elements for commercial LLW disposal facilities that are different from those at the DOE sites such as NTS.
- FIU-HCET attended DOE's Waste Issues Team Workshop V in Las Vegas, NV, to make a presentation on the LCCA-RSM project goals and objectives. The Nevada Test Site personnel provided information on the disposal costs for the NTS LLW facility.
- As of June 15, 1999, completed RSM survey questionnaires were returned by two of the 11 sites surveyed.

### **Assessment of current status and issues**

As of June 15, 1999, completed RSM survey questionnaires were returned by two of the 11 sites surveyed. Follow-up telephone calls have been made to the other nine sites.

Phase I of the project will be completed using updated data from the two respondents and existing data from *Accelerating Cleanup: Paths to Closure Baseline Disposition Maps*. An initial outline of the report to DOE on Phase I activities has been drafted and is awaiting data from the survey.

Due to the lack of responses to the RSM inventory survey, the estimates of current and future quantities of RSM compiled by FIU-HCET will not be up-to-date.

### **Plans for the next two months**

During the next two months, the following will be accomplished:

- FIU-HCET will develop a comprehensive list of cost elements associated with DOE disposal facilities and commercial disposal facilities. In conjunction with this, these cost elements will be reviewed and verified by facility representatives during site visitation.
- FIU-HCET will complete its report to DOE on Phase I activities. Current and future RSM inventories will be a composite of up-to-date data provided by the survey respondents and the baseline disposition maps of those sites that did not respond. Where available, contamination ranges, site points of contact, level of expected cooperation, and specific types of metals will be provided.
- Project activities to determine cost per unit volume for disposal of LLW RSM will be accelerated to expedite data acquisition, information evaluation, and LCCA production.

### **FIU-HCET Collaborators**

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## Legacy Waste Disposition for the Oak Ridge Reservation

Project Number: HCET-1999-D044

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### Project objectives

Deactivation and decommissioning (D&D) of the surplus facilities at the Oak Ridge Reservation (ORR) will result in millions of cubic meters of waste of varying degrees of hazard and toxicity, requiring treatment, storage, and disposal (TSD). A large portion of the waste consists of low-level, uncharacterized, heterogeneous mixed waste streams. Currently, disposition paths do not exist at ORR for much of the mixed low-level waste (MLLW), which has to be sent to commercial waste facilities for disposition.

There are over 60 storage facilities on the ORR where MLLW is stockpiled. It is the goal of the U.S. Department of Energy (DOE) to eliminate this stockpile of legacy MLLW by the year 2006.

Several options exist for the TSD of contaminated waste streams at the ORR. These include neutralization, separation, vitrification, volume reduction by incineration or evaporation, packaging and direct disposal, and decontamination for reuse/recycling. In disposing of waste, the key objectives of the DOE's waste management program include safety, pollution prevention, waste minimization, and resource recovery. A clear understanding of proven TSD alternatives (disposition paths) for particular waste streams is therefore critical to achieving waste management goals and objectives. By their very nature, MLLW streams could potentially require an infinite number of disposition options for characterization, treatment, storage, and disposal, which could prove to be prohibitively costly. The need exists for a systematic means of evaluating MLLW streams and selecting the most appropriate disposition path for each stream from a limited number of options. This would minimize the number of disposition processes that would have to be set up to characterize, treat, store, and dispose of MLLW streams and would reduce costs for waste management.

Under this subtask, FIU-HCET will

- Perform a series of technical reviews for the DOE to aid in determining TSD options for MLLW streams at the ORR and to support the DOE's goal of eliminating the MLLW inventory by the year 2006.
- Investigate feasible TSD options and technologies for legacy MLLW streams at the ORR for which no disposition paths currently exist.

The original tasks identified in this project were defined by Bechtel-Jacobs, LLC (hereinafter referred to as Bechtel Jacobs), the Management and Integration contractor for the ORR, based on preliminary needs assessments conducted at ORR. These needs have since been reassessed and the tasks were redefined in March 1999 by Bechtel Jacobs in consultation with FIU-HCET. The new tasks are within the scope and goals of the project and are reflected in the Major Milestones table below.



## Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
D044-M1 (deleted)	Report on TSD options for residue from MLLW metal feeds to the TSCA incinerator	A set of feasible disposition paths for the MLLW metal feeds to the TSCA incinerator.	Scheduled for completion 4/30/99. This task has been deleted by Bechtel Jacobs (see Note 1).
D044-M2 (deleted)	Report on TSD options for contaminated accelerator lead shielding.	At least 2 feasible options for disposing of the contaminated lead shielding.	This task was deleted at the request of Bechtel Jacobs (see Note 2).
D044-M3 (deleted)	Report on TSD options for contaminated cadmium plates.	At least 2 feasible options for disposing of the contaminated cadmium plates.	This task was deleted at the request of Bechtel Jacobs (see Note 2).
D044-M4 (deleted)	Report on wastewater residue TSD options at Y-12.	A set of feasible disposition paths for the Y-12 wastewater residues.	This task was deleted at the request of Bechtel Jacobs (see Note 1).
D044-M5	Report on performance of PM-CEMs in meeting EPA monitoring guidelines.	Report on Technical Review of PM-CEMs Performance Evaluation Test Plan	Scheduled for completion 6/30/99. Delay in installation and testing schedule for TSCA Incinerator PM-CEMs shifted FIU-HCET support initiation to 5/15/99. For this reason, FIU-HCET's FY99 technical support will be limited to a technical review of the PM-CEM Performance Evaluation Test Plan.
D044-M6	Final Report summarizing findings, incorporating previous Bechtel Jacobs review comments, and providing guidance on use of the developed decision tool	Final report submitted to Bechtel Jacobs	Due 10/31/99

The following task milestones were added at the request of Bechtel Jacobs in March 1999 in consultation with FIU-HCET:

Milestone No.	Milestone Description	Completion Criteria	Status
D044-M7 (added)	Regulatory update of the BDAT database	All waste codes in ORR MLLW Balance of Inventory (BOI) database updated to current RCRA/LDR regulations	Completed on schedule 4/15/99
D044-M8 (added)	Report on waste codes in sample populations of the ORR MLLW BOI database	Resolution of problematic waste code assignments and groupings	Completed on schedule 4/30/99
D044-M9 (added)	Report on potential waste disposition conflicts and their resolution	Resolution of potential disposition conflicts; and identification of options	Completed on schedule 5/15/99
D044-M10 (added)	Documentation of effectiveness of systematic approach to ORR MLLW evaluation and disposition	Documentation of reduced treatment effort required	Completed on schedule 6/15/99

Note 1. These tasks were deleted on March 31, 1999 at the request of John Patterson, Manager of Planning and Integration at Bechtel Jacobs.

Note 2. These tasks were deleted on May 17, 1999 at the request of John Patterson, Manager of Planning and Integration at Bechtel Jacobs.

### Significant events for this reporting period

- FIU-HCET is addressing disposition conflicts and options for four waste streams in order to evaluate the consequences of dropping waste codes and/or reassigning waste populations to alternative treatability groups.
- Work associated with milestone D044-M5 has begun with technical assistance from UT Knoxville, viz., a comprehensive technical review of the Test Plan for the performance evaluation of 3 PM-CEM systems to be co-installed this summer at the TSCA Incinerator.

### Accomplishments and technical progress to date

Bechtel Jacobs and DOE established an initiative to expedite the treatment of broad-spectrum waste streams. In 1996 and early 1997, analysis of contractors' responses to a Broad Spectrum Invitation for Bid led to the development of five broad MLLW treatment categories, a make/buy study and life-cycle cost analysis to evaluate onsite and offsite treatment options, and an approach for awarding contracts for MLLW treatment. In June 1998, five Broad Spectrum Treatment Contracts (BSTC) were awarded to two commercial mixed-waste TSD vendors and earmarked an anticipated expenditure of between \$40 million and \$260 million for TSD services. Through this vehicle, up to 36 million kilograms of MLLW will be processed at the two permitted facilities for ultimate land disposal. The BSTC initiative has also led to the development of a website that provides tools and information for DOE project personnel and other users to evaluate process knowledge about their specific MLLW streams, determine appropriate treatment vendors, estimate transport and treatment costs, and obtain contract-related information.

Discussions between Bechtel Jacobs and FIU-HCET during March 1999 identified the following needs:

- Review waste codes assigned to waste populations in the ORR MLLW inventory and update them to current RCRA/Best Demonstrated Available Technology (BDAT) treatment regulations and standards.
- Review waste code groups within these waste populations for the correctness of their assignment and to determine the impact of current waste groupings on required treatment type. This latter information can correct potentially costly problems such as the generation of small “orphan” groups requiring special, more costly TSD effort, or by inclusion of such groups in larger populations, causing the entire population to undergo unnecessary treatment.
- These developments have led to a redefinition by Bechtel Jacobs of the scope of technical assistance that FIU-HCET will provide under this project. The overall scope and objectives of the project remain essentially the same; however, some tasks and milestones have been redefined to better address the needs identified above. The revised plan takes a more comprehensive and systematic approach to assessing TSD options and processes for waste streams, rather than simply identifying disposition paths for a limited number of specific streams. Several of the specific streams originally identified by ORNL to be investigated by FIU-HCET (namely, those related to milestones 1 through 4) have been subsumed by the revised scope of work or are no longer of interest to Bechtel Jacobs.
- FIU-HCET is working with Bechtel Jacobs personnel to identify, define, and develop tasks associated with the Broad Spectrum waste disposition effort and the identification of potential orphan MLLW streams, which FIU-HCET can address in this project.

The overall outcome of this project will be a systematic process for evaluating MLLW waste streams to assist in waste code and waste grouping assignment and the choice of most cost-effective disposition option.

### **Assessment of current status and issues**

The scope of this project has been reviewed with Bechtel Jacobs and the DOE’s Federal Energy Technology Center in light of the redefined needs of Bechtel Jacobs. This review has resulted in the modification of the tasks, milestones, and deliverables for the project as reflected in this current monthly report. It is believed that the time and effort invested in re-evaluating this project will result in a more comprehensive and useful decision support model with application not only at ORR but at waste processing sites across the DOE complex.

### **Plans for the next two months**

FIU-HCET will

- Complete the assessment of the MLLW BSTP developed by Bechtel Jacobs.
- Complete a detailed review of the MLLW database and of waste populations of particular interest to Bechtel Jacobs.

- Work with Bechtel Jacobs to assess and document the current processes and options for characterizing, transporting/handling, treating, and disposing of difficult MLLW streams.
- Complete the outline of a systematic approach for evaluating waste streams in the MLLW inventory.
- Complete a report on the technical review of the test plan to be followed in the performance evaluation of three PM-CEM systems to be installed and tested at the TSCA incinerator this summer.

### **FIU-HCET Collaborators**

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## National Contract for Radioactive Scrap Metal Recycle

Project Number: HCET-1999-W002

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### Project objectives

In September 1996, the Assistant Secretary of the U.S. Department of Energy's Office of Environmental Management (U.S. DOE-EM) issued a challenge to the DOE community that, to the degree that recycling is economically advantageous and protective of worker and public health, radioactively contaminated scrap metal (RSM) presently in storage, or projected to be generated by future EM activities, should be recycled.

Future deactivation and decommissioning (D&D) of the DOE's surplus facilities is expected to generate more than 600,000 tons of metal and 23 million cubic meters of concrete. Already there are more than 400,000 tons of RSM from past D&D activities temporarily stockpiled at DOE sites and pending disposition. There are also large quantities of RSM buried at commercial and DOE-managed low-level waste (LLW) disposal facilities across the country. In total, it is estimated that more than 2 million tons of RSM will be generated from the D&D of radioactively contaminated facilities at the DOE and in the private sector.

Current waste disposal costing methodologies at DOE-managed waste disposal sites favor direct disposal of RSM over recycling. Two primary reasons for this preference include both cost differential perceptions and the difficulty of attaining and managing recycle contracts. The DOE National Center of Excellence for Metals Recycle (NMR) intends to reduce the difficulty of attaining and managing recycle contracts by implementing a national contract that provides low cost and flexibility along with ease of implementation.

FIU-HCET provides the following services to the DOE complex via NMR:

- Supporting accelerated site cleanup and closure in a safe, environmentally protective manner and in compliance with applicable environmental regulation
- Assisting in the mitigation of risks to ensure that site conditions do not pose unacceptable risks to workers or public
- Endorsing the disposition of contamination, waste materials, buildings, facilities, and infrastructure consistent with national goals.

These services are in direct support of the objectives of NMR. Specific tasks associated with these services and identified in this project include the following:

- Propose a strategic plan for the development of a national contract for radioactive scrap metal recycle.
- Identify radioactive scrap metal recyclers providing both decontamination and metal melting capabilities.
- Assist in the development of the Statement of Work, Prequalification Criteria and Selection Criteria for the radioactive scrap metal handling, transportation, processing, and dispositioning.

## Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
W002-M1	Propose a strategic plan for the implementation of a national contract.	Communicate the strategic plan for consideration by the DOE.	Completed 3/02/99.
W002-M2	Identify radioactive scrap metal processors with Metal Melt capabilities.	Provide a list of processors capable of providing decontamination services, metal melting services and dispositioning services.	Completed 3/22/99.
W002-M3	Assist in the development of a draft Statement of Work, Prequalification Criteria and Selection Criteria for consideration and evaluation by the DOE.	Formalize draft documents for the Statement of Work, Prequalification Criteria and Selection Criteria.	Completed 3/22/99.
W002-M4	Assist in the development of an Acquisition Plan utilizing the National Metal Contract strategic plan.	Submit an Acquisition Plan for the National Metal Contract.	Assigned 6/99. Target completion date of 7/01/99.

Note: Additional milestones to be determined by NMR.

## Significant events for this reporting period

- A new milestone was assigned by the National Center of Excellence for Metals Recycle. The new milestone will lead to the development and submittal of a standard Acquisition Plan as support for the procurement of a National Metal Contract. A meeting was held between the Hemispheric Center for Environmental Technology and the National Center of Excellence for Metals Recycle to discuss scope, objectives, cost, and schedule. Work toward completion of the new milestone has begun and will be completed by July 1, 1999.

## Accomplishments and technical progress to date

Milestones W002-M1 through W002-M3 have been completed. These milestones were communicated to the National Center of Excellence for Metals Recycle as formal reports. These documents were reviewed and accepted by the National Center of Excellence for Metals Recycle.

## Assessment of current status and issues

Completion of milestones W002-M1 through W002-M3 had moved FIU-HCET's involvement with the National Contract for Radioactive Scrap Metal Recycle to an inactive status. However, the introduction of milestone W002-M4 has reactivated FIU-HCET's involvement. FIU-HCET is expected to complete task W002-M4 by July 1, 1999.

### **Plans for the next two months**

- FIU-HCET will continue working toward completion of milestone W002-M4 through July 1, 1999. As additional assignments are generated and assigned by the DOE, FIU-HCET will further support implementation and optimization of the Strategic Plan for Radioactive Scrap Metal Recycling.

### **FIU-HCET Collaborator**

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## II. TANKS FOCUS AREA (TFA)

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### MONTHLY PROGRESS REPORT

**FIU-HCET Principal Investigator**  
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## Waste Conditioning for Tank Slurry Transfer

Project Number: HCET-1998-T004

### Project objectives

There are millions of gallons of radioactive waste slurries stored in underground tanks located at different U.S. Department of Energy (DOE) sites. DOE needs information and technologies to treat the wastes and close the tanks. Treatment of these wastes into safe waste forms and closure of these tanks require information of chemical and physical properties of the waste and fundamental data related to tank slurry conditioning, mixing, transport, and processing.

FIU-HCET is conducting research and examination on waste conditioning for tank slurry transfer. In this project, FIU-HCET is performing experimental tests to obtain reliable data in order to understand problems encountered in tank slurry mixing and transfer processes. Based on the data and results obtained from the experiments, FIU-HCET is investigating possible solutions to prevent pipeline plugging during slurry transfer and the problems that occur in slurry mixing. Additionally, this project has reviewed and compared the actual slurry natures at different DOE sites and facilities, such as Fluor Daniel Fernald (FDF), Oak Ridge National Laboratory (ORNL), Savannah River Sites (SRS), and Hanford, and identified the requirements for slurry transfer.

This project should accomplish the following:

- Determine the effect of chemical and physical properties on the tank slurry transfer process.
- Provide information for the transfer equipment design and operation.
- Identify and evaluate the most sensitive parameters that influence the waste conditioning and transfer operations.

### Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
T004-M1	Review previous work and adjust experimental setup	Experimental facility must fulfill M2-6 test requirements	Completed by 02/14/99 Due date: 02/26/99
T004-M2	Measure surrogates particle size distribution	Perform six different particle size distribution tests as described in Table 1 in the PTP	Completed by 03/15/99 Due date: 04/12/99
T004-M3	Determine surrogates particle shapes	Perform six particle geometry tests as described in Table 2 in the PTP	Completed by 04/30/99 Due date: 05/17/99
T004-M4	Characterize solid particle solubility and crystallization behavior	Perform nine solubility and crystallization tests as described in Table 3 in the PTP	On schedule. Due date: 07/05/99
T004-M5	Measure particle settling velocity.	Perform 27 settling tests as described in Table 4 in the PTP	Due date: 08/15/99
T004-M6	Measure slurry viscosity	Perform 26 viscosity tests as described in Table 5 in the PTP	Due date: 09/30/99
T004-M7	Perform data correlation and documentation	Write a project final report	Due date: 10/30/99

### Significant events for this reporting period

- Wax and concentrated slurry blockages were created in conjunction with the plugging-and-unplugging project. These blockages are being tested in the lab and are intended to be used in the large-scale test bed demos in the near future.
- A paper summarizing the experimental results and findings was submitted to the 1999 annual meeting of the American Institute of Chemical Engineers (AIChE) and the submission has been accepted.
- Mr. Gerald Boyd, Acting Deputy Assistant Secretary of the Office of Science and Technology, Department of Energy, visited FIU-HCET on June 3, 1999. Mr. Boyd visited the waste conditioning experimental facility at FIU-HCET and was briefed on the objective and the progress of the project.

### Accomplishments and technical progress to date

- The blockages created in the lab are about two to three feet in dimension and each is located in a two-inch diameter plastic pipe. Blockages tested so far correspond to the following description:
  - Concentrated SRS and Hanford slurries (70-90 wt%). Intended to simulate actual waste slurry blockages.
  - Concentrated SRS and Hanford slurries with bentonite. Bentonite consolidates the blockages better.
  - Wax and epoxy blockages. The intention here is to produce a hard, adherent coating on the inside surface of the pipe when placing these blockages in the pipe.
- Crystallization tests are still in process. To date, no major solids accumulation is observed in the samples. This behavior was expected though, since kinetics of the expected precipitates are extremely slow (several months).
- A report authored by Agnew and Johnston, titled: *Microstructural Properties of High Level Waste Concentrates and Gels with Raman and Infrared Spectroscopies*, was obtained and referred to the current project. This paper describes a similar solid structural investigation performed at LANL with SRS and Hanford simulants. Since we are focusing our research on these two simulants, the results presented are very helpful.
- Particle settling tests have been started. These tests are performed in graduated cylinders and over a long period of time (72 or more hrs.). This task is described in table 4 in the PTP.
- A technical report is prepared on the analysis of particle characteristics and will be send to Mr. P. Gibbons who is the DOE contact for this project. Some of the analytical results are shown in Figures 1 and 2.



Figure 1. Solids particle in Hanford slurry after six-hour mixing.

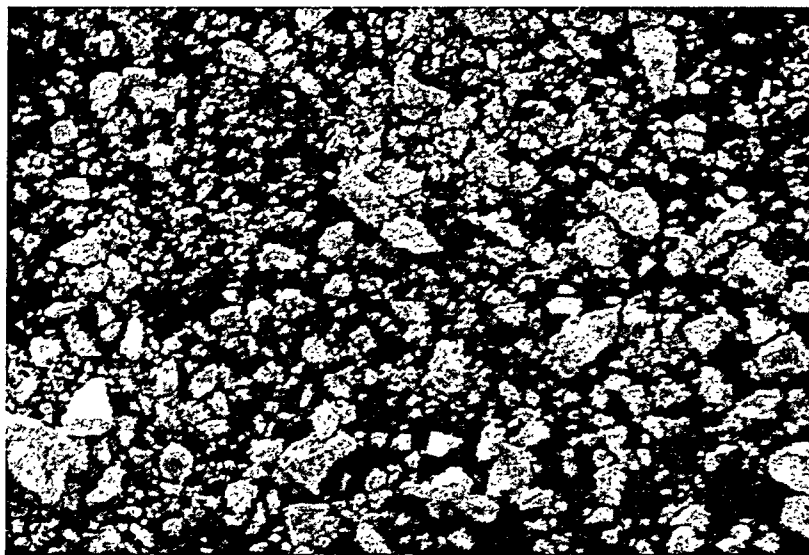


Figure 2. Solids particle in SRS slurry after six-hour mixing.

### Assessment of current status and issues

The wax blockage, concentrated slurry blockage, and the concentrated slurry with bentonite blockage created in the lab need to be evaluated for their actual applications in the large-scale testing beds.

### **Plan for the next two months**

- Continue with particle settling tests as described in Table 4 in the PTP.
- Investigate potential formulae to form gel blockages.
- Test blockages in a different diameter pipe (3 in. and 1 in.).
- Continue solids formation tests. Test solids concentration variation in supernate.
- Characterize waste slurry simulant, which will be used in flow loop tests.

### **FIU-HCET collaborators**

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## Plugging and Unplugging of Waste Transfer Pipelines

Project Number: HCET-1998-T005

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### Project objectives

As the waste tank clean-out and decommissioning program becomes active at the DOE sites, there is an increasing potential that the waste slurry transfer lines will become plugged and unable to transport from one tank to another or from the mixing tank to processing facilities. Whereas some sites, such as Savannah River, Hanford, and Oak Ridge, have already experienced plugged or blocked lines, plugging may occur at additional sites at the onset of waste transfer.

FIU-HCET will continue to investigate pipe plugging and unplugging behaviors of waste slurry transfer lines for a high-level waste (HLW) system on the waste transfer simulation flow loop in FY99. In addition to pipe plugging caused by settling, pipe plugging and unplugging phenomena induced by gelling will also be studied by both experimental and theoretical methods. Key aspects of particle deposition associated with pipe plugging will be addressed. These will include particle agglomeration leading to larger particles that fall out of suspension and particle deposition in the pipe at the end of the transfer as a function of pipe slope or dip depth. The experimental setup used for settling-induced plugging will be modified for the study of gelling-induced plugging and unplugging. The core-annular flow technology, which may be used to unplug the gel-caused blockage, will be examined.

In FY99, activities of industrial equipment tests and demonstrations of plug locating and pipe unplugging technologies will be coordinated by FIU-HCET, Numatec Hanford Corporation (NHC), Pacific Northwest National Laboratory (PNNL), Federal Energy Technology Center (FETC), and DOE sites. FIU-HCET will complete the design and construct the Plug Locating and Removal Demonstration test bed for the industrial equipment test and demonstration to be conducted in FY00. FIU-HCET will also plan additions to the large-scale (full-size) test bed required for pipeline inspection tools testing in the future.

The objectives of this work include the following:

- Further understand the pipeline plugging and unplugging mechanism by particle settling and gel formation.
- Identify and test industrial methods to locate and remove waste transfer pipeline blockage.
- Inspect and verify the condition of those pipelines.

## Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
T005-M1	Issue project technical/test plan for pipeline plugging and unplugging activities	Planned activities, tasks, and milestones of slurry transport experiments in a flow loop, and construction of full-size test beds for demonstration of blockage locating and pipe unplugging technologies	Completed 2/15/99; met the schedule
T005-M2	Develop systematic methods for characterization of slurries for transport experiments	Documentation and application of slurry characterization method for slurry preparation, rheology measurement, and data presentation of slurry transport experiments.	Completed 3/20/99, met the schedule
T005-M3	Modification of flow loop setup for additional slurry transport experiments with horizontal pipeline	Set up the flow loop with a higher capacity pump, improved sampling system, and an additional pressure transducer.	Scheduled completion 3/30/99, met the schedule
T005-M4	Finalize the design of full-size test bed for equipment tests and demonstrations	Detailed design drawings of the pipelines for the three full-size test beds.	Scheduled completion 3/30/99, met the schedule
T005-M5	Perform additional slurry transport experiments in flow loop with horizontal pipeline	Obtain data by data acquisition system and video recording system at one additional slurry concentration. Some critical velocity data will be repeated by varying slurry flow rate from very high level to low level.	Scheduled completion 5/28/99 Test loop is modified and tasks are under performing.
T005-M6	Plan, design, and modification of flow loop with inclined pipelines	Set up a flow loop with inclined pipelines that have the same geometrical layout as those used at DOE sites.	Scheduled completion 6/25/99. Test loop is modified and tasks are under performing.
T005-M7	Construction of the test beds for equipment tests and demonstrations	Three test beds representing gravity pipeline, long pipeline, and buried pipeline will be fabricated with the specified material and dimensions.	Scheduled completion 9/15/99.
T005-M8	Perform slurry transport experiments in flow loop with two inclined pipelines	Obtain results of pressure drop and critical velocity in the flow loop with two kinds of inclined pipeline	Scheduled completion 9/30/99.
T005-M9	Data processing, correlation, and comparison	Present the measured data and data correlation for the slurry transport experiments	Scheduled completion 10/15/99.
T005-M10	Identify and determine industry companies and potential technologies for equipment tests and demonstrations	Create a database with a list of potential companies and technologies with contact information for the large-scale equipment test.	Scheduled completion 11/01/99.
T005-M11	Draft and distribute the year-end report of the plugging and unplugging project	Report covers detailed experimental studies and progress of the full-size test bed in FY99.	Scheduled completion 11/15/99.



## Significant events for this reporting period

- The signal problem with the LabView Data Acquisition System has been fixed.
- The calibration of the modified test loop with water has been finished.
- Chemical components for the new recipe (including NiO) have been ordered.
- Pictures of the construction phase of Large-scale Test Beds have been taken. They are currently available on the FIU-HCET web homepage.

## Accomplishments and technical progress to date

### Part 1 Flow Loop Research on Pipeline Plugging and Unplugging

#### 1.1 Modified Loop Calibration with Water

Since the visit of Dr. Erian from PNNL at FIU-HCET during May 17-19, the signal problem with the LabView Data Acquisition System has been fixed by changing the connection method of the grounded wires. The flow loop is currently up and running and ready to conduct slurry transport experiments. Figure 1 shows the schematic drawing of the modified test loop. A new pipe connection has been installed as well as the new sampling section near the tank. Also a differential pressure transducer was installed in the straight section to observe the flow development in the loop. In the mixing tank, baffles were added for more agitation, and a Moyno<sup>®</sup> pump was installed to achieve higher Reynolds number. The calibration work in this loop has been done with water, and the result is shown in Figure 2. After the comparison of measured friction factor with calculated values (Blasius 1913), it was found that the deviation was within 4%, which indicates the flow loop is reliable and measuring the system with acceptable accuracy.

#### 1.2 Test Cases for Slurry Transport Experiments

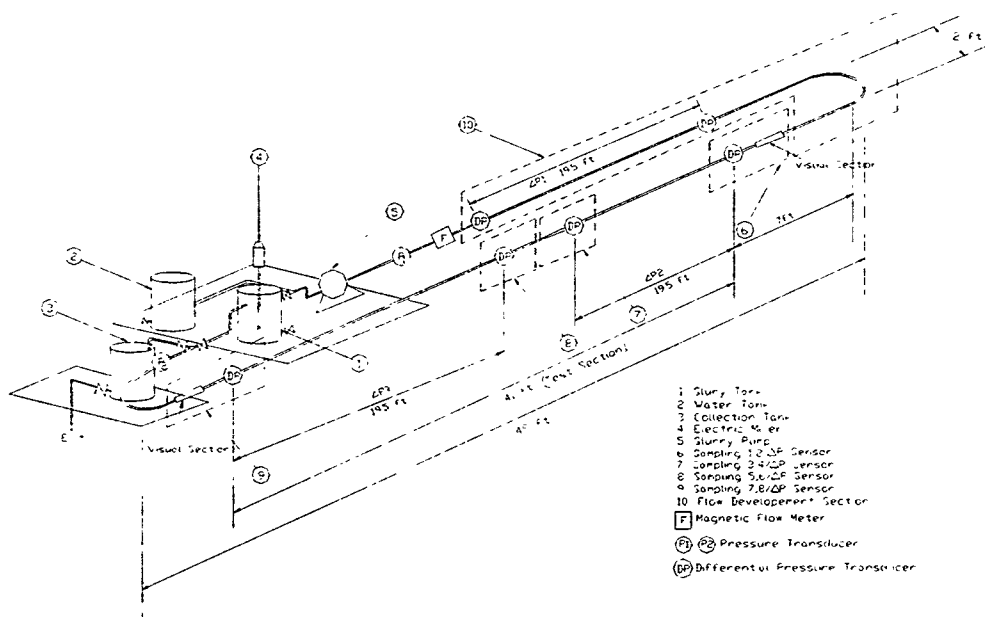
Table 1 lists the updated cases that will be conducted with horizontal pipe. According to Dr. Erian's suggestion, four more cases for each test material (e.g., the velocity will be 1.25, 0.7, 0.4, 0.25 m/s for water) were added in the test case plan. It makes the planned test case increase from 70 to 98.

After cables were used to fix the test setup frame and the hose was changed, there is currently no existing vibration when the system is in operation.

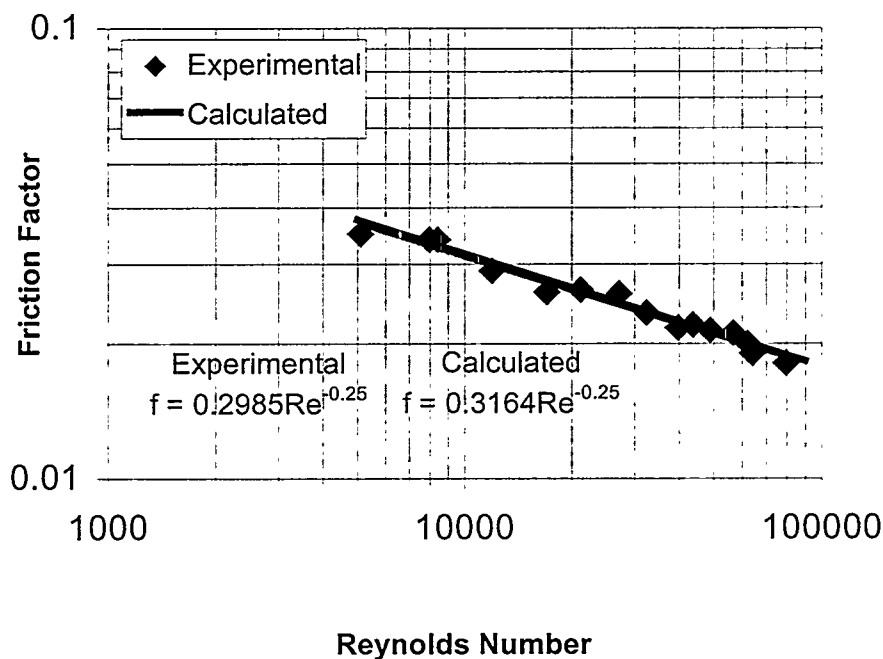
Tables 2 and 3 list the weight concentrations of the chemical components of SRS slurry. They are the revised recipes of Table 4, which lists the densities and weight concentrations of SRS chemical components found in Chapman *et al.* (1986). Table 2 represents a new recipe that uses NiO instead of Na<sub>2</sub>O used in the old recipe shown in Table 3.

It should be noted that UO<sub>2</sub> was not considered as a possible candidate for slurry due to its radioactive characteristics although its weight concentration is 7.1%. In its place, NiO, which possesses similar density, chemical properties, and weight concentration, had to be selected. For all the components in Table 4 not selected, other materials are considered by adjusting the weight concentration to make up for the loss. For example, CaO, one of the materials deleted from the list (see Table 4), has a density of 3.25-3.38 g/l and a weight concentration of 3.3%. Among the materials selected, the density of Al<sub>2</sub>O<sub>3</sub> was found to be 3.98 g/l, which possesses the closest density

to CaO. Therefore,  $\text{Al}_2\text{O}_3$  was added to the list in place of CaO while increasing the weight concentration by 3.3%. In the same manner, substitutes were added to the experimental list whenever the materials were found to be unsuitable for the experiment.



**Figure 1. Schematics of the test system.**



**Figure 2. Comparison of measured friction factor with calculated values (Blasius 1913).**

**Table 1.**  
**Matrix of slurry transport experiments**

Water		Velocity m/s													
		4.0	3.5	3.0	2.5	2.0	1.5	1.25	1.0	0.7	0.5	0.4	0.3	0.25	0.2
S R S	10% wt	3.0	2.75	2.5	2.25	2.0	1.75	1.6	1.5	1.4	1.25	1.1	1.0	0.9	0.75
	20% wt	3.0	2.75	2.5	2.25	2.0	1.75	1.6	1.5	1.4	1.25	1.1	1.0	0.9	0.75
	30% wt	3.0	2.75	2.5	2.2	2.0	1.75	1.6	1.5	1.4	1.25	1.1	1.0	0.9	0.75
H A N F O R D	10% wt	3.0	2.75	2.5	2.25	2.0	1.75	1.6	1.5	1.4	1.25	1.1	1.0	0.9	0.75
	20% wt	3.0	2.75	2.5	2.25	2.0	1.75	1.6	1.5	1.4	1.25	1.1	1.0	0.9	0.75
	30% wt	3.0	2.75	2.5	2.2	2.0	1.75	1.6	1.5	1.4	1.25	1.1	1.0	0.9	0.75
Total cases: 98															

Note: 10wt% corresponds to 2.54% volume concentration;  
 20wt %corresponds to 7.0% volume concentration;  
 30wt %corresponds to 11.0% volume concentration.

**Table 2.**  
**New recipe with weight concentration of SRS**  
**chemical components found in literature (Chapman et al. 1986)**

Chemical Component	Weight Concentration	Adjustment Based on Density	Other Balance	Total
Fe <sub>2</sub> O <sub>3</sub>	36.7%	0.5%		37.2%
Al <sub>2</sub> O <sub>3</sub>	16.3%	3.3%		19.6%
NiO	3.0%	8.7%		11.7%
MnO <sub>2</sub>	10.8%			10.8%
SiO <sub>2</sub>	10.0%	6.1%	4.6%	20.7%
Subtotal	76.8%	18.6%	4.6%	100%

**Table 3.**  
**Old recipe with weight concentrations of SRS**  
**chemical components found in the literature (Chapman et al. 1986)**

Chemical Component	Weight Concentration	Adjustment Based on Density	Other Balance	Total
Fe <sub>2</sub> O <sub>3</sub>	36.7%	12.2%		48.9%
Al <sub>2</sub> O <sub>3</sub>	16.3%			16.3%
Na <sub>2</sub> O	6.1%	3.3%		9.4%
MnO <sub>2</sub>	10.8%			10.8%
SiO <sub>2</sub>	10.0%		4.6%	14.6%
Subtotal	79.9%	15.5%	4.6%	100%

**Table 4.**  
**Densities and weight concentrations of SRS**  
**chemical components found in literature (Chapman et al. 1986)**

Chemical Component	Densities (g/cm <sup>3</sup> )	Wt %
Fe <sub>2</sub> O <sub>3</sub>	5.24	36.7
Al <sub>2</sub> O <sub>3</sub>	3.94	16.3
Na <sub>2</sub> O	2.27	6.1
Cr <sub>2</sub> O <sub>3</sub>	5.21	0.5
SiO <sub>2</sub>	2.13 – 2.635	10.0
ZrO <sub>2</sub>	5.89	N/A
NiO	6.67	3.0
F <sub>2</sub>	1.69 <sup>(15)</sup> (gas, g/l)	N/A
UO <sub>2</sub>	10.96	7.1
MnO <sub>2</sub>	5.026	10.8
CaO	3.25 – 3.38	3.3
ThO <sub>2</sub>	9.86	0.9
BaO	5.72	N/A

CeO <sub>2</sub>	7.132 <sup>(23)</sup>	N/A
Cs <sub>2</sub> O	4.25	N/A
MoO <sub>3</sub>	4.692 <sup>(21)</sup>	N/A
RuO <sub>2</sub>	6.97	N/A
PdO	9.7 <sup>(4-20)</sup>	N/A
Re <sub>2</sub> O <sub>3</sub>	8.4	0.7

## **Part 2 Large-Scale Industrial Equipment Test Bed of Plug Locating and Unplugging Technologies**

### **2.1     *The Construction of the Test Beds***

Construction of Test Beds #1 and #2 is in progress and expected to be completed as planned. The contractor is working on the sections where the pipelines have to be cut for the desired length because the section of the pipe comes in a 20-foot length per piece.

Construction of Test Bed #3 is to be resumed upon arrival of the 3-inch diameter stainless steel pipe. Other materials such as railroad ties have already been received. It is assumed that construction is to be completed within the next few weeks.

The construction of all three test beds is predicted to be completed in the next couple of weeks, which is well ahead of the schedule of September 15, 1999 (Milestone No. T005-M7). Aerial photos and video of construction stage of the Large-scale test beds are being considered.

Figure 3 is the updated schematic diagram of Large-scale Test Bed #3. It has been drawn to scale, and it shows the details more clearly.

### **2.2     *Blockage material simulation and its location***

Table 5 is the description of a large-scale test bed sample of blockage material and location revised according to advice from NHC. There are several types of materials already tested as a blockage simulation: 1) two types of wax, one with melting point of about 130 °F and the other 150 °F, 2) SRS & Hanford slurries, and 3) SRS & Hanford slurries with bentonite.

Wax blockage is considered for Test Bed #1; however, due to its low melting point, epoxy is also considered in order to keep the blockages in place. The blockage might melt and flow out of the pipeline with high solar radiation during summer. Another option is to use solid cylinders, which possess the materials similar to SRS & Hanford slurries.

## **Assessment of current status and issues**

As of this writing, most of the milestones are completed on schedule. However, due to the delivery problem of the vendor, the chemicals ordered for the flow loop test have not been received. The slurry transport experiments currently have a very tight time frame.

The plan for the inclined pipeline to be tested in the flow loop with SRS dip is still being discussed.

The soil to be used for the ramp of Test Bed #3 is still to be discussed. Possible candidate for the material includes local Florida soil.

## **Plans for the next two months**

- CBD announcement for the test beds will be finalized in order to solicit the technology application.
- Perform additional slurry experiments and obtain data in flow loop with horizontal pipeline.

- The construction of the three Large-scale Test Beds will be completed.
- Potential candidate technologies for pipe plugging inspection and removal will be identified.
- Test Plan of the large-scale test beds is in progress and expected to be completed after the candidates of technology demonstration are identified.

## References

- Blasius, H., Das Ähnlichkeitsgesetz bei Reibungsvorgängen in Flüssigkeiten, Forschg. Arb. Ing.-Wes., No. 131, Berlin, 1913.
- Chapman, C.C. , Pope,J.M., and Barnes, S.M., “*Electric melting of nuclear waste glasses*”, Journal of non-crystalline solids”, 86, pp.226-240, Elsevier Science Publisher, Amsterdam, 1986.

**Table 5.**  
**Large-scale test bed description**

Test Bed	Description of the Test Bed	Blockage Material	Location	Preparation
# 1	An 86ft. length of 2 inch, Sched. 10, grooved, Carbon Steel pipe with a nominal inside diameter of 2.1 inch will be constructed on elevated supports at an angle of 2.67°, which will give an elevation of 4 ft. over the 86 ft. length. (See TB#1-001) Support system of the pipe with elevation is described in TB#1-002. The elevation can be adjusted with Unistrut® and angle fittings. The bottom elevation of the test bed will have a 1 inch cleaning tool access pipe, radius of curvature of 10 inch., welded to the 2 inch pipe. The free end of the 1 inch pipe will have a 1 inch threaded ball valve attached. The top elevation will have a 5 ft. length of 2 inch diameter pipe attached by 90° elbow of 3 ft. 6 inch radius.	Wax, epoxy or other simulant producing a hard, adherent coating on the inside surface of the pipe	Blockages will be placed in the middle of the pipe and also at two locations before the curves. (See figure TB#1-001)	All the blockages will be prepared on site or in the lab. Strength of the blockage should be tested using tension (or pressure) gage. For all the test beds, each pipe section is made for a length of 20 ft. For special cases, pipes will be cut for the desired length (10 ft. to 15 ft.) in the CMST lab. Blockage can be pushed into the pipe by a metal thread with rubber bumper. Blockage can also be placed by taking the pipelines apart and place another pipe section with a blockage already in place.
# 2	Hanford connector will be attached to the entry of the 3 inch, Sched. 10, grooved, Carbon Steel pipe with a nominal inside diameter of 3.1 inches. The access point is at 3 ft. elevation with either a three-inch pipe thread or a Hanford connector as the interface. A 3 inch male pipe thread is also available. The total length of the pipeline is 1765 ft. with both left and right turning elbows to test the technology. Support system of the pipe with elevation is described in figure TB#1-002. A separate 15-20 ft. entry section will be set up in parallel to the access to the long pipeline for close-coupled blockage removal testing for comparison with removal of blockages far down the pipeline.	(1) Concentrated (70-80%) SRS & Hanford slurry simulants used by the current loop test at FIU-HCET (2) above + Bentonite (3) Gel with no solid particles as suggested by Dr. Erian	It depends on the capability of the blockage removal apparatus, however, initial planning is made at following locations: section B-C, section E-F, section F-G (or section I-J), and section J-K, and separate piece next to the entry section of the pipe. (See figure TB#2-001)	Same as above
# 3	Two pipes are buried next to each other for test bed #3. One pipe is a 3 inch Stainless Steel 304, Sched. 40, seamless pipe. The other is also a 3 inch SS304 pipe that is placed inside or jacketed by a 4 inch Carbon Steel, Sched. 10 pipe. Both pipelines are 60 ft. long and buried under a 5 ft. berm. The berm is made of compacted sand with measures to reduce top soil erosion. One side to the berm has a ramp of 12° inclination for easy accessibility of vehicles. A thirty by fifteen ft. working area is available on top of the berm for blockage detection equipment.	Same as above	Blockages will be placed in the middle and at the end of the pipeline for both cases, however, the location may vary for the jacketed pipe. (See figure TB#3-001)	Same as above



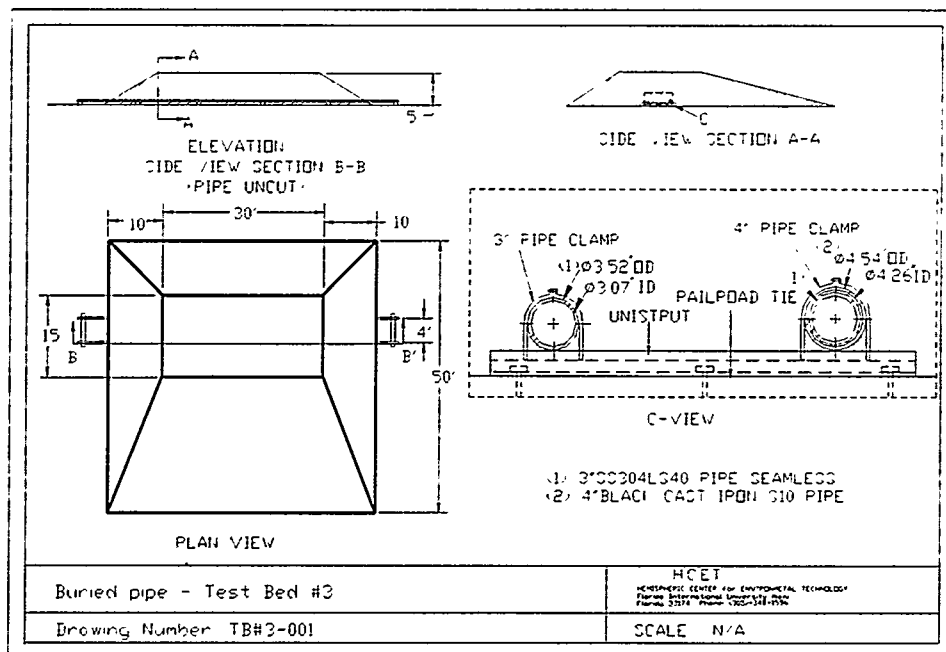


Figure 3. Schematic diagram of large-scale test bed #3.

**FIU-HCET collaborators**

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## Investigation of Waste Glass Pouring Process Over a Knife Edge

Project Number: HCET-1997-T003

### Project objectives

Vitrification is the process of capturing radioactive waste in glass. The Savannah River Site's (SRS) Defense Waste Processing Facility (DWPF) is one of the facilities using the vitrification technology to treat and immobilize radioactive waste since March 1996. However, the operation has been marked by extreme difficulty in maintaining a stable pouring process. There have been flow fluctuations accompanied by an unusual flow phenomenon, termed "wicking." In this situation, the falling glass stream wavers and departs from a normal vertical trajectory. The pour spout and associated hardware connecting it to the canister have been coated and often plugged with glass. The objective of the project is to investigate the pouring behavior of molten glass over a pour spout knife edge.

The work to be performed at FIU-HCET in support of the Tank Focus Area (TFA) Technology Implementation Manager (EM-50) and the Savannah River Technology Center (SRTC) consists of three phases. Phase 1 involved the assembly, construction, and testing of a melter capable of supplying molten glass at operational flow rates over a break-off point knife edge. Phase 2 evaluated the effect of glass and pour spout temperatures as well as glass flow rates on the glass flow behavior over the knife edge. Phase 3 (current phase) of the project will identify the effects on wicking that result from varying the knife edge diameter and height as well as changes to the back-cut angle of the knife edge.

### Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
T003-M1	Installation of an additional heat zone	Achievement of 1150 °C by the knife edge	Completed as scheduled. Due date: 1/31/99
T003-M2	Report the effect of crud deposits on the back side of the knife edge	Experiments ES-1, ES-2, ES-3, and ES-4	Completed as scheduled. Due date: 5/31/99
T003-M3	Report the effect of eroded knife edges	Experiments ES-5, ES-6, ES-7, ES-8, ES-9, ES-10, ES-11, ES-12, ES-13, ES-14, ES-15, and ES-16	Due Date: 8/31/99
T003-M4	Report the effect of glass chemistry	Experiments II-SF-1, II-SF-2, II-SF-3, II-SF-4, II-SF-5, II-TF-1, and II-TF-2	Due Date: 9/30/99
T003-M5	Final report	Draft and distribute the Final report on results of the project delivered to DOE	Due Date: 10/31/99

### Significant events for this reporting period

- Mr. Gerald Boyd, Acting Deputy Assistant Secretary of the Office of Science and Technology, Department of Energy, visited FIU-HCET on June 3, 1999. Mr. Boyd visited the Vitrification project site and was briefed on the objective and the progress of the project.
- Milestone T003-M2 was completed on schedule with the completion of steady-state experiments with zero cut back insert installed on the knife edge. With the zero cut back insert, the cut back angle on the knife edge was reduced to a flat surface instead of the sharp break.

### Accomplishments and technical progress to date

- For the pulsating flow three experiments have been carried out. The data is being analyzed for results.
  1. Film thickness according to frame by frame.
  2. Statistical analysis will be performed on the film thickness data.
  3. A copy of video shall be provided to SRTC.
- The zero cut back angle insert was installed in the pour spout behind the knife-edge. The insert was welded behind the knife-edge in the melter and four steady flow experiments were done at a bulk glass and knife-edge temperature of 1150°C to study the effect of changing the cut back angle on the knife edge from 45° (sharp edge) to 0° (flat). No major changes were observed in the glass flow (see Figures 1 and 2). More precise numerical data analysis will be done after the analysis of the pulsating flow experiments is completed.



Figure 1. Front view of glass flows over a flat knife edge.

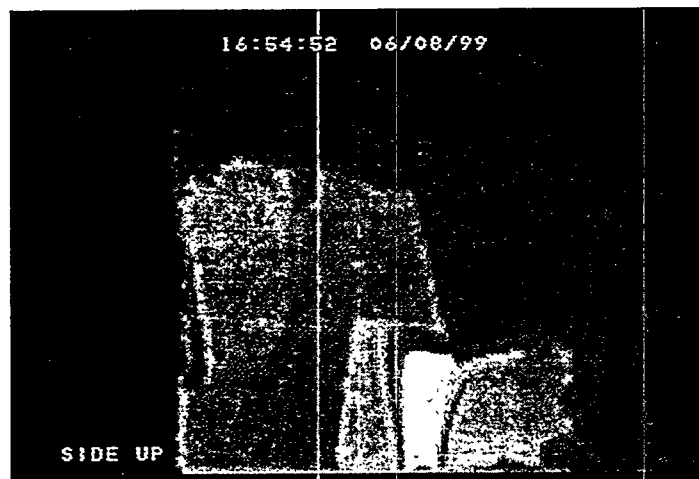


Figure 2. Side view of glass flows over a flat knife edge.

- A leak was detected in the solenoid-controlled valve that controls the melter head pressure that in turn regulates the glass flow. The solenoid valve was removed, and a manual valve was installed in its place. The manual valve configuration can be well set up for the glass flow rate, and it can be controlled and respond faster than the old one by reducing overhead involved in terms of changing the reading in the LabView panel on the computer screen and rerunning the program.
- The post-experiment inspection revealed a breakage in Zone 3 heating elements, and the elements of Zone 3 and Zone 4 were found to be hanging loose. There was disruption in the side bottom view of the camera.
- The furnace was disassembled, and the repair work in Zone 3 and Zone 4 was done. New holes were drilled in the furnace to hold the ceramic anchors. These anchors, in turn, hold the heating elements in place firmly.
- A tri-fold brochure to highlight the reasons to consider the FIU-HCET melter for vitrification research needs has been prepared.

### Assessment of current status and issues

The project is on schedule. The planned experiments on the flat knife edge are being performed. All data and images coming out of this set of experiments will be analyzed.

### Plans for the next two months

- The project will perform transient glass flow experiments every week in the coming months. The transient glass flow experiments have shown the “wicking” phenomenon that is causing problems for the DWPF melter operation. The data obtained from these transient runs will be of extreme importance to SRTC and may shed light on the cause of the phenomenon, which may lead to a solution to the problem.

**FIU-HCET collaborators**

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### **III. CHARACTERIZATION, MONITORING, AND SENSOR TECHNOLOGY**

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#### **MONTHLY PROGRESS REPORT**

<b>FIU-HCET Principal Investigator</b>	<b>M.A. Ebadian</b>
<b>FIU-HCET CMST Program Manager</b>	<b>Paul Szerszen</b>
<b>Focus Area Technical Lead</b>	<b>Charles Nalezny</b>
<b>Program Officers</b>	<b>John Wengle</b>
	<b>Karl-Heinz Frohne</b>





## Online Measurement of the Progress of Decontamination

Project Number: HCET-1998-C005

### Project objectives

There is a critical need for accurately characterizing contaminants during several phases of deactivation and decommissioning (D&D) operations. Present characterization technologies typically require the cessation of decontamination activities, so as to properly assess existing contamination areas using some method of radiological surveying. This project focuses directly on in-process characterization, with specific aims that will include the following:

- Find in-process characterization methods, specifically in the area of radiation sensor systems capable of being integrated with a suitable decontamination technology so as to combine decontamination and characterization activities.
- Technology integration data collection, storage, and transmission components on the instrument for remote monitoring and computer downloading functions, allowing for continuous decontamination activities coupled by real-time assessments of the amount of contamination remaining. The result would be an overall gain in productivity accompanied by cost and time savings. A second important advantage would be a minimum amount of material could be removed with the production of little residual waste.
- Adapt an existing decontamination technology with commercially available characterization technologies to develop a prototype instrument that will be assessed and then commercially deployed. A closed-system decontamination technology will be selected that utilizes a vacuum or contaminant collection system and will be integrated with appropriate radiation sensing devices and data collection components. The integration of technologies will provide an improved instrument that may be continuously operated, removing contaminated materials and simultaneously assessing the removal progress.

### Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
C005-M1	Operational prototype	Prototype functional	Due 3/3/99 *Delayed until 6/25/99
C005-M2	Demonstration at FIU-HCET	Documented demonstration of prototype	Due 5/30/99 *Delayed until 7/30/99
C005-M3	Deployment	Initiate deployment at DOE site	Due 8/28/99
C005-M4	Year-end report	Submission	Due 9/30/99

\*As per FY99 PTP and Assessment of Current Status following, a design and implementation review required revisions to design and procurement. Milestone 1 is expected to be delayed until no later than June 25, 1999, and milestone 2 until no later than July 30, 1999.

### **Significant events for this reporting period**

- Delivered presentation to DDFA management visiting HCET. The presentation was well received.
- Progress continues toward milestones.

### **Accomplishments and technical progress to date**

- Prepared and delivered project status presentations to visiting DDFA management.
- Initiated the integration process of the online system into the Idaho LSDDP. Technology screening forms have been received and are being completed.
- Completed a detailed component design of the detector mechanical arrangements:
  - Vibration, shock, and debris isolation suspension for pre- and post-decontamination
  - Replaceable shields (brush) and 'tear-off' windows
  - Radiation shielding for background from room and mechanical shields also affecting collimation
  - Shot blast suspension modifications
  - Low-cost disposable pneumatic tube section for effluent (waste stream) sensor array liner.
- Operator interface and associated components design refined:
  - Simple indication using commercial circular colored indicator light arrays with absolute value indication
  - Simplified limit calibration, either absolute engineering units or placement of the sensors over calibration surfaces
  - Preliminary operational procedures generated for creation of control coding.
- Pursuit of an applicable commercial 3D position-determining system while continuing preliminary design of a proprietary system:
  - Combination angulation/range relational geometry
  - Mixed source technologies
  - Single stationary station required
  - No RF links necessary.
- Specific contacts have been established with representatives directly involved with DOE site demonstration and deployment to ascertain a scheduled demonstration.

## Assessment of current status and issues

- Review of conceptual design and proposed implementation, as required by FY99 PTP, revealed discrepancies between design and specified equipment with original scope and plan. A revised design and requisition is in process with any additional schedule time being absorbed within the previous intervals between tasks. Minimal disruption of the initial milestone and task procession will result, and the deployment should take place as scheduled.
- Parallel projects are providing synergism and effectively accelerating the rate of progress. One of these projects, High Productivity Vacuum Blasting System, includes real-time operator feedback of the efficacy of the decontamination process. Another is Integrated Vertical and Overhead Decontamination and includes real-time characterization of vertical and overhead surfaces during decontamination. The function and implementation of the three sensor systems will by intent include interchangeable processes and components.
- The primary decontamination machine for the project prototype is available at FIU-HCET and required modification is underway.
- Demonstration prototype detectors, interface electronics, display components, and communication modules have been selected.
- Calibration electronics to accompany the detectors were selected.
- Assembly of characterization components has begun.
- Detailed mechanical, electrical, and control software design is nearly ready for FIU-HCET QA review.

## Plans for the next two months

- Submit completed LSDDP technology screening forms for Idaho LSDDP.
- Continue design/development activities on position determination system.
- Completion of the mechanical design and fabrication of mechanical components to be integrated with sensors and indicators to decon machine.
- Complete electronic design including control software.
- Assemble all components into prototype assembly.

## FIU-HCET collaborator

Richard Musgrove, (305) 348-6622

## **Remote Surveillance of Facilities Awaiting Deactivation and Decommissioning**

**Project Number: HCET-1998-C006**

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### **Project objectives**

FY99 is the second year of a three-year project. Many DOE sites -- Albuquerque Operations Office, Chicago Operations Office, Idaho Operations Office, Ohio Operations Office, Oak Ridge Operations Office, and Savannah Operations Office -- require remote surveillance of their facilities, such as, production areas, structures, utilities, equipment, drums, tanks, and effluent lines. Currently, these facilities awaiting deactivation and decommissioning (D&D) must be periodically surveyed for various criteria including contamination levels, structural deterioration, water intrusion, animal intrusion, integrity of storage containers, the atmospheric conditions, and radioactive and hazardous substance releases. The surveys themselves are intrusive, time-consuming, expensive, and expose survey personnel to radioactive contamination and radiation. The purpose of this project is to develop a remote surveillance system that is capable of collecting data from a DOE site (remote station) and transmitting the data to a central location (base station).

Following are the objectives of the project:

- Define specific surveillance needs among the facilities awaiting D&D.
- Select appropriate sensors for different facilities and test them for their performance.
- Select components of the measuring system, integrate them, and test the performance of the sensors and the system.
- Select appropriate data collection, storage, transmission, and receiving units.
- Design a central monitoring unit.
- Integrate the different units into a prototype surveillance system and test the system.
- Test the system at a DOE site.
- Deploy the system at a DOE site.
- Design and implement a plan for commercialization.

## Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
C006-M1	Testing at FIU-HCET	Components and integrated unit tested at FIU-HCET	Due: 1/11/99 *. Rescheduled for 7/31/99
C006-M2	Testing at a DOE site	Tested at a DOE site for site-specific parameters	Due: 4/16/99 *. Rescheduled for 8/30/99
C006-M3	System Improvement	Modifications completed.	Due: 5/17/99 *. Rescheduled for 10/30/99
C006-M4	Performance evaluation	Performance evaluated under ambient environmental conditions	Due: 8/27/99 *. Rescheduled for FY00
C006-M5	Deployment plan	DOE site deployment plan created.	Due: 10/1/99
C006-M6	Commercialization plan	Industrial partner interested in commercialization of the system identified	Due: 10/30/99
C006-M7	Year-end report	Report completion	Due: 11/30/99

\* In FY98 the project has had difficulty securing site user support that was originally planned to be the driver for technology development and integration. During FY99 this approach has been reversed as users expressed an interest in reviewing an a-priori design and then ordering customized options for deployment at their sites. The project has been redirected accordingly. Additional explanation is provided below in *Assessment of current status and issues*.

## Significant events for this reporting period

- Delivered presentation to DDFA management visiting HCET. The presentation was well received.
- Progress continues toward milestones.

## Accomplishments and technical progress to date

- Initiated discussions with representatives of Bechtel-Hanford and Pacific Northwest National Laboratory (PNNL) regarding deployment of custom remote surveillance systems at Hanford facilities. Discussions were set up in response to an expression of interest by Bechtel-Hanford at the DDFA Mid-year Review. Discussions are currently in progress.
- Prepared and delivered project status presentations to visiting DDFA.
- Initiated the integration process of the Remote Surveillance system into the Idaho LSDDP. Technology screening forms have been received and are being completed.
- Commercial sources of remote power maintenance subsystems investigated.
- Matrix of possible transducers, power sources, and sampling conventions assembled.
- Incorporation with and improvements to existing DOE remote sampling systems investigated.

## **Assessment of current status and issues**

- Project has been reviewed, and redirection has been created enabling convergence with initial scheduled status within fourth quarter of the fiscal year. Securing a deployment site still remains difficult.
- FY98 tasks incomplete and in progress for execution within FY99 include
  - Selection of suitable technology
  - Assessment of cost-saving and safety improvements expected from the development of the monitoring system
  - Engineering review of the selected remote surveillance technology
  - Procurement of sensors, components, and measurement units
  - System integration.
- Selection and procurement of sensor components is underway.
- Communication hardware and protocol structure is being engineered.
- Incorporation of/with existing commercial intermittent remote data sampling systems investigated.

## **Plans for the next two months**

- Finalize all potential possibilities for closure on deployment issues at Hanford and begin planning stage. Reach a decision from Bechtel-Hanford regarding deployment of a custom system.
- Submit completed LSDDP technology screening forms for Idaho LSDDP.
- Continue detailed electronic and mechanical design of sensing modules.
- Further purchase of system components and test at FIU-HCET.
- Continue to provide FIU-HCET's site liaisons with detailed design information to aid their site participation solicitation efforts and to clarify the details of system design in light of actual needs expressed.
- Finalize designs to meet FIU-HCET QA standards.

## **FIU-HCET collaborator**

Richard Musgrove, (305) 348-6622

## Measurement of Alpha Contamination on Contaminated Surfaces Using an Electret Ion Chamber

Project Number: HCET-1998-C008

### Project objectives

In and around nuclear plants such as vitrification plants, fuel reprocessing plants, uranium plants, thorium plants, waste storage facilities, reactors, and radiological laboratories, surfaces (floors, walls, ceiling, and equipment) and soil may become contaminated with alpha-emitting radionuclides such as uranium, thorium, radium, americium, or plutonium. It is important to be able to measure such contamination and classify it as below or above the permissible levels. The permissible levels of alpha contamination are low. The DOE requires low-cost, reliable methods for measuring low levels of alpha contamination. Current methods for measurement of low levels of alpha contamination in a large facility are expensive and expose survey personnel to radiation. The goal of this two-year project:

- Develop a system for low-cost, low exposure and reliable measurement of surface alpha contamination and deploy it at a DOE site. This involves the use of commercially available electret ion chambers and their calibration using reference alpha sources.
- Determine times required for measurement of an alpha contamination at the free release level for six different chamber-electret combinations, their useful range, effect of environmental radon and gamma radiation on alpha contamination measurement, cost comparison with baseline technologies, and demonstration and deployment at a site.

### Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
C008-M1	Cost-benefit analysis	Data showing performance of EIC vs. baseline technologies	<p>Scheduled for completion by 12/15/98.</p> <ol style="list-style-type: none"> <li>1. Measurements using EICs and baseline technology (alpha probe) completed at a test-bed at FIU-HCET. Cost comparison performed.</li> <li>2. Comparative assessment with baseline technology performed.</li> </ol> <p>Completed on 2/26/99. The reason for delay addressed in section "Assessment of current status and issues" of this report.</p>

Milestone No.	Milestone Description	Completion Criteria	Status
C008-M2	Deployment Plan and Demonstration at DOE facilities	Integration with D&D Focus Area's Large Scale Demonstration and Deployment Program (LSDDP). Commitment for use of EICs for alpha contamination measurement from one or more DOE sites	Originally scheduled for completion by 2/8/99. Delayed due to slow response from DOE site users.  1. HCET will support DDFA for LSDDP at Savannah River, including evaluation of EICs and preparation of the Innovative Technical Summary Report (ITSR). HCET reviewed the test plan for EIC. LSDDP begun in June.  2. Deployment plan for Oak Ridge reviewed on April 17, 1999, and suggested changes were incorporated. Pending site approval of the plan, tentative completion date of May 17 is likely to be moved to July 1999.
C008-M3	Deployment of EICs at DRS, Oak Ridge (K-1420) for characterization of floor. Main source of contamination: depleted and enriched uranium.	Deployment of the EIC system at one or more DOE sites	Scheduled for completion by 5/17/99.  Delayed due to pending approval of the test plan by DRS, Oak Ridge. Date currently under negotiation.
C008-M4	Information flow- HCET development of work and controlling documents	Transmittal of procedures, instructions, manuals, and information on measuring contaminants on DOE sites	Scheduled for completion before 10/30/99
C008-M5	Final report	Report completed and issued	Scheduled for completion by 11/30/99

### Significant events for this reporting period

- Coordination activities to support DDFA with the SRS LSDDP continued. A full paper entitled "Evaluation of electret ion chambers for measurement of surface alpha contamination in preparation for SRS-LSDDP, coauthored by FIU-HCET and SRS-LSDDP, was submitted to the American Nuclear Society's 2<sup>nd</sup> Topical Meeting on Decontamination, Decommissioning, and Reutilization of Commercial and Government Facilities, Knoxville, Tennessee.
- Discussions are being held with the representative of the Decon Recovery Systems, Oak Ridge, for testing and deployment of EICs at DRS.
- Additional measurements were performed with the aim of extending use of EICs for alpha spectral measurement.



## Accomplishments and technical progress to date

- To enhance measurement capability of EICs to alpha spectrometry, measurements at FIU-HCET were performed on different energy alpha sources and response factors of ST electrets in 960-mL chamber were determined. Earlier, EIC was considered as only a charge-integrating device without spectrometric capability. This is a potentially significant development accomplished by FIU-HCET. It could appreciably lower the current cost of spectral characterization.
- Gamma spectrometric measurement on a FIU-HCET test-bed ceramic tile was performed at the National Institute for Standards and Technology (NIST) with collaboration of Rad Elec, Inc. The spectrum shows the presence of uranium and thorium and their decay products, including short-lived, in the tile. Short-lived decay products of radon and thoron are high energy alpha emitters. The presence of short-lived decay products in the tile confirms our earlier measurement that radon gas is trapped in the tiles and is not emitted out.

## Assessment of current status and issues

- The system has been calibrated and is ready for demonstration and deployment. FIU-HCET is working with representatives from Fernald, Oak Ridge, Rocky Flats, and Savannah River for demonstration and deployment of the technology. Among these sites, LSDDP is scheduled at SRS. FIU-HCET reviewed the test plan of using EICs for SRS LSDDP. It will continue to support DDFA at SRS LSDDP and in preparation of ITSR. Test plan for DRS, Oak Ridge, which was reviewed by FIU-HCET liaison at Oak Ridge, was submitted to DRS for approval. DRS has reviewed the plan. Further discussions are being held for its implementation.
- Milestone 1 was completed on February 26, 1999. Milestone 2 is moving forward because user involvement has occurred, and DDFA has committed to using EICs at SRS LSDDP. However, the final step to completion is being delayed due to still slow user response. Based on recent progress and existing commitments, pending approval of DRS test plan, Milestone 3 will be delayed, probably until July, which is when the negotiations with DRS expect to be completed. All project objectives planned for FY99 will be met during the FY but with schedule slippage. The user response continues to be a moving target.
- It is possible that FIU-HCET found an important extension of the EIC technical performance in developing a spectral measurement methodology.

## Plans for the next two months

- Complete approval of the test plan for floor characterization at K-1420, DRS, Oak Ridge.
- Get commitment from user on actual date of deployment.
- Continue supporting the SRS-LSDDP and prepare for demonstration.
- Present a paper entitled "ceramic tiles as inexpensive large area test-beds for electret ion chambers and other instruments used for measuring alpha contamination on surfaces" at the 44<sup>th</sup> Annual meeting of the Health Physics Society, Philadelphia, PA, June 27-July 1, 1999.
- Continue to refine spectral measurement methodology.

**FIU-HCET collaborator**

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## Review of Current Characterization and Monitoring Practices at DOE Sites

Project Number: HCET-1999-C009

### Project objectives

The goal of this project is to document current practices (baseline technology) for environmental technologies in the areas of site characterization and waste/processing monitoring at DOE sites. Data concerning each technology's cost and performance will be tabulated in a database. This information will assist the Characterization, Monitoring, and Sensor Technology Crosscutting Program (CMST-CP) in evaluating innovative technologies by facilitating the comparison of performance and cost data for the new technologies to the baseline technologies.

This activity, during its previous stages in FY97 and FY98, collected and compiled information from technology users, purchasers, and project sponsors. This information was published and converted into a database. FY99 is the first year that this project is managed by FIU-HCET. FY99 activities include the following objectives:

- Review the current characterization and monitoring practices and baseline technologies at Hanford (RL) and Oak Ridge (OR).
- Collect and assess cost and performance data for these baseline technologies.
- Update the database to include this new information.

### Major milestones

Milestone No.	Description	Completion Criteria	Status
C009-M1	Evaluate Current DOE Characterization and Monitoring Needs at Hanford and Oak Ridge.	Table of the current STCG needs indicating title, description, requirements, regulations, baseline method/technology, and point of contacts	Completed on 1/11/99, before due date of 2/11/99
C009-M2	Identify DOE Baseline Characterization and Monitoring Technologies at Hanford and Oak Ridge.	List of the baseline methods and technologies currently used to meet the STCG needs.	Completed on 3/1/99, before due date of 4/16/99
C009-M3	Describe the baseline technologies and the DOE requirements they meet.	List of the description and performance data of each method/technology identified in milestone #2.	Completed on schedule 5/17/99
C009-M4	Assess costs of use of baseline technologies	Table of the cost data of each method/technology identified in milestone #2.	On schedule to be completed by 8/27/99
C009-M5	Maintain and describe the CMST-CP current practice database	Incorporation of the data from milestones #1, 2, 3, and 4 into a database	To be completed by 10/30/99
C009-M6	Prepare year-end report for FY99	Report summarizing the accomplishments of Fiscal Year 1999 for this project.	To be completed by 11/30/99

### **Significant events for this reporting period**

- Concluded compiling data for one-third of the baseline technologies identified.

### **Accomplishments and technical progress to date**

- Continued obtaining and compiling cost information for the baseline technologies. Documents were reviewed and STCG representatives at Oak Ridge were contacted to obtain information.
- Designed database and initiated programming activities that will make the database accessible from the Internet.

### **Assessment of current status and issues**

This project is proceeding and no scheduling deadlines have been missed. Milestones 1, 2, and 3 have been completed. Currently, no impediments are known that could delay the on-schedule completion of the milestones.

### **Plans for the next two months**

- Continue obtaining cost data for the baseline technologies by reviewing documents and contacting vendors and site personnel.
- Continue programming activities to make database accessible from the Internet.

### **FIU-HCET collaborator**

Hans Weger, (305) 348-6620

## Demonstration and Deployment of CMST-CP Technologies

Project Number: HCET-1998-C010

### Project objectives

The Characterization, Monitoring, and Sensor Technology Crosscutting Program (CMST-CP) exists to deliver appropriate characterization, monitoring, and sensor technologies to the DOE, Office of Waste Management (EM-30), Office of Environmental Restoration (EM-40), and Office of Facility Transition and Management (EM-60).

The purpose of this project is to assist CMST-CP with the final steps of this process. In short, it will help take the technologies developed by CMST-CP to their ultimate use in the field. It is also a goal of this project to strengthen CMST-CP relationships with the users with the idea of deploying technologies more quickly and efficiently. To that end, FIU-HCET will help coordinate some of the deployment and related activities between the CMST-CP and the site users. In addition, this activity will directly support CMST-CP's D&D coordinator.

To assist CMST-CP, FIU-HCET will provide the following:

- Examine the technology development activities and work together with CMST-CP to develop schedules for demonstration and deployment of these technologies.
- Match the technologies with characterization and monitoring needs of the customers.
- Choose sites to help facilitate demonstration and/or deployment.
- Use FIU-HCET's existing relationships with the rest of EM and the other focus areas to assist CMST-CP in selling the use of its technologies.
- Once an agreement has been reached, work with the customer to refine the demonstration/deployment process and schedule. If the user and CMST-CP so desire, FIU-HCET could then coordinate and perform the demonstration at the user's site.

### Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
C010-M1	Schedule & number of demonstrations and/or deployments	Definitive list of activities generated.	Completed on schedule 3/15/99
C010-M2	Choose sites	Deployment/demonstration sites identified.	Completed on schedule 3/31/99
C010-M3	Demonstrations	Complete scheduling and organization	Rescheduled for 7/19/99
C010-M4	Deployment	Site commitment to deploy a selected CMST-CP technology.	Due 10/30/99
C010-M5	Marketing	Site commitment to deploy	Due 10/30/99

### **Significant events for this reporting period**

- Detailed discussions with the Principal Investigators (PIs) from Special Technologies Laboratory (STL), FIU-HCET personnel from Miami and Oak Ridge, Oak Ridge personnel, CMST-CP representatives, and DDFA representatives were held and valuable information obtained concerning the last demonstration, plans and aims for further demonstrations, and deployment strategy.

### **Accomplishments and technical progress to date**

- Discussed in a conference call with the Principal Investigators (PIs) from Special Technologies Laboratory (STL), FIU-HCET personnel from Miami and Oak Ridge, Oak Ridge personnel, CMST-CP representatives, and DDFA representatives the demonstration and deployment of LIFI.
- Discussed with the PI of STL and a CMST-CP representative the plans and aims for a further demonstration and strategy for deployment.
- Discussed with Oak Ridge personnel about obtaining a metal sample from the facility where the March demonstration took place. Further analysis of this metal sample would greatly improve LIFI's performance.
- Discussed with Oak Ridge personnel at the March demonstration concerning their impressions of LIFI. This information is being used to identify what needs to be improved or emphasized in any future demonstrations or to assist deployment.
- Discussed with Oak Ridge personnel about setting up a further demonstration with the aim of deployment.
- Submitted LIFI to be considered in LSDDP for Idaho.
- Looked into other possible demonstration/deployment sites for LIFI.

### **Assessment of current status and issues**

Due to funding cuts from CMST-CP, the project scope has been reduced. Discussions about scope with the CMST-CP representatives continued during the first quarter of FY99. The project work began in the second quarter. Milestones 1 and 2 have been completed. Milestone 3 has been rescheduled.

### **Plans for the next two months**

- Visit STL for LIFI technology training and discussions with the PI and a CMST-CP representative.
- Obtain and review information from the PI of the LIFI project concerning technical specifications and performance data. This information will be used to write a brochure describing the technology.

- Discuss with site managers at Oak Ridge and the FIU-HCET personnel at the field office at Oak Ridge about demonstrating and deploying LIFI at Oak Ridge.
- Submit LIFI for the Savannah River LSDDP.
- Pursue other sites for demonstration and deployment.

**FIU-HCET collaborator**

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## Identification of DOE's Post-Closure Monitoring Needs and Requirements

Project Number: HCET-1998-C011

### Project objectives

The 2006 plan sets an ambitious agenda for the DOE, Office of Environmental Management's (DOE-EM) cleanup work. In the context of Accelerating Cleanup: Focus on 2006, closure refers to the completion of area- or facility-specific cleanup subtasks. The cleanup levels are determined by the planned future use of the site or facility. Many of the future land use decisions have yet to be made, though certain basic cost-based land use assumptions have been determined. Little or no EM land will be remediated to "residential use" levels; most will be remediated to "industrial use" levels with access restrictions, while some areas will be closed off through containment.

Most of the industrial use and closed-off lands will require monitoring. In the restricted and waste storage areas, the waste levels, condition, and containment will need to be monitored. In the nearby areas, groundwater and soils will need to be monitored per monitoring requirements imposed by regulators and stakeholders. Regulators will not approve closure plans without the specification of clearly defined monitoring methods using approved technologies. Therefore, inadequate planning for monitoring and the lack of appropriate monitoring technologies often prevent closure.

The current and evolving post-closure monitoring requirements at DOE-EM sites must be determined, documented, and tracked to provide the Characterization, Monitoring, and Sensor Technology Crosscutting Program (CMST-CP) with information to guide its post-closure technology development and deployment efforts. As part of this project, FIU-HCET will

- Determine and track post-closure monitoring needs at the Hanford, Savannah River, and Fernald sites (FY98) and the Oak Ridge (OR) and Rocky Flats (RF) sites (FY99).

### Major milestones

Milestone No.	Description	Completion Criteria	Status
C011-M1	Identify key post-closure monitoring needs and commitments at Oak Ridge.	A report, to be included as part of the final report, of the post-closure monitoring needs and commitments for Oak Ridge.	Completed on 4/5/99, ahead of schedule 4/30/99
C011-M2	Identify key post-closure monitoring needs and commitments at Rocky Flats.	A report, to be included as part of the final report, of the post-closure monitoring needs and commitments for Rocky Flats.	Completed on 6/10/99, ahead of schedule 6/30/99
C011-M3	Identify the most common post-closure monitoring needs within EM	A report, to be included as part of the final report, of the most pressing post-closure needs based on the five sites reviewed in FY98 and FY99.	On schedule to be completed by 9/30/99
C011-M4	Write the final report for the project	Report describing the post-closure needs for Oak Ridge and Rocky Flats, summarizes the post-closure needs for all five sites reviewed in FY98 and FY99, and the most pressing post-closure needs within EM	To be completed by 10/31/99



**Significant events for this reporting period**

- Completed milestone 2 (identify key post-closure monitoring needs and commitments at Rocky Flats) ahead of schedule.

**Accomplishments and technical progress to date**

- Concluded the identification of post-closure needs and requirements at Rocky Flats.
- Continued the identification of technologies, either available or being developed, that are capable of meeting post-closure needs of DOE sites.
- Initiated the identification of the most common post-closure needs within EM.

**Assessment of current status and issues**

This project is proceeding and no scheduling deadlines have been missed. Milestones 1 and 2 have been completed. Currently, no impediments are known that could delay the on-schedule completion of the milestones.

**Plans for the next two months**

- Continue identifying of technologies, either available or being developed, that are capable of meeting post-closure needs of DOE sites.
- Continue summarizing the common post-closure needs for the five DOE sites reviewed and the most pressing post-closure needs within EM.

**FIU-HCET collaborator**

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#### IV. INTERNATIONAL TECHNOLOGY INTEGRATION (ITI)

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#### MONTHLY PROGRESS REPORT

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## **Opportunities to Market U.S. Technologies Throughout the Western Hemisphere**

**Project Number: HCET 1996-I001**

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### **Project objectives**

Because of its size, sophistication, and geographic proximity, the U.S. environmental industry has the potential to become a major player in the environmental markets in Latin America and the Caribbean. Building on the alliances previously established by Florida International University (FIU) with organizations in Latin America and the Caribbean, the Hemispheric Center for Environmental Technology (FIU-HCET) will work with U.S. governmental agencies and industry to develop, adapt, and market/transfer their technologies throughout the Western Hemisphere. FIU-HCET will aid government leaders of the Americas in the promotion of the use of efficient and non-polluting technologies.

FIU-HCET manages an aggressive international program for applied research, development, demonstration, testing, and evaluation. This program to identify opportunities to market U.S. technologies throughout the Western Hemisphere has been successful. It has made a number of cooperative agreements that seek to identify technologies to aid in the cleanup of DOE nuclear component manufacturing sites and, at the same time, identify technologies for international usage to work faster, safer, and cheaper than current available technologies.

### *D&D 2000*

FIU-HCET's international focus includes the coordination of conferences that promote investment in Latin America and the Caribbean by U.S. industry. To this end, this project involves participating and hosting a number of prestigious international conferences, workshops, and/or seminars. To fulfill this task, FIU-HCET will co-host with the U.S. Department of Energy the Fourth USDOE International Decommissioning Symposium. The international program will be tasked with coordinating all international activities. This includes the development of international marketing material and customized proposals, targeting international organizations and industries, recruiting and appropriate marketing calls.

This project involves an open-ended, continuous process of information gathering with respect to Latin American and Caribbean environmental issues. This entails the development of contacts with individuals and institutions conducting research and work on issues of sustainability and environmental technology in the Americas. As part of this phase, a database containing information on firms, non-governmental organizations (NGOs), governmental institutions, and other participants in Latin America's environmental sector is being developed.

### *Website*

FIU-HCET is also host to the Interactive Communication Website. The Website supports the energy cooperative undertaking agreed to at the 1994 Summit of the Americas in Miami. This entails collecting information on the Latin American energy sector, as well as updating contact information for energy personnel in Latin America. The Energy Minister, the Steering Committee, and working

groups responsible for environmental and economic energy related tasks set by the heads of states of their respective countries use this site ([www.americasenergy.org](http://www.americasenergy.org)).

## Major milestones

Milestone No.	Milestone Description	Completion Criteria	Status
I001-M1	Database: Formulate a database of U.S. business contacts working in the field of environmental technologies	This milestone is ongoing.	Will continue to identify organizations to incorporate on database. Will discuss with DOE's Office of Policy, the possibility of incorporating database with energy website. Due date: 7/10/99. Date was postponed due to Secretary of Energy's travel schedule.
I001-M2	Interactive Communication Website: Maintain the Energy web site for the members/participants of the Western Hemisphere Energy Initiative	Identify funding mechanism for the support of the Interactive Communication Website and prepare site for presentation at the IV Ministerial Meeting.	A tentative meeting was proposed by DOE's Office of Policy to discuss funding the Website. The Office of Policy to support the Energy website has allocated additional funding. Due date: 7/28/99 (Note: The due date has been assigned by DOE's Office of Policy.)
I001-M3	Participate at the next Hemispheric Energy Steering Committee meeting in Lima, Peru.	Make a presentation of the 'Virtual Secretariat' and introduce FIU-HCET to participants of the Steering Committee.	Completed: 2/11/99
I001-M4	Enterprise Florida: Identify U.S. companies who would be interested in participating in the next Export Marketing Mission to Argentina, April 10-16, 1999.	Identify a minimum of 20 companies for mission. Enterprise FL has suggested that FIU-HCET participate.	Responses by companies were forwarded to Enterprise FL. Completed: 3/2/99 ahead of schedule.
I001-M5	ITI Year End Report	Letter by EM/OST to accompany report needs to be sent to FIU-HCET publications.	Report was completed and a draft letter to accompany report was sent. Report has been reviewed by EM/OST. Letter to accompany report has been sent by EM/OST. Due Date: Completed, 5/19/99

Milestone No.	Milestone Description	Completion Criteria	Status
I001-M6	The Fourth USDOE International Decommissioning Symposium (D&D 2000)	Coordinate all international activities associated with this event.	Target international organizations and participants for the symposium. Date: TBD (NOTE: Waiting for DOE funding to be transferred to begin work).
I001-M7	Open contract vehicle between the Office of Policy (PO) and FIU-HCET	Draft a Statement of Work and prepare a five-year budget plan.	Statement of Work and Budget were completed ahead of schedule (due date for this action item was 6/28). Copies were sent to International Affairs Budget Officer. He is in the process of reviewing documentation. The next step in establishing contract vehicle is responsibility of DOE budget person. Due Date: 8/28/99

### Significant events for this reporting period

- The preliminary funding meeting for the website proposed by DOE for March 1999 has been postponed. DOE representatives will determine the new date. The date was changed due to Secretary's Richardson extensive travel schedule to Latin America. However, additional funding to support the website until a meeting can be scheduled has been identified by the Office of Policy (PO), DOE. PO has sent the paperwork to FETC.
- FIU-HCET has been requested to make a presentation of the Interactive Communication Website to the Ministers of Energy of the Western Hemisphere at the IV Ministerial meeting being held in New Orleans at the end of July. In addition, FIU-HCET has turned in a proposal to the Office of International Affairs to bring the IV Ministerial Meeting online.
- Working on identifying the international participants for the Fourth USDOE International Symposium, June 2000. This has included targeting international organizations and industries for a promotional purpose.
- An FIU-HCET representative will attend the Fourth Annual Latin American Power '99 Conference and Exhibition on June 29. This is an opportunity for FIU-HCET to explore the future of electric power in Latin America and be introduced to cutting-edge technologies by U.S. companies in the industry.

- FIU-HCET met with Lic. Fernando Silveira Galban, Director of Institutional Relations of Universidad de la Marina Mercante (U de MM) in Argentina. The preliminary meeting set forth the proceedings for the signing of an MOU between FIU-HCET and U de MM. U de MM is highly interested in collaborative work and in promoting environmental technologies to the Argentinean market.
- FIU-HCET met with Mr. Henley Jones, International Trade Specialist, U.S. Commercial Service, U.S. Department of Commerce (DOC). The meeting was an introductory meeting by Mr. Jones who will be managing the U.S. Export Assistance Center, on behalf of DOC, in Miami. Mr. Jones is seeking FIU-HCET assistance in identifying U.S. environmental companies doing business or interested in doing business in Latin America.

### **Plans for the next two months**

- FIU-HCET personnel will continue to assist the DOE-EM international program manager in activities with the CNEA of Argentina.
- FIU-HCET personnel will continue to send bi-weekly e-mails to DOE-EM on the Center's Latin American initiatives on behalf of DOE.

### **FIU-HCET Collaborator**

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