

INNOVATIVE AND IMPROVED D&D TECHNOLOGIES TO MEET DEPARTMENT OF ENERGY'S ACCELERATING CLEANUP AND PATHS TO CLOSURE

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ABSTRACT

Innovative and improved D&D technologies are needed to address the pressing needs of deactivating more than 7000 contaminated facilities and decommissioning more than 700 others. In addition material disposition is required for over 600,000 tons of metals and 23 million cubic meters of concrete in contaminated buildings.

The major drivers for the need for these technologies are the high safety and health risks associated with working in aged and contaminated facilities and the high costs associated with facility deactivation, surveillance, and maintenance using currently available baseline technologies.

The strategy for the Deactivation and Decommissioning Focus Area over the next several years is to support the Office of Environmental Management's(EM's) four major thrust areas for its Science and Technology Program: (1) Accelerate technology deployment; (2) Reduce cost; (3) Meet high priority needs; and (4) Reduce EM's technological risk.

PRESENTATION

The Office of Science and Technology used the Deactivation and Decommissioning Focus Area(DDFA) to jointly fund D&D technology demonstrations with Department of Energy Sites who have real projects requiring cleanup. These demonstrations solve real customer-identified needs to characterize, deactivate, survey and maintain, decontaminate, dismantle, and dispose of or recycle DOE surplus facilities and their contents.

In the past 2 years over 50 D&D technology demonstrations have been conducted at full scale, resulting in the dissemination of meaningful cost and performance data. Comparisons to the baseline technologies and validation of cost and performance results is being performed by the U.S. Army Corps of Engineers.

Information concerning the D&D Program is located on the Internet at www.fetc.doe.gov/dd. The D&D Annual Report and other documents may be obtained from the D&D Focus Area, located at Federal Energy Technology Center, 3610 Collins Ferry Road, Morgantown, West Virginia 26507-0880. Published Innovative Technology Summary Reports may also be obtained

from the Office of Science and Technology, U.S. Department of Energy, 1990l Germantown Road, Germantown, Maryland 20874.

1. PAST PROJECTS: Three Large-Scale Technology Demonstration/Deployment Projects(LSDDPs) were started in 1996 and several more are currently being planned. The first three were:

(1) CP-5 Research Reactor at Argonne National Laboratory; (2) Fernald's Uranium Processing Facilities; (3) Hanford's Production Reactor© Interim Safe Storage.

2. EXAMPLES OF TECHNOLOGIES DEMONSTRATED ON FIRST 3 LSDDPs:

Characterization: Pipe Explorer to survey radioactively contaminated drain lines; Surface Contamination Monitor and Survey Information Management System(SCM/SIMS)(motorized equipment for surveying contaminated floor surfaces);

Decontamination: ROTO-PEEN Scaler for removing contaminated coatings on concrete and steel; Centrifugal Shot Blast Equipment for scabbling concrete floors; EMPORE Membrane Separation Cartridge for removal of cesium and cobalt from fuel storage pool water; Surface decontamination of lead and structural steel; Sponge Jet and steam cleaning;

Dismantlement: Oxygen-Gasoline cutting torch and fiber-optics lasers for cutting metals; VECLOADER high efficiency particulate air vacuum equipment for vacuuming insulation from walls; Robotic Work Platform and Dual Arms for removal of reactor components; Thick concrete cutting; Self-contained pipe cutting shears; Clam Shell cutter for large bore pipe cutting; Mobile work platforms for reaching overhead piping and equipment;

Worker Health and Safety: Personal Protective Equipment such as different types of suits and heat stress monitoring system;

3. FUTURE PROJECTS BEGINNING IN FISCAL YEAR 1998:

(1) Decommissioning of a Tritium Contaminated Facility at DOE's Mound Site at Miamisburg, Ohio;(2)Deactivation of Highly Enriched Uranium(HEU) Fuel Fabrication Facility at Savannah River; (3)Decommissioning of Fuel Storage Canals and Associated Facilities (4) Transuranic Waste Characterization, Decontamination and Disposition.

Each project is managed by an Integrating Contractor at the Department of Energy Sites. They have a Technology Selection Team, who prepares criteria and evaluates proposed D&D technologies to be selected. Usually Requests For Proposals are issued to meet specific project needs.

4. TRITIUM CONTAMINATED FACILITIES LSDDPs:

This LSDDP would demonstrate innovative technologies during the decommissioning of a tritium production facility at DOE's Mound Site.

Innovative characterization, decontamination, dismantlement, material disposition, and worker protection technologies would be demonstrated.

Innovative technologies(20-25) can be demonstrated in the areas of tritiated glove boxes, piping systems decontamination, tritiated ductwork decontamination and size reduction, building materials decontamination, robotics/remote handling applications, and mixed waste issues.

The first 4 technologies to be conducted during second quarter of fiscal year 1998 are: (1) Direct Reading Tritium Monitor; (2) Portable Scintillation Counter; (3) Water Solidification; and (4) Oil Solidification. Characterization would include technologies for real-time, rapid, facility survey of concrete floors and tritium contamination inside piping.

Benefits and applications-The Mound Ohio Site has 58 facilities in the Tritium complex with over 275,000 square feet of floor space and over 400 tritium laboratories. Savannah River Site also has tritium contamination in F and H Chemical Reprocessing Plants.

5. DEACTIVATION OF HIGHLY ENRICHED URANIUM(HEU) FUEL FABRICATION FACILITY AT SAVANNAH RIVER SITE:

Savannah River Site's(SRS) 321-M fuel fabrication facility was used to manufacture fuel and target assemblies for irradiation in the site's production reactors. About 1,200 grams of highly-enriched uranium(HEU) remains in the ventilation ducts, processing systems, and other areas of the facility. Removal of HEU contamination will stabilize the 321-M facility and reduce its long-term surveillance and maintenance and material control and accountability costs. The SRS LSDDP will demonstrate 8-10 innovative and improved D&D technologies. The SRS LSDDP is the first LSDDP that the DDFA will sponsor with EM-60, which manages DOE's deactivation and interim safe-storage projects. Technologies demonstrated in the SRS LSDDP will benefit DOE's future deactivation and safe-storage projects which are expected to increase in the near future. Potential cost savings and mortgage reductions are estimated at \$20 million.

Some of the technologies to be demonstrated include: (1) Long Range Alpha Detector; (2) X-Ray, K-Edge Heavy Metal Detector; (3) Strippable Coatings; (4) Thermal Spray Vitrification; (5) In Situ Chemical Treatment of Asbestos; (6) Heat Stress Mitigation; and (7) Equipment Dismantlement/Size Reduction

Objectives are to perform characterization of the holdup HEU in ductwork, overhead trays, process equipment and inaccessible locations; Decontaminate process equipment, ductwork, concrete, electrical cable trays and other components; Stabilize the contamination in ventilation ducts and process equipment; and Dismantle/remove ventilation ducts, process equipment and selected overhead items.

6. DECOMMISSIONING OF FUEL STORAGE CANALS AND ASSOCIATED UNDERWATER AND UNDERGROUND FACILITIES:

This LSDDP at Idaho National Engineering and Environmental Laboratory(INEEL) involves decommissioning of Fuel Storage Canals and Associated Underwater and Underground Facilities. In addition to the debris, equipment and sludge in the fuel storage canals, the LSDDP will include 2 underwater reactors which are the Advanced Reactor Material Facility and Coupled Fast Reactivity Measurement Facility with interconnecting water canal in Test Reactor Area(TRA) 660; TRA Filter Pits in buildings 655, 704, 705, and 706 which are located

underground in restricted entry pits; and the Initial Engine Test Control Room in Test Area North 620.

The INEEL LSDDP will demonstrate 16-18 improved and innovative technologies. The demonstrated technologies will be deployed in other fuel storage pools throughout the DOE Weapons Complex including the Hanford K-Basins. Potential cost savings and mortgage reductions are estimated at \$20 million. The INEEL LSDDP is the first LSDDP to offer full-scale demonstrations opportunities for underwater characterization, decontamination, dismantlement and removal technologies. Technologies demonstrated in the INEEL LSDDP will also have deployment opportunities in the nuclear utility market through the DOE/Commercial Nuclear Utilities D&D Consortium. This LSDDP is a high priority for this DOE/Utility D&D Consortium. Federal Energy Technology Center, Morgantown, West Virginia leads the negotiations establishing this Consortium via an Memorandum of Understanding(MOU) which was signed on December 3, 1997.

Some of the technologies to be demonstrated include: (1) Soft-Sided Waste Containers; (2) Fogging Technique for Airborne Asbestos Control; (3) Underwater Germanium Detector; (4) Directional Drilling for Sampling Under Facilities; (5) Biodecontamination of Concrete; (6) Asbestos Pipe Insulation Removal System; (7) Portable Containment/Isolation Facility; (8) Snap Together Scaffolding; (9) Quick-Decon Lattice Scaffolding; (10) Robotic Vacuum-Deployed Wall Scabbler/Detector; (11) Membrane Filtration During Underwater Cutting; and others to be selected by the Screening/Selection Team.

The technologies will address underwater visual inspection, characterization and dismantlement as well as removal and treatment of fuel pool sludges, debris and water. These improved/innovative technologies will reduce the worker risk in high radiation fuel pools and significantly reduce the cost of deactivation and decommissioning of such facilities.

Benefit: Improved technologies in the areas of debris/sludge removal from fuel storage pools, fuel storage pool water decontamination, and decontamination of the storage pool surface will have validated cost and performance, so that DOE can deploy them for this and other INEEL D&D projects, as well as across the DOE Weapons Complex. These improved technologies are expected to reduce D&D unit costs by 25%. Also, D&D schedules will be substantially shortened. Specific application sites are at INEEL, Savannah River, and Hanford.

7. TRANSURANIC WASTE CHARACTERIZATION, DECONTAMINATION AND DISPOSITION:

Across the DOE Weapons Complex, there is a large number of surplus plutonium contaminated processing equipment including piping, ducts, tanks and glove boxes. Technologies for characterization of contaminated surfaces to determine transuranic(TRU), low-level waste(LLW) or free-release segregation and packaging of transuranic contaminated waste will be demonstrated and deployed. This will minimize the amount of glove box materials requiring disposal as transuranic waste.

LANL currently has approximately 2,400 cubic meters of oversized metallic TRU waste in storage and expects to generate another 3,000 cubic meters from ongoing waste management operations in coming years (starting in fiscal year 2000). Much of the waste is currently stored in fiberglass reinforced plywood boxes that do not meet WIPP's Waste Acceptance Criteria. In order to limit the amount of waste classified as TRU, which will ultimately be sent to WIPP, these 2,400 cubic meters need to be characterized, sorted and segregated into TRU and LLW. In addition, this waste must be repackaged in containers which meet the WIPP acceptance criteria.

This LSDDP provides opportunities to demonstrate and deploy improved technologies that can enhance or improve the TRU metallic waste management process, including aspects of characterization, decontamination, size reduction, material handling, and worker safety. LANL waste management operations are expected to realize improvements in cost, schedule, and risk from this LSDDP and its associated ASTD project. The LSDDP has direct applicability to Rocky Flats plutonium processing facility D&D projects. The technology identification and selection process has begun, but no final selections have yet to be made to date.

8. LONGER TERM PROJECTS BEGINNING IN FUTURE FISCAL YEARS:

Several research reactors will be undergoing D&D during the time span of 2000 to 2005, i.e. Brookhaven Graphite, Argonne-FNG, ZPR, ATSR, and Juggernaut. One particular technology need is the containment of aerosols and airborne contamination (graphite particles) during dismantlement operations.

Scrap Metal Recycling and Release-Need for improved characterization techniques which better detect release limits and enhance the ability to segregate contaminated from non-contaminated materials. Paducah, Portsmouth, Oak Ridge, and Savannah River all have significant quantities of metals.

Fuel Storage Pool Deactivations-Hanford and Savannah River both have technology needs to improve facility assessments, characterizations, the removal and treatments of sludges/water, and the stabilization of basin walls.

D&D of laboratory facilities including hot cells and glove boxes-These facilities are very radioactive and often require remote/robotic applications to reduce worker exposure risk. Examples of these type of facilities are the General Atomics and General Electric Hot Cell Facilities and glove boxes located at DOE Oakland Operations.

Processing Facilities for ETEC Sodium Metal Loop Systems and Pantex Plant High Explosives Facilities both have unique D&D technology requirements.

REFERENCES:

1. Federal Energy Technology Center, September 1998. Deactivation and Decommissioning Focus Area Multi-Year Program Plan for Fiscal Years 1999-2003. Office of Science and Technology, U.S. Department of Energy.

2. Federal Energy Technology Center, October 1998. Deactivation and Decommissioning Focus Area Fiscal Year 1999 Annual Performance Plan.

Office of Science and Technology, U.S. Department of Energy.

3. Federal Energy Technology Center, Fiscal Year 1998. Fact Sheets and Quarterly Reports for Deactivation and Decommissioning Focus Area.

Office of Science and Technology, U.S. Department of Energy.

ATTACHMENT: List of D&D Technologies Demonstrated. DDFA. Morgantown, WV.

<u>OST #</u>	<u>Technology Title</u>	<u>LSDDP</u>
74	PipeExplorer	CP-5
179	Empore Separations Membrane	CP-5
224	Asbestos Conversion Process	na
1450	TechXtract Chemical Lead Decontamination	C-Rx
1476	2-D Linear Motion System(wall survey w/LARADS)	C-Rx
1780	Steam Vacuum Cleaning "Kelly System"	Plt-1
1784	VecLoader HEPA VAC	Plt-1
1787	Dual Arm Work Platform	CP-5
1790	X-Ray Fluorescence (HEPA) Characterization	CP-5
1790	X-Ray Fluorescence (Surface) Characterization	CP-5
1793	Gamma Ray Imaging	C-Rx
1795	Mobile Integrated Temporary Utility System	C-Rx
1798	Mobile Automated Characterization System	CP-5
1799	Rosie Mobile Work System	CP-5
1807	High-Speed Clamshell Pipe Cutter	C-Rx
1810	Pipe Crawler	CP-5
1810	Pipe Crawler	Plt-1
1811	Pipe Inspection	Plt-1
1812	Rotopeen with Captive Shot	CP-5
1815	Swing Free Crane	CP-5
1816	Urethane Foam Void Filling	Plt-1
1839	Reactor Stabilization	C-Rx
1840	GammaCam	CP-5
1846	Low-Density Cement Grout Void Filling	Plt-1
1847	Oxy-Gasoline Torch	Plt-1
1851	Centrifugal Shot Blasting	CP-5
1851	Centrifugal Shot Blasting	Plt-1
1853	Field Transportable Beta Counting System	CP-5
1854	FRHAM-TEX Cool Suit	CP-5
1855	Nu-FAB Suit	CP-5
1898	Personal Ice Cooling(PIC) System	Plt-1

1899	Soft Media Blasting System	Plt-l
1942	Surface Contamination Monitor	CP-5
1946	Laser-Assisted Ranging and Data System(LARDS)	C-Rx
1947	STREAM Management Database System	C-Rx
1948	Self-Contained Pipe Cutting Shears	C-Rx
1950	Concrete Shaving	C-Rx
1953	Heat Stress Monitoring System	C-Rx
1954	Seam-Sealed Sack Suit	C-Rx
1971	Advanced Recyclable Media System	CP-5
1999	Laser Induced Fluorescence Imaging	Plt-l
2098	In Situ Object Counting System	CP-5
2099	Remote Operated Scabbler	CP-5
2100	Remote Control Concrete Demolition System(Brok)	CP-5
2102	Concrete Diamond Grinder	C-Rx
2103	RESRAD-BUILD	C-Rx
2104	Wireless Remote Monitoring System	C-Rx
2107	Liq. Nitrogen-Cooled Diamond-Wire Conc.Cutting	C-Rx
2151	Remote Underwater Characterization System	INEEL
2152	Concrete Spaller	C-Rx
2153	Compact Subsurface Investigation System	C-Rx
2154	Concrete Dust Suppression System	C-Rx
2178	ANDROS Remote Characterization	U-Plt
2241	DISPIM Characterization System	RFETS
TBD	Mobile-Work Platform	Plt-l