DEACTIVATION AND
DECOMMISSIONING
FOCUS AREA
ANNUAL REPORT

PROBLEMS CANNOT
BE SOLVED AT THE
SAME LEVEL OF
AWARENESS THAT
CREATED THEM.

—ALBERT EINSTEIN

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IN MEMORIAM

PAUL HART, PH.D.
1945 - 2000

DEACTIVATION & DECOMMISSIONING FOCUS AREA

FY2000 ANNUAL REPORT

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DEACTIVATION & DECOMMISSIONING FOCUS AREA

FOCUSED ON BENEFITS OF IMPLEMENTING INNOVATIVE TECHNOLOGIES

Einstein had it right all along– “Problems cannot be solved at the same level of awareness that created them.” Solving DOE’s long-term challenges requires new and different ways of dealing with cleanup problems. The Deactivation and Decommissioning Focus Area (DDFA) will meet its cost reduction goals through development and rapid deployment of improved and innovative technologies across the DOE complex.

DDFA is fully committed to its goal of reducing the estimated \$39 billion DOE D&D mortgage by 25% for pre-FY2006 costs and 50% for post-FY2006 costs. The DDFA is committed to achieving this goal while reducing risks to workers, the public and the environment, and accelerating schedules for D&D of the more than 7,000 surplus facilities.

In FY 2000, with strengthened emphasis on collaboration with other focus areas, Crosscut Programs, Industry and University Programs, and other organizations, DDFA expanded its strategy of demonstrating innovative technologies alongside baselines through the Large-Scale Demonstration and Deployment Projects (LSDDP). The LSDDP strategy, coupled with the leveraged Accelerated Site Technology Deployment (ASTD) projects, has served to substantially accelerate deployments of superior technologies to meet near-term, high-priority needs.

Beginning in FY2000 and to be continued in FY2001, DDFA enhanced its technical resources through the use of Lead Laboratory affiliates. For DDFA, representatives from The National Energy Technology Laboratory (NETL), Oak Ridge National Laboratory (ORNL), the Florida International University Hemispheric Center for Environmental Technology (FIU-HCET), and the Electric Power Research Institute (EPRI) provide their capabilities to ensure a full range of scientific, engineering, and management expertise is available. The Lead Laboratory greatly contributes to DDFA’s planning, execution, and evaluation activities.

The strategic direction chosen for DDFA’s research, development and demonstrations is leading to many commercially-viable, field-deployable solutions. This FY 2000 Annual Report describes these successes and illustrates DDFA’s commitment to bringing a fresh perspective to solving the cleanup problem.

FY2000 DEPLOYMENTS

The Environmental Management Mission

TO CLEAN UP THE ENVIRONMENTAL LEGACY OF U.S. NUCLEAR WEAPONS PRODUCTION AND OTHER SOURCES OF POLLUTANTS SUCH AS DOE NUCLEAR RESEARCH

“THE DEPARTMENT OF ENERGY IS RESPONSIBLE FOR THE WORLD'S LARGEST ENVIRONMENTAL CLEANUP PROGRAM. THIS ENORMOUS TECHNICAL CHALLENGE IS A NATIONAL PRIORITY THAT MUST BE BASED ON THOROUGH, SCIENTIFIC ANALYSIS.”

—SECRETARY OF ENERGY, JUNE 1998

DDFA—IMPACTING THE OFFICE OF ENVIRONMENTAL MANAGEMENT

THE DDFA IMPACT

DDFA impacts the mission of the Office of Environmental Management through the implementation of a comprehensive program of basic science grants, applied research, large-scale demonstrations, and accelerated site technology deployments. All facets of this program are geared towards:

- Reducing the cost of cleanup projects
- Reducing risks to workers, the public and the environment
- Accelerating cleanup schedules

EM is already reaping returns on its investment in DDFA. The program has identified more than \$1.5 billion in savings against EM's \$14+ billion D&D mortgage to taxpayers to clean up facilities within the weapons complex.

DDFA'S STRATEGY – QUICKLY ASSESS, DEMONSTRATE, AND VALIDATE COMMERCIALY AVAILABLE TECHNOLOGIES

- Large-Scale Demonstration and Deployment Projects (LSDDP) coupled with the leveraged Accelerated Site Technology Deployment (ASTD) projects form the foundation of the DDFA comprehensive program. In addition to reducing costs, this strategy also promises to reduce risks and shorten deactivation and decommissioning schedules.
- Collaboration with other focus areas and organizations enhances the process of finding solutions to D&D problems and issues. The DDFA strategy emphasizes research in areas such as robotics from basic science, through applied research, to demonstrations to lower worker risk and increase productivity.

GLOBAL POSITIONING RADIOMETRIC SCANNER DEMO AT INEEL

SOFT-SIDED WASTE CONTAINERS
BEING DEMONSTRATED AT INEEL

MISSION OF THE TAL MANAGEMENT

- Recognition that there are 109 U.S. commercial nuclear utilities, as well as university, medical, and industrial facilities licensed (5000 licensees) by the U.S. Nuclear Regulatory Commission (NRC) that share many of the same D&D problems as DOE.
- Through the EM Science Program, the DDFA long-term strategy also targets fundamental research aimed at gaining a better understanding of deactivation and decommissioning problems such that “breakthrough” technologies will emerge. An increased emphasis is placed on long-term stewardship, end states, surveillance and maintenance, accelerated decommissioning, and remote systems.

COPPER RECYCLE
DEMO AT INEEL

ENGAGING “END-USERS”

DDFA interacts with DOE-EM site representatives and technology end-users to identify solutions to their needs. By designing and implementing a comprehensive program that addresses basic research, applied research, and demonstrations through technology deployments, DDFA continues to demonstrate its responsiveness to end-user needs. Still, in FY 2000, some issues have had no identified technological solutions. These issues represent mid to long-term opportunities for the RD&D market for DDFA. The DDFA program is integral to deriving benefits of innovative technology development.

WATER SOLIDIFICATION
DEMONSTRATION AT
MOUND LSDDP

THE DDFA PROJECTS

Successfully demonstrated and deployed technologies are described throughout this annual report. These successes support and amplify the importance and impact DDFA has on achieving the DOE-EM mission.

LARGE-SCALE DEMONSTRATION & DEPLOYMENT PROJECTS

COMPLETED PROJECTS

CHICAGO PILE 5 (CP-5)
REACTOR AT ANL-EAST

HANFORD C-REACTOR

FERNALD PLANT-1

ACTIVE IN FY 2000

MOUND TRITIUM D&D

INEEL FUEL STORAGE
CANAL AND ASSOCIATED
UNDERWATER AND
UNDERGROUND
FACILITIES D&D

LANL TRU WASTE
CHARACTERIZATION,
DECONTAMINATION
AND DISPOSITION

SAVANNAH RIVER
321-M FUEL
FABRICATION FACILITY

As of the end of FY 2000, 82 innovative technologies have been demonstrated, accumulating 302 deployments. Active LSDDPs are described below.

MOUND TRITIUM D&D

Facility: Building SW/R, T, and HH at Mound site used for weapons-related R&D and production

Challenges: tritium-contaminated gloveboxes, tritium characterization, mixed waste treatment and disposal, tritiated water treatment, piping system removal, etc.

Project Schedule: April 1998 – September 2001

Technologies Demonstrated to Date: Portable Liquid Scintillation Counter, Water Solidification, Oil Solidification, Waste Isolation Composite, Barter Process, Pipe Crimping and Cutting System, Fiber Optic Tritium Detector and Quantifier

INEEL FUEL STORAGE CANAL AND ASSOCIATED UNDERWATER AND UNDERGROUND FACILITIES D&D

Facility: Test Reactor Area TRA-660, housing two underwater research reactors; TRA Filter Pit System, consisting of five structures containing large filters associated with the test reactor operation; and TAN-620 Initial Engine Test Control Room, a massive underground, shielded, heavily reinforced, concrete structure

Challenges: underwater inspection, characterization and dismantlement; inspection, characterization and dismantlement in confined spaces; recycle of materials; removal of loose radiological contamination on walls, floors, piping and equipment; etc.

Project Schedule: April 1998 – September 2000

Technologies Demonstrated to Date: Remote Underwater Characterization System, Soft-Sided Waste Containers, Excel Automatic Locking Scaffold, Lead Paint Analyzer, Niton 800 Series Multi-Element Spectrum Analyzer and Electromagnetic Radiography, SAMS, In Situ Underwater Gamma Spectroscopy, ISOCS, EnVac Corner/Wall Scabbler, PCB Analyzer, Nukem Copper Recycling

LANL TRU WASTE CHARACTERIZATION, DECONTAMINATION, AND DISPOSITION

Facility: Technical Area 54 (TA-54)

Challenges: plutonium-contaminated gloveboxes, plutonium characterization, TRU and LLW segregation and packaging, imaging of packaged crate contents

Project Schedule: April 1998 – September 2001

Technologies Demonstrated to Date: AeroGo Lift Pallet System, Vehicle and Cargo Inspection System (VACIS), Mega-Tech Hydraulic Shears, Mobile Characterization System for Large Crates, NTVision System

SAVANNAH RIVER SITE 321-M FUEL FABRICATION FACILITY DEACTIVATION

Facility: 321-M Facility

Challenges: HEU contaminated components, piping, ducts, enclosures; HEU (alpha) characterization, surface decontamination

Project Schedule: April 1998 – December 1999

Technologies Demonstrated: Strippable Coatings and Fixatives; Portable X-Ray, K-Edge Heavy Metal Detector; Size Reduction Machine; Electret Ion Chamber; Soft Media Blasting; Rad Elec Passive Tritium Air & Surface Monitor

ACCELERATED SITE TECHNOLOGY DEPLOYMENTS

The ASTD program was initiated in 1997 and acts as a catalyst between Site Managers and technology owners to generate less expensive technology solutions and D&D process methods. Projected cost savings from the completion of the ASTDs shown to the right exceeds \$166 million. Those active in FY 2000 include:

INEEL INTEGRATED DEACTIVATION AND DECOMMISSIONING

Facility: Idaho National Environmental Engineering Laboratory

Challenges: Identify a variety of new technologies to assist in D&D

Project Schedule: 1998 - 2001

Technologies Demonstrated to Date: Brokk BM 250; DDROPS; Lead Paint Analyzer; Spectro Xeops XRF Analyzer; PICS; SAMS; Soft-Sided Waste Containers; Excel Modular Scaffolding; Gamma Cam; Oxy-Gas Cutting Torch; Hand-held Shear; Track Mounted Shear; GPRS; En-Vac Robotic Wall Scabbler

Benefits: Saved \$797k; project savings: \$25.6 million over 10 years

LANL DECONTAMINATION AND VOLUME REDUCTION SYSTEM (DVRS)

Facility: Los Alamos National Laboratory

Challenges: Find a more efficient system for characterizing and addressing TRU waste processing needs

Project Schedule: 1998 - 2001

Benefits: Estimated cost savings of \$168 million

PPPL DIAMOND WIRE CUTTING OF THE TOKAMAK FUSION TEST REACTOR VACUUM VESSEL

Facility: Princeton Plasma Physics Laboratory

Challenge: Dismantlement of large radiologically contaminated vessel without the risk of undue worker exposure

Project Schedule: 1999

Benefits: Demonstrated a 37% reduction in cutting cost over the baseline technology of plasma cutting

CEMP DIAMOND WIRE SAW FOR SIZE REDUCTION OF BIO-SHIELD

Facility: Columbus Environmental Management Project

Challenges: Faster demolition of large concrete structures

Project Schedule: 2000 - 2001

Benefits: Estimated cost savings of \$271k

COMPLETED PRIOR TO FY 2000

SURFACE CONTAMINATION MONITOR AND SURVEY INFORMATION MANAGEMENT SYSTEM (NTS)

PICS (FEMP)

REUSE OF CONCRETE WITHIN DOE FROM D&D PROJECTS (INEEL)

ACTIVE IN FY 2000

INTEGRATED D&D (INEEL/FEMP)

DECONTAMINATION AND VOLUME REDUCTION SYSTEM, DVRS (LANL)

DIAMOND WIRE SAW FOR SIZE REDUCTION OF BIO-SHIELD (CEMP)

3D SMART CHARACTERIZATION (BNL)

DEPLOYMENT OF CHARACTERIZATION/MARSSIM (BNL)

ENHANCED IN SITU DECON AND SIZE REDUCTION (RFETS)

ACCELERATED CLOSURE OF BUILDING 776/77 WITH REMOTE TECH (RFETS)

DECON OF GLOVEBOXES AND EQUIPMENT WITHOUT SIZE REDUCTION (RFETS)

REMOTE IN SITU SIZE REDUCTION OF PLUTONIUM GLOVEBOXES (RFETS)

UPGRADE RADIATION INSTRUMENTS (RFETS)

HIGHLY SELECTIVE NUCLIDE REMOVAL SYSTEM (SRS)

RECYCLING CONCRETE AND SEGMENTING PLATE STEEL (FEMP)

REMOTE PRISMLESS TOTAL STATION AND PHYSICAL MONITOR (FEMP)

MOBILE WORK PLATFORM (FEMP)

OVERSIZE TRU WASTE LASER CUTTING SYSTEM (NTS)

INTRUSIVE AND NON-INTRUSIVE CHARACTERIZATION THROUGH CONCRETE (MEMP)

REMOTE SIZE REDUCTION FOR LARGE HOT CELL DEACTOVATION (HANFORD)

“HAVING DDEA EFFORTS DIRECTED AT MOUND IS A GREAT HELP FOR COMPLETING CLEANUP OF THE SITE. PROJECTS SUCH AS TRITIUM LSDDP AND THE CONCRETE CHARACTERIZATION ASTD HAVE GIVEN US TECHNOLOGIES AND INSIGHTS THAT ARE CONTRIBUTING TOWARD REDUCING CLEANUP SCHEDULE AND COSTS. THE OIL SOLIDIFICATION TECHNOLOGY, NOCHAR PETROBOND, HAS GIVEN THE SITE A PATH FORWARD IN TRITIATED OIL DISPOSAL WHERE NO REASONABLE PATH EXISTED.”

—RICHARD PROVENCHER, DIRECTOR
MIAMISBURG ENVIRONMENTAL MANAGEMENT PROJECT

DEPLOYMENT

EMPORE(TM) MEMBRANE SEPARATION TECHNOLOGY (SELECTIVE SEPARATION CARTRIDGE) TECH ID 1543

The side-by-side deployment of 3M's Selective Separation Cartridge (SSC) technology and the Selion/Graver Ion Exchange (S/GIE) technology at Savannah River's R-Basin has successfully treated large volumes of cesium- and strontium-contaminated water, saving millions of dollars in cleanup costs.

The SSC technology is based on an innovative membrane technology developed by 3M. It is designed to remove specific radionuclides from aqueous solutions at high flow rates. The membrane is unique in that it is made up of sorbent particles that are loaded or enmeshed onto a web or membrane. The membrane is fabricated into a spiral-wound, cartridge filter.

The S/GIE technology is a highly selective nuclide removal system provided by Graver Technologies in Newark, DE. The system is based on the use of ion selective media provided by Selion OY, Finland. Contaminated water runs across a high-surface-area packed bed of media selected for removal of specific nuclides. The high selectivity allows large volumes of wastewater to be treated, with low secondary waste volume.

The systems are currently deployed at Savannah River Site and have had great success to date. Since its deployment, the S/GIE system has treated 1.2 million gallons of water, removing 94-99% of cesium and SSC has treated 2.4 million gallons, removing 97-99.8% of cesium. Both systems will remove and treat water and return it to the basin until the cesium concentration meets release requirements.

Treatment for strontium contamination is planned for startup in January 2001. A savings of approximately \$5 million has been projected.

ABOVE:

EMPORE(TM) MEMBRANE SEPARATION TECHNOLOGY
(SELECTIVE SEPARATION CARTRIDGE)

NOCHAR
PETROBOND

NOCHAR PETROBOND (OIL SOLIDIFICATION)

Tech ID 2313

The NOCHAR Petrobond absorbent polymer oil solidification agent is a high technology polymer solidifying agent offered by the Nochar Corporation of Indianapolis, Indiana. NOCHAR Petrobond will absorb oil with no mixing or required mixing equipment, and with a combination or "formula" of high-tech polymers, can be specifically designed to address the characteristics of waste oil as it exists on a given site. NOCHAR Petrobond can be effectively used for free liquid control in storage, transport, and disposal of radioactive and RCRA-defined waste oils. Petrobond polymer crystals have been found to be non-toxic, non-biodegradable and incinerable to less than 0.02% ash with an absorbent capacity of up to 15:1 (oil to solidification agent ratio by weight). In previous demonstrations the NOCHAR agent formed an acceptable solidified mass with waste oils. The Toxicity Characteristics Leaching Procedure values were found to be several magnitudes below burial site limits on specific metals.

The product has proved very easy to use and requires no agitation or mixing, thus facilitating safety & ALARA, and providing a quick and efficient solidification agent. In a restrictive environment that will not allow for mixing and/or other typical solidification steps this agent would prove to be the ideal material. The product is safe, easy to use, and cost effective and has the potential to produce considerable savings over other disposal options.

The NOCHAR Petrobond was demonstrated at the Mound Environmental Management Project in August of 1999, as part of a large-scale demonstration and deployment project (LSDDP). Subsequent to that demonstration, NOCHAR Petrobond was deployed at Savannah River Site, Ashtabula, Sandia, and Mound.

DEPLOYED TECHNOLOGIES

TECH ID	TECHNOLOGY
70	BETASCINT FIBER-OPTIC SENSOR FOR DETECTING STRONTIUM-90 AND URANIUM-238 IN SOIL
73	IN SITU CHEMICAL TREATMENT OF ASBESTOS
224	THERMAL CONVERSION OF ASBESTOS
1450	LEAD TECHXTRACT CHEMICAL DECONTAMINATION
1462	TOOLING SYSTEMS FOR MASSIVE EQUIPMENT SIZE REDUCTION AND REMOVAL
1543/179	EMPORE(TM) MEMBRANE SEPARATION TECHNOLOGY/MEMBRANE-SUPPORTED PARTICLE-BOUND LIGANDS FOR CESIUM REMOVAL
1799	ROSIE: MOBILE TELEOPERATED ROBOT WORKSYSTEM
1847	OXY-GASOLINE TORCH
1898	PERSONAL ICE COOLING SYSTEM (PICS)
1899	SOFT MEDIA BLAST CLEANING
1942	POSITION SENSITIVE RADIATION MONITORING (SURFACE CONTAMINATION MONITOR)
2098	IN SITU OBJECT COUNTING SYSTEM
2151	REMOTE UNDERWATER CHARACTERIZATION SYSTEM (RUCS)
2178	CDI REMOTE CHARACTERIZATION SYSTEM
2180	COMPACT REMOTE OPERATOR CONSOLE
2240	SOFT-SIDED WASTE CONTAINERS
2312	WATER SOLIDIFICATION
2313	OIL SOLIDIFICATION
2317	LEAD PAINT ANALYZER
2321	EN-VAC ROBOTIC WALL SCABBLER
2328	DRAIN LINE CHARACTERIZATION ROBOT
2329	REMOTE CONCRETE CORING
2374	BNL ASTD: DEPLOYMENT OF INNOVATIVE CHARACTERIZATION TECHNOLOGIES AND IMPLEMENTATION OF THE MARSSIM PROCESS AT RADIOLOGICALLY CONTAMINATED SITES
2389	DIAMOND WIRE CUTTING OF THE TOKAMAK FUSION TEST REACTOR VACUUM VESSEL
2398	XRF ANALYSIS OF PCBs AND INORGANICS
2937	NURES NUCLIDE REMOVAL SYSTEM
2938	MODIFIED BROKK DEMOLITION MACHINE WITH REMOTE CONSOLE
2952	PAINT SCALER
2953	MEGA-TECH HYDRAULIC SHEARS
2954	GLOBAL POSITIONING RADIOMETRIC SCANNER SYSTEM
2955	PIPE CUTTING AND CRIMPING SYSTEM
2977	SURVEILLANCE AND MEASUREMENT SYSTEM (SAMS)
2982	INTRUSIVE & NON-INTRUSIVE CHARACTERIZATION THROUGH CONCRETE WALLS
2990	IN SITU UNDERWATER GAMMA SPECTROSCOPY
3001	ULTRASONIC LIQUID LEVEL DETECTION SYSTEM
TBD	WIDE-ENERGY NEUTRON DETECTORS
TBD	SYSTEM INTEGRATION OF DATA FOR RESIDUE PROCESSING

“HERE’S WHY WE REALLY LIKE D&D FOCUS AREA ACTIVITIES, SUCH AS THE LARGE SCALE DEMONSTRATION AND DEPLOYMENT PROJECT. IT’S BECAUSE IT FOSTERS TEAMWORK BETWEEN INEEL R&D AND OPERATIONS— THAT RESULTED IN 26 TECHNOLOGY DEPLOYMENTS LAST FISCAL YEAR AND FUTURE PROJECT SAVINGS OF NEARLY \$20 MILLION DOLLARS. THAT’S GOOD BUSINESS.”

—JERRY LYLE, ASSISTANT MANAGER
DOE IDAHO OPERATIONS OFFICE

DEMONSTRATI

IN SITU UNDERWATER GAMMA SPECTROSCOPY TECH ID 2990

The In Situ Underwater Gamma Spectroscopy (ISUGS) System identifies and quantifies the radiological characteristics of objects stored or located underwater. The ISUGS System is operated underwater and provides dose rate and isotopic details for making D&D decisions (e.g., disposal or decontamination alternatives) about the radioactive objects stored in spent fuel pools or canals. This system provides near real-time information essential for D&D activities and reduces radiation exposure of the work force. This innovative technology is based on the In Situ Object Counting System (ISOCs) (Tech ID 2098) from Canberra. What is unique about this technology is that the ISOCs is placed in a watertight vessel and objects to be characterized are brought to the unit, while shielded by the water. The ISOCs technology has been evaluated and verified independently as a significant characterization improvement [“Chicago Pile 5 (CP-5) Research Reactor Large Scale Demonstration Project Argonne National Laboratory-East,” February 1998.]. The ISUGS uses the same instrumentation and computer software by Canberra, and includes the submersible unit and extra parameters to correct the efficiency calculations for underwater applications.

IN SITU UNDERWATER
GAMMA SPECTROSCOPY

The ISUGS System was demonstrated at the Materials Test Reactor (MTR) canal, as part of the INEEL Fuel Storage Canals and Associated Facilities D&D LSDDP in May 2000. The ISUGS provided underwater radiological characterization of various objects located inside the canal. The submersible unit, along with the detector and collimators, weighs approximately 500 pounds. The ISUGS System was lowered into the canal in an area where no fuel rods or other radiological material was located. A scan was collected from this area to measure background radiation levels. Different collimators can be applied to the detector as necessary. Once the size of the collimator had been established, objects were transported underwater to the unit for scanning. The scan times typically ranged from 90 to 300 seconds to account for dead time with the detector. Cost analysis based on demonstration data revealed that ISUGS reduced costs by 80% for characterization of ten objects compared to the baseline approach of removal from the canal, transport and identification at lab facilities, and transport back.

SURVEILLANCE AND
MEASUREMENT
SYSTEM (SAMS)

O N S

SURVEILLANCE AND MEASUREMENT SYSTEM (SAMS)

TECH ID 2977

The SAM 935, a product of Berkeley Nucleonics, uses a thallium-activated sodium iodide (NaI(Tl)) detector to provide isotopic identification in a hand-held radiation detector. This innovative technology combines the (NaI(Tl)) detector with a time-slicing, data compression technique resulting in shorter acquisition times, accurate identification, and spectroscopic capabilities. Quadratic Compression Conversion (QCC), a data compression technique, allows the operator the ability to identify multiple isotopes in one-second intervals. Using an internal database, the SAM 935 can detect up to 70 radionuclides. The library is expandable to 95 radionuclides by adding an optional neutron detector. The basic model 935 comes with a 1.5-inch x 2-inch (NaI(Tl)) crystal. Two other sizes (2-inch and 3-inch x 3-inch) are also available.

The SAMS was demonstrated in April 2000 at various INEEL D&D projects in the Test Area North. Measurements were performed on a variety of media, including equipment, paint, and soil. The SAMS provides real-time data and is able to identify the contributing isotopes where the baseline handheld detectors cannot. Analytical laboratories generally require about 100 grams of sample, which can take hours to collect. By using the SAMS, technicians can take fewer samples resulting in less time spent in potentially hazardous environments. The SAMS provides almost instantaneous results while the contract laboratory can take up to 90 days to provide equivalent results. The demonstration was able to reduce costs associated with sample collection and expedite D&D schedules. In addition, both worker exposure and waste generation were significantly reduced. At a cost of approximately \$10,000, the breakeven point between SAMS and laboratory analysis is approximately 36 analyzed samples.

DEMONSTRATED TECHNOLOGIES

TECH ID	TECHNOLOGY
70	BETASCINT FIBER-OPTIC SENSOR FOR DETECTING STRONTIUM AND URANIUM IN SOIL
1450	LEAD TECHXTRACT CHEMICAL DECONTAMINATION
1899	SOFT MEDIA BLAST CLEANING
1950	CONCRETE SHAVER
2047	MERCURY SEPARATION FROM ORGANIC LIQUIDS USING SAMMS TECHNOLOGY
2224	HIGH PRODUCTIVITY VACUUM BLASTING SYSTEM
2375	MOBILE INTEGRATED PIPING DECONTAMINATION AND CHARACTERIZATION SYSTEM
2396	AEROGO AIR LIFT PALLET SYSTEM
2974	TRITIUM CLEAN-UP CART
2977	SURVEILLANCE AND MEASUREMENT SYSTEM (SAMS)
2990	IN SITU UNDERWATER GAMMA SPECTROSCOPY
3059	ACCESS, CHARACTERIZATION, AND CLEANOUT OF TANK 105
3060	VORTEX AMPLIFIER
3061	WASTE ISOLATION COMPOSITE
3062	BARTER PROCESS
2098	IN SITU OBJECT COUNTING SYSTEM
2171	ROBOT TASK SPACE ANALYZER
2321	EN-VAC ROBOTIC WALL SCABBLER
2376	ONLINE MEASUREMENT OF THE PROGRESS OF DECONTAMINATION
2377	REMOTE SURVEILLANCE OF FACILITIES AWAITING D&D
2379	IN SITU PIPE DECONTAMINATION SYSTEM
2398	XRF ANALYSIS OF PCBs AND INORGANICS
2955	PIPE CUTTING AND CRIMPING SYSTEM
2956	FIBER OPTIC TRITIUM DETECTOR AND QUANTIFIER
2957	PASSIVE TRITIUM AIR AND SURFACE MONITOR
2958	NUKEM COPPER RECYCLE SYSTEM
2959	MOBILE CHARACTERIZATION SYSTEM FOR LARGE CRATES
3069	NT VISION

“THE DDFA APPROACH ENABLES RFETS TO INVESTIGATE MULTIPLE POSSIBILITIES TO IMPROVE SAFETY AND COST EFFECTIVENESS FOR D&D.”

—HANK DALTON, DOE-RFFO
ASSISTANT MANAGER, FACILITY DISPOSITION
ROCKY FLATS

RESEARCH & DEVELOPMENT

INTEGRATED VERTICAL AND OVERHEAD DECONTAMINATION SYSTEM (IVOD)

TECH ID 2378

IVOD is an integrated decontamination and robotic deployment system, designed and developed by FIU-HCET for removing layers of concrete from wall, ceiling and floor surfaces as well as removal of coatings from metal surfaces, combined with a real-time characterization information system. A decontamination system (a remote-controlled, free-climbing robot) was designed using a shrouded concrete shaving decontamination unit. The decontamination system employs a self-propelled, remote, joystick-operated robotic deployment system.

INTEGRATED VERTICAL AND OVERHEAD
DECONTAMINATION SYSTEM (IVOD)

The decontamination of concrete walls, ceilings, and internal and external surfaces of tanks is a major concern throughout the DOE complex. Commercially available systems are labor-intensive and often fail to meet the remediation objectives or health and safety standards, besides being costly to implement. This integrated system can be remotely operated and will greatly reduce the D&D work force's exposure to high levels of contamination, thereby improving personnel health and safety and increasing productivity. Such a system—designed for walls and ceiling decontamination—allows the free release of these surfaces, which reduces disposal costs and increases material recycling.

HIGH PRODUCTIVITY VACUUM BLASTING

TECH ID 2224

In order to increase the productivity and economics of an existing (or baseline) vacuum blasting technology, which has been used to remove radioactive contamination, PCBs, and lead-based paint at DOE sites, the DDFA is currently working on the redevelopment and design of certain components used in vacuum blasting. These new components include a new rectangular blast nozzle, a blasthead with a wind curtain and sensors, and new dust separator. These components have been designed and fabricated based on data derived from mathematical models. The mathematical models were validated by the experimental data with a deviation within $\pm 10\%$. The results of pre-prototype testing indicated that the efficiency and economics of the redesigned blasting vacuum system with implementation of the above innovative components can be increased almost 50% over the baseline technology.

Based on the modeling data, the design, manufacture, and final testing of a new innovative rectangular nozzle and a new centrifugal separator have been completed and tested. The experimental results agree with the numerical estimated data with a deviation within $\pm 10\%$, thus proving the mathematical model and the model test successful.

MODULAR MANIPULATOR FOR ROBOTIC APPLICATIONS TECH ID 2199

The Modular Manipulator for Robotic Applications focuses on the needs of Automated Plutonium Processing (APP) tasks which involve the manipulation of plutonium containers and the transfer of their contents. Specific challenges of plutonium contaminated gloveboxes include restrictive entry ports, confined workspace, limited maintenance access and destructive plutonium particulates, which make this task virtually impossible to automate with existing technology.

The proposed family of modular actuators, with their DISC® (Distributed Intelligent Servo Control) electronics and the associated links and yokes, provides a set of tools from which an almost limitless variety of automated machines can be created on demand. Each actuator module contains sensors, DISC® control electronics, motor, bearings, geartrain and mechanical interfaces. With the addition of low-cost links, yokes, an open-architecture PC-based system controller, and unified operational software, this spectrum of actuators can be integrated into a completely functional robotic manipulator system. The use of DISC® technology provides embedded intelligence and the capacity for true 'plug-and-play' operation. The Modular Manipulator for Robotic Applications is quickly deployable, has simple maintenance and repair, can be easily integrated into existing APP glovebox operations, and has a lower life-cycle cost (4 to 7 times lower).

To date, all of the custom components have been machined, other components have been procured, and the Control and Communication Interface has been fabricated. When all of the components have been completed, the manipulator will be tested at a DOE site using the full-scale equipment and process mock-ups.

R&D TECHNOLOGIES

TECH ID	TECHNOLOGY
97	3D-INTEGRATED CHARACTERIZATION AND ARCHIVING SYSTEM
2180	COMPACT REMOTE OPERATOR CONSOLE
2181	TELEROBOTIC MANIPULATION SYSTEM
2199	MODULAR MANIPULATOR FOR ROBOTIC APPLICATION
2224	HIGH PRODUCTIVITY VACUUM BLASTING SYSTEM
2225	FAST RESPONSE ISOTOPIC AIR MONITOR
2376	ONLINE MEASUREMENT OF THE PROGRESS OF DECONTAMINATION
2377	REMOTE SURVEILLANCE OF FACILITIES AWAITING DEACTIVATION AND DECOMMISSIONING
2378	INTEGRATED VERTICAL AND OVERHEAD DECONTAMINATION SYSTEM
2379	IN SITU PIPE DECONTAMINATION SYSTEM
2914	BERYLLIUM AIR MONITOR
2915	BERYLLIUM SWIPE MONITOR
2938	MODIFIED BROKK WITH REMOTE CONSOLE
2939	TELEROBOTIC CONTROL
2978	VOLUMETRIC LEAD ASSAY

“THE TECHNOLOGY SUPPORT WE HAVE RECEIVED FROM THE DEACTIVATION AND DECOMMISSIONING FOCUS AREA HAS BEEN EXTREMELY VALUABLE TO US AT SRS. MANY TECHNOLOGIES, E.G., 3-M’s SELECTIVE SEPARATION CARTRIDGES, WHICH WERE INTRODUCED BY THE DDFA, CONTINUED TO BE DEPLOYED. WITHOUT A DOUBT, WE’LL LOOK TO THE DDFA FOR SOLUTIONS TO THE MORE CHALLENGING D&D PROBLEMS AT SAVANNAH RIVER.”

—ROBBIE CORDANI, VICE PRESIDENT AND GENERAL MANAGER,
FACILITIES DISPOSITION DIVISION, WESTINGHOUSE SAVANNAH RIVER COMPANY

BASIC SCIENCE

TRU DECONTAMINATION WITH PLASMA ETCHING

P.I.: DR. ROBERT F. HICKS, UCLA

PROJECT NUMBER 54914

This UCLA/LANL project developed an atmospheric pressure plasma jet for removing transuranic wastes from surfaces. Improvements to the plasma source design have enabled stable operation

with several different gas mixtures, so the plasma jet can be used to produce oxygen atoms and radicals for removal of paint films from surfaces or to produce fluorine atoms for removal of metals. The etching of actinide metals was simulated using tantalum, a surrogate for plutonium. Etching rates ten times faster than conventional plasma systems were demonstrated. Vast improvements in the operability and reliability of the plasma source have been made. The source has been scaled up from a reactive beam area of 1.0 cm^2 to over 1.0 ft^2 .

The benefits of using plasma etching include decontamination of TRU contaminated waste, low-pressure low-temperature operation, a cleaning rate of $1/2\text{-ft}^2/\text{minute}$, low operating cost of less than $\$5/\text{ft}^2$, low capital equipment cost less than $\$100\text{K}$, no secondary waste, and field mobility.

TRU DECONTAMINATION
WITH PLASMA ETCHING

ADVANCED SENSING AND CONTROL TO FACILITATE SEMI-AUTONOMOUS DECOMMISSIONING

P.I.: DR. ROBERT J. SHALKOFF, CLEMSON UNIVERSITY

PROJECT NUMBER 55052

The Clemson University project is intended to advance the technology of semi-autonomous teleoperated robotics as applied to D&D tasks. The goal is to combine artificial intelligence, computer vision, and multi-manipulator robotics for complex disassembly tasks. The intention is for the operator to perform tasks in the form of virtual reality actions rather than by the use of joystick interfaces or by manually teleoperated devices.

This project provides a 3-dimensional model for project planning and visualization; virtual world operator training; collision avoidance and tele-robotic guidance; waste packaging and handling optimization; and reduces worker exposure in hazardous environments. A fourth generation vision sensing head has been built and tested.

ADVANCED SENSING AND
CONTROL TO FACILITATE
SEMI-AUTONOMOUS
DECOMMISSIONING

COMPLETED PROJECTS

PROJECT NUMBER	PROJECT TITLE
54724	SYNTHESIS OF NEW WATER-SOLUBLE METAL-BINDING POLYMERS: COMBINATORIAL CHEMISTRY APPROACH
54914	ATMOSPHERIC-PRESSURE PLASMA CLEANING OF CONTAMINATED SURFACES
55052	ADVANCED SENSING AND CONTROL TO FACILITATE SEMI-AUTONOMOUS DECOMMISSIONING
55380	IN SITU SPECTRO-ELECTROCHEMICAL STUDIES OF RADIONUCLIDE CONTAMINATED SURFACE FILMS ON METALS AND THE MECHANISM OF THEIR FORMATION AND DISSOLUTION
59925	MODELING OF DIFFUSION OF PLUTONIUM IN OTHER METALS AND OF GASEOUS SPECIES IN PLUTONIUM-BASED SYSTEMS
60040	DEVELOPMENT OF MONITORING AND DIAGNOSTIC METHODS FOR ROBOTS USED IN REMEDIATION OF WASTE SITES
60283	WASTE VOLUME REDUCTION USING SURFACE CHARACTERIZATION AND DECONTAMINATION BY LASER ABLATION
60363	OPTIMIZATION OF THERMOCHEMICAL, KINETIC, AND ELECTROCHEMICAL FACTORS GOVERNING PARTITIONING OF RADIONUCLIDES DURING MELT DECONTAMINATION OF RADIOACTIVELY CONTAMINATED STAINLESS STEEL

ONGOING PROJECTS

PROJECT NUMBER	PROJECT TITLE
54914	TRU DECONTAMINATION WITH PLASMA ETCHING
60041	REMOVAL OF RADIOACTIVE CATIONS AND ANIONS FROM POLLUTED WATER USING LIGAND-MODIFIED COLLOID-ENHANCED ULTRAFILTRATION
64865	MICELLE FORMATION AND SURFACE INTERACTIONS IN SUPERCRITICAL CO ₂ FUNDAMENTAL STUDIES FOR THE EXTRACTION OF ACTINIDES FROM CONTAMINATED SURFACES
64896	DECONTAMINATION OF RADIONUCLIDES FROM CONCRETE DURING AND AFTER THERMAL TREATMENT
64907	"GREEN" BIOPOLYMERS FOR IMPROVED DECONTAMINATION OF METALS FROM SURFACES: SORPTIVE CHARACTERIZATION AND COSTING PROPERTIES
64912	IMPROVED DECONTAMINATION: INTERFACIAL, TRANSPORT, AND CHEMICAL PROPERTIES OF AQUEOUS SURFACTANT CLEANERS
64931	MICROBIOLOGICALLY PROMOTED SOLUBILIZATION OF STEEL CORROSION PRODUCTS AND FATE OF ASSOCIATED ACTINIDES
64946	MECHANISMS OF RADIONUCLIDE-HYDROXYCARBOXYLIC ACID INTERACTIONS FOR DECONTAMINATION OF METALLIC SURFACES
64947	CONTAMINANT-ORGANIC COMPLEXES, THEIR STRUCTURE AND ENERGETICS IN SURFACE DECONTAMINATION PROCESSES
64965	SUPERCRITICAL CARBON DIOXIDE-SOLUBLE LIGANDS FOR EXTRACTING ACTINIDE METAL IONS FROM POROUS SOLIDS
64979	BASIC ENGINEERING RESEARCH FOR D&D OF R. REACTOR STORAGE POND SLUDGE: ELECTROKINETICS, CARBON DIOXIDE EXTRACTION, AND SUPERCRITICAL WATER OXIDATION
64982	METAL ION ANALYSIS USING NEAR-INFRARED DYES AND THE "LABORATORY-ON-A-CHIP"
65001	DEVELOPMENT OF NOVEL, SIMPLE MULTIANALYTE SENSORS FOR REMOTE ENVIRONMENTAL ANALYSIS
65004	REAL-TIME IDENTIFICATION AND CHARACTERIZATION OF ASBESTOS AND CONCRETE MATERIALS WITH RADIOACTIVE CONTAMINATION
65015	THREE-DIMENSIONAL POSITION-SENSITIVE GERMANIUM DETECTORS

TECH ASSISTANCE / D&D CON

TECHNICAL ASSISTANCE

The DDFA mission is to identify and develop improved technologies to reduce the DOE D&D mortgage. This mission is pursued through a comprehensive program addressing D&D needs through basic science grants, applied R&D and engineering projects, and full-scale demonstrations and deployments. The technical assistance provided by DDFA ensures that a full range of scientific, engineering, and management expertise is made available to provide technical solutions to the weapons complex needs.

IN FY 2000, DDFA PROVIDED ITS TECHNICAL EXPERTISE FOR:

Reducing costs at the Old Cave facility at the Mound Environmental Management Project—

Using the Value Engineering process, a six-member team developed three proposals that will result in a two-fold decrease in decommissioning costs.

Reviewing plans to decommission the Tokamak Fusion Test Reactor— The technical approach and regulatory compliance issues were addressed during the review to assist in reducing cost and schedule.

A Value Engineering study to eliminate unnecessary costs for management of 100,000 ft³ of TRU waste at West Valley— Through redesign of the TRU waste facility and changes in operational practices, the cost of the project was estimated to be reduced from \$80 million to \$70 million with a two year shorter schedule. In December 1999 upon award of a 'fixed-price' contract, West Valley stated that "the conceptual facility design recommended by the VE Team reduced the contract award by \$3.6 million."

The DDFA strategy encompasses collaboration with end user organizations to enhance technical problem solving abilities. The greatest benefit that this collaboration provides is a new way to see problems with different perspective. Another benefit of the technical assistance provided by DDFA is the widespread deployment and implementation of improved and innovative technologies that result in cost savings, shorter schedules and improved safety.

DOE/NUCLEAR UTILITIES D&D CONSORTIUM

In December 1997, DOE signed a Memorandum of Understanding (MOU) with the Electric Power Research Institute (EPRI) and several nuclear utilities to jointly develop and deploy new D&D technologies. DOE's objective is to expand the market for technologies being deployed within the DOE nuclear complex, thus leveraging technology deployments to solve common problems. Several new utility members were added to the MOU roster during the year. This expansion, coupled with the EPRI workshops and technology demonstrations at commercial utility sites, is evidence of the success and benefits brought about through cooperation between government and private sectors.

Demonstrations were conducted at Rancho Seco and Big Rock Point this year.

Concrete shaving technology developed by Marcryst Industries, Ltd. — At Rancho Seco, a diamond-impregnated shaving drum was used as a cutting tool for removal of the concrete surface. Dust generated was collected by a vacuum system. This cutting drum was applied to both the self-propelled electric-powered floor shaving unit and a hydraulically-powered wall-shaving unit.

Technology to measure decontamination as work progresses— Also at Rancho Seco, an in-line radiation measuring system was integrated into the operation of a floor shot blast concrete cleaning system. This system allowed the operator to observe the contamination removal on a computer read-out while in progress.

The success of these demonstrations contribute to an ongoing interest at Rancho Seco to participate in future demonstrations.

Mobile integrated piping characterization system— This system decontaminates, characterizes and segregates piping and structural steel with minimal human interaction. The system reduces time, cost, and worker exposure for decontamination of piping while minimizing the spread of contamination during operations. It was demonstrated at Big Rock Point.

INTERNATIONAL

To find solutions to remaining D&D challenges, DDFA has forged a new relationship with the International community. This relationship marries solutions from abroad with D&D problem holders to meet their pressing needs.

TANK 105 MOCKUP DEMONSTRATION
AT AEA TECHNOLOGY'S FACILITY IN
NORTH CAROLINA.

AEA TECHNOLOGY

AEA Technology partnered with DDFA at multiple sites, including Hanford, Savannah River, and Rocky Flats, to successfully complete a variety of projects during FY 2000. At the Hanford site, AEA Technology assisted the Building 324 project in developing an Option Study to characterize and decontaminate the exhaust ductwork in the facility. The study was completed in July 2000 and detailed specific recommendations for the site including the use of a remote crawler to survey and then decontaminate the inside diameter of ductwork. Other AEA Technology projects at Hanford included assessing the inspection, sampling, and remediation options for Tank 105 in the High Level Waste Vault in Building 324. The results included a system using a simple mechanical arm to deploy a camera, light, and sampling mechanism as well as dosimetry equipment. The system was successfully demonstrated in August 2000 at the AEA Technology facility in Morrisville, NC. The system will be functionally tested on a replica tank at Hanford in FY 2001.

AEA Technology projects at Savannah River Site included the demonstration of a soft media decontamination technique. AEA Technology provided a manual sponge blast decontamination system to the Decontamination Facility at SRS to decontaminate riser plugs and lead bricks. The system successfully decontaminated the outside surface of a riser plug and lead bricks without generating a mixed waste stream.

RUSSIA

In 1990, DOE and the Ministry of Atomic Energy for the Russian Federation (MINATOM) signed a Memorandum of Cooperation (MOC) in the areas of environmental restoration and waste management under the umbrella of the Peaceful Uses of Atomic Energy (PUAE) Agreement of 1972 between the U.S. and Russian governments. DOE and MINATOM established the Joint Coordinating Committee for Environmental Restoration and Waste Management (JCCEM) to oversee and manage the activities conducted under the MOC. The highly successful program of cooperation is now in its tenth year. During its existence, JCCEM has developed and deployed numerous new technologies that have enabled DOE to fulfill its clean-up mission more effectively. Active DDFA projects during FY 2000 include:

Distance Method for the Determination of Activity Density Distribution on a Surface— To perform remote radiological characterization effectively, a device developed by the Research and Development Institute of Construction Technology (NIKIMT) in Moscow, Russia was demonstrated at INEEL. The device consists of a gamma ray detector mounted on a remotely controlled, mobile platform. It provides real-time collection of radiological information including identity, intensity and exact location of gamma-ray emitters in highly contaminated or otherwise inaccessible areas. The device was demonstrated at NIKIMT to INEEL personnel and has been modified according to DOE specifications prior to its demonstration at INEEL and the Mound facility in March 2000.

Detailed Evaluation of the NIKIMT Strippable and Non-Strippable Coatings for Possible Demonstration at the Mound facility— The Mound facility is currently demonstrating technologies that show potential for improvements over baseline technologies in order to reduce costs of D&D operations. One of these demonstrations analyzes the fixative coating technologies that were developed at NIKIMT. These coatings could be used for decontaminating gloveboxes, large pieces of equipment, flooring, walls, ceilings, and most other surfaces with high or intermediate levels of contamination.

Detailed Evaluation of Russian Electrochemical and Foam Decontamination Methods for Los Alamos National Laboratory— LANL LSDDP is evaluating innovative technologies for the characterization, decontamination, size reduction and disposal of metallic transuranic waste that has resulted from the decontamination of 313 gloveboxes that were used for handling plutonium. The purpose of this project is to provide data on the cost-effectiveness and advantages of the electrochemical and foam decontamination technologies that were developed at the Russian Project and Scientific Research Institute of Complex Power Technology (VNIPIET). These technologies will be demonstrated at LANL during FY 2001.

FUTURE DIRECTION

FUTURE DIRECTION OF DDFA

DDFA continues with its strategy of demonstrating innovative technologies alongside baselines through the LSDDP. The LSDDP strategy, coupled with the leveraged ASTD projects serve to accelerate subsequent deployments of successfully demonstrated technologies to meet near-term, high-priority needs. Collaboration with other focus areas and organizations is integral to the program and its success.

Post-FY2006, schedules for the longer-term completion sites offer opportunities to consider a full range of R&D activities from basic science through full-scale development. However, many facilities will be maintained in a surveillance and maintenance status until such time that appropriate levels of funding are made available to pursue deactivation and decommissioning activities. Central to the DDFA long-term strategy is the identification and prioritization of issues with the highest complex-wide return on investment. An increased emphasis is being placed on long-term stewardship, end states, surveillance and maintenance, accelerated decommissioning and remote systems.

For example, the future holds an increased emphasis on robotics research from basic science and applied research and demonstrations to lower worker risk and increase productivity. Through competitive procurements, DDFA will advance basic science and applied research to find innovative technology solutions to issues requiring remote/robotic solutions. This major thrust will advance systems beyond the “joystick and tether” technology into fully automated systems.

DDFA will continue to recognize and address the fact that there are 109 U.S. commercial nuclear utilities, as well as university, medical and industrial facilities licensed (5000 licensees) by the U.S. Nuclear Regulatory Commission (NRC) that share many of the same D&D problems as DOE. DDFA will continue its collaboration with the nuclear utilities to broaden the market for DOE-developed D&D technologies.

NEW EM PROGRAM INITIATIVES

Significant contributions have been made to the DOE-EM program through the management of technology development, demonstration, and deployment projects. The following represent significant opportunities for the DDFA to further the goals of EM and related program areas:

Long-Term Stewardship— Few radioactively contaminated sites within the DOE complex will be remediated to the level that they can be released to the public for unrestricted use. Therefore, attention is turning to the issue of long-term stewardship of these sites.

Applied Research— The Environmental Management Science Program (EMSP) has funded basic scientific research on behalf of OST. Since 1996, EMSP has invested over \$148 million in 268 projects at the DOE National Laboratories and universities throughout the country. The transition from basic science to a fully deployable and commercially available technology represents a challenge and considerable opportunity for OST.

Transfer of Surplus Facilities— In 1997, the EM program instituted a moratorium on the transfer of surplus facilities from other DOE programs to EM for D&D. Beginning in FY 2002, this moratorium is to be lifted, and facility transfer will restart from Defense Programs, Nuclear Energy, and the Office of Science.

CHARACTERIZATION

TECH ID	TECHNOLOGY TITLE
70	BETA SCINT FIBER-OPTIC SENSOR FOR DETECTING STRONTIUM-90 AND URANIUM-238 IN SOIL
74	PIPE EXPLORER (TM) SURVEYING SYSTEM
134	PORTABLE X-RAY, K-EDGE HEAVY METAL DETECTION
873	FIELD RAMAN SPECTROGRAPH
1476	2-D LINEAR MOTION SYSTEM
1790	PORTABLE X-RAY FLUORESCENCE SPECTROMETER
1793	GAMMA RAY IMAGING SYSTEM
1798	MOBILE AUTOMATED CHARACTERIZATION SYSTEM
1810	PIPE CRAWLER INTERNAL PIPING CHARACTERIZATION SYSTEM
1811	PIPE INSPECTION
1840	GAMMA CAM (TM) RADIATION IMAGING SYSTEM
1853	FIELD TRANSPORTABLE BETA SPECTROMETER
1942	POSITION SENSITIVE RADIATION MONITORING (SURFACE CONTAMINATION MONITOR)
1946	INDOOR RADIATION MAPPING USING LASER-ASSISTED RANGING AND DATA SYSTEM
1999	GROUND BASED LASER INDUCED FLUORESCENCE IMAGING
2098	IN SITU OBJECT COUNTING SYSTEM
2103	RESRAD-BUILD
2151	REMOTE UNDERWATER CHARACTERIZATION SYSTEM (RUCS)
2153	COMPACT SUBSURFACE INVESTIGATION SYSTEM
2178	CDI REMOTE CHARACTERIZATION SYSTEM
2241	DECOMMISSIONING IN SITU PLUTONIUM INVENTORY MONITOR (DISPIM)
2310	DIRECT READING TRITIUM MONITOR
2311	PORTABLE SCINTILLATION COUNTER
2315	ELECTRET ION CHAMBERS
2317	LEAD PAINT ANALYZER
2321	EN-VAC ROBOTIC WALL SCABBLER
2382	LONG RANGE ALPHA DETECTION FOR COMPONENT MONITORING
2390	ELECTROMAGNETIC RADIOGRAPHY
2397	NITON 800 SERIES MULTI-ELEMENT SPECTRUM ANALYZER
2398	XRF ANALYSIS OF PCBs AND INORGANICS
2402	3-D VISUAL AND GAMMA RAY IMAGING SYSTEM
2403	NON-INTRUSIVE LIQUID LEVEL DETECTION SYSTEM
2912	VEHICLE AND CARGO INSPECTION SYSTEM (VACIS)
2933	REAL-TIME SURFACE TRITIUM MONITOR
2952	PAINT SCALER
2954	GLOBAL POSITIONING RADIOMETRIC SCANNER
2956	SOLID STATE PIN DIODE DIRECT READING SURFACE TRITIUM DETECTOR
2957	PASSIVE TRITIUM AIR AND SURFACE MONITOR
2959	MOBILE CHARACTERIZATION SYSTEM FOR LARGE CRATES
2960	QUANTRAD SCOUT GAMMA SPECTROSCOPY SYSTEM
2977	SURVEILLANCE AND MEASUREMENT SYSTEM (SAMS)
2990	IN SITU UNDERWATER GAMMA SPECTROSCOPY

DECONTAMINATION

TECH ID	TECHNOLOGY TITLE
87	CORPEX NUCLEAR DECONTAMINATION PROCESS
1421	BIODEGRADATION OF CONCRETE
1450	LEAD TECHXTRACT CHEMICAL DECONTAMINATION
1476	2-D LINEAR MOTION SYSTEM
1543	EMPORE (TM) MEMBRANE SEPARATION TECHNOLOGY
1780	STEAM VACUUM CLEANING
1796	STARBOLT (TM) FLASHLAMP
1812	ROTARY PEENING WITH CAPTIVE SHOT
1839	REACTOR SURFACE CONTAMINANT STABILIZATION
1851	CENTRIFUGAL SHOT BLASTING
1899	SOFT MEDIA BLAST CLEANING
1943	ROTO PEEN SCALER AND VAC PAC SYSTEM
1945	PEGASUS COATING REMOVAL
1950	CONCRETE SHAVER
1971	ADVANCED RECYCLABLE MEDIA SYSTEM
2099	REMOTELY OPERATED SCABBLING
2102	CONCRETE GRINDER
2152	CONCRETE SPALLER
2224	HIGH-PRODUCTIVITY VACUUM BLASTING SYSTEM
2314	STRIPPABLE COATINGS AND FIXATIVES
2375	MOBILE INTEGRATED PIPING DECONTAMINATION AND CHARACTERIZATION SYSTEM
2397	IN SITU PIPE DECONTAMINATION SYSTEM
2937	NURES NUCLIDE REMOVAL SYSTEM
2974	TRITIUM CLEAN-UP CART

DISMANTLEMENT

1477	LASER CUTTING AND SIZE REDUCTION
1787	DUAL ARM WORK PLATFORM TELEOPERATED ROBOTICS SYSTEM
1799	ROSIE: MOBILE TELEOPERATED ROBOT WORKSYSTEM
1807	HIGH-SPEED CLAMSHELL PIPE CUTTER
1815	SWING-REDUCED CRANE CONTROL
1847	OXY-GASOLINE TORCH
1948	SELF-CONTAINED PIPE CUTTING SHEAR
2100	REMOTE CONTROL CONCRETE DEMOLITION SYSTEM
2107	LIQUID NITROGEN-COOLED DIAMOND-WIRE CONCRETE CUTTING
2154	CONCRETE DUST SUPPRESSION SYSTEM
2243	MOBILE-WORK PLATFORM
2303	TRACK MOUNTED SHEAR/CRUSHER
2304	HAND HELD SHEAR
2320	EXCEL AUTOMATIC LOCKING SCAFFOLD
2389	DIAMOND WIRE CUTTING OF THE TOKAMAK FUSION TEST REACTOR VACUUM VESSEL

CONTINUED ON PAGE 16

DDFA TECHNOLOGY PORTFOLIO, CONTINUED

DISMANTLEMENT, continued

TECH ID	TECHNOLOGY TITLE
2395	SIZE REDUCTION MACHINE
2916	REMOTE OPERATED SIZE REDUCTION SYSTEM (ROSRS)
2953	MEGA-TECH HYDRAULIC SHEARS
2955	PIPE CUTTING AND CRIMPING SYSTEM

MATERIAL DISPOSITION

73	IN SITU CHEMICAL TREATMENT OF ASBESTOS
80	STAINLESS STEEL BENEFICIAL REUSE
224	THERMAL CONVERSION OF ASBESTOS
1595	SEG RECYCLE AND REUSE OF RADIOACTIVELY CONTAMINATED SCRAP METAL
1784	VECLOADER HEPA VACUUM INSULATION REMOVAL
1816	URETHANE FOAM VOID FILLING
1846	LOW-DENSITY CELLULAR CONCRETE VOID FILLING
2047	MERCURY SEPARATION FOR ORGANIC LIQUIDS USING SAMMS TECHNOLOGY
2240	SOFT-SIDED WASTE CONTAINERS
2312	WATER SOLIDIFICATION
2313	OIL SOLIDIFICATION
2958	NUKEM COPPER RECYCLE SYSTEM

WORKER SAFETY AND OTHER

1795	MOBILE INTEGRATED TEMPORARY UTILITY SYSTEM
1854	FRHAM-TEX ANTI-CONTAMINATION SUIT
1855	NU FAB ANTI-CONTAMINATION SUIT
1898	PERSONAL ICE COOLING SYSTEM (PICS)
1947	SYSTEM FOR TRACKING REMEDIATION, EXPOSURE, ACTIVITIES AND MATERIALS (STREAM)
1953	HEAT STRESS MONITORING SYSTEM
1954	SEALED-SEAM SACK SUIT
2104	WIRELESS REMOTE RADIATION MONITORING SYSTEM (WRRMS)
2171	ROBOTIC TASK SPACE ANALYZER
2322	D&D AND REMEDIATION OPTIMAL PLANNING SYSTEM (DDROPS)
2376	ONLINE MEASUREMENT OF THE PROGRESS OF DECONTAMINATION
2377	REMOTE SURVEILLANCE OF FACILITIES AWAITING D&D
2396	AEROGO AIR LIFT PALLET SYSTEM
3059	ACCESS, CHARACTERIZATION, AND CLEANOUT OF TANK 105
3060	VORTEX AMPLIFIER
3061	WASTE ISOLATION COMPOSITE BARTER SYSTEM
3069	NT VISION SYSTEM

A TRIBUTE TO PAUL HART

THIS FISCAL YEAR 2000 DEACTIVATION AND DECOMMISSIONING FOCUS AREA ANNUAL REPORT IS DEDICATED TO THE MEMORY OF OUR FRIEND AND COLLEAGUE, DR. PAUL W. HART.

It is appropriate that we dedicate this Annual Report to Dr. Paul W. Hart because his vision led to the first Annual Report for the Deactivation and Decommissioning Focus Area (DDFA) to convey our business approach to technology development, demonstration, and deployment. Most recently, Dr. Hart served as an Associate Laboratory Director on the Senior Executive Board of the National Energy Technology Laboratory (NETL). In this capacity, he directed the activities of the Office of Environmental Quality and Nuclear Security at the NETL sites in Morgantown, West Virginia and Pittsburgh, Pennsylvania. He has been a member of the Executive Committee of the American Nuclear Society's Decommissioning, Decontamination and Reutilization Division. Prior to joining DDFA in 1995, Paul was the Headquarters Program Manager for the Mixed Waste Focus Area. Paul began his career as a research and development scientist with the Union Carbide Corporation, and later became a technology team leader. Paul spent more than 17 years with "Carbide."

While Paul accomplished great things everywhere he went, it was his contributions to the DDFA that exemplified Paul's leadership, vision, and dedication. Paul joined the DDFA in its infancy, and through his hard work and guidance the program has achieved great success. Paul created and refined the DDFA's Large-Scale Demonstration and Deployment Program which has resulted in demonstration of 121 improved decontamination and decommissioning (D&D) technologies in myriad projects. Eighty-two of these technologies have been subsequently deployed over 300 times as a result of their validated benefits. All of us in the DDFA can be proud of Paul and ourselves in these accomplishments because our technology program is making a real difference in the way that deactivation and decommissioning projects are being conducted worldwide. Paul also recognized the similarity of DOE's D&D problems with those of the nuclear utility industry. It was this insight that led to the creation of the DOE/Utility D&D Consortium, which is just beginning to reap benefits to both DOE and the nuclear utilities.

Paul was a real road warrior; he traveled frequently for both business and pleasure. We will remember Paul Hart as a loyal friend, and as a strong person with a great sense of humor who loved to have fun. We will truly miss him. We will always remember Paul's friendly greeting, "Hey, Buddy."

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