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US Department of Energy Office of Environmental Restoration & Waste Management

Office of Technology Development

Office of Research and Development
Office of Demonstration, Testing, and Evaluation

1994 Mid-Year Program Review

March 8-9, 1994

Gaithersburg Marriott Washingtonian Center

MASTER

U.S. Department of Energy
Office of Environmental Restoration and Waste Management
Office of Technology Development
Research, Development, Demonstration, Testing and Evaluation

1994 MID-YEAR PROGRAM REVIEW

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Department of Energy
Washington, DC 20585

March 8, 1994

Dear Attendee:

Welcome to the Office of Technology Development's Research, Development, Demonstration, Testing and Evaluation Mid-Year Program Review. On behalf of Hazel R. O'Leary, Secretary of Energy and Thomas P. Grumbly, Assistant Secretary for Environmental Restoration and Waste Management, I wish to thank you for taking time out of your busy schedules in order to participate in this two-day program review. I believe you'll find that your decision to attend was the right one, insofar as the agenda is full of timely, thought-provoking and informative topics which will bring you up-to-date on all of OTD's RDDT&E activities.

In view of the emphasis placed on technology development by Secretary O'Leary during a recent news conference on the Fiscal Year 1995 Budget Request, this program review takes on an even greater degree of importance, and is certain to provide those attending with productive and focused information.

With an FY 95 Budget Request of \$426 million, representing 7% of the total request for the Department of Energy's Environmental Management Program, it is vital that the Department of Energy continues to seek the best "bang for the buck" with taxpayer dollars and manage all of our activities in the most cost-effective way. It is, after all, technology development which provides the means for significant returns on investment. With a budget that has expanded more than two and a half times since FY 90, OTD's efforts will continue to be in the public's eye and we'll be judged by our accomplishments, not merely our intentions.

Your full participation in this Mid-Year Review will assist OTD in formulating its approaches to technology development and enable all the various elements of OTD to function with our customers and stakeholders as a team to tackle some of the toughest obstacles and challenges that the cleanup of the Nation's nuclear weapons complex offers.

I look forward to speaking with as many of you as possible during the next two days. We're always looking for "a few good solutions" and your ideas would be very much appreciated.

Sincerely,

C. W. Frank
Deputy Assistant Secretary
for Technology Development

U.S. Department of Energy
Office of Environmental Restoration and Waste Management
Office of Technology Development
Research, Development, Demonstration, Testing and Evaluation

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Agenda

Tuesday, March 8, 1994 – Ballroom Salon C

8:00 am - 8:15 am	Opening Remarks	Clyde Frank, EM-50
8:15 am - 8:45 am	Overview of Research, Development, Demonstration, Testing and Evaluation	Bill Schutte, EM-55
8:45 am - 9:05 am	A New Approach to DOE Environmental Research and Technology Development	Gerald Boyd, EM-50
9:05 am - 9:25 am	Overview of Groundwater and Soils Investment Area	Jef Walker, EM-541
9:25 am - 9:45 am	Overview of Waste Retrieval and Processing Investment Area	Stan Wolf, EM-542
9:45 am - 10:15 am	Break	
10:15 am - 10:35 am	VOCs in Non-Arid Soils Overview	Kurt Gerdes, EM-551
10:35 am - 10:50 am	Savannah River Economic Development Program	Kurt Gerdes, EM-551
10:50 am - 11:25 am	Volatile Organic Compounds in Arid Soils Integrated Demonstration	Dave Biancosino, EM-551
11:25 am - 12:00 pm	Mixed Waste Landfill Integrated Demonstration	Skip Chamberlain, EM-551
12:00 pm - 1:30 pm	Lunch (on your own)	
1:30 pm - 1:55 pm	Uranium in Soils Integrated Demonstration	Mike Malone, EM-551
1:55 pm - 2:40 pm	Characterization, Monitoring, and Sensor Technology Integrated Program	Caroline Purdy, EM-541 Eric Lightner, EM-541 Al Tardiff, EM-541
2:40 pm - 3:10 pm	Break	
3:10 pm - 3:50 pm	In Situ Remediation Technology Development Integrated Program	Jef Walker, EM-541
3:50 pm - 4:15 pm	Minimum Additive Waste Stabilization (MAWS) Program	Grace Ordaz, EM-541
4:15 pm - 4:35 pm	Resource Recovery Project	John Mathur, EM-551
4:35 pm - 4:55 pm	Heavy Metal Contaminated Soil Project	John Mathur, EM-551
2:00 pm - 5:30 pm	Exhibits and Poster Sessions in Ballroom Salons F and G	

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Agenda

Wednesday, March 9, 1994 – Ballroom Salon C

8:00 am - 8:10 am	Opening Remarks	Steve Lien, EM-54
8:10 am - 8:50 am	Buried Waste Integrated Demonstration	Jaffer Mohiuddin, EM-552
8:50 am - 9:30 am	Underground Storage Tank Integrated Demonstration	Sherry Gibson, EM-552
9:30 am - 10:00 am	Decontamination and Decommissioning of Facilities Integrated Demonstration	Jerry Hyde, EM-551
10:00 am - 10:30 am	Break	
10:30 am - 11:05 am	Efficient Separations and Processing Integrated Program	Teresa Fryberger, EM-542
11:05 am - 11:45 am	Mixed Waste Integrated Program	Paul Hart, EM-542
11:45 am - 12:00 pm	Waste Management and Technologies Analytical Database System (WMTADS)	Paul Lurk, EM-552
12:00 pm - 1:30 pm	Lunch (on your own)	
1:30 pm - 1:50 pm	Rocky Flats Compliance Program	Jim Taylor, EM-552
1:50 pm - 2:10 pm	Supercritical Water Oxidation Program	Jaffer Mohiuddin, EM-552
2:10 pm - 2:30 pm	U.S. DOE/U.S. Air Force Memorandum of Understanding Program	Miles Dionisio, EM-552
2:30 pm - 3:00 pm	Break	
3:00 pm - 3:40 pm	RDDT&E Innovation and Support	Susan Weber, EM-541
3:40 pm - 4:20 pm	Robotics Technology Development Program	Lin Yarbrough, EM-551
4:20 pm - 4:45 pm	Closing Remarks	Clyde Frank, EM-50
8:00 am - 3:00 pm	Exhibits and Poster Sessions in Ballroom Salons F and G	

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Exhibits and Poster Sessions

Tuesday, March 8, 1994 – 2:00 pm - 5:30 pm

Wednesday, March 9, 1994 – 8:00 am - 3:00 pm

Ballroom Salons F and G

Clean Up of VOCs at Non-Arid Sites–Savannah River Site
Savannah River Economic Development
VOC Arid Integrated Demonstration
Mixed Waste Landfill Integrated Demonstration
Uranium Soils Integrated Demonstration
Characterization, Monitoring and Sensor Technology Integrated Program
In Situ Remediation Integrated Program
Minimum Additive Waste Stabilization (MAWS)
Resource Recovery Project
Buried Waste Integrated Demonstration/Characterization Technologies
Underground Storage Tank Integrated Demonstration
Disposal/Storage Technologies
Decontamination and Decommissioning Integrated Demonstration
Efficient Separations and Processing Integrated Program
Mixed Waste Integrated Program
Treatment Technologies:
 Thermal Desorption
 Microwave Solidification for Mixed Waste
 Two Stage Advanced Oxidation Reduction Unit for Mixed Waste
U.S. DOE/U.S. Air Force Memorandum of Understanding
Robotics Program
Advanced Identification of Robotics Integration
Industrial Partnerships–Morgantown Energy Technology Center
DOIT Program
Cost Saving Analysis Program

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Abbreviated Acronym Listing

ANL	Argonne National Laboratory
API	American Petroleum Institute
BDAT	Best Demonstrated Available Technology
BNL	Brookhaven National Laboratory
BWID	Buried Waste Integrated Demonstration
CBD	Citrate-Bicarbonate-Dithionitr
CFC	Chlorofluorocarbon
CMST-IP	Characterization, Monitoring, and Sensor Technology Integrated Program
CRADA	Cooperative Research and Development Agreement
CSTP	Conceptual Site Treatment Plan
CTMP	Comprehensive Treatment and Management Plan
CWA	Clean Water Act
D&D II)	Decontamination and Decommissioning Integrated Demonstration
DIAL	Diagnostic Instrumentation and Analysis Laboratory
DNAPI.s	Dense Non-Aqueous Phase Liquids
DOE	U.S. Department of Energy
DoD	U.S. Department of Defense
ECM	Environmentally Conscious Manufacturing
EM	Office of Environmental Restoration and Waste Management
EM-30	Office of Waste Operations
EM-40	Office of Environmental Restoration
EM-50	Office of Technology Development
EPA	Environmental Protection Agency
ERMC	Environmental Restoration Management Contractor
ER/WM	Environmental Restoration and Waste Management
ES&H	Environment, Safety, and Health
ESPIP	Efficient Separations and Processing Integrated Program
FEMP	Fernald Environmental Management Project
FFA/Co	Federal Facility Agreement and Consent Order
FFCA	Federal Facilities Compliance Act of 1992
FY	Fiscal Year
HAZWRAP	Hazardous Waste Remedial Action Program
HLW	High-Level Waste
HWPP	Hazardous Waste Pilot Plant
ID	Integrated Demonstrations
INEL	Idaho National Engineering Laboratory
IP	Integrated Programs
IR	infrared
LANL	Los Alamos National Laboratory
LLNL	Lawrence Livermore National Laboratory
LLW	Low-level waste
METC	Morgantown Energy Technology Center
MLLW	Mixed low-level wastes
M&O	Management and Operating [contractors]
MOU	Memorandum of Understanding
MWIP	Mixed Waste Integrated Program
MWLID	Mixed Waste Landfill Integrated Demonstration

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MWIP	Mixed Waste Integrated Program
MWLID	Mixed Waste Landfill Integrated Demonstration
MWPP	Mixed Waste Pilot Plant
NAPLs	non-aqueous phase liquids
NTS	Nevada Test Site
ORNL	Oak Ridge National Laboratory
ORTA	Office of Research and Technology Applications
OSHA	Occupational Safety and Health Administration
OTD	Office of Technology Development, EM-50
PCB	poly-chlorinated biphenyl
PETC	Pittsburgh Energy Technology Center
PNL	Pacific Northwestern Laboratory
PRDA	Program Research and Development Announcement
PVC	poly-vinyl chloride
RCRA	Resource Conservation and Recovery Act
RDDT&E	Research, Development, Demonstration, Testing, and Evaluation
ROA	Research Opportunity Announcement
ROD	Record of Decision
RRP	Resource Recovery Project
RTDP	Robotics Technology Development Program
RTML	Rapid TRU Monitoring Laboratory
SBIR	Small Business Innovation Research
SCWOP	Supercritical Water Oxidation Program
SII E	Superfund Innovative Technology Evaluation
SKID	Skid-mounted Ion exchange Demonstration
SNL	Sandia National Laboratory
SRS	Savannah River Site
SRTC	Savannah River Technology Center
SST	single-shell tank
SVE	soil vapor extraction
SVOs	semi-volatile organics
TAG	Technical Areas Working Groups
TASR	Technical Area Status Reports
TCE	trichlorethylene
TRU	transuranic
TSCA	Toxic Substances Control Act
TTP	Technical Task Plan
TWR	Tank Waste Retrieval
UMTRA	Uranium Mill Tailings Remedial Action
USBOM	U.S. Bureau of Mines
USGS	U.S. Geological Survey
UST-ID	Underground Storage Tank Integrated Demonstration
U	ultraviolet
VOC	Volatile Organic Compounds
VOCN	Volatile Organic Compounds in Non-Arid Soils
WeDID	Waste Component Recycle, Treatment & Disposal Integrated Demonstration
WIPP	Waste Isolation Pilot Plant

Office of Technology Development

Research, Development, Demonstration, Testing and Evaluation

**Fiscal 1994
Midyear Review
March 8-9, 1994**

**Dr. William C. Schutte
Acting Office Director
Office of Demonstration, Testing and Evaluation**

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Purpose of Mid Year Review

- **Present a review of Office of Technology Development Research, Development, Demonstration, Testing and Evaluation (RDDT&E) Program**
- **Solicit comments and feedback from**
 - **DOE environmental technology users**
 - **Stakeholders**
- **Conduct a critical review of the RDDT&E Program and its constituent programs by an expert panel from industry and government**

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EM-50 has the Responsibility of Technology Development for EM

Mission:

The Office of Technology Development within Environmental Management was established to carry out an aggressive national program of applied research, development, demonstration, testing, and evaluation for innovative solutions that are safer and more time- and cost-effective than those currently available.

Goal:

Focus the technology development program on DOE's major Environmental Management issues while involving the best talent in DOE and the national (public and private) science and engineering communities.

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EM-50 RDDT&E Initiatives in 1994

Groundwater and Soil Cleanup

Volatile Organic Compounds
(VOCs) in Non-Arid Soils
Integrated Demonstration (ID)
VOCs in Arid Soils ID
Uranium in Soils ID
Mixed Waste Landfill ID
In Situ Remediation Technology
Integrated Program (IP)
Characterization, Monitoring, and
Sensor Technology (CMST) IP
Dynamic Stripping Program
Resource Recovery Program
Minimum Additive Waste
Stabilization Program
Heavy Metal Contaminated Soils Program
Savannah River Technology Transfer and
Economic Development Program

Waste Retrieval and Processing

Buried Waste ID
Underground Storage Tank ID
Efficient Separations IP
Mixed Waste IP
Supercritical Water Oxidation Program
Decontamination and Decommissioning Program

Pollution Prevention

DOE/U.S. Air Force MOU Program

Crosscutting Programs

Robotics Program
Innovative Technologies

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Office of Technology Development

RDDT&E Budget Summary (\$ in Thousands)

	FY92	FY93	FY94
Groundwater and Soils Cleanup	54,588	79,989	81,866
Waste Retrieval and Processing	54,177	73,167	119,384
Pollution Prevention	6,004	3,502	1,374
RDDT&E Innovation and Support	54,694	34,525	50,172
Robotics	17,480	27,300	21,403
Total RDDT&E	\$186,943	\$215,463	\$274,199

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Breakout of FY94 RDDT&E Funding

Program Area	Program	Value (\$M)	Percent
Waste Retrieval and Processing (W R & P)	UST D	22.5	8.2
	BW D	21.1	7.7
	HW P	22.3	8.1
	Other W R & P Programs	53.5	19.5
Groundwater and Soils Cleanup (GW & S)	CMST	21.6	7.9
	BRP	15.6	5.7
	Other GW & S	44.7	16.3
Pollution Prevention	Pollution Prevention	1.4	0.5
Cross-cutting Programs	Robots	21.4	7.8
	RDDT&E Innovation and Support	50.2	18.3

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Early Tally of Potential Payoff from Technology Development Investment

- Potential Savings in Environmental Restoration **\$20-30B**
- 10-year Technology Development program for Environmental Restoration at \$200M/year assumed **\$2B**
- Minimum Expected Return on Investment **10-15:1**
- This is a very conservative estimate and is
 - Being refined as the baseline is clarified and more potential savings are identified
 - Being expanded as waste management savings are identified

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New & More Efficient Technologies Could Yield \$20-30B in Savings by 2005

Selected 1994 Environmental Technology Development Activities

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EM-50 Technologies Transferred or Available for Transfer

Technology

Biocube
Chemical Fiber Optic Sensors
Contamination Control Unit
Cross Borehole Electromagnetic Imaging
Dynamic Underground Stripping
Electric Resistivity Tomography
Expedited Site Characterization
Forge Hammer
Heavy Weight Cone Penetrometer
Halo Snif
High Energy Corona

Hybrid Directional Boring and Horizontal Cogging
Infrared Analysis of Process Control of Wastes

Private Industry Partner

EG&G ROTRON
Burge & Associates/Purus, Inc.
TBD
RIM Tech., Inc.

TBD
Rim Tech., Inc.
TBD
TBD
Applied Research Associates
Quanta Physik
Three Firms Potential Private Industry Partners

Charles Machine Works

TBD

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EM-50 Technologies Transferred or Available for Transfer (Continued)

<u>Technology</u>	<u>Private Industry Partner</u>
Inverting Membrane Borehole Instrumentation Technique (SEAMIST)	Science and Engineering Associates
Large Volume Flow thru Detector System	Several Partners
Long-Range Alpha Detection Magnetometer Towed Array	Eberline Instrument Corp.
Methane Enhanced Boremediation Using Horizontal Wells	Geo Centers, Inc.
Minimum Additive Waste Stabilization (MAWs)	Several Partners
Optimization of Sampling Using Steplanner & Plume	GTS Dura1EK
Portable Acoustic Wave Sensor	Consolve, Inc.
Rapid Geophysical Surveyor	TBD
	TBD

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EM-50 Technologies Transferred or Available for Transfer (Continued)

<u>Technology</u>	<u>Private Industry Partner</u>
Rapid TRU Monitoring Laboratory	TBD
Remote Excavation System	TBD
Resonant Sonic Drilling	Water Development Corporation
Safe Solvents Testing Laboratory	TBD
Site Characterization & Analysis Penetrometer System	TBD
Spectrometer for Continuous Emission Monitoring	TBD
Thermal Enhanced Vapor Extraction System	Private Industry Contract Pending
Unsaturated Flow Apparatus	Beckman Instruments, Inc.
Vapor Extraction/Air Sparging via Horizontal Wells	TBD
Waste Acid Detoxification and Reclamation of Metals	TBD

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Demonstration of Innovative Technologies (DOIT) Committee

FY95 Demonstrations

- Arc Melter Vitrification
- Compact Processing Unit
- Crystalline Silicotitanates
- Direct Current Graphic Arc Plasma Furnace
- Full-Scale Buried Waste Integrated Demonstration
- Geographic Information Systems
- In Situ Anaerobic Biodegradation
- In Situ Microbial Filter
- Laser Induced Fluorescence
- Laser Spark Spectroscopy for Continuous Metal Emissions
- Light Duty Utility Arm
- Minimum Additive Waste Stabilization (MAWS)
- Mixed Waste Vitrification
- Near Infrared Spectroscopy
- Pillared Clays for Separation of Cesium and Strontium
- Plasma Hearth Process for Treatment of Mixed Waste
- Polymer Encapsulation of Debris
- Supercritical Water Oxidation
- Supported Particle-Bound Sequestrant (3M/IBC)
- 3-Dimensional, 3-Component Reflection Seismic Data for Site Characterization

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OTD Publications

Programmatic

- Office of Technology Development (A National Program) FY 1993 Program Summary, October 1993, DOE/EM-0109P
- FY 1993 Program Mid-Year Summaries RDDT&E, October 1993, DOE/EM-0110P

Technology Transfer

- Technology Catalogue
- Business and Research Opportunities Guide

Program Technology Summaries*

- Characterization, Monitoring, and Sensor Technology Integrated Program, DOE/EM-0107P
- In Situ Remediation Integrated Program
- Efficient Separations and Processing Integrated Program
- Minimum Additive Waste Stabilization

*Drafts available, except for those marked**, which are in progress

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OTD Publications (Continued)

• Program Technology Summaries* (Continued)

- Pollution Prevention**
- Underground Storage Tanks Integrated Demonstration**
- Mixed Waste Landfill Integrated Demonstration**
- Buried Waste Integrated Demonstration****
- Deactivation & Decommission of Facilities Integrated Demonstration****
- Rocky Flats Compliance Program**
- Supercritical Water Oxidation Program**
- Fernald Uranium in Soils Integrated Demonstration****
- Robotics**
- Heavy Metals Contaminated Soils/Resource Recovery/Dynamic Underground Stripping Projects**
- RDDT&E New Initiatives & Innovative Technologies****

***Drafts available, except for those marked**, which are in progress**

Office of Technology Development

FY 1994 Mid-Year Review

Overview of Groundwater and Soils Investment Area

**Melvin W. Shupe, Director
Environmental Restoration R&D Division
EM Office of Technology Development**

March 8, 1994

MD4-GT-0137- 1

Groundwater and Soils Outline

- **Mission/EM Program Goals**
- **Technology Needs/Window of Opportunity**
- **Focusing on Major Problem Areas**
- **Program Management & Funding**
- **Technology Flow Process - Examples**
- **Accomplishments**
- **Technology Challenges/Opportunities**
- **Industry Participation Initiatives**
- **Conclusions - Future Directions**

MD4-GT-0137- 2

Groundwater and Soils Mission

Implement an applied RDDT&E Program to develop and deliver:

- **Technologies to reduce risk to human health and the environment from radioactive and hazardous materials in groundwater and soils**
- **Systems to remediate organic and inorganic hazardous, radioactive, and mixed waste contamination in soils and groundwater**
- **Methods of soil stabilization and revegetation**
- **Optimum systems for cleanup using innovative waste minimization concepts**

M94-GT-0137- 3

Groundwater and Soils (G&S) Program Goals

EM Goals*	G&S Actions
Be more outcome oriented	Develop technologies to remediate groundwater and soil contamination in a more timely manner, with less waste generation; develop effective performance indicators
Focus technology development on major problems using the best national talent	Provide technologies for EM's major problem areas, especially groundwater & soils cleanup and landfill stabilization, through implementation teams representing the national labs
Develop strong partnerships between DOE and its stakeholders	Stakeholders are direct participants in the management system for OTD

* Identified by the Assistant Secretary in the recent EM Strategy Plan

M94-GT-0137- 4

Groundwater and Soils EM Technology Needs

Comprehensive evaluation of EM problem areas has led to identification of the following general technology needs, which have broad applicability across the DOE Complex:

- **An expedited characterization process for contaminated sites, including rapid field analysis and advanced drilling/sampling**
- **Improved barrier design, emplacement, and performance verification technologies to prevent subsurface migration of contaminants**
- **Faster and cheaper remediation techniques for groundwater and soil, including bioremediation and enhanced contaminant extraction/mobilization**
- **Methods to treat and destroy contaminants in situ to avoid or minimize worker exposure and health risk**
- **Innovative systems to minimize waste generation and maximize resource recovery**
- **Improved analytical field monitoring systems**

MB4-GT-0137- 5

Groundwater and Soils Window of Opportunity

Technology demonstration and transfer is timed to meet major Records of Decision at DOE facilities in the mid- to late 1990's

Example: Records of Decision dates for cleanup of VOCs in non-arid sites (subject to renegotiation in some cases).

MB4-GT-0137- 6

Groundwater and Soils Focus on Major Problem Areas

MP4-GT-0137- 7

Groundwater and Soils Major Problem Area/Program Crosswalk

G&S ACTIVITIES	HIGH LEVEL WASTE	MIXED WASTE	CONTAMINANT PLUMES	LANDFILL STABILIZATION	FACILITY D & D
VOCs in Non-Arid Soils			●	●	●
VOCs in Arid Soils			●	●	●
Mixed Waste Landfill		●	●	●	●
Uranium in Soils	●	●	●	●	●
Characterization/Sensor	●	●	●	●	●
In Situ Remediation	●	●	●	●	●
MAWS Project	●	●	●	●	●
Resource Recovery		●	●		●

MP4-GT-0137- 8

Groundwater and Soils Program Management and Funding

G&S Activities	Program Manager	FY 93 (\$ M)	FY 94 (\$ M)
VOCs in Non-Arid Soils ID	K. Gerdes	12.3	2.0
VOCs in Arid Soils ID	D. Biancosino	13.7	11.4
Mixed Waste Landfill ID	S. Chamberlain	8.3	7.0
Plutonium in Soils ID	M. Mathur	3.6	0
Uranium in Soils ID	M. Malone	7.2	6.4
Dynamic Underground Stripping	K. Gerdes	4.9	0
Characterization/Sensor IP	C. Purdy	9.2	21.6
In Situ Remediation IP	J. Walker	12.8	15.6
Min. Additive Waste Stabilization	G. Ordaz	1.6	1.9
Resource Recovery Program	J. Mathur	0	2.8
G&S Other Technologies	S. Weber	1.4	4.6
Other Technologies (SR Region)	K. Gerdes	0	8.6
Tulane Universities Project	I. Sewell	5.0	5.0
Totals		80.0	86.9

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Groundwater and Soils Technology Flow Process Example

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Groundwater and Soils Selected Accomplishments

Site Characterization:

- Demonstrated Expedited Site Characterization concept at two sites

Groundwater Remediation:

- Demonstrated sonic and directional drilling technologies
- Demonstrated dynamic underground stripping technology for gasoline remediation

In Situ Remediation:

- Completed full-scale in situ bioremediation of volatile organic compounds

Waste Minimization/Resource Recovery:

- Demonstrated uranium cleanup technology that avoids repository disposal
- Completed bench-scale tests on Fernald waste using MAWS concept

Field Monitoring:

- Demonstrated borehole sensor system based on SEAMIST™

MS4-GT-0137- 11

Groundwater and Soils Technology Challenges and Opportunities

Future Programs* are designed to address newly identified technology needs and eliminate gaps in the current program:

- Remediation of non-volatile organic compounds at non-arid sites, focusing on deep DNAPL contamination
- Cleanup of heavy metals in groundwater and soils
- In situ radioactive and mixed waste contaminant remediation
- Development of barriers for groundwater remediation
- Application of Expedited Site Characterization at DOE sites

* Subject to modification/redirection under the new management system for OTD

MS4-GT-0137- 12

Groundwater and Soils Industry Participation Initiatives

PROGRAM	G&S-Related Projects	
	Approx. Funding	No. of Participants
Program R&D Announcements		
PRDA #1	7.3 M	12
PRDA #2	3.5 M	5
Research Opportunity Announcements	8.0 M	3
Small Business Innovative Research Solicitations	1.13 M	15
Cooperative R&D Agreements	5.5 M	17

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Groundwater and Soils Conclusions – Future Directions

The RDDT&E Program is focusing on the major technological problems in the area of groundwater and soil remediation. Delivery of the appropriate technology systems depends upon effective implementation of the new OTD management system, which will facilitate the following:

- Better definition of customer needs, project requirements, and performance measurements
- Direct involvement with stakeholders in technology development planning
- New mechanisms for lab/industry partnerships

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Office of Technology Development

FY 1994 Mid-Year Review

Overview of Waste Retrieval and Processing Investment Area

**Stanley M. Wolf, Director
Waste Management R&D Division
Office of Research and Development**

March 8, 1994

M94-GT-0140- 1

EM-50 Waste Retrieval and Processing (WRP)

Outline of Presentation

- **Overall EM Need for WRP**
 - **EM Waste Classes**
 - **Waste Distribution and Volume**
- **WRP Mission**
- **Responsiveness to EM Goals**
 - **List of WRP Programs**
 - **WRP Stakeholder-Related Issues and Activities**
 - **WRP Technology Development Issues and Activities**
 - **Accomplishments**
 - **Commercialization and Technology Transfer Activities**

M94-GT-0140- 2

Waste Retrieval and Processing

EM objectives for different waste types (predecisional)

- **High Level Waste:** Provide for treatment and interim storage of HLW until the permanent geologic repository is available
- **Transuranic Waste:** Treat waste to meet WIPP criteria
- **Low-Level Waste/Low-Level Mixed Waste:** Identify viable treatment, storage, and disposal options, recommend optimum approaches, and support best alternatives
- **Hazardous Waste:** Determine optimum mix of commercial and DOE treatment, storage, and disposal facilities and support best approach to T/S/D
- **Spent Fuel:** Provide for stabilization conditioning for interim storage of spent fuels until the permanent geologic repository is available
- **Waste Generated from Facility Transition:** Remove radioactive and hazardous materials to place them in a safe and stable condition until ultimate conversion to another use or permanent shutdown

OTD Objective - Treat to Dispose (in Final Waste Form)

MS4-GT-0140- 3

Total Volumes by Site

MS4-GT-0140- 4

Waste Retrieval and Processing

Overall EM Need

- **Cost-effective, safe retrieval/treatment technology to produce stable final waste forms for hazardous, radioactive, and mixed waste streams from:**
 - **Current DOE operations, including those of Waste Management and Environmental Restoration**
 - **Buried or stored waste sites (> 1 million 55 gallon drums; 50 sites have mixed waste in current inventory or will generate it during cleanup)**
 - **Underground storage tanks (over 300, most containing HLW, especially very large tanks)**
 - **Decontamination and decommissioning (D&D) of current and future surplus facilities (over 1500 identified and/or projected)**

(All technologies must focus on minimizing waste generation during treatment.)

M94-GT-0140- 5

Waste Retrieval and Processing

Some Windows of Opportunity for WRP activities Based on Specific Site Compliance Agreements:

- **USTID/ESPIP:** Driven by Hanford Tri-Party Agreement (subject to change); most milestones in late 1990's and shortly after 2000
- **BWID:** Driven by Idaho National Engineering Lab (INEL) compliance agreement; major milestones in late 1990's
- **MWIP:** Driven by Federal Facility Compliance Act of 1992; improved baseline treatment design needed by EM-30 by FY 1998
- **SCWOP:** Demonstrate alternatives for INEL and Rocky Flats by 2000; milestones at other sites subject to compliance agreements
- **D&D ID:** Schedule based on various site assessments (e.g., at FEMP, D&D to be completed in 1997, other sites later)

Other Potential Schedule Constraints:

- **Late 1994:** Draft of EM Programmatic Environmental Impact Statement
 - **DOE response to Federal Facility Compliance Act of 1992**
 - **EM Spent Fuel EIS**
- **Early/mid 1995:** Final version of above documents

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Waste Retrieval and Processing

Planned Outcome of OTD Programs

Development and demonstration of advanced technology systems in the near term for:

- **Characterization, especially on-line processing and diagnostics of waste streams**
- **Remote/robotic handling of wastes during retrieval and processing operations**
- **Separation and treatment systems to reduce volume, environmental/worker health risk, and life-cycle costs**
- **Remediation systems for contaminated soil associated with underground storage tanks and buried waste**
- **Stable waste forms for storage and ultimate disposal**
- **Recycling of contaminated materials (e.g., for use in cleanup activities)**

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Waste Retrieval and Processing

Mission

Develop and implement an applied RDDT&E Program to:

- **Address Waste Management and Facility Transition technology needs by providing solutions to key technical problems, which predominantly include:**
 - **High level waste tank remediation**
 - **Mixed waste characterization, treatment, and disposal**
 - **Facility transitioning, decommissioning, and final disposal****and to a lesser extent include:**
 - **Landfill stabilization and remediation**
 - **Contaminant plume containment and remediation**
- **Advance rapidly beyond currently available technologies for the above areas**

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Waste Retrieval and Processing

WRP Programs are responsive to specific goals identified by the Assistant Secretary in the recent EM Strategy Plan:

EM Goals	EM-50 WRP Actions
Focus technology development on major problems using the best national talent	Provide technologies to each of the five major EM problem areas, especially for storage tanks, mixed waste, and D&D
Develop strong partnerships between DOE and its stakeholders	Involve stakeholders as key participants in the current and new management structure for EM-50
Be more outcome oriented	Develop technologies to enhance safety, schedule, and cost-effectiveness and to minimize waste generation

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Waste Retrieval and Processing Focus on Major Problem Areas

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Waste Retrieval and Processing

Activity	Prog. Mgr.	Location	Purpose
Buried Waste ID	J. Mohluddin	Idaho Nat'l. Eng. Lab	Remediate DOE-wide buried mixed, transuranic, and low-level waste
Underground Storage Tanks ID	S. Gibson	Hanford	Remediate underground storage tanks containing high-level, low-level, transuranic, and mixed waste
Efficient Separations IP	T. Fryberger	DOE Complex	Improved options for processing radioactive wastes to minimize volumes and risks; develop stable waste forms for disposal; reduce waste management costs
Mixed Waste IP	P. Hart	DOE Complex	Detect, treat, store, and dispose DOE mixed, hazardous, and rad. waste
Decommissioning & Decontamination ID	J. Hyde	K-25, Oak Ridge Nat'l. Lab	Technologies to reduce worker risks, costs, and generation of wastes during D & D of facilities
SuperCritical Water Oxidation	J. Mohluddin	Idaho Nat'l. Eng. Lab	Technology to remediate DOE mixed and hazardous wastes
Rocky Flats CTMP	J. Taylor	Rocky Flats	Technologies to meet Rocky Flats Compliance Agreement commitments
WGA/DOIT Project	G. Coyle	Western States	Stimulate commercialization of waste treatment technologies
Innovative Technology	S. Weber	DOE Complex	Provide proof-of-concept testing of innovative treatment technologies
CMST IP Projects	C. Purdy (A. Tardiff-WRP Projects)	DOE Complex	Develop technologies for waste stream diagnostics and controls; couple these to processing/treatments

M94-QT-0140- 11

Waste Retrieval and Processing

WRP Stakeholder-Related Issues and Activities

(EM Goal: Develop strong partnerships between DOE and its stakeholders)

- Stakeholders for WRP activities and results:
 - Customers - EM-1, U.S. Public
 - DOE Users - EM-30/40/60, Sites
 - Others - State and local governments and groups
- WRP Objective: Establish an "Infrastructure" to assist timely implementation of technology development results
- Selected Activities:
 - Involving regional stakeholders in approval of technology demonstrations - through the Western Governors Association
 - Discussing regulatory issues such as delisting mixed waste, resolving de minimis standards issues, allowing a risk-based approach - through several programs

M94-QT-0140- 12

Waste Retrieval and Processing

Technology Development Issues and Activities

(EM Goal: Be more outcome oriented)

WRP Objective: Focus on near term technology demonstrations involving modification of existing technology and innovative technology

- **Key attributes of technologies/systems supported**
 - System effectiveness
 - Public and regulator acceptability
 - Demonstration schedule
- **Use appropriate characterization for treatment**
 - Noninvasive on line/at line capabilities
 - Diagnostics coupled with treatment technologies
- **Develop versatile treatment technologies**
 - Broad applicability to many waste streams
 - Potential mobility
 - Small capacity effectiveness
 - Output: Stable waste form and minimum secondary waste stream volume
- **Achieve and qualify stable final waste form**

M04-GT-0140- 13

Accomplishments Waste Retrieval and Processing

- UST-ID:** Performed hot demonstrations of a multi-sensor system, including Raman and infrared spectroscopy techniques, for in situ characterization of Hanford tank waste
- ESPIP:** A joint industry/DOE R&D program has had early success with a molecular recognition technology which may be able to separate out a major portion of the radioactivity in high level waste
- BWID:** Demonstrated a Rapid Geophysical surveyor to map boundaries of buried waste areas and 12 key characterization and retrieval technologies
- MWIP:** A versatile plasma arc process has been shown to destroy organics in surrogate Rocky Flats compacted waste and effectively vitrify buried waste soils; initial tests with surrogate wastes have produced a stable glass waste form, and an extension to testing radioactive waste has been planned
- SCWOP:** Completed performance specification for a nonradioactive supercritical water oxidation pilot plant for treating organic liquid hazardous waste
- D&D ID:** Demonstrated the surface decontamination of concrete using a bench-scale microwave ablation process in the laboratory

M04-GT-0140- 14

Waste Retrieval and Processing

WRP Programs include participation in OTD's major commercialization/technology transfer initiatives

PROGRAM	WRP-Related Projects	
	Approx. Funding	No. of Participants
Program R&D Announcements PRDA #1	7.4 M	10
	18.0 M	15
PRDA #2		
Research Opportunity Announcements	4.6M	4
Cooperative R&D Agreements	5.2M	17
Small Business Innovative Research Solicitations	0.15M	2

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Waste Retrieval and Processing

Conclusions

WRP Programs have made substantial progress and contributions in:

- Working with customers and "stakeholders" in planning and implementation
 - Next step: Involvement of EM customers and other stakeholders through entire RDDT&E cycle as part of focus area
- Developing and demonstrating improved technologies for treating major waste types
 - Next step: More rapid implementation through close collaboration with customers/users/stakeholders through focus areas

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WRP-Supplemental Information

Potential General Schedule Limitations Imposed on WRP

- **EM Programmatic Environmental Impact Statement for wastes other than spent fuels and facilities**
 - **To evaluate strategic-level alternatives for both waste treatment/storage/disposal and site cleanup to minimize their impact on the environment;**
 - **To consider impact of technology development on the alternatives for waste management and environmental restoration;**
 - **August 1994: Draft PEIS to be published**
 - **February 1995: Final PEIS to be published**
- **EM response to the Federal Facility Compliance Act of 1992:**
 - **Sets forth plan to treat, or develop responsibilities to treat, mixed waste; requires approval of some states; schedules may preclude use of Technology Development results.**
 - **August 1994: Draft Site Treatment Plan to be published**
 - **February 1995: Final Site Treatment Plan to be published**
 - **October 1995: Final Site Treatment Plan submitted to Congress**

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WRP-Supplemental Information

Potential General Schedule Limitations Imposed on WRP (Continued)

- **EM Facility Transition: No EIS-level document at this time**
- **EM Spent Fuel EIS: Complex-Wide EIS for Spent Nuclear Fuels**
 - **To evaluate alternatives for conditioning and stabilization, and movement to storage locations, of spent fuels to minimize the impact on the environment;**
 - **To include technology development plan;**
 - **December 1994: Draft EIS to be published**
 - **June 1995: Final EIS to be published**

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WRP-Supplemental Information

Crosswalk between current WRP activities and the major EM problem areas

WRP Activities	High Level Waste Tanks	Mixed Waste	Migration of Plumes	Landfill Containment	Facility Transition/D & D
Buried Waste ID	•	•	•	•	•
UST ID	•	•	•	•	•
D&D	•	•	•		•
Efficient Sep. IP	•	•			•
Mixed Waste IP	•	•			•
WGA Projects*	•	•			•
Rocky Flats*		•			
Others *	•	•			•
SCWO Program	•	•			•
Innovative Tech.	•	•	•	•	•
Other Technologies	•	•	•	•	•
CMST IP	•	•	•	•	•

* Related to Mixed Waste IP

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WRP-Supplemental Information

Major WRP Activity Funding

Activities	FY 93 (\$M)	FY 94 (\$M)
Buried Waste ID	14.1	21.1
Underground Storage Tank ID	18.8	22.5
Decommissioning & Decontamination ID	1.7	4.8
Efficient Separations IP	10.8	13.3
Mixed Waste IP	17.7	22.3
Rocky Flats CTMP*		7.5
Western Governors Assoc./DOIT Projects*		
Others *		
Super Critical Water Oxidation Program	2.4	4.9
Other Technologies (Savannah River Region)	0	9.6
Innovative Technologies	**	**

* Related to Mixed Waste IP

** Funded through Groundwater & Soils Investment Area

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WRP-Supplemental Information

WRP activities directed toward EM-30 technology needs

High Level Waste

- **ESPIP identifies/develops separation processes to reduce volume and toxicity (e.g., sequestering agents)**
- **UST-ID demonstrates separations technologies on tank wastes (e.g., TRUEX)**
- **UST-ID develops technologies to characterize and retrieve HLW from underground storage tanks**
- **ESPIP & UST-ID develop/test sludge treatment by dissolution, separations, and vitrification to minimize final disposal volume**
- **MWIP & BWID are also developing potentially applicable technologies (e.g., characterization, treatment, waste form performance assessment)**

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WRP-Supplemental Information

WRP activities directed toward EM-30 technology needs

TRU/TRU Mixed Waste:

- **ESPIP - Identifies/develops separation processes to reduce volume and toxicity (e.g., sequestering agents)**
- **MWIP & BWID - Demonstrates characterization & retrieval technologies for TRU in tanks and buried TRU**
- **UST-ID - Demonstrates separations technologies for TRU tank wastes**
- **MWIP - Chemical/physical separations technologies developed for mixed waste are applicable**
- **MWIP - Pretreatment and thermal treatments developed for mixed waste are applicable**
- **ESPIP & UST-ID - Develop/test sludge treatment by dissolution, separations, and vitrification to minimize final disposal volume**
- **BWID & MWIP - Performance assessment of final waste forms for TRU waste**
- **D&D & MWIP - Develop/extend metal melting recycle technology to minimize waste**
- **MWIP - DT&E of plasma and vitrification processes for LLMW are applicable to TRU waste**

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WRP-Supplemental Information

WRP activities directed toward EM-30 technology needs

Low Level Mixed Waste/Low Level Waste:

- **MWIP - Chemical/physical separations technologies for LLMW**
- **ESPIP - R&D on separation processes to reduce volume and toxicity are applicable for LLMW**
- **UST-ID - Separations technologies for tank wastes are applicable to LLMW**
- **MWIP - Identifies and develops pretreatments followed by thermal treatments specifically for mixed waste, but also may be applicable to LLW**
- **BWID - DT&E for thermal treatment processes are applicable to LLW/LLMW**
- **MWIP - DT&E of plasma and vitrification processes for LLW/LLMW**
- **D&D & MWIP - Develop/extend metal melting recycle technology to minimize waste**
- **ESPIP & UST-ID - Develop/test sludge treatment by dissolution, separations, and vitrification to minimize final disposal volume**
- **MWIP & BWID - Performance assessment of final waste forms for storage and ultimate disposal**
- **MWIP - Treatment to delist plasma product as final waste form for LLMW**

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WRP-Supplemental Information

HLW Treatment: Selective Removal of Cesium and Strontium

- **Need: Efficient Process(es) to Treat Hanford Tank Alkaline Waste**
- **Drivers for Separation Processes:**
 - **Reduction in HLW volume requirements in repository**
 - **Cost savings**
 - **Revised Tri-Party Agreement for DOE-Hanford Site**
- **Result: Extremely selective membrane using crown ethers ($K_d > 2000$) demonstrated on actual waste (supported by Efficient Separations and Processing Integrated Program)**
- **Plans: FY 1994: Full-scale demonstration on cold waste and small-scale demonstration on actual waste under UST-ID.**
 - **FY 1995: Transfer to EM-36**

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Waste Retrieval and Processing

HLW Treatment: Isolation of Cesium and Strontium

(Supported by Efficient Separations and Processing Integrated Program)

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WRP-Supplemental Information

Mixed LLW Final Waste Form: Sludge Processed into Glass

- **Need:** Effective and Acceptable Waste Form for MLLW Sludges
- **Drivers:**
 - Concern over grout as acceptable waste form for SRS sludge
 - Revised Tri-Party Agreement for Hanford
- **Result:** Sound glass produced from actual inorganic and organic sludges

- **Plans:**
 - FY 1994: Treatability study on inorganic sludges with a DOE Lab - Industry Consortium
 - FY 1995: Full-scale mobile demonstration unit
 - FY 1996: Transfer to EM-30

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A New Approach to DOE Environmental Research & Technology Development

**Environmental Management
Office of Technology Development
Mid-Year Review
March 8–9, 1994**

MD4-GT-0112- 1

What is the New Approach?

- **An integrated team structure for solving environmental management problems**
- **High-level management involvement across DOE**
- **Mechanism for involving the national science and engineering communities**
- **Development of stronger partnerships between DOE and its stakeholders**
- **Initial emphasis on five major focus areas:**
 - **Contaminant Plume Containment and Remediation**
 - **High-Level Waste Tank Remediation**
 - **Mixed Waste Characterization, Treatment, and Disposal**
 - **Landfill Stabilization**
 - **Facility Transitioning, Decommissioning, and Final Disposition**

MD4-GT-0112- 2

Purpose and Benefits of New Approach

Purpose

- EM requires technology to achieve program goals at reasonable cost
- More effective use of Department-wide environmental research and technology development
- Stronger ties needed between EM-50 and EM Operations (customer)
- DOE laboratories should be used more effectively

Benefits

- Development of solutions to DOE's environmental problems
- Effective utilization of DOE's resources
- Effective mechanism for stakeholder involvement

M94-GT-0112- 3

Integrated Team Structure for Environmental Research & Technology Development in DOE

M94-GT-0112- 4

Integrated Team Structure— Roles and Responsibilities

DOE National Environmental Science & Technology Council

- Uses national scientific and technical talents
- Recommends high-level priorities
- Ensures role of basic research

Focus Area Review Groups

- Recommend specific technical priorities and approaches
- Provide peer review

Site Technology Coordination Groups

- Compile and validate needs and problems at individual sites
- Facilitate local stakeholder/regulator interactions
- Foster technology transfer and applications at sites

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Integrated Team Structure— Roles and Responsibilities (Continued)

Steering Committee

- Provides strategic direction and policy
- Develops priorities and resources across focus areas
- Oversees Management Teams

Management Teams

- Address customer needs
- Propose Strategic Plans for focus areas, incorporating Integrated Programs/Demonstrations as appropriate
- Recommend Implementation Team to Steering Committee
- Review and evaluate technical programs

Implementation Teams

- Led by Lead Organizations
- Develop technical development plans: research through commercialization
- Provide technical leadership
- Manage projects—cost, scope, and schedule

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Steering Committee

- **Standing Members:**

- S-1 (Ex Officio)
- S-3 (Ex Officio)
- EM-1 (Ex Officio)
- ER-1 (Ex Officio)
- EM DAS/ADAS (EM-10, -20, -30, -40, -50, -60)
- DP, ER, RW, EE, FE, FM

- **Working Representatives**

- EM-30 L. Harmon
- EM-40 W. Wisenbaker
- EM-50 G. Boyd, W. Schutte
- EM-60 E. Schmitt

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Core Management Team Members

- **High-Level Tank Waste Tank Remediation Team**

- Sherry Gibson (EM-50)
- John Mocknick (EM-30)
- Donald Mackenzie (EM-40)

- **Contaminant Plume Containment and Remediation Team**

- Jef Walker (EM-50)
- Gene Chou (EM-30)
- Paul Beam (EM-40)

- **Mixed Waste Characterization, Treatment, and Disposal Team**

- Paul Hart (EM-50)
- Larry Harmon (EM-30)
- Rodger Jump (EM-40)

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Core Management Team Members (Continued)

- **Landfill Stabilization Team**
 - Jaffer Mohiuddin (EM-50)
 - Michael Torbert (EM-30)
 - Stephen Warren (EM-40)
- **Facility Transitioning, Decommissioning, and Final Disposition Team**
 - Jerry Hyde (EM-50)
 - David Mark (EM-30)
 - Judd Lilly (EM-40)
 - Charles Spoons (EM-60)

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Implementing the New Approach

Focus Area	Action	Program Execution	Lead Organization
High-Level Waste Tank Remediation	Activate Management and Implementation Teams	FY 1995	DOE laboratory system
Contaminant Plume Containment and Remediation	Activate Management and Implementation Teams	FY 1995	DOE system
Mixed Waste Characterization, Treatment, and Disposal	Activate Management Team (WGA identified as stakeholder representative)	FY 1995 (Manage implementation through existing system)	To be determined not later than 3/95
Landfill Stabilization	Activate Management Team	FY 1995 (Manage implementation through existing system)	To be determined not later than 3/95
Facility Transitioning, Decommissioning, and Final Disposition	Activate Management Team	FY 1995 (Manage implementation through existing system)	To be determined not later than 3/95

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DOE Environmental Research and Technology Development Program

Working Schedule

Action/Milestones	Date
1. Complete Draft Action Plan	Completed
2. Activate Steering Committee	Completed
3. Establish Steering Committee Support Team	Completed
4. Complete Briefing Package for S-1	Completed
5. Conduct Briefing to EM-1 on "A New Approach"	Completed
6. Conduct Briefing to S-1 on EM Strategic Plan	Completed
7. Conduct Planning for Focus Area Management Teams <ul style="list-style-type: none">- Contaminant Plume Containment and Remediation- High-Level Waste Tank Remediation- Mixed Waste Characterization, Treatment, and Disposal- Landfill Stabilization- Facility Transitioning, Decommissioning, and Final Disposition	Completed
8. Conduct Kick-Off Meeting for All Focus Area Management Teams	Completed
9. Finalize and Distribute Action Plan via Memo from EM-1	Completed
10. Establish the DOE National Environmental Science and Technology Council	(In Planning)
11. Issue Guidance Memo to Operations Offices on Site Technology Coordination Groups	Completed
12. Submit Standardized Outline of Strategic Plans to Steering Committee	Completed

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DOE Environmental Research and Technology Development Program

Working Schedule (Continued)

Action/Milestones	Date
13. Submit Standardized Outline of Management Plans to Steering Committee	(In Planning)
14. Complete Strategic Plans for Focus Areas	April 1, 1994
15. Issue Calls for Interest and Qualifications for Two Focus Area Implementation Teams <ul style="list-style-type: none">- Contaminant Plume Containment and Remediation- High-Level Waste Tank Remediation	April 1, 1994
16. Submit Proposals for Two Focus Area Implementation Teams	May 1, 1994
17. Submit Management Plans for Focus Areas to Steering Committee	May 1, 1994
18. Select Lead Organizations for Two Focus Areas <ul style="list-style-type: none">- Contaminant Plume Containment and Remediation- High-Level Waste Tank Remediation	May 13, 1994
19. Submit Site Technology Coordination Plans from Operations Offices	June 1, 1994
20. Submit Draft Implementation Plans <ul style="list-style-type: none">- Contaminant Plume Containment and Remediation- High-Level Waste Tank Remediation	July 8, 1994

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DOE Environmental Research and Technology Development Program

Working Schedule (Continued)

Action/ Milestone	Date
21. Submit Final Implementation Plans <ul style="list-style-type: none">- Contaminant Plume Containment and Remediation- High-Level Waste Tank Remediation- Mixed Waste Characterization, Treatment, and Disposal- Landfill Stabilization- Facility Transitioning, Decommissioning, and Final Disposition	August 2, 1994
22. Issue Initial FY95 Guidance and Approved Funding Program for all Focus Areas	August 10, 1994
23. Decide Whether Lead Organizations Will be Used for Remaining Implementation Teams <ul style="list-style-type: none">- Mixed Waste Characterization, Treatment, and Disposal- Landfill Stabilization- Facility Transitioning, Decommissioning, and Final Disposition	NLT March 1995

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Management Teams—Near-Term Effort Strategic Plans

• Contents of Strategic Plans

- Mission
- Current issues
- Technology needs
- Problem description
- Scientific foundations
- Metrics
- Others as needed

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Management Teams—Near-Term Effort Management Plans

- **Contents of Management Plans**
 - Near-term schedule (FY94)
 - Longer-term schedule (FY95–96)
 - Decision process
 - Membership and structure
 - Stakeholder involvement process
 - Work breakdown structure
 - Process for technology needs identification
 - Process to identify current efforts across DOE
 - Budget process
 - Funding for non-DOE participants
 - Process for establishing and using Focus Area Review Groups
 - Vertical and horizontal communication process
 - Documentation
 - Establishing and utilizing metrics
 - Integration across teams
 - Field/customer ties
 - Interactions across DOE and outside
 - Process and schedule for selection of Implementation Team

VOCs in Non-Arid Soils Overview

Mid-Year Program Review

Kurt Gerdes

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Volatile Organic Compounds in Non-Arid Soils Integrated Demonstration

PM:	Kurt Gerdes
TPO:	James Wright
IDC:	John Steele
Operations Office:	Savannah River
Laboratory Sites:	All
EM-50 Division:	DT&E
Principal Customers:	EM-40, DoD
Application Areas:	Soils & Groundwater

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Objective

Programmatic

- **Test Integrated Demonstration Concept**

Technical

- **Demonstrate and evaluate innovative technologies/systems for remediation of VOCs in soils and groundwater**

Technology Transfer

- **Transfer technologies and systems to internal and external customers for use in full scale remediation system**

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Scope

- **Demonstration of innovative technologies for Characterization, Retrieval, and Treatment of Volatile Organic Compounds in Non-Arid Soils**
- **Destruction/Recovery-Recycle of VOCs in Off-Gases**

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End Point (Define Success)

Documentation of Technology Performance and Transfer of Successful Technologies To:

EM-40 (SR-ER)

- Actual remediation at demonstration site by ER
- Other Federal Agencies
- DoD (U.S. Air Force – Kelly AFB)

Industry

- Major development partner with various applications of horizontal wells
- Directly involved in most of the demonstrations
- Licenses for technologies granted

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VOCs in Non-Arid Soils Window of Opportunity

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User/Regulatory Interface

- **EM-40**
- **EPA Region IV**
- **South Carolina Department of Health and Environmental Control (SCDHEC)**
- **Industry, through technology transfer meetings**
- **The public, through the SR Citizens Advisory Board**
- **Southern States Energy Board (SSEB)**
- **Western Governors Association**

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Ties to Other Efforts

- **VOCs in Arid Soils ID**
- **Mixed Waste Landfill ID**
- **Characterization, Monitoring, and Sensor Technology IP**
- **In-Situ Remediation IP**
- **Rocky Flats DNAPL Remediation**
- **DoD (United States Air Force)**
- **EPA**

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VOCs in Non-Arid Soils ID

* Will be required in 1995 for all vapor streams generated by ER site cleanup activities as the result of 1992 Clean Air Act Amendments

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Funding FY94 Characterization

TTP	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
AL201101	Groundwater Flow Sensor/Seismic Imaging	70	S. Ballard	SIE, Service Fugro McClelland
RL321102	Biomolecular Probe Analysis	30	F. Brockman	Washington State University
SF221102	Underground Imaging	135	A. Ramirez	Univ. of Arizona, WRR, British Petroleum
SR121102	Characterization & Monitoring	470	C. Eddy - Dilek	EMTC, RUST

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Funding FY94 Retrieval

TTP	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
RF141001	SRS Integrated Demonstration	60	D. Kaback	

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Funding FY94 Treatment

TTP	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
ID121102	Soil Bioreactor Studies	45	G. Andrews	
OR111101	Integrated Demonstration of TCE Degradation	250	A. Palumbo	University of Tennessee
RL331002	Six-Phase Soil Heating	340	M. Schlender	
SR131001	In Situ Heating	700	T. Jarosch	Custom Sensors, KAI, Ford, B.F. Goodrich, ITTTRI, WSTC, Kelly and Tyndall AFBs

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Funding FY94 Off-Gas Treatment

TTP	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
AL121109	Cold Plasma Destruction of Off-Gas VOCs	30	L. Rosocha	EPRI
CH221107	Pulsed UV Irradiation/Dry Scrubbing	30	M. Wilkey	Purus, Inc.
SR121107	Off-Gas Treatment	250	J. Haselow	Allied Signal, Ecova, Engelhardt, EPRI, J. Mathey, NuTech, Purus, SERI, Ultrox

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Funding FY94 Management

	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
RL341001	Savannah River ID Support	150	T. Walton	
SR121103	Operations and Management	380	J. Steele	
SR131002	Planning for Phase-out of SRID	125	J. Steele	

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Program Funding Profile

(In \$ Millions)

FY90	FY91	FY92	FY93	FY94	FY95
0.9	8.2	17.5	12.7	3.1	0.0

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VOCs in Non-Arid Soils Timeline

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Major Milestones/Deliverables

- **Complete field test of Cold Plasma destruction and issue final report on treatment of off-gas VOCs**
- **Complete coordination and support of heating demonstrations and issue final report that summarizes the results from the radio frequency and six-phase heating demonstrations**
- **Issue final report on system support technologies**
- **Issue final ID close-out documentation package and close out demonstration**

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VOCs in Non-Arid Soils ID

Cost-Benefit Assumptions:

- **Site Characterization and Analysis Penetrometer System (SCAPS)**
 - **SCAPS is an innovative technology for characterizing soil types and detecting subsurface contaminants**
 - **Number of wells can be reduced by 50 percent using SCAPS**
 - **There are 2,500 similar sites across the DOE Complex**
 - **Typically twenty 23-meter deep monitoring wells are utilized for characterizing a waste site at Savannah River**
 - **Cost for installing monitoring wells is \$600 per meter**

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VOCs in Non-Arid Soils ID

Cost-Benefit Assumptions (Continued):

- **In Situ Air Stripping**
 - In situ air stripping via horizontal wells can remediate suitable VOC contaminated sites for 60 percent of the cost of conventional pump-and-treat with vapor extraction
 - About 10 percent of the 1,800 DOE and DoD sites with VOCs can use in situ air stripping
- **Methane Enhanced Bioremediation with In Situ Air Stripping**
 - About 15 percent of the 1,800 DOE and DoD sites with VOCs can use bioremediation with in situ air stripping
 - Assumes an enhancement of 10 percent over the in situ air stripping technology (reports under preparation)

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VOCs in Non-Arid Soils ID

Cost Benefits:

- **SCAPS**
 - Cost of using monitoring wells
(baseline technology) \$300K per site
 - Cost of using SCAPS (50% fewer wells): \$180K per site
 - Cost reduction using SCAPS: 40%
 - Potential cost savings across DOE Complex: \$300M
- **In Situ Air Stripping**
 - Cost of using pump-and-treat with vapor
extraction (baseline technology): \$50 per kg
 - Cost of using in situ air stripping with
horizontal wells: \$30 per kg
 - Cost reduction using horizontal wells: 40%
 - Potential cost savings across DOE Complex: \$140M

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VOCs in Non-Arid Soils ID

Cost Benefits (Continued):

• Methane Enhanced Bioremediation with In Situ Air Stripping

- Cost of using pump and treat with vapor extraction (baseline technology):** **\$50 per kg**
- Cost of using bioremediation with in situ air stripping with horizontal wells:** **\$27 per kg**
- Cost reduction using bioremediation with in situ air stripping:** **46%**
- Potential cost savings across DOE Complex:** **\$280M**

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VOCs in Non-Arid Soils ID

Cost Benefits

• SCAPS

- Cost reduction** **40 %**
- Potential cost savings across DOE complex** **\$300M**

• In Situ Air Stripping

- Cost reduction** **40 %**
- Potential cost savings across DOE complex** **\$140M**

• Methane Enhanced Bioremediation With In Situ Air Stripping

- Cost reduction** **46 %**
- Potential savings across DOE complex** **\$280M**

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VOCs in Non-Arid Soils Integrated Demonstration

FY94 Plans:

- Complete ID close-out documentation
- Complete ongoing technology demonstrations
- Transfer unresolved technical issues (e.g., RF and six-phase heating) to other programs

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References/Documentation

- FY 93 IRB Briefing
- FY 93 and 94 Mid-Year Program Review Briefings
- VOCs Non-Arid Soils ID Fact Sheet
- In Situ Air Stripping: Cost Effectiveness of a Remediation Technology Field tested at the SR ID Site; LANL Report LA-UR-92-1927
- Cost Effectiveness of the Site Characterization and Analysis Penetrometer System; LANL Report LA-UR-91-4016
- Chemical Contaminants on DOE Lands and Selection of Contaminant Mixtures for Subsurface Science Research, DOE/ER 0547T, 1992

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ID Accomplishments

- **Established national model for implementation of the Integrated Demonstration concept to field innovative environmental solutions (national labs, industry, universities, other Federal agencies)**
- **Successfully collaborated with industry to demonstrate four full-scale remediation systems including characterization, monitoring and drilling support technologies**
- **Transferred numerous technologies and systems to EM-40, industry and other government agencies**
- **Developed and implemented the approach for Integrated Demonstration close-out**
- **Collaborated with Environmental Restoration to prepare and implement a turnover plan for technologies successfully demonstrated in the ID**

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Directional Drilling Accomplishments

- **Incorporated directional drilling technologies into innovative remediation systems (system vision)**
- **Advanced directional drilling industry through DOE/industry collaboration**
- **Over 30 environmental horizontal wells installed nationwide**

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In Situ Air Stripping Accomplishments

- **Developed and demonstrated an innovative remediation system integrating in situ air stripping with horizontal wells**
- **Demonstrated increased efficiency (5:1) and reduced cost (40%) over baseline technology (projected DOE savings \$140M)**
- **13 license applications filed and 1 full scale system in commercial operation at 3M site (Minnesota)**

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In Situ Bioremediation Accomplishments

- **Integrated biotechnology into in situ air stripping system to enhance performance (methane/nutrient injection)**
- **Full-scale demonstration has shown positive indications of biostimulation and bioremediation (TCE/PCE degradation)**
- **SRS-ER technology transfer**
 - **ER will operate existing bioremediation equipment**
 - **Biosystem incorporated into other remediation projects at SRS**

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In Situ Heating Accomplishments

- **Teamed with industry to integrate radio frequency heating technology and horizontal wells for environmental applications**
- **Completed the six-phase heating demonstration**
- **Packaged innovative characterization and monitoring technologies (e.g., temperature sensors) to evaluate system performance**
- **Teamed with the Department of Defense (DoD) to demonstrate radio frequency heating at Kelly AFB**

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Off-Gas Treatment Accomplishments

- **Established innovative means to collaborate with industry on technology demonstrations at permitted test bed**
- **Successfully demonstrated nine off-gas treatment systems**
- **Completed long term evaluation of thermal catalytic treatment technology and successfully transferred the technology into the SRS environmental remediation activities**
- **Initiated technology transfer to Rocky Flats and Hanford**

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System Support Technologies Accomplishments

- **Integrated characterization/monitoring technologies into innovative remediation systems**
 - e.g., Geophysical tomography for in situ bioremediation system
- **Several characterization technologies have been integrated into SRS-ER programs (e.g., cone penetrometer, depth discrete sampling, and 3D imaging)**
- **Active DOE technology transfer program has generated numerous patents and licenses (e.g., flow and temperature sensors)**
- **Reduced site characterization costs**
 - e.g., SCAPS cone penetrometer potential savings of \$300 million

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FY94 Accomplishments

- **Completed Six-Phase Heating Demonstration and associated characterization activities**
- **Developed and demonstrated Fiber Optic Heat Sensor**
- **Prepared technical reports for FY93 demonstrations**
 - in situ bioremediation
 - innovative monitoring technologies
- **Continued demonstrations of Off-Gas treatment technologies**
- **Transferred in situ Air Stripping Technology to industry**
- **Transferring Six-Phase Heating Technology to Rocky Flats**
- **Implemented ID close-out including technology development files and summary documentation to facilitate technology transfer**

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Future Program Objectives – FY94

Issue final ID close-out documentation package, including documentation of ID accomplishments; commercialization/technology transfer; identification of alternative site uses options; unresolved technical issues; and lessons learned

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Commercialization

Industry

3M Corporation	Hydrogeochem
Allied Signal	Johnson Matthey
AMS	Man-Tech
Applied Research Associates	Membrane Technology and Research
BAY Geophysical	Nucon
Bruei & Kjaer	NuTech
Burge and Associates	O'Brien and Gere
CH2M Hill	Purus
Charles Machine Works	R.J. Electronics
Eastman Christensen	SAIC
ECOVA	Science Engineering Associates
EIC Laboratories	SEC Donahue
Engelhardt	Shonberg Radiation Corporation
Environmental Monitoring and Testing Corporation	Solar Energy Institute
EPRI	Synthetica Technologies
Fiberchem	Transducer Research
Gas Research Institute	Ultrox
General Engineering Laboratory	US Geological Survey
Graves Well Digging	Viking Instruments

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Commercialization (Continued)

University

**Auburn University
Clemson University
Medical College of Georgia
New Jersey Institute of Technology
Stanford University
University of Arizona
University of Minnesota
University of New Mexico
University of North Carolina
University of South Carolina
University of Tennessee
University of Wisconsin
Washington State University**

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Commercialization (Continued)

Technology Transfer

Current Licenses of Integrated Demonstration Technologies

In Situ Remediation System Using Horizontal Wells

- **Barr Engineering (Isanti Trust)**
- **Groundwater Technology, Inc.**
- **Pollution Equipment Co.**
- **AWD Technologies**
- **Heritage Remediation & Engineering, Inc.**
- **Sierra Environmental**
- **Nine other applications in negotiation with DOE**

Bioremediation of Contaminated Groundwater

- **Heritage Remediation & Engineering, Inc.**
- **Three other applications in negotiation with DOE**

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Cost/Schedule Performance

Date Printed: 02/18/94 EM Progress Tracking System
SUMMARY REPORT

MM-GT-0123-37

Savannah River Economic Development Program

PM:	Kurt D. Gerdes
TPO:	James Wright
FPM:	John L. Steele
Operations Offices:	HQ
Laboratory Sites:	SRTC
EM-50 Division:	DT&E
Principal Customers:	EM-30, EM-40
Application Areas:	Soils and Groundwater Waste Retrieval & Processing Regional Technology Initiatives
Joint Participants:	(See Attached)

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Joint Participants - Soils and Groundwater

• Argonne National Laboratories	• Oak Ridge National Laboratories
• Babcock & Wilson	• Rust Engineering
• Barrier Membrane Corp.	• University of South Carolina
• Blend Manufacturing Co.	• USGS
• Bradtec	• Westinghouse Hanford Co.
• Clemson University	• Westinghouse Science & Technology Center
• Environwall	• Westinghouse Scientific Ecology Group, Inc.
• HOPS International	
• Lawrence Berkeley Laboratories	

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Joint Participants - Waste Retrieval & Processing

- BNFL
- Boulder Scientific Co.
- Clark Atlanta University
- Clemson University
- DuPont Separation Systems, Inc.
- Georgia Institute of Technology
- Glasstech, Inc.
- Idaho National Engineering Laboratories
- Mott Metallurgical Corp.
- Oak Ridge National Laboratories
- Pacific Northwest Laboratories
- Plasma Energy Co.
- Rohrback Cosasco Systems
- Sandia National Laboratories
- University of Miami
- University of South Carolina
- VACCO, Inc.
- Waste Management
- Westinghouse Hanford Co.
- West Valley Nuclear Services Co.

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Joint Participants - Regional Technology Initiatives

- Carolina Metals Co.
- ERDA
- RimTech
- Sciencetech
- SCUREF
- South Carolina Research Authority
- Southeast Technology Center
- Southern States Energy Board

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Objectives

Soils and Groundwater

- Demonstrate in situ technologies for treatment and containment of contaminants in groundwater and soils

Waste Retrieval & Processing

- Demonstrate, test, and evaluate technologies for improving interim storage of high-level wastes and for disposing of a range of radioactive and mixed wastes

Regional Technology Initiatives

- Be recognized by our public and industrial customers as an important contributing partner of innovative technologies that enhance regional and industrial competitiveness
- Within three years, greater than 25 percent of Savannah River Site's Research & Development program will be dedicated to dual-use technologies, technology development partnerships, and work for others

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End Point (Define Success)

- Transfer of successful technologies to:
 - Mixed Waste Integrated Program, Efficient Separations and Processing Integrated Program, and other Demonstration, Testing & Evaluation programs
 - EM-30 / EM-40
 - Industry
- Bring economic benefit to the region by establishing SRTC core competencies in ER and WM, networking and partnering with new local entities through application and commercialization of new innovative technologies

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Customer Needs/Window of Opportunity

- **Customer Needs**
 - **Operate from a market pull perspective**
- **Window of Opportunity**
 - **Networking with business, academia, national laboratories and other government agencies**

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User/Regulatory Interface

- **EM-30**
- **EM-40**
- **Mixed Waste Integrated Program**
- **Efficient Separations and Processing Integrated Program**
- **South Carolina Department of Health and Environmental Control**
- **Environmental Protection Agency**
- **Southern States Energy Board**

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Ties to Other Efforts

- **Decontamination and Decommissioning**
- **Mixed Waste Integrated Program**
- **Efficient Separations and Processing Integrated Program**
- **In Situ Remediation Integrated Program**
- **Volatile Organic Compounds in Non-Arid Soils Integrated Demonstration**
- **Volatile Organic Compounds in Arid Soils Integrated Demonstration**

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Savannah River Economic Development Program

Soils and Groundwater Environmental Remediation	Waste Retrieval and Processing	Regional Technology Initiatives
Dense Nonaqueous Liquids Integrated Demonstration (DNAPL)	DOE/Industry Vitrification Center at Clemson	Stainless Steel Beneficial Reuse SRS Program Support
Characterization & Monitoring of DNAPL	Vitrification Demonstration on Actual Mixed Waste	Regional Environmental Technology Development
Remediation Technology Demonstration	Plasma Demonstration on Actual Mixed Waste	Regional Technology Transfer and Integration
In Situ Remediation and Supporting Technologies	HLW Development	
Characterization & Monitoring of Magnetic Separation Demonstration	UST: Cs Extraction Testing	
Magnetic Separation Demonstration	Dynamic Computer Simulation of Complex Waste Flowsheets	

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Savannah River Economic Development Program

Soils and Groundwater	\$8,950K
Waste Retrieval & Processing	\$10,850K
Regional Technology Initiatives	\$10,200K
	\$30M

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Funding FY94 ***Savannah River Economic Development Program***

Soils and Groundwater Remediation

Dense Non-Aqueous Phase Liquids Integrated Demonstration (DNAPL)

TTP	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
141008	Environmental Restoration Liaison	100	Brian Looney	Clemson University, U.S. Geological Survey
141009	Characterization and Monitoring of Dense Non-Aqueous Phase Liquids (DNAPL)	2200	Joe Rossabi	Clemson University, U.S. Geological Survey
141010	DNAPL Mobilization and Monitoring	500	David Tuck	Clemson University, U.S. Geological Survey
141011	Remediation Technology Demonstration	1300	Brian Looney	Clemson University, U.S. Geological Survey

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Funding FY94

Savannah River Economic Development Program

Soils and Groundwater Remediation

In-Situ Remediation and Supporting Technologies

TTP	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
141012	In-situ Inorganic Remediation of Groundwater - Operations & Management	435	Todd Coleman	Bradtec, Inc., Babcock & Wilcox, Rust Engineering, Argonne National Laboratory, Pacific Northwest Laboratory
141013	Characterization and Monitoring of the Magnetic Separation Demonstration	780	Ralph Nichols	SST (Cone Penetrometer)
141014	Removal of Inorganic Contaminants from Groundwater Operational Interface	100	Scott McMullin	
141015	Magnetic Separation Demonstration	265	Jane Bibler	Bradtec, Inc.
141016	In-situ Characterization of Hazardous Soil Constituents by Prompt Gamma Neutron Activation Analysis (PGNAA)	250	Ray Sigg	Westinghouse Hanford Co., Westinghouse Scientific Ecology Group, Inc., U.S. EPA Region 4
141017	HOPS: A Technical Information System for CERCLA Waste Sites	480	Jim Bowers	HOPS International, Inc.
141018	Integrated Rapid Bioassessment Technologies for Cost Effective Risk Assessments	550	Michael Paller	Clemson University
141019	In-situ Bioremediation of Toxic Metals	700	Ed Wilde	University of South Carolina, PRAMCO
141020	Gas Phase Bioreactor Field test for Chlorinated Solvent Contaminated Ground Water	1500	Terry Hazen	Medical University of South Carolina, Envirogen

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Funding FY94

Savannah River Economic Development Program

Waste Retrieval and Processing

DOE/Industry Vitrification Center at Clemson

TTP	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
142005	Plasma Demonstration on Actual Mixed Waste	1350	Ray Schumacher	Clemson University, South Carolina Research Authority, Massachusetts Institute of Technology
142006	MLLW/CIF Blowdown/Bottom Ash Stabilization	1000	Jim Marra	Clemson University, Battelle Pacific Northwest Laboratory, Scientific Ecology Group, Inc.
142007	Noble Metal Reclamation	270	Ken Imrich	Clemson University, Georgia Institute of Technology Zenith, Corning/Asahi, Inc.
142008	Vitrification Processes for Safe, Permanent Storage of Transuranic Elements	1000	Gene Ramsey	Square D, Inc., Clemson University
142009	Vitrification Demonstration on Actual Mixed Waste	2030	Carol Jantzen	Clemson University, Oak Ridge National Laboratory, Scientific Ecology Group, Inc.

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Funding FY94

Savannah River Economic Development Program

Waste Retrieval and Processing

HLW Development

TTP	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
142010	UST: Cs Extraction Testing	1300	Jane Bibler	Westinghouse Hanford Co., Pacific Northwest Laboratory, Oak Ridge National Laboratory, Clark Atlanta University, British Nuclear Fuels, Boulder Scientific Co.
142011	Defense Waste Process Filter Testing Program	1400	Charles Nash	SCUREF, University of Miami, Mott Metallurgical Corp., DuPont Separation Systems, Inc., VACCO, Inc.
142012	Dynamic Computer Simulation of Complex Waste Flowsheets	1100	Steve Wach	
142013	In situ Characterization & On-line Monitoring of UST Waste	600	Natraj Iyer	West Valley Nuclear Services Co., University of South Carolina, Clemson University, Rohrbach Cosasco Systems, Westinghouse Hanford Co.
142014	Deployment Systems & In-Tank Video/Photography for UST ID	600	Frank Heckendorn	WHC, LLNL, PNL, INEL, ORNL, SNL

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Funding FY94

Savannah River Economic Development Program

Regional Technology Initiatives

TTP	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
144101	Stainless Steel Beneficial Reuse SRS Program Support	1600	Bill Boettinger	Carolina Metals Co.
144102	Regional Environmental Technology Development	2800	John Steele	ARPA, VOCNID, SCIENTECH, RIMTECH, SSEB, VOCAID, ISR-IP, MWIP
144103	Commercial Application of DOE Environmental Facilities	800	Bill Summers	South Carolina Research Authority, SCUREF, ERDA
144104	Environmental Technology Platform Development & User Facilities	500	Joe Rossabi	EPA-EMSL, Clemson Univ., SCDHEC, EPA-Region 4, Local Industry, SC Wildlife Fed.
144105	Regional Technology Transfer and Integration	2700	Don Blankenship	
144106	Characterization of CIF Off-Gas Stream for Health Risk Assessments	1300	Don Burge	ERDA, Georgia Institute of Technology
144107	Radioactive - PCB Treatment	500	Christine Langton	Rust Engineering

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Program Funding Profile (\$M)

FY90	FY91	FY92	FY93	FY94	FY95
—	—	—	—	—	—
0	0	0	0	30.0*	0

***This is a Congressional Appropriation for only FY94**

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Schedule

	FY94	FY95	FY96
DNAPL			
Demonstration Integration	■		
Characterization & Monitoring of DNAPL	■		
DNAPL Mobilization	■		
Demonstration of DNAPL Remediation Technologies	■		
In Situ Remediation & Supporting Technologies			
PGNAA Field Demonstration	■		
Develop Tech. Info. System for CERCLA Waste Sites	■		
Develop Methodology for Rapid Bioassessment	■		
Demonstrate Processes for Bioremediation of Toxic Metals		■	
Characterization/Monitoring for Magnetic Separation Demonstration	■		
DOE/Industry Vitrification Center at Clemson			
Demonstrate Blowdown/Bottom Ash Waste Stabilization	■		
Demonstrate High-temperature Vitrification	■		
Demonstrate Vitrification of an Existing SRS Waste Stream		■	

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Schedule

	FY94	FY95	FY96
HLW Development			
Develop Basic Data on use of resorcinol-formaldehyde resin for cesium removal	■		
Issue Technology Transfer Documentation for Advanced In-Tank Video, Photography, & Sensor Deployment Systems		■	
Develop Technology and select UST for On-Line Corrosion Monitoring of High Level Waste Tanks	■		
Issue Operational Information from Two-year Filter Testing Program	■		
Regional Technology Initiatives			
Initiate First Stainless Steel Remanufacturing Process	■		
Commercial Application of DOE Environmental Facilities	■		
Establish Training Activities at Test Platform Site	■		
Complete Report on Health-based Risk Assessment for all exposure pathways for Range of Toxic Compounds in the CIF Stack Emissions	■		
Identify and Demonstrate Technology for destruction of PCB in radioactively contaminated solid waste	■		

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Major Milestones/Deliverables

- Final DNAPL Mobilization Report
- Final DNAPL Remediation Report
- Final Magnetic Separation Characterization and Monitoring Report
- Initiate Pilot Scale Tests in High Temperature Melter
- Issue Pilot Scale Melter Test Results for MLLW/CIF Blowdown Ash Stabilization
- Final Report on Vitrification of Transuranic Elements
- Complete Chemical Runs using Oak Ridge, Savannah River, and Hanford Simulant for UST Cesium extraction testing
- Complete Demonstration of Primary Filter for Waste Separations
- Technology Transfer Documentation for Deployment Systems and In-Tank Video/Photography For UST
- Deliver First Product from Stainless Steel Beneficial Reuse Program
- Place 10 OTD CRADAs in Region
- Recommend CIF Emission Monitors Based on Health Risk Assessment Results

MS4-GT-0122- 20

Benefits

Cost/Savings

- Reduce costs for removing VOCs from soils and groundwater
- Reduce costs of radioactive waste treatment
- Reduce costs associated with characterization of waste site constituents and removal of those wastes for removal and treatment
- Reduce costs and/or time for waste retrieval and processing
- Better, safer methods and technologies in targeted areas

Performance

- Improved quality of final waste forms
- Reduce secondary waste streams generated from waste treatment

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Benefits

Safety/Risk

- Decrease health/safety risks of mixed treatment of radioactive waste and contaminated soils and groundwater

Regulatory

- Compliance with Federal Facility Compliance, Interagency, and Tri-Party Agreements
- Multi-State/Regional Regulatory Approvals

Industry

- Many technologies will have use in/benefit to industry

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Program Issues

This is a one-year program, and all projects are new starts. TTPs are being revised to reflect the release of initial funding to the contractor on December 6, 1993. While every effort is being made to place contracts, many of the milestones are being pushed late in the fiscal year. Significant work will be continued in fiscal year 1995 with funds obligated in fiscal year 1994

A major emphasis of this program will be regional economic development. While every effort is being made to gain early impacts, most initiatives of this nature will take years for benefits to be realized

MS4-GT-0122- 23

Reference / Documentation

- Savannah River FY94 Technology Transfer and Economic Development Plan
- Technical Task Plans
- Management Plan
- DOE-SR Manager Briefings
- DOE-HQ Progress Tracking System

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Accomplishments

**Delivered Savannah River Technology
Transfer and Economic Development Plan
to Congress on January 27, 1994**

M04-GT-0122- 25

Future Program Objectives - FY94

Dense Non-Aqueous Phase Liquids Integrated Demonstration (DNAPL)

- Develop and demonstrate innovative characterization and monitoring of DNAPL
- Demonstrate selected remediation technologies for DNAPL

In Situ Remediation and Supporting Technologies

- Field demonstration of in situ groundwater barriers and electromagnetic separation of absorbed inorganic contamination using magnetized ion-exchange resins
- Use PGNAAs technology to map the subsurface element concentrations of hazardous soils constituents beneath a coal pile at SRS

DOE/Industry Vitrification Center at Clemson

- Demonstrate the ability to vitrify and stabilize hazardous ash type wastes and provide valuable data regarding actual performance of LLMW vitrified waste forms in a RCRA landfill
- Field demonstration of vitrification in a mobile reusable facility

M04-GT-0122- 26

Future Program Objectives - FY94

HLW Development

- Complete installation of the Skid-mounted Ion exchange Demonstration unit (SKID) and fabricate a resin slurry tank to be used for removal of resin fines and for slurring resin into the columns on the SKID unit
- Model the SRS High Level Liquid Waste flowsheet to demonstrate the capability for dynamic computer simulations to facilitate short and long term decision analysis and strategic planning for complex waste processing flowsheets

Regional Technology Initiatives

- Establish privatization of the integrated demonstration of recycling radioactively contaminated stainless steel
- Establish account executive program to work closely with licensees on DOE technology
- Establish technology applications and commercialization network within region and nationally

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Future Program Objectives – FY95

Completing activities that have been obligated in FY94

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Technology Commercialization Applications Accomplishments

- Formed a regional/national network to focus and consolidate elements for technology development applications, commercialization, and business expansion
- Generated letters of interest from ten potential industry partners for teaming and cost sharing
- Developed methods to leverage private funding resources, including more direct applications of new innovative technologies
- Developed commercialization success criteria for evaluation and selection of the highest potential technology businesses
- Refined and modified a commercialization model (joint industry/EPA/DOE effort) for application at SRS

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EM PTS Summary Report

Date Printed: 82/18/94 EM Progress Tracking System

SUMMARY REPORT

PROGRAM/PROJECT TITLE SAVANNAH RIVER ECONOMIC DEVELO	UBS OR ID. NUMBER 1. 5. 1. 1.23	REPORTING PERIOD December 1993
Budget at Completion	0	Total Estimated Cost
Estimate at Completion	0	Total Project Cost

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EM PTS Summary Report

Date Printed: 82/18/94 EM Progress Tracking System
SUMMARY REPORT

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EM PTS Summary Report

Date Printed: 82/18/94 EM Progress Tracking System
SUMMARY REPORT

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Volatile Organic Compounds in Arid Soils Integrated Demonstration

Program Manager: David Biancosino (301) 903-7961

**Integrated Demonstration
Coordinator:** Tom Brouns (509) 376-7855

Operations Offices:	RL
Laboratory Sites:	All
EM-50 Division:	DT&E
Principal Customers:	EM-40
Applications Areas:	Soils and Groundwater Remediation

M94-GT-0103- 1

VOC Arid ID

Mission:

- To identify, and rapidly develop, demonstrate, and transfer for deployment, needed systems to effectively characterize and remediate soils and groundwater at arid sites contaminated with VOCs

Scope:

- VOCs and associated contaminants
- Soils and groundwater at arid sites
- All contaminant phases (vapor, liquid, solid)

M94-GT-0103- 2

Needs

Solvent ¹	Abbrev.	Grdw. ²	Soil ²
Trichloroethylene	TCE	14	11
Trichloroethane	TCA	11	10
Dichloroethylene	DCE	11	11
Tetrachloroethylene	PCE	10	9
Dichloroethane	DCA	10	2
Chloroform	CF	10	5
Carbon Tetrachloride	CT	7	6
Dichloromethane	DCM	7	9
Freon	Freon	6	3
Vinyl Chloride	VC	5	2

¹ Most common DOE halocarbons in order of prevalence

² Number of sites with groundwater or soil contamination reported out of 18 U.S. DOE facilities

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Needs

Co-Contaminant	No. Facilit. ²	No. Sites ²
Metals – Pb, Cr	12	38
Radionuclides – H ³ , U, Tc, Pu	10	32
Anions – NO ₃ ⁻ , CN ⁻	9	26
Fuel hydrocarbons – toluene, xylenes	7	17

¹ Common halocarbon co-contaminant classes listed with representative example compounds

² Number of 18 U.S. DOE facilities and 91 waste sites surveyed containing these contaminants

M04-GT-0103- 4

Hanford 200 West Area

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VOC Arid ID

End Point (Define Success):

- Develop and demonstrate a minimum of four remediation systems for enhanced removal or in situ destruction of VOCs and associated contaminants
- Commercialization or partnership plans for all technologies
- Establish clear performance criteria, goals, and procedures for all field demonstrations based on stakeholder input
- Establish a process with end users and other technical experts to ensure that the remediation systems are compatible with the baseline approach
- Identify and initiate at least one field demonstration at another site

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Key Performance Indicators

- Number of field demonstrations (individual technologies, and overall remediation systems) conducted, results documented, performance evaluations completed, profiles prepared
- Percentage of university and industry involvement
- Number of technologies successfully commercialized
- Percentage of technology users participating in program planning and implementation functions

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Customer Needs/Window of Opportunity

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VOC Arid ID

User/Regulatory Interface:

- EM-40
- EM-30
- U.S. Environmental Protection Agency
- Hanford Expedited Response Action

Ties to Other Efforts:

- VOCs in Non-Arid Soils ID
- Mixed Waste Landfill ID
- In Situ Remediation IP
- Characterization, Monitoring, and Sensor Technology IP

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WBS

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Funding FY94 Drilling

<u>TTP#</u>	<u>Name</u>	<u>\$(K)</u>	<u>PI</u>	<u>Industry/University Partner</u>
AL231005	Arid Sonic Drilling	420	J. Wise	Water Development Corp. Westinghouse Hanford Co.
RL421103	Arid Drilling Technology Development	1415	D. Moak WHC	Applied Research Assoc. Argonne National Lab. New Mexico Institute of Technology Pacific Northwest Lab. Sandia National Lab. Water Development Corp.

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Funding FY94 Characterization and Monitoring

<u>TTP#</u>	<u>Name</u>	<u>\$(K)</u>	<u>PI</u>	<u>Industry/University Partner</u>
OR141006	Arid Monitoring Microbial Population Changes	75	A. Palumbo MMES	University of Tennessee
RL321105	Arid Site Characterization and Monitoring	1103	S. Tomich PNL	Washington State University Quanta Physik, Inc.
RL321104	Arid DT&E for Design and Evaluation	867	K. Roberson PNL	Rice University

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2 of 3

Funding FY94 Retrieval of Contaminants

<u>TTP#</u>	<u>Name</u>	<u>\$(K)</u>	<u>PI</u>	<u>Industry/University Partner</u>
AL141002	Arid Barometric Pumping Soil Microscale Evaluation/ Simulation	75	N. Rosenberg	
ID141001	Arid Passive Venting	150	W. Downs INEL	
SF241001	Arid Enhanced Passive Soil Vapor Extraction	80	J. Shinn LLNL	

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Funding FY94 Above Ground Treatment of Contaminants

<u>TTP#</u>	<u>Name</u>	<u>\$(K)</u>	<u>PI</u>	<u>Industry/University Partner</u>
RL421104	Arid Membrane Separation Technologies	290	K. Hodgson WHC	Bend Research Inc.
RL343501	Arid Tunable Hybrid Plasma	400	T. Brouns PNL	Massachusetts Inst. of Tech. Westinghouse Hanford Co.

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Funding FY94

In Ground Treatment of Contaminants

TTP#	Name	\$(K)	PI	Industry/University Partner
RL311104	Arid Engineered System for In Situ Groundwater Treatment	2438	R. Skeen PNL	Washington State University Rice University Stanford University Massachusetts Inst. of Tech. Westinghouse Hanford Co.
RL342005	Six Phase Soil Heating at Rocky Flats	283	T. Bergsman PNL	EG&G Rocky Flats

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VOC-Arid ID Schedule* and Budget

*All milestones indicate start dates

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Schedule

- VOC Arid ID has a Three Phase Approach that provides:
 - Rapid transfer of technologies to EM-40
 - Logical progression in the complexity of demonstrations
 - Reduced overall cost of the technology demonstrations
- Technology demonstrations within the ID are leveraged on an Expedited Response Action
- The ID will develop and demonstrate technologies in all phases of the program

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Phase 1 – Characterization, Monitoring, and Off-Gas (FY92 – FY94)

Goal:

- Demonstrate and deploy systems to better access the site, characterize the extent and nature of contamination, and improve upon the baseline off-gas treatment systems

Approach:

- Provide immediate support to ongoing and near-term VOC remedial actions
- Enhance operations of SVE systems for improved removal and containment of vadose zone plumes
- Develop and demonstrate alternatives to granular activated carbon adsorption and offsite treatment

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Phase 1 – Characterization, Monitoring, and Off-Gas (FY92 – FY94) (Continued)

Activities:

- Vertical, angle, and horizontal drilling enhancements
- VOC characterization and monitoring tools
- Off-gas treatment demonstrations
- Improved conceptual model development tools, and baseline performance monitoring

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Phase 2 – Enhanced VOC Removal and Containment (FY93 – FY95)

Goal:

- Provide effective tools and systems to remove and destroy, or contain highly mobile VOC vapors in vadose and groundwater zones

Approach:

- Develop and demonstrate techniques to enhance the performance, or augment, the baseline SVE system for removal of VOC vapors
- Combine extraction and containment techniques with improved access technologies from Phase 1
- Demonstrate and deploy in situ monitoring systems for remediation performance evaluation

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Phase 2 – Enhanced VOC Removal and Containment (FY93 – FY95) (Continued)

Activities:

- Enhance SVE and containment technologies with soil heating, barometric pumping, and in situ vapor stripping
- Demonstrate downhole sensor technologies, such as PAWS and Optrodes
- Transfer design tools for evaluation of alternative operating strategies and performance evaluation

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Phase 3 – In Situ VOC Treatment and Co-Contaminants

Goal:

- Replace or significantly augment existing baseline technologies to destroy VOCs in place and more cost-effectively treat co-contaminants

Approach:

- Integrate novel in situ VOC destruction technologies with access, vapor removal, monitoring, and design tools to attain both bulk and residual contaminant treatment
- Improve upon co-contaminant treatment baseline technologies to reduce ultimate costs of remediation of the most common DOE VOC sites

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Phase 3 – In Situ VOC Treatment and Co-Contaminants (Continued)

Activities:

- **In situ destruction of VOCs through Bioremediation process**
- **Separation and concentration of co-contaminants from extracted groundwater**
- **In situ immobilization of co-contaminants in conjunction with VOC treatment, or as follow on treatment as an integrated system**

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FY94 Major Milestones/Deliverables

- **Initiate demonstration of pilot-scale tunable hybrid plasma**
- **Initiate in situ vapor stripping demonstration**
- **Initiate six-phase soil heating demonstration at Rocky Flats**
- **Initiate in situ bioremediation demonstration**
- **Complete demonstration of supported liquid membrane system for co-contaminants**
- **Demonstrate and transfer complete engineering simulator**
- **Initiate barometric pumping enhancements for vadose zone VOC control**

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FY95 Major Milestones/Deliverables

- **Complete in situ bioremediation demonstration and transfer system to ER**
- **Complete demonstration of horizontal drilling tools for arid site applications**
- **Initiate demonstration of in situ immobilization of co-contaminants**
- **Complete demonstration of pilot-scale tunable hybrid plasma**
- **Complete in situ vapor stripping demonstration**

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Cost Benefit Analysis

Investment:

- **DOE cost will be between \$60 and \$80 million for the ID from FY91 through FY97 (combined EM-40/50 costs)**

Savings:

- **Based on technologies being pursued, savings will be in the 30 percent to 50 percent range**
- **This represents a total savings of \$15 to \$30 billion**

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Cost Benefit Examples

ResonantSonicSM Drilling Technology:

- Cost for cable tool drilling (baseline) is \$1000 per foot in non-rad conditions
- 123 wells were drilled in FY92
- Sonic drilling is at least twice as fast as cable tool
- Drilling fluids are not required with sonic drilling
- Sonic drilling produces approximately 5 times less drilling waste than does cable tool rig

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Cost Benefit Examples

In Situ Anaerobic Bioremediation of VOCs and Nitrates:

- Conventional treatment includes denitrification, air stripping, and activated carbon adsorption
- Conventional remediation costs would be \$690 per cubic meter of contaminated groundwater (\$1 billion for the Hanford 200 west area plume)
- Cost of using bioremediation is \$250 per cubic meter of contaminated groundwater, a 64 percent savings
- Test volume was 3000 cubic meters

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Cost Benefit Examples (Continued)

Unsaturated Flow Apparatus:

- Soil column studies (baseline) require a minimum of three columns and three samples per data point
- Lab space and equipment costs are essentially equal, difference is the available lab time for other uses
- Cost of using soil column studies is \$7000 per sample
- Cost of using UFA™ is \$1000 per sample
- Cost reduction of 85 percent

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Program Issues

- Industry Integration
- Transfer of Technologies Out of Host Site
- Directional Drilling in Hanford Soils

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Accomplishments

- Completed on-line monitoring and many offgas treatment demos
- Completed directional and angle drilling demonstrations
- Released first version of engineering simulator to aid in the design and evaluation of subsurface remediation technologies
- Initiated installation of innovative mixing wells for use in conjunction with the bioremediation system
- Completed membrane separations demonstration
- Demonstrated sonic drilling and heavy-weight cone penetrometer
- Completed commercialization/technology transfer plans for all ID technologies
- Completed public involvement process

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Accomplishments (Continued)

- Demonstrated sonic drilling and heavy-weight cone penetrometer
- Completed commercialization/technology transfer plans for all ID technologies
- Completed public regional stakeholder involvement process for groundwater remediation systems
- ProTech system for ID complete
- Phase 1 demonstrations nearly complete
Phase 2 demonstrations are being initiated
- Twenty-six (26) technologies have been demonstrated

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Accomplishments (Continued)

Technologies Transferred to EM-40

- **Heavy-Weight Cone Penetrometer**
- **ResonantSonicSM Drilling**
- **BoreSampler**
- **Unsaturated Flow Apparatus**
- **SEAMIST**
- **PAWS**
- **HaloSnif**
- **Membrane Separations**
- **Odyssey**

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Future Program Objectives FY94

- **Complete off-gas treatment and vadose zone monitoring**
- **Demonstrate directional drilling in contaminated soil**
- **Demonstrate vibratory techniques with the CPT**
- **Demonstrate engineering simulator for design and evaluation**
- **Initiate groundwater in situ bioremediation demonstration**
- **Complete SLM demonstration for co-contaminants**
- **Initiate barometric pumping activities**

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Future Program Objectives FY95

- Complete groundwater in situ bioremediation demonstration
- Continue barometric pumping demonstration
- Switch focus to remediation of metals and radionuclides
- Focus efforts on in situ treatment and recovery techniques for americium and plutonium in soils, and uranium and chromium in groundwater
- Complete in-well vapor stripping demonstration

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Commercialization

- Applied Research Assoc. – Heavy-Weight Cone Penetrometer
- Bend Research – Supported Liquid Membrane
- MTR, Inc. – Off-gas Membrane Separations
- Water Development Corp – ResonantSonicSM Drilling
- Beckman Instruments – UFATM
- MIT – Tunable Hybrid Plasma
- SNL/Industry – PAWS
- NoVOC, Inc. – In-Well Vapor Stripping

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FY94 Mid-Year Review

March 8, 1994

Skip Chamberlain
HQ Program Manager

Dan Krivitzky
Field Program Manager

Jennifer Nelson
Integrated Demonstration Coordinator

08/94

To assess, demonstrate, and transfer
technologies and systems that lead to faster,
better, cheaper, and safer **in situ**
characterization, monitoring, remediation
and containment of mixed waste landfills in
arid environments

08/94

Mixed Waste Landfill Integrated Demonstration

Motivation

- "Clean closure" is not practical for most mixed-waste landfills
- Successful closure will require removal of the fastest moving contaminants and containment of the remainder of the contents
- Risk assessments to support the closure include transport properties, contaminant location and speciation as critical data needs
- Vadose zone post-closure monitoring will be required for long-term success of containment strategies

08/94

MWLLID Characterization/Monitoring

Emphasis

- Characterization technologies to determine transport properties, contaminant location and speciation to facilitate risk assessment
- Extending our systems approach to include monitoring to complement our containment program

Method

- Field demonstrate characterization/monitoring technologies

Metric

- Complete Commercialization of technologies to industry/transfer to ER

08/94

MWLID Remediation Technologies

Emphasis

- Extraction or transformation of mobile contaminants
- Containment or stabilization of remaining contaminants

Method

- Field Demonstration and evaluation of remediation technologies

Metric

- Remediation technologies considered in RCRA Corrective Measures Studies and CERCLA Feasibility Studies as a competitor to baseline technologies

108/94

ER CUSTOMERS

MWLID is currently interacting with the following ER customers:

- SNL/ER
- Hanford/ER
- LANL/ER
- Nevada Test Site
- US Air Force
- US Navy
- Defense Environmental Strategic Activity (DESA)

108/94

THE MISSION OF THE MATERIALS WIDE AREA JOURNAL

02/1994

THE MISSION OF THE MATERIALS WIDE AREA JOURNAL

06/1994

Industry Partners

- Argonne National Laboratory
- Brookhaven National Laboratory
- Idaho National Engineering Laboratory
- Lawrence Livermore National Laboratory
- Los Alamos National Laboratory
- Lawrence Berkeley Laboratory
- Pacific Northwest Laboratory
- EPA Environmental Monitoring Systems Laboratory
- US Air Force, Hill & Kirtland Air Force Bases
- US Department of Agriculture-Agriculture Research Station
- US Navy, Naval Civil Engineering Laboratory
- US Naval Research Laboratory
- New Mexico Environment Department
- Advanced Analytical, Inc.
- Campbell Scientific
- Charles Machines Works, Inc.
- Chem-Nuclear Geotech
- ConSolve Inc.
- D. B. Stephens and Associates, Inc.
- Depont
- Geocenters, Inc.
- Golder Associates

- Illinois Institute of Technology Research Institute
- Pfizer
- Raton Technology Research
- Raytheon, Nevada
- Rimtech
- Science and Engineering Associates
- Scitek Corporation
- SHB Agra Inc.
- Spectrace Instruments
- Stolar, Inc.
- Tronier Electronics Laboratory
- United Technologies
- Viking Instruments
- Water Development Corporation
- Westinghouse-Hanford Operations
- Colorado State University
- New Mexico State University
- University of California Santa Barbara
- University of Houston
- University of New Mexico
- University of Washington

108/94

Deep Vadlose Zone Monitoring

08/94

Magnetometer Towed Array

02/18/94

Optimization Sampling Strategy

08/94

Stripping Voltammetry

Adsorptive Stripping Voltammetry

08/94

Hybrid Directional Boring

Cost Savings

Costs can be lowered by a factor of 2 - 6

Savings to DOE Using Hybrid Directional Boring for Applicable Sites

08/94

Hybrid Directional Boring

08/94

- Real time data while the drill process is occurring

08/94

Cross Borehole Imaging

08/94

Post-Closure Monitoring

108/94

X-Ray Fluorescence

108/44

Environmental Decision Support System

A software product designed to:

- Integrate and store all available information/data
- Evaluate this data with process models
- Allow explicit comparison of results with a performance measure

'08/94

Borehole Permeameter

'08/94

108/94

Electrokinetics

108/94

ALCD

08/94

Dry Barriers

Barrier Placement

108/94

In Situ Containment of Buried Waste

Containment and Stabilization of Buried Wastes

108/94

Migration Barrier Covers

08/94

SERDP

The goal of the Strategic Environmental Research & Development Program (SERDP) is to Demonstrate an innovative characterization approach using SitePlanner/Plume that will save time and money when compared to the EPA approved Workplan

08/94

Strategic Environmental Research & Development Plan (SERDP)

Uranium Soils ID

PM: Mike Malone

IDC: Kim Nuhfer

Operations Office: FN
Laboratory Sites: ORNL, LANL, ANL, BNL, LBL, SR,
LLNL, INEL, SNL, PNL
EM-50 Division: DT & E
Principal Customer: EM-40
Application Area: Groundwater and Soils
Joint Participants: EM-40

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Objectives and Scope

Objectives:

- Rapid characterization and mapping of uranium-contaminated sites
- Characterization of uranium forms to determine applicability of decontamination technologies
- Precision excavation with dust control measures
- Soil decontamination for 80 percent or better volume reduction
- Risk-based cleanup criteria and compliance monitoring

Scope:

- Cradle-to-grave systems approach
- Ex situ chemical separations
- Transferring characterization efforts to CMST-IP

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End Point

- **Evaluation of potential technologies**
 - **Performance**
 - **Applicability**
 - **Cost**
- **DOE-wide dissemination of results**
- **Transfer of technologies**
 - **EM-40**
 - **Private industry**

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Interfaces

- **User/Regulatory:**
 - **EM-40 task group membership**
 - **EM-40 joint funding of soil decontamination pilot plant**
 - **EPA participation in regulatory meetings**
 - **EPA program review group membership**
- **Ties to Other Efforts:**
 - **Fernald RI/FS**
 - **BWID for excavation demonstrations**
 - **ISRIP for plant uptake and electrokinetics**
 - **CMSTIP for development of the Beta Scintillation detector and future characterization devices**

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Breakdown of Technologies

MS4-GT-0113- 5

Funding FY94

Characterization Support To Decontamination

TTP	TECHNOLOGY	\$ (K)	PI	INDUSTRY / ACADEMIC PARTNER (Cost Share)
OR121105 Task 3	Mineralogical Characterization	300	S.Y. Lee	University of Tennessee
AL121121 Task 2	Speciation	400	David Morris	None
CH231103	Electron Microscopy	200	Jim Cunnane	None

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Funding FY94 (Continued)

Real-Time Characterization

TTP	TECHNOLOGY	\$ (K)	PI	INDUSTRY/ ACADEMIC/PARTNER (Cost Share)
AL121121 Task 4	LRAD	100	Duncan MacArthur	Eberline
RL321103	Gamma Spectroscopy	150	Alan Schilk	None
Funded by CMST-IP	Beta Scintillation	0	Alan Schilk	None
OR121105 Task 7	Passive Monitors	50	C. S. Dudney	Rad Elec, Inc. Landauer, Inc.
Funded by CMST-IP	LA - ICP - OES	0	Marvin Anderson	None

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Funding FY94 (Continued)

Decontamination

TTP	TECHNOLOGY	\$ (K)	PI	INDUSTRY/ ACADEMIC/PARTNER (Cost Share)
OR121105 Task 1	Carbonate, Citric Acid & Dithionite Extractions	800	Chet Francis	• Oak Ridge Associated Universities • Michigan State University
AL121121 Task 1	Biochelators	400	Jim Brainard	• Hampshire Chemical Co. • Environmental Scientific, Inc.
CH221106	Aqueous Biphasic Separation	525	David Chalko	None
AL121121 Task 3	Heap Leaching	325	Don York	University of New Mexico
ID121103	Bioextraction (Bacteria/Fungi)	155	Gretchen Matthern	None

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Funding FY94 (Continued)

Waste Treatment

TTP	TECHNOLOGY	\$ (K)	PI	INDUSTRY/ ACADEMIC/PARTNER (Cost Share)
OR121105 Task 5	Carbonate, Citric Acid & Dithionite Effluent Treatment	450	Moonis Ally	None
OR121105 Task 6	Bioprecipitation	125	Brenda Folson	None
FN111001	Microwave Dryer	348	Kim Nuhfer	Technical Dryer Corporation
CH341001	Citrate Biodegradation	125	A. J. Francis	None

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Funding FY94 (Continued)

Performance Assessment

TTP	TECHNOLOGY	\$ (K)	PI	INDUSTRY/ ACADEMIC/PARTNER (Cost Share)
OR121105 Task 2	Performance Assessment Support	260	Anthony Armstrong	<ul style="list-style-type: none">• University of Tennessee• Clemson University• Spectra Research, Inc.
SF231003 OR121105 Task 4	Methodology for Determining Cleanup Limits	200	Dave Layton Anthony Armstrong	<ul style="list-style-type: none">• National Radiological Protection Board, UK• SENES Oak Ridge, Inc.
AL231007	Cost/Risk Assessment of Characterization Technologies	550	Paul Kaplan	<ul style="list-style-type: none">• Spectra Research, Inc.• Los Alamos Technical Associates• Oregon State University• U. of California at Berkeley
FN111001	Demonstration Field Support	1412	Kim Nuhfer	None

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Program Funding Profile (\$M)

1990	1991	1992	1993	1994	1995
0	1.0	6.0	8.0	7.2	7.4

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Schedule

▲ Major Test / Demo

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Major Milestones / Deliverables

- 1. Characterization of uranium contamination and soil**
- 2. Develop and demonstrate real-time field screening technologies**
- 3. Conduct lab-scale soil decontamination tests**
- 4. Demonstrate soil decontamination technologies**
- 5. Develop and demonstrate secondary waste treatment technologies**
- 6. Develop a methodology for determining cleanup limits**
- 7. Develop and demonstrate conveyor monitors**
- 8. Demonstrate excavation technologies**
- 9. Characterization of uranium contamination in the "clean" soil**
- 10. ID close-out**

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Benefits

Cost Savings:

- **\$36 million investment**
- **Cost of conventional technology - \$3.5 billion**
- **Cost using improved technology - \$760 million**
- **Potential cost savings at Fernald - \$2.7 billion**
- **Potential cost savings DOE complex - \$7.1 billion**

Performance:

- **80 percent waste volume reduction**
- **Clean productive soils**
- **Real-time site characterization and mapping**

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Benefits (Continued)

Safety/Risk:

- Worker safety/risk
- Characterization of safe uranium residuals (levels and forms)

Regulatory:

- Risk-based methodology to determine cleanup levels
- ARARs tool for accelerated regulatory planning

Industry:

- Improved industry capability (technology transfer)
- Application of mining industry technologies
- Defensible decision support tool

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Program Issues

- Demonstration of technologies at the pilot scale is more expensive than lab-scale efforts. Program will need to discontinue some promising immature lab-scale decontamination efforts, excavations and conveyor monitor development to conduct pilot-scale demonstrations
- DOE complex participation
- Industry technology transfer

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Reference / Documentation

- 12 technical reports
- 23 technical papers
- Proceedings on national workshop involving DOE, DoD, EPA and industry on soil decontamination for radionuclides and heavy metals
- Real-time characterization video

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Accomplishments

- Developed the Integrated Spectroscopic System for Environmental Contaminant Speciation (ISSECS)
 - Commercialization plan
- Completed characterization of untreated soil for ID and FERMCO ER treatability studies
- Applied characterization data for optimization of treatment train
- Field test of real-time field screening devices

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Accomplishments (Continued)

- **Lab-scale treatability test demonstrated applicability of chemical extraction**
 - Carbonate 69 - 148 ppm
 - Citrate 24 - 113 ppm
 - CBD 54 - 144 ppm
 - Sulfuric 72 - 261 ppm
 - Heap 70 - 150 ppm
 - ABS 60 - 200 ppm
 - SEG 118 - 185 ppm
 - TIRON 49 - 136 ppm
 - TIRON-Dithionite 16 - 98 ppm
- **Field test of two real-time characterization devices for conveyor application**
- **Demonstration of two precise excavation technologies in conjunction with BWID**

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Accomplishments (Continued)

- **Conducting pilot-scale soil decontamination tests at Fernald**
 - Carbonate - Reactor kinetics
 - Citrate - Effects of attrition scrubber
 - CBD - Sulfuric
- **Constructed 5 ft. columns for heap leaching tests at LANL**
- **Constructed pilot-scale continuous counter-current ABS System at ANL**
- **Submitted risk-based methodology for determining cleanup levels to EPA for review**
- **Gained UMTRA participation in geostatistical simulations and risk-based decision tools**

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Accomplishments (Continued)

- **Analytical TEM identified an insoluble uranium phase in the soil which ANL is currently modeling as a synthetic final waste form**
- **Completed phytotoxicity test on treated soil**
- **Developed protocols to determine the uranium residual transport risk**
- **EPA solicited ID participation on their team to prepare guidance for conducting treatability test on radionuclide-contaminated soil**

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Future Program Objectives – FY94

- **Demonstrate nine real-time characterization tools**
- **Demonstrate geostatistical approach for optimum in-field characterization**
- **Demonstrate a novel sludge dryer/dewatering technology (microwave dryer)**
- **Demonstrate the gamma sensor in a cone penetrometer**
- **Complete Infiltration Study to identify preferential contaminant flow/distribution in subsurface soil**

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Future Program Objectives – FY94 (Continued)

- **Complete pilot plant soil decontamination batch test**
 - Carbonate – CBD
 - Citrate – Sulfuric
- **Conduct pilot-scale counter current ABS tests**
- **Test flocculents for uranium solution/soil separation**
- **Test BNL process for citric acid effluent treatment**
- **Develop full-scale process flow diagrams and cost estimates for decontamination systems implementation**

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Future Program Objectives – FY95

- **Pilot-scale test of soil decontamination**
 - DOE labs technologies
 - Private industry technologies
- **Pilot-scale test of waste treatment**
- **Determine risk of uranium residual in soils**
- **Initiate full system cost/benefit analysis**
- **Complete cost/benefit analysis of characterization technologies**

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Commercialization

Characterization Technologies:

- ISSECS – Commercialization plan
- LRAD – Eberline
- Passive Monitors – Rad Elec, Inc. (CRADA)
– Landauer, Inc. (CRADA)
- Geostatistics – UMTRA
 - Intergraph
 - Restoration consultants
 - Petroleum industry

Excavation Technologies:

- Private industry owned

Soil Washing / Waste Treatment:

- Fernald and other DOE sites
- Mining industry
- Soil washing/restoration industry

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Characterization, Monitoring, and Sensor Technology – Integrated Program

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Additional Advisory Members:

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Joint Participants

EM-40, EM-30

**Argonne National Laboratory
Los Alamos National Laboratory
Lawrence Livermore National Laboratory
Pacific National Laboratory
Special Technologies Laboratory-EG&G
Inhalation Toxicology Research Institute
Oak Ridge National Laboratory
Idaho Engineering Laboratory-EG&G
National Security Agency
University of CA, Berkeley
University of Vermont
Tufts University
Florida State University
University of Washington
University of CA, Santa Barbara
Babcock and Wilcox Nuclear Service
Environmental and Energy Associates
Clean Air Engineering
Mattson Instrument Co.
Coleman Research Corp.
AGEX Consulting**

**Lawrence Berkeley Laboratory
Remote Sensing Laboratory
Ames Laboratory
U.S. EPA
U.S. Geological Survey
Grand Junction Project Office
U.S. Army
NASA
Westinghouse Hanford Co.
Night Vision Laboratory
Purdue University
Iowa State University
New Mexico State University
Columbia University
University of Arizona
University of Colorado
Motorola Corp.
Microfabrication Applications
Infrared Analysis
Applied Scientific Associates
EIC Laboratories, Inc.
ARA**

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Scope

Cross-cutting Integrated Program:

- **Monitors and sensors for D&D, site characterization, waste characterization, waste processing, site remediation, and post-closure site monitoring**
- **RDDT&E of innovative, emerging or re-engineered technologies**
- **Sampling strategies, DQOs, analytical methods, modeling, simulations**
- **Central POC for baseline technology, in-progress technology development, characterization requirements, and technology development needs for characterization technologies applied to EM problems**
- **Develop technologies that can be deployed across the DOE complex**

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Objectives

- **Facilitate the acceptance of improved characterization technologies and methods**
- **Coordinate and communicate with the primary stakeholders in EM**
- **Leverage DOE funds for use with other government agencies, to accomplish similar objectives**
- **Establish communication links with other government agencies, industry, academia, etc.**
- **Conduct focused R&D programs that will provide substantial return on investment**
- **Promote partnerships between the laboratories and industry**
- **Implement cross-cutting development projects which benefit overall EM program**
- **Serve as central source of information for characterization performance specifications**
- **Assist focus area teams in defining their technical requirements for characterization**

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End Point (Define Success)

- Transfer to and subsequent use of successful technologies by EM-30, EM-40, EM-60, industry, and other government agencies
- High percentage of successful technology demonstrations so that return on investment of overall program remains high
- Total dollars to industry and number of national laboratory partnerships with industry fostered by the program

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Characterization, Monitoring, and Sensor Technology-Integrated Program

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Projected Funding

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Schedule

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User/Regulatory Interface

- **EM-30**
- **EM-40**
- **EM-60**
- **All EM-55 Programs**
- **EPA-HQ**
- **10 Regional EPA Offices**
- **EPA-empowered, state agencies**
(e.g., Texas Natural Resources Conservation Commission)

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Ties to Other Efforts

- **EPA Superfund Program**
- **EPA SITE Program**
- **Technology Reinvestment Project**
- **Western Governors Association**
- **Environmental Molecular Science Laboratory**
- **Diagnostic Instruments Analysis Laboratory**
- **USDA Commodity Credit Corporation**
- **DoD**
- **NASA**
- **Site Mixed Waste Treatment Plans (FFCA-1992)**
- **Russian Academy of Science and MINATOM**

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Commercialization

Industry:

- Projects range from applied R&D to commercialized product

Technology transfer:

- Eberline Instruments has manufactured ten commercial electrometer alpha detection devices
- Funding LLNL (via a CRADA) to transfer hardware, software and troubleshooting expertise to RlmTech for Electric Resistivity Tomography
- Working with most PIs regarding market analysis and commercialization plans for demonstrated technologies
- Foster partnerships between national laboratories and industry on many TTPs (e.g., ESC at DOE sites)

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Program Funding Profile (\$M)

FY 1990	FY 1991	FY 1992	FY 1993	FY 1994	FY 1995
0	1.0	6.1	9.1	21.6	21.4

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Funding FY94

Containment Identification and Localization

TFP	Technology	\$ (K)	PI	Industry/Academic/Partner (Cost-Share)
AL131004	Multispectral Neutron Logging	474	John Conway	Environmental Measurements Corp.
AL131001	Multispectral Neutron Logging	423	Dave George	U.S. Geological Survey
AL131006	Chlorinated and Aromatic Hydrocarbon Thin Film Sensors	486	Dequan Li	U.C. Berkeley, Motorola
AL131007	Air Quality Boundary Monitoring for VOCs	274	Phil Hemberger	Purdue University
AL141008	Raman Probe Radiation Study	190	Bob Deneboe	None
AL141008	In Situ RT-RA Metals Analysis	480	Aaron Kaskela	PerkinElmer Corp.
AL141007	Air Monitoring for Alpha-emitting Contaminants	185	Duncan McArthur	Sterling Instruments Corp.
AL231104	Portable Acoustic Wave Sensor	430	Greg Frye	Regulating Contract
AL241009	Miniaturized Chemical Flow Probe Sensor Development	300	George Laguna	CPAC
CH101103	Improvements in Inductively-Coupled Plasma Mass Spectroscopy	102	Robert Houk	None
CH131005	Aerosol Integration	1777	Al Bevale	Numerous
CH141001	LA-ICP-AES Using a High Resolution Fiber Optic Interferometer	295	Art D'Silva	None
CH231004	Expedited Site Characterization - Application to Federal Facilities	837	Jeanelle Burton	Numerous
CH231006	Cone Penetrometer Support: Op., Maint., and R&D on the OTD Vehicle	1037	John Walker	Applied Research Associates
CH241001	Development of Screening and Quantitative Field Methods	375	Paul Dankey	Texas University
ID121110	SIMS Analysis: Development and Evaluation	490	Jim Dalmore	None
NY001102	Mult- and Hyper-Spectral Scanning, Laser Fluorescence, and GIS Development	1040	Larry Timney, John DeBenedetto, Joe Zamudio	University of Santa Barbara, Ocean Optics
OR111103	Direct Sampling Ion Trap Mass Spectrometry Instrumentation	633	Marcus Wine	Two Potential Companies
OR141004	Arrayed Sampler for Collection of Vadose Zone VOCs	171	Roger Jemline	None
OR141005	Airborne Miniature Platform: Surveys and Guidance	200	John Nyquist	Brighton Young University, University of Tennessee
RL331007	Direct Measurement of Sr-90 and U-238 in Soils on a Real-Time Basis	376	Alan Schlich	Sieron, Inc.
RL341009	International Environmental Assessment	692	Don Bradley	None
WR141005	Characterization & Monitoring Support for BRW	400	Carol Kady-Dink	None

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Objectives for Contaminant Identification, Localization and Quantification

- Demonstrate, promote, and tech transfer of the Expedited Site Characterization (ESC) Methodology
- Development and systems integration of real-time sensors for the Cone Penetrometer and other deployment platforms
- Continued development and demonstration of airborne remote sensing technologies
- Continued development and demonstration of field-deployable chemical analysis instrumentation for site characterization, D&D, and other EM operations

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Milestones/Deliverables-FY94 Contaminant Identification, Localization and Qualification

- Demonstrate ANL's Expedited Site Characterization Methodology at the Pantex site
- Demonstrate person-portable laser-induced fluorescence system for detecting uranium on surfaces for D&D at Oak Ridge
- Determine expected contaminant concentration sensitivities for a pulsed multispectral neutron logging system
- Deliver five volume set detailing the baseline chemical sensor technology, R&D in this area: where is it and what is being developed, and more
- Evaluation of remote chemical sensor technologies under a joint agency (DoD/DOE) coordinated project
- Demonstration of airborne multispectral scanning for contaminant identification
- Demonstration of chemical sensor system to work with a laser radar 3D mapping system for surface contaminant identification

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Funding FY94

Waste Monitors

TTP	Technology	\$/Q	PI	Industry/Academic/Partner (Cost-Share)
CH131001	Infrared Analysis of Waste (FTIR-PAS and TIRS)	347	John McClelland	Accurate, Inc.; Balstone Bio-Rd.; Bomem; Kilian
CH131004	Sensing Head Space Gases and Continuous in situ Monitoring	652	Glenn Bartians	None
CH221202	Continuous Emission Monitoring of Incinerators	506	Jack Demirgian	Clean Air Engineering Infrared Analysis Inc.
CH231001	Technology Performance Specifications OTD Developed Technologies	242	Mitch Erikson	None
OR121111	Problem-Directed Rapid Chemical Characterization	129	Roger Jenkins	None
OR121112	Sensor Characterization Support (HZWP)	603	Fred Hencker	AGEX Consulting
RL341003	TRU and Moisture Measurements in HLW Tanks by Neutron Activation	300	Ron Brodzinski	None
RL341005	Imaging Through Obscuration for Sluicing	175	Tim Peters	None
RL341007	Laser Ablation Mass Spectrometry Scanning of Waste Tank Core Sample	425	Steve Colson	None
RL341008	Electromagnetic Moisture Measurement in Single Shell Tank Waste	475	Ron Hockey	Halliburton Logging Services
RL441001	Cone Penetrometer for In Situ Waste Tank Characterization	500	Leonard Bunes	None
SF231004	Multi-analyte, Single Fiber Optical Sensor	505	Fred Miknovich	Tufts University, University of Cal. Berkeley, Hybridown Facility
SR141005	Sol-Gel Indication Program	150	George Wicks	None
SR141006 (not in PINPLAN)	In-Tank Interface Detection Using Time Domain Reflectometry		H.R. Tilley	None
NV021701	Associated Particle Imaging	1571	Paul Hurley	University of California, Santa Barbara

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Objectives for Waste Monitors

- **Develop monitors for optimization of thermal treatment systems for mixed low level waste**
- **Develop continuous off-gas monitors**
- **Develop characterization technologies for the safe and efficient retrieval and processing of high level waste**
- **Characterization for assigning and sorting waste streams for appropriate waste processing**

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Milestones/Deliverables-FY94 Waste Monitors

- **Demonstrate the ability to place and read 12 individual sensors on a single optic fiber terminus**
- **Measurement of plasma torch temperature and chemical speciation in plasma off-gas**
- **Identify the feasibility of measuring moisture in UST via electromagnetic sensor**
- **Identification of contaminant concentration and total amount in containers of waste for NDA technologies**
- **Issue joint EPA/DOE document on status of characterization technologies for mixed waste process streams**

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Funding FY94

Geophysical Site Characterization

TTP	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
SF141001	Analog Site for Characterization of Fractured Rock	75	Jane Long	None
SF141002	Contaminant Transport Modeling Studies of Russian Sites	350	Chin-Fu Tsang	Russian Academy of Sciences
AL241002	Crosswell Compressional/Shear Wave Seismic Tomography	238	Greg Elbrink	None
AL241010	TDR and Fiber Optic Probes for the Cone Penetrometer	330	Robert Knowlton	Geo Centers (\$?)
AL932803	Geophysical Test Range at Rabbit Valley	487	Jim Allen	None
AL941001	3D/3 Component Seismic	310	Jim Haabrouck	Resolution Resources, Inc
CH131002	Zero Tension Lychneters	170	Michael Thompson	Iowa State University
SF241002	Electrical Resistivity Tomography	470	Bill Daily	RimTech

Data Integration and Visualization and Sampling Strategies

TTP	Technology	\$(K)	PI	Industry/Academic/Partner (Cost-Share)
RL341006	Data Fusion	190	Stan Tomich	Coleman Research Corp.

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Benefits

Regulatory - Develop sensors and monitors to assist DOE in complying with:

- Clean Air Act
- Federal Facilities Compliance Act-1992
- Superfund Reauthorization
- Schedule for Records of Decision for DOE sites
- Interagency (e.g., Tri-Party) Agreements

Industry:

- Many technologies developed by DOE are applicable throughout US
- Commercialization plans under development by using Technology Transfer experts to assist individual principal investigators
- Developing technologies that U.S. industries can utilize to capture global environmental markets

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Program Issues

- **How does one make decisions on appropriate technology development projects in light of such critical issues as lack of waste acceptance criteria, transportation ban, undefined de minimis levels, and conflict regulations?**
- **Demonstrating technologies on DOE sites can take an inordinate amount of time. How can advanced technology demonstrations be expedited? (e.g., sensors put into UST in 6 months, not 18 months)**
- **How can we insure that sites requiring characterization and facilities managing waste remain open to the use of advanced technologies?**
- **What are the specific performance indicators our customers and stakeholders want?**

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Reference/Documentation

- **CMST-IP Fact Sheet**
- **FY95 Needs Statement**
- **Status of Chemical Sensor Development (HAZWRAP, 5 vol. set)**
- **Report on Geophysical Sensors and Their Costs**
- **Over 20, two-page Technology Data Sheets**
- **Characterization Focus Group – FY94 Strategic Plan**
- **CMST-IP FY94 Mid-year Review Program Summary Booklet, and Presentation**
- **Non-invasive Site Characterization and Remote Sensing Workshops documents**
- **Numerous Technical Reports from Ames Laboratory**

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In Situ Remediation Technology Development Integrated Program

Program Manager: **Jef Walker, U.S. Department of
Energy (301) 903-7966**

**Integrated Program
Coordinator:** **Mary Peterson, Pacific Northwest
Laboratory (509) 372-4655**

**Mid-Year Review
Gaithersburg, Maryland
March 8-9, 1994**

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In Situ Remediation Integrated Program Objective

- **Develop and deliver innovative in situ remediation technologies**
- **Maximize the applicability of in situ technologies to multiple end users**
- **Expand the applicability of available technologies**

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In Situ Remediation Integrated Program *Approach*

- **Facilitate linkages between the technology development activities, the end users, and industry**
- **Leverage investment in R&D with other federal agencies and industry**
- **Define needs and identify opportunities for in situ technologies**
- **Evaluate new, emerging, and existing technologies and design in situ remediation technology systems**
- **Promote early interactions with the regulators and stakeholders to incorporate their needs into the technology development activities**
- **Broadly and rapidly communicate technical data and results**

M04-GT-0130- 3

In Situ Remediation Integrated Program *Scope*

- **Remediation technologies will be developed to focus on current and future needs/applications**
 - **Contaminated groundwater**
 - **Contaminated soils**
 - **Uncontained landfills**
 - **Underground storage tanks (containment systems only)**
- **Technologies applicable to organics, inorganics, metals, and radionuclides**

M04-GT-0130- 4

In Situ Remediation Integrated Program

Vision

Develop promising technologies to a point where the technology can be reliably evaluated for demonstration. The information from this program will be developed in such a manner that it is not site specific but can be utilized by all sites in support of RCRA, CERCLA, and NEPA activities

M04-GT-0130- 5

In Situ Remediation Integrated Program

Customer Needs/Window of Opportunity

To capitalize on the significant cost, schedule, and performance impact, development of in situ remediation technologies must be completed by 1997

M04-GT-0130- 6

In Situ Remediation Integrated Program *Interfaces*

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In Situ Remediation Integrated Program *User/Regulatory Interfaces*

- Integrated Demonstrations
 - VOC in Non-Arid Soils
 - VOC in Arid Soils
 - Mixed Waste Landfill
 - Buried Waste
 - Underground Storage Tanks
 - U in Soils
- EM-30
 - Hanford Site
- EM-40
 - Paducah Site
 - Savannah River Site
 - Hanford Site
 - Portsmouth Site
 - Fernald Site
 - Monticello Uranium Mill Waste Site
 - Kansas City Site
- Other
 - Industry
 - Resource Recovery
 - NASA
 - American Petroleum Institute

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In Situ Remediation Integrated Program

Linkages to Other Research and Development Activities

- Efficient Separations and Processing Integrated Program
- Characterization, Monitoring, and Sensor Technology Integrated Program
- Industry—Monsanto, DuPont, General Electric, Gas Research Institute, BP, numerous others
- International Technology Exchange Program
- PRDA, SBIR, and ROA Activities
- EPA's Hazardous Substance Research Center

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In Situ Remediation Integrated Program

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In Situ Remediation Integrated Program *Funding by Program Areas*

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In Situ Remediation Integrated Program *Funding Allocations*

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In Situ Remediation Integrated Program *ISR IP Funding Profile*

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In Situ Remediation Integrated Program *Cost/Schedule Performance (from PTS)*

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In Situ Remediation Integrated Program

FY 1994 Major Milestones/Deliverables

Treatment Technologies:

- **Initiate field testing for electrokinetic remediation of heavy metals in unsaturated soil at SNL – 7/94. Issue final technical report – 9/94**
- **Complete proof-of-concept studies to determine the applicability of foams for the remediation of NAPLS – 9/94**
- **Complete treatability studies to evaluate the applicability of electrokinetics to uranium-contaminated soils – 9/94**
- **Under the DOE/API cooperative agreement, complete technology focus papers for remediating DNAPLs – 4/94. Initiate a field test – 9/94. Complete the laboratory evaluation of the chemical oxidation of organics in soils – 9/94**
- **Complete pilot-scale experiments using recirculation wells and treatment modules to remediate groundwater contaminated with organics, metals, and radionuclides – 9/94**

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In Situ Remediation Integrated Program

FY 1994 Major Milestones/Deliverables

Treatment Technologies (Continued):

- **Complete R&D of the in situ corona technology to prepare the technology for field demonstration by FY 1996**
- **Initiate a field test of the in situ redox manipulation technology to test different reagents for their efficiency in manipulating the redox conditions of an unconfined aquifer – 10/94**
- **Complete the evaluation of depth enhancement and methods to melt low alkalinity soils using the in situ vitrification technology – 7/94**
- **Complete laboratory treatability studies on using in situ chemical treatment for remediating chromium- and uranium-contaminated soils – 9/94. Transfer the technology to the mixed waste landfill integrated demonstration for demonstration in FY 1995 – 9/94**
- **Complete field test on the electrokinetics technology for removing mercury from SRS soil – 7/94**

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In Situ Remediation Integrated Program

FY 1994 Major Milestones/Deliverables

Containment Technologies:

- Complete development and evaluation of two flowable grout techniques and transfer to the end users for demonstration. Issue final technical report – 9/94
- Complete development and evaluation of permeable treatment barriers and transfer to the end users for demonstration. Issue final technical reports – 9/94
- Complete laboratory studies evaluating the applicability of frozen soil barriers to arid sites – 7/94
- Complete barrier material and emplacement testing for hydraulic and diffusion barriers and transfer to the end users for demonstration. Issue final technical report – 5/94

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In Situ Remediation Integrated Program

FY 1994 Major Milestones/Deliverables

Containment Technologies (Continued):

- Initiate field testing of a horizontal barrier emplacement technology at Fernald - 5/94. Issue final technical report – 7/94
- Complete field tests to evaluate the cryocell frozen soil barrier technology for containing hazardous contaminants in non-arid soils. Issue final report on field experiments – 5/94
- Complete the laboratory and large-scale evaluation of viscous liquids as a subsurface barrier – 9/94. Transfer the technology to a field demonstration in FY 1995

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In Situ Remediation Integrated Program

FY 1994 Major Milestones/Deliverables

Bioremediation:

- **Publish, in journals, the results of R&D focusing on techniques for delivery and mixing of reagents for in situ bioremediation – 6/94. Participate in a field demonstration with the VOC Arid ID to evaluate these techniques – 9/94**
- **Complete bench-scale tests on the removal of uranium from aqueous streams using biosorption and transfer the technology to the end user for field testing – 9/94**
- **Complete technical report on the effectiveness of green plants for removing metals from soil and aqueous streams and demonstrate the Ukrainian Fractionation Separation Technology for concentrating and recovering the metals – 5/94**
- **Complete field test of the in situ microbial filter – 9/94**

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In Situ Remediation Integrated Program

Accomplishments

- **A suite of in situ remediation technologies is being developed**
- **Technology development teams have been established with industry. Industry is participating in R&D activities and in field tests at DOE sites**
- **A technical review of all projects has been completed. Comments will be transmitted to the principal investigators for use in revising the current work scope or developing FY95 work plans**

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In Situ Remediation Integrated Program *Accomplishments (Continued)*

- Approximately 10 technologies will be transferred to the integrated demonstrations, EM-40, or EM-30 in FY 1995
- The ISR IP is a major player, along with industry and EPA, in the Remediation Technology Development Forum. The objective of the Forum is advancing in situ technologies
- International technologies are being evaluated for their application at DOE sites
- R&D activities for in situ technologies from the PRDA, ROA, and SBIR solicitation are being integrated into the ISR IP and linked with the end users

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In Situ Remediation Integrated Program *Benefits of In Situ Remediation Technologies*

- Reduce remediation costs by eliminating excavation and reducing the time required for remediation
- Minimize costs and liability for offsite disposal
- Reduce health/safety risks to workers and the public by reducing contact exposure
- Enable treatment of contaminated media beneath existing buildings and structures
- Permit remediation of the deep subsurface where excavation and treatment would not be practical
- Provide remedial alternatives that will replace the currently ineffective and costly baseline technologies such as pump and treat

Throughout the U.S., industry is turning toward in situ technologies for remediating its contaminated sites

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In Situ Remediation Integrated Program

Year in Which Technology Ready for Demonstration

Treatment Technologies	Fiscal Years		
	1994	1995	1996
Electrokinetics Migration at TNX Basin	X		
Electrokinetic Remediation of Heavy Metals	X		
Chemical Barriers	X		
DNAPL Remediation in Low Permeability Soils	X		
Optimal Remedial Design for Groundwater Remediation	X		
In Situ Vitrification		X	
In Situ Redox Manipulation		X	
Electrokinetics in Uranium-Contaminated Soils		X	
In Situ Chemical Oxidation in Soils		X	
In Situ Corona		X	
In Situ Chemical Treatment		X	
In Situ Magnetic Separation		X	
NAPL Remediation Using Foams			X
In Situ Treatment of Mixed Contaminants			X

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In Situ Remediation Integrated Program

Year in Which Technology Ready for Demonstration

Bioremediation Technologies	Fiscal Years		
	1994	1995	1996
Co-Metabolic Techniques	X		
Optimization of In Situ Bioremediation	X		
Bioremediation of PCBs	X		
In Situ Microbial Filters		X	
Biosorption of Uranium		X	
Biomass Remediation Systems		X	
Bioremediation of Mixed Chlorinated Solvents			X

Containment Technologies	Fiscal Years		
	1994	1995	1996
Cryocell Technology	X		
Flowable Grout Techniques	X		
Hydraulic and Diffusion Barriers	X		
Horizontal Grout Barriers	X		
Chemically Enhanced Barriers	X		
Water Permeable Reactive Barriers		X	
Frozen Soil Barriers for Arid Sites		X	
Viscous Liquid Barriers		X	

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In Situ Remediation Integrated Program

Reference/Documentation

- DOE/EM-0108P, "EM-54 Technology Development In Situ Remediation Integrated Program, FY 1993 Report," National Technical Information Service, U.S. Department of Commerce, Springfield, VA 22161
- Program Plans for in situ physical/chemical treatment technologies, containment technologies, bioremediation, and subsurface manipulation which describe the state-of-the-art for these areas and the research requirements
- Bibliography of all publications to date for ISR IP activities
- ISR IP Fact Sheet

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In Situ Remediation Integrated Program

Program Issues

- Development of in situ remediation requires field testing in order to evaluate the technology in actual subsurface environments
- Regulatory requirements for the field testing activities are not well defined and can change significantly
- Enabling technologies such as monitoring and sensor technologies and emplacement technologies are critical to the development and deployment of in situ technologies. Concurrent development is required so that an in situ remediation system is available
- The selection of in situ remediation technologies will require incentives so that end users are encouraged to include new, innovative technologies in their treatability studies

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In Situ Remediation Integrated Program ***R&D Areas of Emphasis in FY 1995***

- **R&D activities will be increased for the treatment of DNAPLs**
- **Research in bioremediation will focus on:**
 - 1) **methods to increase the bioavailability of contaminants or to increase the rates and efficiency of biodegradation;**
 - 2) **development of the technology to enable the treatment of mixtures of chlorinated solvents;**
 - 3) **advancing bioremediation to enable treatment of heavy metals and radionuclides; and**
 - 4) **methods to measure and detect biodegradation**
- **Activities to establish subsurface barriers will continue, with a major emphasis on the emplacement and monitoring of barrier performance. Teaming with end users to conduct field tests and demonstrate the technologies will be a high priority**
- **Emphasis will be placed on participating with end users in field testing approximately 15 treatment, bioremediation, and containment technologies**

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In Situ Remediation Integrated Program ***Moving New Technologies Forward***

- **Program is growing rapidly to meet the needs of the Integrated Demonstrations, Environmental Restoration, and Waste Management**
- **Three technologies have been field tested**
- **At least 15 technologies are expected to be ready for demonstration by FY 1995**
- **Early research will foster the success of new technologies**
- **Regulatory input is being sought as new technologies are developed**
- **ID/ER/WM linkages are being established and the ISR IP continues to solicit input for specific applications**

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In Situ Remediation Integrated Program

Industrial Participants:
B&W Nuclear Technologies
Barrier Member Containment, Inc.
Bechtel Co.
BP America
Bradtec-U.S., Inc.
DuPont
Easch Environmental
Envirogen, Inc.
Environmental Systems & Technologies
Gas Research Institute/Illinois Institute of Gas
Technology
Golden Federal Services, Inc.
Halliburton NUS
Harbor Branch Oceanographic Institute/MPI
Incon Corporation
K-Tech, Inc.
Mantech, Inc.
MTI
Opden Environmental and Energy Services, Inc.
RUST Environment and Infrastructure
Set-Umat, Inc.

ISRI IP Funded Projects:
Argonne National Laboratory
Brookhaven National Laboratory
FERMCO
Lawrence Berkeley Laboratory
Lawrence Livermore National Laboratory
Martin Marietta Energy Systems
MSE, Inc.
Oak Ridge National Laboratory
Pacific Northwest Laboratory
RUST Geotech
Sandia National Laboratory
Westinghouse Hanford Company
Westinghouse Savannah River Company

ISRI IP Universities:
Michigan State University - Lansing
MIT
Oregon Graduate Institute - Portland
Stanford University
Texas A&M
University of Cincinnati
University of Texas - Austin
University of Houston
University of North Carolina - Chapel Hill
University of Vermont
University of Tennessee - Knoxville
Washington State University - Pullman

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In Situ Remediation Integrated Program *Interfaces Example*

In Situ Magnetic Separation

M94-GT-0136- 30

Minimum Additive Waste Stabilization (MAWS) Program

Program Manager: Grace C. Ordaz

Operations Offices: Headquarters

Demonstration Sites: Fernald

Office of Technology

Development: R&D Division

Customers: All DOE Sites, other Federal Agencies,
private industry

Application Areas: Characterization, Treatment, and Disposal of
Radioactive and Mixed Wastes

Joint Participants: Office of Environmental Restoration, Catholic
University of America, GTS Duratek,
Lockheed Env. Serv. Co., Argonne National
Lab., FERMCO, MSE Inc., Retech Inc.

M94-GT-0099- 1

MAWS

Minimum Additive Waste Stabilization

Utilizes waste streams as substitutes for necessary stabilization additives to produce a stable, high quality waste form. MAWS results in the minimum waste volume for disposal.

M94-GT-0099- 2

Objectives and Goals

Objectives:

- **Provide cost-effective and environmentally sound stabilization technology systems that are required to remediate radioactive and mixed waste through utilization of the MAWS concepts**

Goals:

- **Identify, develop, and demonstrate innovative technologies that are required to remediate various types of wastes**
- **Focus on the development of technologies that will produce environmentally sound final waste forms, and minimize the production of secondary waste streams**
- **Validate the cost-effectiveness of the developed technology systems through life cycle cost analyses**
- **Encourage the partnership of universities, industries, and national labs, and promote technology transfer to the users both within and outside of DOE**

M94-GT-0099- 3

Scope

- **Materials science studies**
- **Technology development of safe, cost-effective, and environmentally sound systems**
- **Environmental assessment of waste form performance**
- **Life cycle cost analysis**
- **Technology transfer to sites and private industry**

M94-GT-0099- 4

End Point

- **Implement the developed technology at DOE sites, resulting in minimized waste volumes for disposal**
- **Achieve significant savings over baseline treatment approaches focused on individual waste streams in the DOE-wide effort to clean up the legacy of radioactive and mixed wastes**
- **Achieve regulatory compliance using developed technologies**
- **Transfer developed technologies to private sector for commercialization**

M94-GT-0099- 5

Customer Needs/Window of Opportunity

- **Significant sources of inorganic glass-making wastes have been identified at major DOE sites that would be good candidates for MAWS treatment approaches**
- **MAWS concepts are not technology dependent, therefore an evolutionary approach may be pursued to phase in MAWS with ongoing or planned stabilization processes. This implies that a broad window of opportunity exists for many identified waste streams for which MAWS concepts can be considered**
- **Opportunities exist with many environmental waste streams for which the Record of Decision dates will occur through the year 2000**

M94-GT-0099- 6

MAWS Interfaces

User Interface:

- Office of Environmental Restoration
- Office of Waste Management
- Department of Defense (DoD)
- Private Industry

Stakeholder Interface:

- Environmental Protection Agency (EPA)
- States
- Public/Citizen Groups

Ties to Other Efforts:

- Mixed Waste Focus Group
- Tank Waste Focus Group
- DoD (i.e., Defense Logistics Agency, U.S. Army)

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Minimum Additive Waste Stabilization (MAWS) Program

M94-GT-0099- 8

Fernald Demonstration Flow Diagram

M94-GT-0099- 9

Integrated Waste Management (IWM)

M94-GT-0099- 10

Benefits

Cost/Savings:

- Minimum of \$100 M savings is expected over cementation baseline scenario for treatment of Fernald OU-1 wastes and soils
- High waste loading results in significant volume reduction which translates directly into cost savings compared to cementation and other treatment technologies for low-level and mixed wastes

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Benefits (Continued)

Performance:

- Systems approach minimizes secondary waste streams
- Waste loadings of up to 94 weight percent contaminated soils and sludges have been achieved, which substantially reduces additive needs
- Production of high integrity/quality waste forms

Safety/Risk:

- Glass and glassy slags are environmentally low-risk waste forms that retain toxic metals and radionuclides
- Organic waste components are effectively destroyed

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Benefits (Continued)

Stakeholder:

- **Quality final waste forms provide faster and easier stakeholder acceptance**
- **Enables earlier regulatory compliance for mixed wastes**
- **Current Tri-Party Agreement at Hanford specifies vitrification for treatment of low-level tank wastes**

Industry:

- **Private industry is involved in technology development and demonstrations providing ready transfer and economic stimulation**
- **Technology can be applied to industrial waste streams to generate usable products**

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Program Funding Profile

\$(M)

	FY90	FY91	FY92	FY93	FY94	FY95
EM-50	0.0	0.0	2.4	1.6	2.0	5.7
EM-40	0.0	0.0	1.4	2.6	0.0	0.0
TOTAL	0.0	0.0	3.8	4.2	2.0 *	5.7 **

***Fernald demo concluded in FY94**

****WGA demo expected to begin in FY95**

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Funding FY 94 MAWS Program

<u>TTP</u>	<u>Technology</u>	<u>\$(K)</u>	<u>PI</u>	<u>Industry/Academic/Partner (Cost Share)</u>
CH244109	High Temperature Melter Systems Evaluation	1440	I. Pegg	Catholic U. of America/GTS Duratek
CH231008	Glassy Slag Compositional Envelope Study	380	X. Feng	Argonne National Lab
PE021105	Plasma Melter Technology	60	D. Battleson	MSE, Inc.

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FY94 Program Objectives

- **Demonstrate the MAWS technology system on actual radioactive soils and sludges at Fernald. Generate sufficient data to support continued testing at a larger pilot or commercial scale**
- **Expand the compositional envelopes for both glass and glassy slag acceptable waste forms using actual wastes from Hanford, Oak Ridge, and Idaho National Engineering Laboratory (INEL), and thereby provide initial MAWS applicability feasibility studies**
- **Develop melter technology to support compositional envelope studies, which may require higher temperatures or expanded capabilities in generating glass and glassy slag waste forms**
- **Perform preliminary cost/benefit analyses and life cycle cost analyses, where feasible**
- **Continue waste form validation studies to insure quality and integrity of glass, slags, ceramics, etc., generated from various studies**

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Future Program Objectives – FY95 and Beyond

- **Begin integrated demonstration of MAWS technology at selected WGA site(s)**
- **Demonstrate high-temperature melter capabilities at a pilot scale on actual wastes**
- **Pursue technology transfer of MAWS approach to DoD and industry waste streams**
- **Develop waste-form assessments, models, and criteria**
- **Continue and complete compositional envelope studies**
- **Continue cost analyses where appropriate**

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Schedule

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Major Milestones/Deliverables

- 1. Complete Phase II Fernald demonstration objectives and provide input to Nov. '94 ROD**
- 2. Complete glass compositional envelope definition and feasibility studies for major waste streams from three sites**
- 3. Complete plasma centrifugal furnace evaluations on high metals feeds**
- 4. Complete evaluation of other innovative high-temperature melter technologies and select one for pilot-scale demonstration**
- 5. Complete glassy slag compositional envelope definition and feasibility studies for major waste streams from two sites**
- 6. Complete life cycle cost analyses on Fernald demonstration**
- 7. Initiate field demonstration of new technology**
- 8. Complete WGA demonstration of MAWS technology at a Western site**

MD4-GT-0099- 19

Accomplishments

- Bench-scale 10 kg/d and 100 kg/d melters have produced acceptable fluoride glasses with actual Fernald OU-1 waste sludges and soils**
- A 300 kg/d Joule-heated melter system has been constructed at Fernald and successfully completed fluoride surrogate runs. Radioactive runs are scheduled this month**
- Soil washing has been developed at the bench scale and is now operating on site to process 100 yd³ of soil for the vitrification tests scheduled with the melter**

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Accomplishments (Continued)

- Waste loadings of up to 94 weight percent as soils and sludges have been achieved with acceptable glass processability and durability
- Glasses produced with Fernald wastes have met or exceeded Toxicity Characteristic Leaching Procedure (TCLP) criteria and PCT standards for High Level Waste (HLW) glasses
- MAWS has been selected as one of the technologies to be promoted under the Western Governor's Association Demonstration of Innovative Technology (DOIT) committee
- A plasma centrifugal furnace has successfully been tested at the bench scale for producing glassy slag waste forms with up to 70 percent metals loading, which pass TCLP tests

M94-GT-0099- 21

Commercialization

The MAWS program entails extensive collaboration between universities, industries, and national labs. This combines the best of both worlds, which takes basic research to mature technology application

University:

- Catholic University of America is providing glass materials science studies and participating in Joule-heated melter development

Industry:

- GTS Duratek and Lockheed Environmental Systems Corp. have developed melter and soil washing capabilities, respectively, for initial demonstration of MAWS at Fernald
- GTS Duratek has won a contract to treat mixed waste sludge at Savannah River, which will employ melter technology developed under this program

National Lab:

- Argonne analytical expertise provided valuable information to validate the waste form, which enables acceptance of the technology

M94-GT-0099- 22

Commercialization (Continued)

Technology Transfer:

- Evaluations are beginning with the DoD for treatment/disposal of significant quantities of radioactive waste

M94-GT-0099- 23

Program Issues

- Cooperation amongst stakeholders in setting mutual objectives and goals
- Not-invented-here syndrome
- More complete site-wide waste characterization data is required for assessment of MAWS potentials and specific technology development needs
- Waste disposal criteria for radioactive and mixed wastes need to be clearly defined for various sites in conjunction with all stakeholders
- Slow procurement process impacts progress

M94-GT-0099- 24

Reference/Documentation

- **Minimum Additive Waste Stabilization (MAWS) Technology Summary**
- **Minimum Additive Waste Stabilization Fact Sheet**
- **FY95 MAWS Program Needs Statement**
- **Minimum Additive Waste Stabilization Strategic Plan**
- **Development and Testing of the MAWS System for Fernald Wastes – Phase I Report**
- **Long Range Plan for MAWS Technology Development**
- **MAWS Technology – Scoping Cost Savings Analysis – Letter Report**
- **Minimum Additive Waste Stabilization – Soil Washing Report**
- **Operable Unit 1 MAWS Remedial Design Bench Scale Treatability Study Work Plan – Volumes 1 and 2**

M94-GT-0099- 25

Conclusions

- **MAWS makes sense both economically and environmentally**
- **DOE has large quantities of wastes amenable to a MAWS approach**
- **Initial successes at Fernald help to expand application and facilitate implementation at other sites**

M94-GT-0099- 26

Resource Recovery Project

**Headquarter's Program Manager
(DOE-HQ):**

S.P. (John) Mathur

Operations Office:

Pittsburgh (PETC)

Laboratory Site:

CDIF, Butte, MT

EM-50 Division:

DT&E

Principal Customer:

EM-30, 40, 60

Application Areas:

Surface & Groundwater

Joint Participants:

**National Institutes of Water
Resources, Technology
Providers, NEWTTEC, and
MSE, Inc. Montana Tech**

M94-GT-0126- 1

Objective

**To evaluate, test and demonstrate technologies for the recovery of
dissolved metals and minerals from highly acidic solutions and the
reclamation of surface and groundwater**

M94-GT-0126- 2

Scope

- **Evaluate and demonstrate technologies for reclamation of surface and groundwater contaminated with metals and minerals**
- **Adapt technological systems to produce clean water in western states to meet needs for local and regional economic advantage**
- **Reduce remediation cost by identifying revenue sources from sale of recovered by-products**
- **Technology transfer to DOE sites, other federal agencies, private industry and foreign countries**

M04-GT-0126- 3

End Point

- **Provide technical and economic performance evaluations of each technology demonstrated**
- **Provide commercialization support to one or more integrated resource recovery systems**
- **Transfer demonstration results to**
 - **EM-30/40**
 - **Private sector users/stakeholders**

M04-GT-0126- 4

Customer Needs/Window of Opportunity

- Based on national and international expenditures for remediation of aqueous solutions bearing dissolved mineral resources, the growth of the environmental remediation industry is projected to be 10 percent per year
- **EXAMPLES**
 - State of Arkansas, Hot Springs Barite Pit remediation (needed in 2 years)
 - Hard-rock mining industry
 - Coal mining industry
 - Eastern Europe and the former Soviet Union with major surface and groundwater problems
 - Closure of U.S. military installations

MD4-GT-0126- 5

DOE Needs

Concentration ranges¹ and guidelines for regulation of most frequently reported constituents in groundwater and/or soils and sediments at DOE facilities

METAL	GROUNDWATER	SOILS/SEDIMENT	GUIDELINES
LEAD	0.56 - 120,000	1,000 - 6.9 x 10 ⁶ 6,900,000	³ 0; ⁴ 50; ⁵ 5
CHROMIUM	0.42 - 9,010	5.1 - 3,950,000	³ 100; ⁴ 50; ⁵ 100
ARSENIC	0.3 - 32,100	100 - 102,000	⁴ 5
ZINC	1 - 697,000	150 - 5,000,000 - 5 x 10 ⁶	⁵ 5,000
COPPER	1 - 3,300	30 - 550,000	³ 1,300; ⁵ 1,300
MERCURY	0.08 - 216,900	0.1 - 1,800,000 - 1.8 x 10 ⁶	³ 2; ⁴ 2; ⁵ 2
CADMIUM	0.005 - 7,600	100 - 345,000	³ 5; ⁴ 10; ⁵ 5
ANIONS			
NITRATE	2.6 - 100 x 10 ⁶ 100,000,000	30 - 1,480,000	^{3,4,5} 10,000

¹ Micrograms per liter (ug/L) and micrograms per kilogram (ug/kg) unless otherwise indicated

³ Proposed U.S. EPA Maximum Contaminant Level Goals (MCLG, ug/L) in Drinking Water

⁴ Existing U.S. EPA Maximum Contaminant Level (MCL, ug/L) in Drinking Water

⁵ Proposed U.S. EPA MCL (ug/L) in Drinking Water

⁶ Nonenforceable U.S. EPA secondary level standard (ug/L) based on taste, odor or appearance guidelines

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DOE Needs

RADIONUCLIDES	GROUNDWATER	SOILS/SEDIMENT	GUIDELINES
Tritium	³ 3.3 - 20.9 x 10 ⁶ 20,9000,000,000	³ 7.8 - 124 x 10 ⁶ 124,000,000	⁶ 20,000; ⁶ 2,000,000 - 2 x 10 ⁶
Uranium	¹⁰ 0.001 - 11,700,000 - 11.7 x 10 ⁶ ⁷ 0.02 - 22,700	¹¹ 0.2 - 16,000 ¹² 0.06 - 18,700	- ⁶ 500 - 600
Strontium	⁷ 0.05 - 231,000	¹³ 0.02 - 540,000	⁶ 8; ⁶ 1,000
Plutonium	⁷ 0.009 - 7,600	¹³ 0.00011 - 3,500,000 - 3.5 x 10 ⁶	⁶ 300 - 400
Cesium	⁷ 0.0027 - 1,830	¹³ 0.02 - 46,900	⁶ 200; ⁶ 3,000

1 micrograms per liter (u/gL) and micrograms per kilogram (ug/kg) unless otherwise indicated

7 Picocuries per liter (pCi/L)

8 National Drinking Water Regulations, Table IV-2A (EPA 1976). Derived guidelines (pCi/L) based on 4 millirem annual dose to target organ

9 DOE-derived concentration guides (pCi/L) based on effective dose limit not to exceed 100 millirems/yr.

10 Micrograms per liter (ug/L)

11 Micrograms per gram (ug/g)

12 Picocuries per gram (pCi/g)

13 Picocuries per kilogram (pCi/kg)

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User/Regulatory Interface

- EM-30 - Potential user
- EM-40 - Potential user
- U.S. EPA - National oversight, alternative technologies for treatment of Berkeley Pit water
- State of Montana and other western states - Oversight by Department of the Environment
- CERCLA responsible parties (PRPs) - ARCO and MRI by reducing potential remediation costs
- Worldwide mining and mineral processing industries - Technology providers and a potential users market
- National Institutes of Water Resources (NIWR) - Contractor

TIES TO OTHER EFFORTS:

- National Environmental Waste Technology Testing and Evaluation Center (NEWTTEC)
- Mine Waste Technology Pilot Program (MWTPP)
- PNL Clean Option Strategy
- Western Governors' Association, DOIT committee
- Biomass Remediation System (BRS)
- In Situ Remediation Integrated Program

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Resource Recovery Project

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Funding FY94 Resource Recovery Project

TTP	Technology	\$ (K)	PI	Industry/ Academic/Partner (Cost Share)
PE021104	Resource Recovery Project	2,600	Thomas M. Malloy	Tetra Technologies, Inc. (\$24 in kind)
RL341004	Clean Option Strategy	190	Mark Gerber	None

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Project Funding Profile (\$M)

FY91	FY92	FY93	FY94	FY95
0	1.2	2.0	2.6	4.0

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Resource Recovery Project

Schedule	FY 93	FY 94	FY 95	FY 96	FY 97
Resource Characterization	██████████				
Regulatory/Legal Issues	██████████				
Complete Facility Modifications	██████████				
Demonstration Plan Requirements	██████████				
Screen Rank and Approve	██████████	██████████	██████████	██████████	██████████
Demonstrate Approved Technologies	██████████	██████████	██████████	██████████	██████████
Establish Business Plan	██████████				
Implement Business Plans	██████████	██████████	██████████	██████████	██████████

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Major Milestones/Deliverables

- **Issue Resource Characterization Report**
- **Issue Regulatory/Legal Issues Report**
- **Complete CDIF Facility Modification**
- **Establish proposal screening, ranking and approval procedures**
- **Establish business plan for commercialization of successful technologies with vendors' assistance**
- **Transfer demonstrated technologies to EM-30/40, private sector users, industry and stakeholders**

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Benefits

COST/SAVINGS:

- **Reduced or eliminated costs and liabilities for waste disposal**
- **Revenue sources to offset costs of remedial actions**
- **Economic development through commercial utilization of recovered resources**
- **Early application of technology based on demonstrated performance**

PERFORMANCE:

- **Resources recovered as marketable products as opposed to wastes**
- **Maximized economic potential of recovered resources. Produce a 'value-added' product when possible**
- **Treat Acid-Mine drainage resulting in cleaner waters (surface and subsurface) to protect and propagate aquatic life**

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Benefits

SAFETY/RISK:

- Minimize non-marketable/non-valuable hazardous waste volumes
- Minimize risks of waste disposal liabilities, by removing a maximum amount of hazardous metals before disposal

REGULATORY:

- Reduced compliance costs for compliance

INDUSTRY:

- Demonstrated technology performance will maximize technology applications
- Economic benefits through sale of recovered resources
- Reduced costs of remediation
- Greater opportunities for economical remediation targets

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Resource Recovery Issues

- Regulatory and legal barriers to applying resource recovery technologies are disincentives to DOE and industry; e.g., recovered marketable materials are still classified as "wastes," e.g., the "derived from" rule
- Regulations provide no incentives, such as liability protection, to allow for innovative technology demonstrations
- Economic impediments exist for the application of resource recovery technologies, e.g., private sector industries have no established economic motive or incentive, such as tax breaks, to minimize wastes generated and recover contaminants as industrial feedstock

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Reference/Documentation

- **Resource Recovery Project - Technology Characterization Interim Report**
- **Resource Recovery Project - Issues Identification and Analysis Interim Report**
- **Resource Recovery Project - Berkeley Pit Water Characterization Interim Report**
- **Resource Recovery Project Preliminary Marketing Report, MSE, Inc.**
- **Resource Recovery Project Technology Demonstration Plan Preparation Requirements**
- **Washington Technology Vol. 1, No. 14; A Toxic Pit's Solution; October 21, 1993**
- **U.S. Water News Vol. 9, No. 10; Abandoned Mine Pit is Montana's Biggest Lake; April 1993**
- **Request for Proposal; Commerce Business Daily, Chemical Engineering News, Chemical Engineering Process, and Chemical Engineering Analysis**
- **Office of Technology Development FY93 Programs Mid-Year Summaries Research, Development, Demonstration, Testing and Evaluation**
- **Natural Resources Recovery Technology Development Symposium, Whitefish, Montana; October 19 - 22, 1993**

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Project Accomplishments

- **Completed Resource Characterization Study and Report**
- **Completed Regulatory/Legal Issues Analysis and Report**
- **Formed technical support group of Berkeley Pit stakeholders**
- **Formed Independent Technology Ranking Committee**
- **Requested, screened, ranked and approved FY94 demonstrations**
- **Completed CDIF modifications for demonstrations**

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Future Project Objectives - FY94

- **Complete proposal selection process for FY94 demonstrations**
- **Complete proposal search and selection process for FY95 demonstrations**
- **Complete FY94 demonstrations**
- **Continue implementation of technology transfer activities to DOE and private sector**
- **Implement business plan for commercializing promising technologies**

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Future Project Objectives - FY95

- **Continue technology search and selection activities**
- **Continue technology demonstration activities**
- **Continue technology transfer activities to DOE and private sector**
- **Continue commercialization activities for promising technologies**

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Resource Recovery Project

FY 94 Budget vs. Actuals

**U.S. Department of Energy
Office of Environmental Restoration and Waste Management
Office of Technology Development
Research, Development, Demonstration, Testing and Evaluation
1994 MID-YEAR PROGRAM REVIEW**

Notes

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Notes

AIM

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Silver Spring, Maryland 20910
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BY APPLIED IMAGE, INC.

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