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INTEGRATED VERTICAL AND OVERHEAD DECONTAMINATION SYSTEM

Principal Investigator:

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Prepared for:

U.S. Department of Energy
Office of Environmental Management
Office of Science and Technology

DISCLAIMER

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ACRONYMS

ARAR	Applicable and Relevant and Appropriate Regulations
D&D	Deactivation and Decommissioning
DOE	U.S. Department of Energy
DOE-EM	U.S. Department of Energy-Environmental Management
DOE-OST	U.S. Department of Energy-Office of Science and Technology
FIU	Florida International University
FIU-HCET	Florida International University's Hemispheric Center for Environmental Technology
FY97	Fiscal Year 1997
FY98	Fiscal Year 1998
FY99	Fiscal Year 1999
HCET	Hemispheric Center for Environmental Technology
RAPIC	Remedial Action Program Information Center

EXECUTIVE SUMMARY

The deactivation and decommissioning of 1200 buildings within the U.S. Department of Energy-Office of Environmental Management complex will require the disposition of a large quantity of contaminated concrete and metal surfaces. It has been estimated that 23 million cubic meters of concrete and over 600,000 tons of metal will need disposition. The disposition of such large quantities of material presents difficulties in the area of decontamination and characterization. The final disposition of this large amount of material will take time and money as well as risk to the D&D work force. A single automated system that would decontaminate and characterize surfaces in one step would not only reduce the schedule and decrease cost during D&D operations but would also protect the D&D workers from unnecessary exposures to contaminated surfaces.

This report summarizes the activities performed during FY98 and describes the planned activities for FY99. Accomplishments for FY98 include identifying and selecting decontamination, the screening of potential characterization technologies, development of minimum performance factors for the decontamination technology, and development and identification of Applicable, Relevant and Appropriate Regulations (ARARs).

1.0 INTRODUCTION

The treatment of radioactively contaminated concrete and metal surfaces is a concern during the deactivation and decommissioning (D&D) process. As buildings undergo D&D, concrete, brick, and metal surfaces contaminated with radionuclides, such as uranium and technetium-99, and others must be decontaminated before final disposal. It is estimated that 23 million cubic meters of concrete and 600,000 tons of metal will require disposition. The disposition of concrete and metal surfaces presents difficulties in the areas of decontamination, characterization, and disposition. Concrete surfaces are potentially internally contaminated up to several inches from the surface as well as externally contaminated. Metal surfaces are usually contaminated on the surface or on the coating protecting the metal. This situation requires a system capable of decontaminating and characterizing concrete surfaces as well as metal surfaces. Current decontamination and characterization systems are not designed to meet the remediation goals for these surfaces, necessitating, in many cases, direct disposal of contaminated concrete and metal. Current D&D practices are labor-intensive and costly to perform on large volumes. Also, direct disposal does not take advantage of recycling, which would provide monetary dividends during the disposition of metal.

1.1 PURPOSE OF THIS INVESTIGATION

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.

2.0 PROJECT DESCRIPTION

The purpose of this project was to define and develop a cost-effective integrated system with which to characterize and decontaminate walls and ceilings surfaces. The following tasks were scheduled for completion during FY98.

Task 1. Performance of Literature Search and Survey of the D&D Community to Determine the Walls/Ceilings Problem Set.

Task 2. Decontamination System Development.

Task 3. Review of Decontamination Systems.

Task 4. Determination of Applicable Regulatory Policies and Procedures.

Task 5. Procure Basic Decontamination System.

Task 6. Perform Decontamination System Design.

Task 7. Characterization System Development.

Task 8. Review Characterization Systems.

Task 9. Procure Characterization System.

Task 10. Integration of Decontamination and Characterization System.

Task 11. Drafting and Distribution of FY98 Year-End Report.

Task 12. Field Test of Integrated System.

Task 13. System Deployment at DOE Site.

Task 14. Technology Transfer.

3.0 RESULTS

The fourteen tasks presented in Section 2 "Project Description" and in the FY98 Project-Technical Plan (PTP) are presented below. The italicized text indicates the task description presented in the FY98 PTP. The results of each task and any deviations are presented in the paragraphs that follow. The project tasks have been grouped into three categories: Decontamination System, Characterization System, and the integration and field implementation of the two systems.

3.1 PROJECT TASKS

Decontamination System

Task 1. Performance of Literature Search and Survey of the D&D Community to Determine the Walls/Ceilings Problem Set.

An initial literature search and a survey of the D&D community to understand the various technologies and research available in this area. In addition, the survey will provide a good firm understanding of the wall/ceiling problem across the DOE complex.

A literature search was performed using the Remedial Action Program Information Center (RAPIC). Over 100 document titles were received on projects related to this topic. A total of five papers were requested from RAPIC. In order to understand the wall/ceiling problem set across the DOE complex, a survey was prepared. The intention of this survey was to get consolidated numbers in term of the quantity, condition, and radiological condition of wall and ceiling surfaces. This survey was going to be sent to a comprehensive list of D&D professionals across DOE. All Site Technology Coordination Group (STCG) members were targeted for this survey and as an additional source of information. Before sending this survey, Steve Bossart (FETC) recommended two sources for information that may contain what FIU-HCET was after. These sources were:

- Market Assessment Decontamination of Radiologically Contaminated Concrete, a report developed by the Global Environmental & Technology Foundation. [6]
- Contaminated Concrete: Occurrence and Emerging Technologies for DOE Decontamination, a document prepared by DOE. [2]
- Baseline Environmental Management Report (BEMR), a document prepared by DOE. [1]

Mr. Bossart asked FIU-HCET to review these documents and decide whether or not a survey of D&D professionals was necessary. This proved to be an excellent recommendation, and the information contained in these documents was sufficient. This was complemented with additional information from the Fernald Environmental Management Project's (FEMP) Feasibility Study Report.

Task 2. Decontamination System Development

FIU-HCET will review possible decontamination systems available for possible integration into this system.

The final design for the decontamination system was completed on June 15, 1998. The detailed design consisted of a narrative and a set of design prints. The final design submittals indicate the requirements set forth in the performance specifications will be met or exceeded. These performance specifications require the following:

Task 3. Review of Decontamination Systems

FIU-HCET will conduct a comprehensive review of commercially available decontamination technologies and systems. FIU-HCET will also review innovative decontamination systems and technologies for possible integration.

During FY98 an extensive search for decontamination technologies was conducted. Several sources were utilized. These sources included RAPIC, FIU-HCET databases for decontamination technologies, among others. Table 1 presents a list of technologies evaluated at HCET. This list was chosen because "real" performance, cost and health and safety data. This data was considered more reliable then vendor provided information; therefore, a selection of the decontamination technology was obtained form this list.

Table 1.
Initial screening table decontamination technologies

TECHNOLOGY TYPE	DESCRIPTION	COMMENTS
Ultra-High Pressure Water (ADMAC and UHP Flow International)	An internal combustion engine or electric motor drives a pump that generates up to 60,000 psig of water pressure. The ultra-high pressure pump supplies water to a system of rotating nozzles that sprays the water stream onto the surface. The coating or substrate is removed by the kinetic impact of the water stream. The contamination and the coating are flushed away from the surface. Water systems can access and flush convoluted surfaces. A standard water supply is required to operate the system. For the treatment of secondary waste, a system is needed to collect and separate the debris from the water. Both would need to be treated.	Based on the testing performed by FIU-HCET, the technology failed to meet the required end point of a near-white metal finish. The floor blasting technology failed to meet the required end point average depth of removal of one-quarter of an inch of concrete floor.

Table 1.
Initial screening table decontamination technologies (Continued)

TECHNOLOGY TYPE	DESCRIPTION	COMMENTS
High-Pressure Water (10K Hydrolazer)	High-pressure water blasting removes coating with a stream of water projected from specially designed nozzles at pressure of 3,000 psig to 15,000 psig. Heavy-duty pumps, typically in the 15 to 600 hp range, supply water at high pressure. The water is sprayed through a nozzle or system of rotating nozzles onto the coated surface. The coating is removed by the impact of the water stream. The stripping action can be supplemented by pre-softening with an alcohol solvent or by including soft or hard abrasives in the water stream.	Based on the testing performed by FIU-HCET, the technology failed to meet the required end point of a near-white metal finish. This technology has not been tested on concrete surfaces.
Carbon Dioxide Blasting (TOMCO)	This technology has a refrigerated liquid CO_2 supply and a system for converting the liquid to a solid media that is used for coating removal. Compressed liquid is allowed to expand in a pressure-controlled chamber in which the temperature drops, causing a mixture of CO_2 vapor and solid CO_2 snow to form. The snow is collected, compressed, and extruded through a die to produce pellets of a selected size and hardness as needed for decontamination. The CO_2 pellets remove the coating and perform decontamination by a combination of impact, embrittlement, thermal contraction, and gas expansion. The frozen pellets provide thermal shock and cause cracking.	Based on the testing performed by FIU-HCET, the technology failed to meet the required end point of a near-white metal finish.

Table 1.
Initial screening table decontamination technologies (Continued)

TECHNOLOGY TYPE	DESCRIPTION	COMMENTS
Ice Blasting (Iceblast)	Compressed air carries the media to a nozzle, which accelerates the media and impinges the surface. The media scrape the coating, rust, and contamination from the surface. A vacuum system that surrounds the nozzle removes the media and the surface removed. The vacuum system separates the usable media from the remaining debris, and the media is reused in the system. Compressed air or electricity may power the vacuum system. Many systems can operate a single nozzle or multiple nozzles, increasing production rates. Various grades and types of media are available to customize the media to the surface conditions. Media type and the surface being removed can significantly affect the amount of secondary waste to be managed.	Based on the testing performed by FIU-HCET, the technology failed to meet the required end point of a near-white metal finish. This technology has not been tested on concrete surfaces.
Plastic Pellet Blasting (Plasblast)	This process uses compressed air or centrifugal wheels to project plastic media at the surface. The sharp-faceted particles fracture on impact, leaving new sharp edges to allow their continued use for stripping. In general, the plastic media are selected to be harder than the coating. In typical applications, the air pressure measures in the range from 10 to 60 psig. Higher pressures remove coating faster but also are more likely to induce substrate damage. A vacuum system is used to collect the media and removed surfaces.	Based on the testing performed by FIU-HCET, the technology failed to meet the required end point of a near-white metal finish. This technology has not been tested on concrete surfaces.
Laser Ablation (YAG ERASER™)	Laser systems have been employed to perform paint removal from airplanes and to remove graffiti. Systems are built to specification. Work is currently underway to develop systems for use in the decontamination field. Laser light impacts the surface causing the coating, rust, and subsurface material to be abraded.	Consider for further review. Based on the testing performed by FIU-HCET, the system failed to achieve a near-white metal finish. This technology has not been tested on concrete surfaces.

Table 1.
Initial screening table decontamination technologies (Continued)

TECHNOLOGY TYPE	DESCRIPTION	COMMENTS
Grit Blasting (LTC 1050 Pn, LTC 1073)	Compressed air carries the media to a nozzle, which accelerates the media and impinges the surface. The media scrapes the coating, rust, and contamination from the surface. A vacuum system that surrounds the nozzle collects the media and removed surface. The vacuum system separates the usable media from the remaining debris, and the media is reused in the system. The system can operate multiple nozzles, increasing production rates. Various grades and types of media are available to customize the media to the surface conditions. Media type and surface being removed significantly affect the amount of secondary waste generated.	Consider for further review. Based on the testing performed by FIU-HCET, the technology was able to achieve a near-white metal finish. The floor steel grit vacuum blasting technology failed to meet the required end point average depth of removal of one-quarter of an inch of concrete floor.
Automated Brushing/Milling (CPM 4E, CPU-10-18-KE, PEENA Cleaner)	This technique uses course brushes, flaps, or metal wheels mounted on a fixed axis to impact the surface by rotating the axis to abrade the targeted surface.	Based on the testing performed by FIU-HCET, the floor technologies were able to remove coatings from concrete floor.
Sponge Blasting (Sponge Jet, ARMS™)	This technique consists of an open blasting system with various grades of media. The sponge media is made of a water-based urethane matrix. During surface contact, the media expands and contracts, exposing the embedded abrasive and creating a scrubbing effect. The sponge then recoils and collapses around the contaminant, trapping it.	Based on the testing performed by FIU-HCET, the technology meets the required end point of a near-white metal finish. The technology was able to remove coatings from concrete walls and ceilings.
Chemical Coating Removal (PCRS-7)	Strippable coatings involve the application of a polymer mixture to a contaminated surface. As the polymer reacts, the contaminants are stabilized and become entrained in the polymer. The contaminated layer is pulled off, or it falls off.	Based on the testing performed by FIU-HCET, the technology failed to meet the required end point of a near-white metal finish. The technology failed to remove coating from concrete wall and ceiling.

Table 1.
Initial screening table decontamination technologies (Continued)

TECHNOLOGY TYPE	DESCRIPTION	COMMENTS
Soda Blasting (Armex)	Compressed air advances the sodium bicarbonate medium from a pressure pot to a nozzle, where the medium combines for stripping with a stream of water. The blast medium and water mixture impacts the surface, removing the coating and contamination. The water helps control the dust produced when the media impacts on the coating and prohibits heat buildup.	Based on the testing performed by FIU-HCET, the technology failed to meet the required end point of a near-white metal finish. This technology has not been tested on concrete surfaces.
Scabbling (Squirrel I®, Squirrel III®, Corner Cutter®, Moose®, Roto-Peen equipped with metal wheels, Scaler hammer, and Needle gun)	Scabbling systems use mechanical force generated by compressed air to impact the surface and remove material. In many cases, a series of tungsten bits are driven in a piston action to impact the surface. Vacuum and dust collections are integrated into the scabbling system to collect the debris removed from the surface. Many systems used compressed air to drive the vacuum system as well as the dust collector. Various size units are available for use in large, open areas, against corners, and around obstructions. Systems range from labor-intensive to remote operation. Bits require replacement after a number of hours used.	Based on the testing performed by FIU-HCET, the floor technologies (Squirrel I®, Squirrel III®, Corner Cutter®, and Moose®) combined meets the required end point average depth of removal of one-quarter of an inch of concrete floor. The PTC-6 with Roto-Peen equipped with metal wheels, Scaler hammer, and Needle gun combined failed to meet the required end point average depth of removal of one-quarter of an inch of concrete wall. The PTC-6 with Roto-Peen equipped with metal wheels or 3M flaps and Needle gun was able to remove coatings from metal.

Table 1.
Initial screening table decontamination technologies (Continued)

TECHNOLOGY TYPE	DESCRIPTION	COMMENTS
Robotic Scabbling (WallWalk-er™)	The robotic scabbler consists of a motion control system and a scabbler head. The motion control system controls the position, velocity, and acceleration of the scabbler head over a vertical surface. This system works by independently controlling the lengths of two separate cables that may be attached to the left and right sides of the wall by mounting brackets, or alternately may be secured to a freestanding jib structure. The scabbler head uses a new low-friction static seal that maintains vacuum flow while maximizing the vacuum pressure between the scabbler head and the wall. The scabbler head houses three pistons, each mounted on an independent suspension to allow for surface height fluctuations and to maintain optimum normal force on the wall. The three piston heads are designed to rotate about a central axis perpendicular to the wall as the scabbler head travels across the wall. The scabbler head has three wheels that allow it to move across the vertical surface.	Based on the testing performed by FIU-HCET, the technology meets the required end point average depth of removal of one-quarter of an inch of concrete wall.
Centrifugal Shot Blasting (EBE-250, EBE-350 and Concrete Cleaning)	The primary unit consists of a blast head and a vacuum system. Hardened steel shot is propelled at a high rate of speed from the blast head to abrade the surface. The materials removed and part of the steel shot are collected by the vacuum system and separated. The removed material is collected in a drum, while the shot is separated for recycling by the unit. The speed of the machine and the volume of shot fired into the blast chamber determine the end condition of the surface.	Based on the testing performed by HCET, the (EBE-250) vertical unit meets the required end point average depth of removal of one-quarter of an inch of concrete wall. The floor shot blasting technology (EBE-350 and Concrete Cleaning) meets the required end point average depth of removal of one-quarter of an inch of concrete floor.

Table 1.
Initial screening table decontamination technologies (Continued)

TECHNOLOGY TYPE	DESCRIPTION	COMMENTS
Centrifugal Shot Blasting (Hand-held unit JHJ-2000)	The primary unit consists of a blast head and a vacuum system. Hardened steel shot is propelled at a high rate of speed from the blast head to abrade the surface. The materials removed and part of the steel shot are collected by the vacuum system and separated. The removed material is collected in a drum, while the shot is separated for recycling by the unit. The speed of the machine and the volume of shot fired into the blast chamber determine the end condition of the surface.	Based on the testing performed by HCET, the technology failed to meet the required end point average depth of removal of one-quarter of an inch of concrete wall. The technology was able to achieve a near-white metal finish on metal.

* Shaded areas indicate potential technology.

After identifying these technologies, additional information was collected in the areas of

- Removal capabilities
- Production rates
- Cost information
- Waste generation
- Health and safety

This information is presented in Tables 2 through 9.

Table 2.
Production rates of technologies

Technology	Production Rate On Various Surfaces (Ft^2/Hr.)	
Robotic Scabbling	Uncoated Concrete Wall:	10.20
(WallWalker™)	Coated Concrete Wall:	8.17
	Coated Brick Wall Surfaces:	20.00
Centrifugal Shot Blasting	Uncoated Concrete Wall:	19.36
(JHJ-2000)	Coated Concrete Wall:	8.67
	Coated Brick Wall Surfaces:	17.22

Table 2.
Production rates of technologies (Continued)

Technology	Production Rate On Various Surfaces (Ft2/Hr.)	
Scabbling (PTC-6 with Roto-Peen equipped with metal wheels, Scaler hammer, and Needle gun)	Uncoated Concrete Wall: Coated Concrete Wall: Coated Brick Wall Surfaces:	11.87 9.18 8.69
Sponge Blasting (ARMS™)	Coated Concrete Wall: Coated Concrete Ceiling:	43.92 127.00
Chemical Coating Removal (PCRS-7)	Coated Concrete Wall: was not able to remove the coating. Coated Concrete Ceiling: was not able to remove the coating.	
Centrifugal Shot Blasting (EBE-250)	Uncoated Concrete Wall: Coated Concrete Wall: Coated Brick Wall Surfaces:	32.80 42.94 53.64
Centrifugal Shot Blasting (EBE-350)	Coated concrete floor: Uncoated concrete floor:	83.78 73.14
Centrifugal Shot Blasting (Concrete Cleaning)	Concrete floor:	173.00
Ultra High Pressure Water (UHP Flow International)	Concrete floor:	42.00
Scabbling (Squirrel I®, Squirrel III®, Corner Cutter®, and Moose®)	Concrete floor: 33.00 combination of all 4 pieces of equipment	
Milling (CPM 4E, CPU-10-18-KE, PEENA Cleaner)	Concrete floor: CPM 4E (95.00), CPU-10-18KE (298), Peena Cleaner (107.00)	
Steel Grit Vacuum Blasting (LTC 1073)	Concrete floor:	48.00
Sponge (ARMS™)	Coated steel plate: Rusted steel plate: Coated steel I-beam: Rusted I-beam :	30.40 75.29 75.47 81.94
LASER (YAG ERASER™)	Coated steel plate: Rusted steel plate: Coated steel I-beam: Rusted I-beam :	0.498 1.28 0.398 0.445

Table 2.
Production rates of technologies (Continued)

Technology	Production Rate On Various Surfaces ($Ft^2/Hr.$)	
Chemical Coating Removal (PCRS-7)	Coated steel plate (w/oxide primer) side 1:	41.64
	Coated steel plate (no oxide primer) side 1:	15.23
	Coated steel plate (w/oxide primer) side 2:	101.67
	Coated steel plate (no oxide primer) side 2:	32.39
	Coated steel I-beam:	27.12
Centrifugal Shot Blasting (JHJ-2000)	Coated steel plate:	4.29
	Rusted steel plate:	13.00
	Coated steel I-beam:	19.81
	Rusted I-beam :	6.40
Carbon Dioxide (TOMCO)	Coated steel plate:	12.00
	Rusted steel plate:	144.00
	Coated steel I-beam:	11.50
	Rusted I-beam :	115.00
Plastic (Plasblast)	Coated steel plate:	1.200
	Rusted steel plate:	28.00
	Coated steel I-beam:	9.10
	Rusted I-beam :	13.60
Soda (Armex)	Coated steel plate:	24.00
	Rusted steel plate:	48.00
	Coated steel I-beam:	23.00
	Rusted I-beam :	28.80
Ultra High Pressure Water (ADMAC)	Coated steel plate:	62.00
	Rusted steel plate:	112.00
	Coated steel I-beam:	57.50
	Rusted I-beam :	78.00
High Pressure Water (10K Hydrolazer)	Coated steel plate:	8.80
	Rusted steel plate:	36.00
	Coated steel I-beam:	14.40
	Rusted I-beam :	40.30

Table 2.
Production rates of technologies (Continued)

Technology	Production Rate On Various Surfaces (Ft^2/Hr.)	
Ice (Iceblast)	Coated steel plate:	5.20
	Rusted steel plate:	72.00
	Coated steel I-beam:	8.50
	Rusted I-beam :	64.00
Sponge (Sponge Jet)	Coated steel plate:	32.00
	Rusted steel plate:	36.00
	Coated steel I-beam:	12.00
	Rusted I-beam :	18.20
Steel Grit (LTC 1050 Pn)	Coated steel plate:	11.60
	Rusted steel plate:	19.50
	Coated steel I-beam:	14.60
	Rusted I-beam :	14.60

Table 3.
Removal capabilities of technologies on coated concrete wall

Technology	Coating Removal	<1/8"	>1/8" <1/4"	>1/4" <1/2"	>1/2" <1"
Robotic Scabbling (WallWalker™)				XXX	
Scabbling (Roto-Peen equipped with metal wheels, Scaler hammer, and Needle gun)		XXX			
Centrifugal Shot Blasting (JHJ-2000)		XXX			
Sponge Blasting (ARMS™)	XXX Also coated concrete ceiling				

Table 3.
Removal capabilities of technologies on coated concrete wall (Continued)

Technology	Coating Removal	<1/8”	>1/8” <1/4”	>1/4” <1/2”	>1/2” <1”
Chemical Coating Removal (PCRS-7)	XXX Also coated concrete ceiling				
Centrifugal Shot Blasting (EBE-250)					XXX

Table 4.
Removal capabilities of technologies on coated concrete floor

Technology	Coating Removal	<1/8”	>1/8” <1/4”	>1/4” <1/2”	>1/2” <1”
Ultra High Pressure Water (UHP Flow International)			XXX		
Centrifugal Shot Blasting (Concrete Cleaning)					XXX
Scabbling (Squirrel I®, Squirrel III®, Corner Cutter®, Moose®)					XXX
Milling (CPM 4E, CPU-10-18-KE, PEENA Cleaner)	XXX				
Steel Grit Vacuum Blasting (LTC 1073)			XXX		
Centrifugal Shot Blasting (EBE-350)					XXX

Table 5.
Removal capabilities of technologies on coated steel plate and rusted steel plate

Technology	Coating Removal	<1/8"	>1/8" <1/4"	>1/4" <1/2"	>1/2" <1"
LASER (YAG ERASER™)	XXX				
Carbon Dioxide (TOMCO)	XXX				
Plastic (Plasblast)	XXX				
Soda (Armex)	XXX				
Ice (Iceblast)	XXX				
Centrifugal Shot Blasting (JHJ-2000)	XXX				
Chemical Coating Removal (PCRS-7)	XXX no rusted plates				
Sponge (Sponge Jet) (ARMS™)	XXX				
Steel Grit (LTC 1050 Pn)	XXX				
Ultra-High Pressure Water (ADMAC)	XXX				
High-Pressure Water (10K Hydrolazer)	XXX				

Table 6.
Removal capabilities of technologies on coated I-beams and rusted I-beams

Technology	Coating Removal	<1/8"	>1/8" <1/4"	>1/4" <1/2"	>1/2" <1"
LASER (YAG ERASER™)	XXX				
Carbon Dioxide (TOMCO)	XXX				
Plastic (Plasblast)	XXX				
Soda (Armex)	XXX				
Ice (Iceblast)	XXX				
Centrifugal Shot Blasting (JHJ-2000)	XXX				
Chemical Coating Removal (PCRS-7)	XXX no rusted I-beam				
Sponge (Sponge Jet) (ARMS™)	XXX				
Steel Grit (LTC 1050 Pn)	XXX				
Ultra-High Pressure Water (ADMAC)	XXX				
High-Pressure Water (10K Hydrolazer)	XXX				

**Table 7.
Cost information of technologies**

Technology	Capital	Support Equipment	Media	Utility
Robotic Scabbling (WallWalker™)	$255,000 (1997)	Air Compressor (375 cfm) rental $375/week	Tungsten bits $300/set of bits and spiral pins	Air Compressor Diesel fuel 2-110 volts 15 amps
Centrifugal Shot Blasting (JHJ-2000)	$3,000	Vacuum Nilfisk GS625 $4,000, floor magnet $500	Steel shot #390 @ $0.40 per pound	2-110 volts 15 amps
Scabbling (PTC-6 with Roto-Peen equipped with metal wheels, Scaler hammer, and Needle gun)	$21,406 (1996)	Air Compressor (250cfm), air dryer No cost information available	Hammer bits: $147/set Needle gun: $21/set Metal wheels: $225/assembly	Compressed air Diesel fuel
Sponge Blasting (ARMS™)	$23,400	Air circulation HEPA filter, air compressor, and 15kW generator (optional)	Aluminum Oxide $70-90 per 50 pound bag	Compressed air at 250 cfm, Diesel fuel 110 volts 15 amps
Chemical Coating Removal (PCRS-7)	Service price range $48-100 per gal	Ultra sprayall $3500, 35 psi air compressor $1250	$125 per 5 gallons bucket	Compressed air at 35 psi
Centrifugal Shot Blasting (EBE-250)	EBE 250 VHC $89,000 Dust Collector: N/A Floor Magnet $500	Generator: 480 Volt at 60 amps	Steel Shot (S390 and S460) $0.40 per pound	480 Volt at 60 amps
Centrifugal Shot Blasting (EBE-350)	EBE 350 Floor Shot Blaster: $79,000 (1997) & Vacuum	Generator: 480 Volt, 45 Amps	G-460 Steel Shot $0.40 per pound	480 Volt, 45 Amps
Centrifugal Shot Blasting (Concrete Cleaning)	$150,000	Air compressor, 110V 15 amps HEPA filter vacuum system	Steel shot #460 @ $.41 per pound	Compressed air 110V 15 amps 480 volts 3 phase
Ultra-High Pressure Water (UHP Flow International)	$160,000	Air compressor	Water	Diesel fuel
Scabbling (Squirrel I®, Squirrel III®, Corner Cutter®, Moose®)	Squirrel I® $8,800 Squirrel III® $9,975 Corner Cutter® $2,900 Moose® $150,000	HEPA filter vacuum system Air compressor	Tungsten bits $1 each, Tungsten bits $3 each, Metal needles $1 per set, Tungsten bits $7 each	Compressed air: Squirrel I® -25 cfm 90psi, Squirrel III® -60 cfm 90 psi, Corner Cutter®-5cfm 90psi, Moose® -280 cfm 90 psi Diesel fuel

Table 7.
Cost information of technologies (Continued)

Technology	Capital	Support Equipment	Media	Utility
Milling (CPM 4E, CPU-10-18-KE, PEENA Cleaner)	CPM 4E $3,500 CPU-10-18KE $7,20 Peena Cleaner $700 0	HEPA vacuum cleaner	Rotopeen Type-A-Flap $50 each, Rotopeen Type-A-Flap $100 each, Rotopeen Type-A-Flap $6 each	220 volts 1 phase Propane 110 volt a5 amps
Steel Grit Vacuum Blasting (LTC 1073)	$63,000	Air compressor (1300 cfm 150psig) Air cooler and dryer	Steel grit $0.48 per pound, 30 pound per hour	Compressed air Diesel fuel
LASER (YAG ERASER™)	$249,000	Generator for 208 Volts AC, 3 phase, 50 amps	Laser lamp needs replacement every 2000 hours of operation.	208 Volts AC, 3 phase, 50 amps Diesel fuel
Carbon Dioxide (TOMCO)	Basic system $89,000 Pelletizer $54,000	N/A	Refrigerated liquid CO_2	Liquid Nitrogen
Plastic (Plasblast)	Total equipment: $70,000 with blast room: $160,000	Air compressor (600 cfm):$49,322	Plastic	Compressed air Diesel fuel 460 volts
Soda (Armex)	Delivery unit $3,700	Air compressor (300 cfm):$27,676	Sodium bicarbonate	Compressed air Diesel fuel
Ultra-High Pressure Water (ADMAC)	Basic equipment: $160,000 Tool box and parts: $70,000	Air compressor (35cfm at 90psi):$27,676	Water	Compressed air Diesel fuel
High-Pressure Water (10K Hydrolazer)	Basic equipment: $61,400 Tool box and parts: $15,000	N/A	Water	Diesel fuel
Ice (Iceblast)	Delivery unit $150,000	Air compressor (400 cfm 200psi): $40,000 Cooler: $5,000	Ice	Compressed air Diesel fuel 3 phase 220 volts at 60 amps
Sponge (Sponge Jet)	$27,000	Air compressor (250 cfm 120psig): $30,114	Sponge	Compressed air Diesel fuel
Steel Grit (LTC 1050 Pn)	Delivery unit: $34,110	Air cooler/dryer: $12,079 Air compressor (750 cfm 125psig): $44,800	Steel grits	Compressed air Diesel fuel

Table 8.
Secondary waste generation of technologies

Technology	Cubic ft. per Square ft. ($ft.^3/ft.^2$) or specified unit	
Robotic Scabbling (WallWalker™)	Uncoated Concrete Wall:	0.0377
	Coated Concrete Wall:	0.0535
	Coated Brick Wall Surfaces:	0.0263
Centrifugal Shot Blasting (JHJ-2000)	Uncoated Concrete Wall:	N/A
	Coated Concrete Wall:	N/A
	Coated Brick Wall Surfaces:	N/A
Scabbling (PTC-6 with Roto-Peen equipped with metal wheels, Scaler hammer, and Needle gun)	Uncoated Concrete Wall:	0.0127
	Coated Concrete Wall:	0.0127
	Coated Brick Wall Surfaces:	0.0127
Sponge Blasting (ARMS™)	Coated Concrete Wall:	4.25
	Coated Concrete Ceiling:	1.84
Chemical Coating Removal (PCRS-7)	Coated Concrete Wall:	N/A
	Coated Concrete Ceiling:	N/A
Centrifugal Shot Blasting (EBE-250)	Uncoated Concrete Wall:	0.043
	Coated Concrete Wall:	0.030
	Coated Brick Wall Surfaces:	0.030
Centrifugal Shot Blasting (EBE-350)	Coated concrete Floor :	0.050
	Uncoated concrete floor:	0.064
Centrifugal Shot Blasting (Concrete Cleaning)	Concrete Floor :	N/A
Ultra-High Pressure Water (UHP Flow International)	Concrete Floor :	N/A
Scabbling (Squirrel I®, Squirrel III®, Corner Cutter®, and Moose®)	Concrete Floor :	N/A
Milling (CPM 4E, CPU-10-18-KE, PEENA Cleaner)	Concrete Floor :	N/A
Steel Grit Vacuum Blasting (LTC 1073)	Concrete Floor :	N/A

Table 8.
Secondary waste generation of technologies (Continued)

Technology	Cubic ft. per Square ft. ($ft.^3/ft.^2$) or specified unit	
Sponge (ARMS™)	Coated plate:	0.021
	Rusted plate:	0.005
	Coated I-beam:	0.005
	Rusted I-beam:	0.005
LASER (YAG ERASER™)	Coated plate:	not measurable
	Rusted plate:	not measurable
	Coated I-beam:	not measurable
	Rusted I-beam:	not measurable
Chemical Coating Removal (PCRS-7)	Coated plate:	0.2099
	Coated I-beam:	0.0607
Centrifugal Shot Blasting (JHJ-2000)	Coated plate:	0.0025
	Rusted plate:	0.0003
	Coated I-beam:	0.0015
	Rusted I-beam:	0.0006
Carbon Dioxide (TOMCO)	Coated plate:	0.008 ft^3 per hour
	Rusted plate:	0.012 ft^3 per hour
	Coated I-beam:	0.003 ft^3 per hour
	Rusted I-beam:	0.009 ft^3 per hour
Plastic (Plasblast)	Coated plate:	0.2500 ft^3 per hour
	Rusted plate:	0.4900 ft^3 per hour
	Coated I-beam:	0.1900 ft^3 per hour
	Rusted I-beam:	0.7513 ft^3 per hour
Soda (Armex)	Coated plate:	5.80 ft^3 per hour
	Rusted plate:	4.80 ft^3 per hour
	Coated I-beam:	5.00 ft^3 per hour
	Rusted I-beam:	4.80 ft^3 per hour
Ultra-High Pressure Water (ADMAC)	Coated plate:	112.0 ft^3 per hour
	Rusted plate:	112.0 ft^3 per hour
	Coated I-beam:	112.0 ft^3 per hour
	Rusted I-beam:	112.0 ft^3 per hour

Table 8.
Secondary waste generation of technologies (Continued)

Technology	Cubic ft. per Square ft. ($ft.^3/ft.^2$) or specified unit	
High-Pressure Water (10K Hydrolazer)	Coated plate:	32.0 ft^3 per hour
	Rusted plate:	32.0 ft^3 per hour
	Coated I-beam:	32.0 ft^3 per hour
	Rusted I-beam:	32.0 ft^3 per hour
Ice (Iceblast)	Coated plate:	3.20 ft^3 per hour
	Rusted plate:	3.20 ft^3 per hour
	Coated I-beam:	3.20 ft^3 per hour
	Rusted I-beam:	3.20 ft^3 per hour
Sponge (Sponge Jet)	Coated plate:	688.2 ft^3 per hour
	Rusted plate:	774.3 ft^3 per hour
	Coated I-beam:	258.1 ft^3 per hour
	Rusted I-beam:	391.4 ft^3 per hour
Steel Grit (LTC 1050 Pn)	Coated plate:	0.02 ft^3 per hour
	Rusted plate:	0.02 ft^3 per hour
	Coated I-beam:	0.02 ft^3 per hour
	Rusted I-beam:	0.02 ft^3 per hour

Table 9.
Health and safety concerns of technologies

Technology	Health and Safety
Robotic Scabbling (WallWalker™)	Sound: 90 dB at 10 ft from scabbler head, 104 dB at scabbler head
Centrifugal Shot Blasting (JHJ-2000)	Sound: 95 dB next to operator Dust, slip hazards, and projectile hazards
Scabbling (PTC-6 with Roto-Peen equipped with metal wheels, Scaler hammer, and Needle gun)	Sound: 120 dB at 20 ft from operator Dust and fatigue from vibrations of hand-held tools
Sponge Blasting (ARMS™)	Sound: 110 at 10 ft from operator High dust levels
Chemical Coating Removal (PCRS-7)	Sound: 90 dB at 30 ft from wall and ceiling Fumes and mists when spray applied

Table 9.
Health and safety concerns of technologies (Continued)

Technology	Health and Safety*
Centrifugal Shot Blasting (EBE-250, EBE-350, and Concrete Cleaning)	Projectile hazard and slip hazard Noise level
Ultra-High Pressure Water (UHP Flow International and ADMAC)	Water back splash, water mists, projectile hazards, and limited visibility Noise protection required
Scabbling (Squirrel I®, Squirrel III®, Corner Cutter®, and Moose®)	Hand-held devices require a great deal of force and are labor-intensive.
Milling (CPM 4E, CPU-10-18-KE, PEENA Cleaner)	High levels of noise and hand-held devices cause little fatigue.
Steel Grit Vacuum Blasting (LTC 1073)	Projectile hazard and fatigue from hand-held device
LASER (YAG ERASER)	Sound: recorded a maximum of 105 dB No dust , no fumes
Carbon Dioxide (TOMCO)	Potentially dangerous CO_2 concentration in work area, extreme cold, sound protection, projectile hazards, and non-automated system causes fatigue from cold, weight and thrust from blast nozzle.
Plastic (Plasblast)	Noise protection, projectile hazards, flammable media and dust
Soda (Armex)	Noise protection and projectile hazards
High-Pressure Water (10K Hydrolazer)	Water back splash, water mists, projectile hazards, and limited visibility Noise protection required
Ice (Iceblast)	Noise protection and projectile hazards
Sponge (Sponge Jet)	Noise protection and high dust level
Steel Grit (LTC 1050 Pn)	Noise protection

* Information collected by the International Union of Operating Engineers.

Eight technologies, which potentially meet the initial criteria, were preselected for further consideration. These technologies are presented in Table 10.

Table 10.
Selected technologies applicable to this project

Robotic Scabbling (WallWalker™)
Centrifugal Shot Blasting (JHJ-2000)
Centrifugal Shot Blasting (EBE-250)
Centrifugal Shot Blasting (EBE-350)
Centrifugal Shot Blasting (Concrete Cleaning)
Scabbling (Squirrel I®, Squirrel III®, Corner Cutter®, Moose®, Roto-Peen equipped with metal wheels, Scaler hammer, and Needle gun)
Ultra-High Pressure Water (UHP Flow International and ADMAC)
Steel Grit Vacuum Blasting (LTC 1073)

An additional technology, diamond wheel shaving system by Marcrist Industries, was discovered and reviewed by FIU-HCET. This last technology was also evaluated at FIU-HCET and from the information collected, this technology was submitted through the same process as the technologies listed on the tables above. Based on the results obtained, this technology demonstrated an excellent potential for integration into the system. This technology is presented in Figure 1.

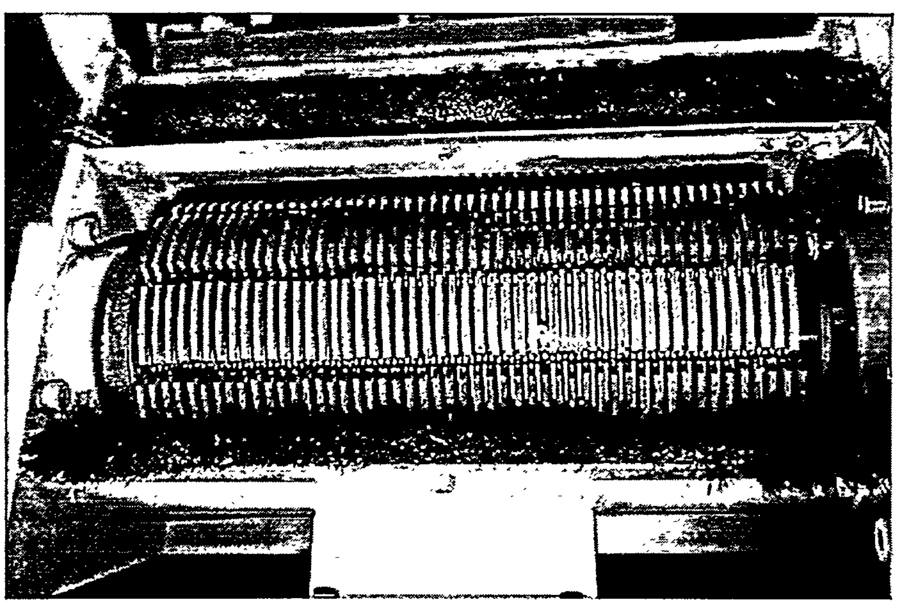

Fig 1. Marcrist's Diamond Wheels decontamination system.

Task 4. Determination of Applicable Regulatory Policies and Procedures

To ensure the applicability of the system, a complete review will be conducted to determine the relevant regulatory policies and procedures for its development and implementation.

Table 11 presents the applicable, relevant, and appropriate regulations (ARARs) to be considered for the design and construction of the decontamination system. Similar ARARs will apply to the characterization system. These ARARs will be presented to vendors and subcontractors for use during design and construction of the system.

Table 11.
Applicable and relevant and appropriate regulations (ARAR)

SOURCE	
GENERAL	**DESCRIPTION**
40 CFR 260.10	Definition of remediation waste
40 CFR 261.3	RCRA[1] hazardous waste determination data
40 CFR 261.3(a)	Definition of hazardous waste
40 CFR 261.6	Requirements for recyclable materials
40 CFR 262.20 through .33, 40 CFR 263.20	RCRA – preparing and transporting hazardous waste off-site
40 CFR 265.171 through .174, .176 and .177	RCRA condition of containers
40 CFR 268.2	RCRA definition of hazardous waste debris
40 USC §4901 et seq.	Noise control
40 USC §6903(27)	Definition of solid waste
42 USC §10101 (12), (16), (23)	Nuclear Waste Policy Act
42 USC §2014(2)(ee)	Atomic Energy Act definition of low-level radioactive material
42 USC §7641	Noise Pollution and Abatement Act
RADIOACTIVE	
10 CFR 1021.2	Provides requirements for complying with NEPA[2] at DOE facilities.

1 Resource Conservation and Recovery Act
2 National Environmental Protection Act

Table 11.
Applicable and relevant and appropriate regulations (ARAR) (Continued)

RADIOACTIVE	
10 CFR 20	Defines the NRC's[3] standards for protection against radiation hazards. Subpart B provides the protection program. Subparts C and D provide dose limits. Proposed Subpart E provides (proposed) radiological criteria for decommissioning. Subpart H provides information on respiration protection and controls to restrict internal exposure in restricted areas. Subpart K provides information on waste disposal.
10 CFR 835	Occupational radiation protection
40 CFR 191.03(b)	Environmental Radiation Protection Standards for Management and disposal of high-level radioactive waste (HLRW), spent nuclear fuel, and transuranic (TRU) wastes
40 CFR 191.13 through .15	Environmental radiation protection standards for the management and disposal of HLRW, spent nuclear fuel, and TRU wastes
DOE Order 441.1	Standards for occupational radiation protection of workers at DOE facilities
DOE Order 5400.5	Radiological protection requirements and guidelines for the cleanup of residual radioactive materials and the management of the resulting waste and residues and release of property
DOE Order 6430.1A, 1324-5.3, -6	Low-level radioactive solid waste confinement (general design criteria)
Reg. Guide 1.86	Section four of this document provides surface decontamination limits for release for unrestricted use.
AIR	
40 CFR 264.1030; .1032 through .1034	Permitted status: air emission standards for process vents
40 CFR 60.672 (a), (d), (e)	Standards of performance for nonmetallic mineral processing plants
Clean Air Act	General provision on air pollution control prevention of air pollution nuisance.
HAZARDOUS WASTE MANAGEMENT (TRANSPORTATION)	
10 CFR 71	Provides requirements that must be used in the packaging and transportation of radioactive material.

3 National Regulatory Commission

Table 11.
Applicable and relevant and appropriate regulations (ARAR) (Continued)

HAZARDOUS WASTE MANAGEMENT (TRANSPORTATION)	
40 CFR 262.20 - 262.33 and 263.20 through 263.31	Generators who transport hazardous waste for off-site treatment, storage, and disposal
49 CFR 171-173, 177, 178	DOT[4] requirements for the transportation of hazardous materials
49 USC §1801-1812	Hazardous Materials Transportation Act
49CFR 171	Prescribes requirements governing transportation of hazardous material and the manufacture and packaging of containers.
49CFR 172	Prescribes requirements for shipping papers; package marking, labeling and placarding; and emergency response and training.
49CFR 173	Includes definitions of hazardous materials, package preparation requirements, and inspection and testing responsibilities.
49CFR 174	Prescribes requirements for the transport of hazardous materials in or on rail cars.
49CFR 175	Prescribes requirements for the transport of hazardous material aboard aircraft.
49CFR 176	Prescribes requirements for the transport of hazardous materials by vessel.
49CFR 177	Prescribes requirements for the transport of hazardous material by motor vehicle.
DOE Order 1540.1C	This order establishes the DOE's policies for management of materials transportation.
DOE Order 1540.2	Standardizes the current approval procedures to ensure that DOE packaging designs and transportation operation provide for public health and safety in accordance with regulations of the DOT and in accordance with standards that are equivalent to the standards prescribed by NRC. Chapter II through Chapter XII of this Order summarize the actions associated with the review and approval of packaging for the transportation of radioactive and other hazardous materials.
DOE Order 1540.3A	Provides definitions used in transportation and packaging of radioactive materials.
DOE Order 5480.3A	Hazardous Materials Packaging and Transportation Safety

4 Department of Transportation

Table 11.
Applicable and relevant and appropriate regulations (ARAR) (Continued)

OTHER REQUIREMENTS	
10 CFR 61	Provides requirements for the land disposal of radioactive waste.
29 CFR 1904 and 1910	Occupational Safety and Health Act (OSHA) Worker Protection Requirements
Clean Water Act	General provision on water pollution control prevention of water pollution nuisance
DOE 5700.6C	Quality Assurance
DOE Order 5440.1E	NEPA Compliance Program
DOE Order 5480.1B	Environmental, safety, and health program for DOE operations
DOE Order 5480.4	Environmental Protection, Safety, and Health Protection Standards
DOE Order 5483.1A	Occupational safety and health programs for DOE employees at government-owned, contractor-operated facilities
Doe Order 6430.1A	General Design Criteria

Sources: DOE/EM-0246 U.S. Department of Energy, 1995, *Decommissioning Resource Manual*, U.S. DOE, Germantown, MD, Appendix E.
U.S. Department of Energy, Draft 4, 1996, *Preferred Decommissioning Technologies Guide*, U.S. DOE, Germantown, MD.

Task 5. Procure Basic Decontamination System

A basic decontamination system will be procured. The procurement process will be conducted according to Florida International University Purchasing Department rules and regulations. A list of capable vendors will be developed, and a Open Bid process will be conducted in order to procure the system.

Based on the information obtained during the execution of task # 4, Marcrist's diamond wheel shaving technology demonstrated as the most appropriate technology available for this application. A search was conducted for other manufacturers, but Marcrist Industries was found to be the only source for this specific technology. Although a decontamination technology was selected, the system was not procured during FY98. Additional work was required in terms of the development of the deployment platform system selected for the integration of the decontamination and characterization systems.

Task 6. Perform Decontamination System Design

In order to develop this system, a methodical approach will be followed. The system design will entail three steps which include Initial Design, Final Design, and Fabrication. The initial design will be carried out in order to meet minimum system performance requirements. After minimum performance requirements have been met, a Final Design and Fabrication will take place.

After reviewing an extensive list of decontamination technologies, it was concluded that an already existing commercially available decontamination method could be integrated into the system. The selected decontamination system will need certain modification for proper integration into the entire system. During FY98, only a conceptual design was developed, and a minimum system performance document was drafted describing some key parameters of the decontamination system

Characterization System

Task 7. Characterization system development

Using the problem statement and specifications developed as part of Task 1, minimum performance factors and ARARs will be determined in order to design a reliable characterization system. In addition, a review of existing proven characterization systems will be performed. This review will aid in identifying areas of improvement. System descriptions will then be developed for each viable alternative. Information related to the type of radiation (alpha, beta, gamma) able to detect, health and safety issues, availability of the equipment, field portability, and training requirements will also be gathered as part of this review.

Task 8. Review of Characterization Systems

A search will be conducted to determine if any existing characterization system technologies meet minimum requirements established during the execution of Task 7. If no system totally satisfies minimum requirements established, a system with the potential of meeting these requirements will be identified.

Based on the review performed by FIU-HCET, a list was developed identifying possible characterization technologies. This list is presented in Table 12 and provides an example of radiation technologies combined with chosen decontamination technologies.

Table 12.
Combination of radiation detection technologies with decontamination technologies

Radiation Detection Technology	Integration Technology
Abacus plastic scintillation detector array	1. Large floor decontamination machines (i.e., shot blasters). 2. Wall decontamination technologies (i.e., the wall walker rigging) 3. Robotic platforms
General radiation detection probes	Trimble GPS unit with repeater for indoor use

Table 12.
Combination of radiation detection technologies with decontamination technologies (Continued)

Radiation Detection Technology	Integration Technology
Radstar by SAIC	1. Floor decontamination units 2. Vertical decontamination units 3. Overhead decontamination units 4. Pentek squirrel 5. CO_2 blasting guns 6. High pressure water washing guns
Rados Multi-purpose survey meter - RDS 110	1. Floor decontamination units 2. Vertical decontamination units 3. Overhead decontamination units 4. Pentek squirrel 5. CO_2 blasting guns 6. High-pressure water washing guns
NE Technology Delta 5 Advanced multi-purpose ratemeter	1. Floor decontamination units 2. Vertical decontamination units 3. Overhead decontamination units
Bicron Electra microprocessor-based ratemeter	1. Floor decontamination units 2. Vertical decontamination units 3. Overhead decontamination units
Bicron PRM510 Portable Radiation monitor	1. Floor decontamination units 2. Vertical decontamination units 3. Overhead decontamination units
Bicron 600 cm_2 scintillation probe, DP8	1. Floor decontamination units 2. Vertical decontamination units 3. Overhead decontamination units
LARADS	1. Floor decontamination units 2. Vertical decontamination units 3. Overhead decontamination units

Task 9. Procurement of Characterization System

A characterization system will be procured. The procurement process will be conducted according to Florida International University Purchasing Department rules and regulations. A list of capable vendors will be developed, and an Open Bid process will be conducted in order to procure the system.

A list of available systems that can be integrated into this system is presented in Table12, but the characterization system was not procured during FY98.

System Integration and Deployment

Task 10. Integration of Decontamination and Characterization System

Using the results of previous tasks and the review of issues associated with fabrication, operations, and health and safety, a complete system will be developed. The system will be of sufficient scale to ensure that all operations and maintenance issues are reviewed. The system will include an HEPA ventilation system, material handling equipment, deployment platform, decontamination system, and a surface characterization system.

The delay in the selection of the decontamination and characterization system has postponed the execution of this task until FY99. Several integration platforms were considered and evaluated during FY98, but information obtained late during FY98 on a couple of available deployment mechanisms for Bartlett and En-vac made FIU-HCET reconsider the selection of the deployment mechanism for this project. Conversation has been conducted with these companies for integration of decontamination technology. In addition, minimum technology performance had been drafted, and an Invitation to Bid is expected in early FY99.

Task 11. Field Test of Integrated System

The testing of this system will include the decontamination of walls and ceilings at the FIU-HCET Test Facility. These tests will be conducted under standard non-nuclear conditions. Based on the results of the testing performed at FIU-HCET, improvement will be incorporated into the system if needed. It is anticipated that the testing of the system at FIU-HCET will continue through FY99.

The delay in the selection of the decontamination and characterization system has postponed the execution of this task until FY99.

Task 12. System Deployment at DOE Site

After test and been successfully conducted at the FIU-HCET Test Facility, the complete system will be transported and deployed at a selected DOE site. It is anticipated that the testing of the system at FIU-HCET will continue through FY99.

The delay in the selection of the decontamination and characterization system has postponed the execution of this task until FY99.

Task 13. Technology Transfer

After successfully testing the system at a contaminated DOE facility and working out any problems encountered during the demonstrations, this technology will be at a point where it can be transferred to a previously identified technology vendor. FIU-HCET capabilities in technology transfer will be used in order to identify an appropriate vendor.

The delay in the selection of the decontamination and characterization system has postponed the execution of this task until FY99.

4.0 ACTIVITIES PLANNED FOR FY99

The following tasks are scheduled for completion during FY99. The project tasks have been grouped into three categories: decontamination system, characterization system, and integration of the two systems.

4.1 PROJECT TASKS

Decontamination System

Task 1. Selection of vendor

During FY98 activities a complete search for decontamination technologies was performed. A comprehensive list was compiled and selection criteria generated for the selection of the decontamination technology. Decontamination technologies field-tested at FIU-HCET were considered on the basis of cost, performance, health and safety, and secondary waste generation. During the execution of task 1, a request for proposal will be sent out to potential vendors to adapt a commercially available selected decontamination technology to a deployment platform. A comprehensive list of available systems will be generated, and the best suitable platform will be selected.

Task 2. Title I Design

An initial design of system and a review of estimated costs for completion will be performed. FIU-HCET will review and approve initial completed design drawings and specifications. FIU-HCET will also approve the expenditure of long lead-time procurement items.

Task 3. Title II Design

FIU-HCET will review and approve the final design of the Vertical and Overhead Decontamination System and review estimated costs for completion.

Task 4. Title III Design

FIU-HCET will monitor the fabrication of the system to ensure that the specifications and design drawings are being followed.

Task 5. Operations

FIU-HCET will test the completed decontamination system at FIU-HCET's Test Site. The D&D assessment group will conduct this test. This test will consist of a combination of wall, ceiling, and metal surfaces. The vendor will develop a detailed operations and maintenance manual. Remediation service companies will be invited when the system is tested to solicit input and determine potential technology transfer partners. In addition, the International Union of

Operating Engineers will be invited to provide input in the Health and Safety aspect of the operation.

Task 6. Close-out

Upon successful field-testing, at least two FIU-HCET employees will be trained to operate and maintain the system.

Characterization System

Task 1. Screen Potential Characterization technologies

A detailed review will be performed on the preliminary list of characterization technologies to determine the viable technology options. This assessment may involve laboratory testing of technologies in which detailed performance data is required to ensure the viability of the system. The technologies, which pass the screening process, will be part of the bidder list for the request for proposal.

Task 2. Procurement of Characterization system

Detailed performance specifications and a request for proposal will be developed and sent to the potential vendors. The specifications will detail minimal detection limits, contaminants of concern, production rates, and deployment requirements. The bid responses that meet the performance specifications with the lowest costs will be selected to design, fabricate, and test the characterization system overseen by FIU-HCET.

Task 3. Title I Design

Title I design will require producing initial design drawings, specifications, and obtaining the approval of long-term procurement items.

Task 4. Title II Design

FIU-HCET will review and approve the final design of the Characterization System and review estimated costs to complete it.

Task 5. Title III Design

FIU-HCET will monitor the fabrication of the system to ensure the specifications and design drawings are being followed.

Task 6. Operations

FIU-HCET will witness the characterization of concrete and metal surfaces at a selected location. A detailed operations and maintenance manual will be written by the vendor describing the calibration and operation processes of the characterization system. Remediation service companies will be invited when the system is tested to solicit input and determine potential technology transfer partners.

Task 7. Close-out

Upon successful field-testing, the system will be transported to FIU-HCET, and at least two people will be trained on the operation and maintenance of the characterization system.

System Integration and Deployment

Task 1. Integrate Decontamination and Characterization Systems

The decontamination and characterization sub-systems will be integrated into one complete deployment platform containing a decontamination tool, characterization instruments, and a waste collection system. Prior to field implementation at a DOE site, the systems will be tested to ensure all material handling, power, and system layout issues are resolved to ensure that the system operates as an integrated system. The system will be further operated at the FIU-HCET test facility to complete this task.

Task 2. Field implementation at a selected DOE Site.

With the help of the D&D Focus Area manager, a remediation project will be initiated on a minimum number of concrete and metal surfaces to operate the system at a selected site.

Remediation service companies will be invited when the system is tested to solicit input and finalize potential technology transfer partners.

5.0 CONCLUSIONS

Through the selection of decontamination and characterization technologies and initial conceptual design of the integrated vertical and overhead decontamination system, the project shows the promise of producing an aggressive, cost-effective alternative to the decontamination and characterization systems currently available. A cost-benefit analysis will be completed for the decontamination and characterization systems during FY99. The cost-benefit analysis should reveal significant savings in the operation of this system over characterization and decontamination processes being conducted throughout the DOE complex. The schedule set forth for the design, procurement, and fabrication of the characterization and decontamination system has been delayed from the baseline schedule established in FY98. These delays were primarily due to amount of time required for the selection of the right technologies for integration.

6.0 REFERENCES

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