

**U.S. DEPARTMENT OF ENERGY SUCCESSES IN DEPLOYMENT OF NEW
TECHNOLOGIES FOR DEACTIVATION AND DECOMMISSIONING OF
FACILITIES: ACCELERATED SITE TECHNOLOGY
DEPLOYMENT CASE STUDIES**

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ABSTRACT

Deactivation and Decommissioning (D&D) of facilities within the U.S. Department of Energy (DOE) Weapons Complex is being accelerated through the use of new, lower-cost technologies. U.S. Department of Energy's (DOE's) Office of Science and Technology (OST) initiated the Accelerated Site Technology Deployment (ASTD) Program in 1998 to provide leveraged funding to the DOE operating programs to help offset the risk of deploying new technology and to accelerate use at multiple sites across the Weapons Complex. Many of the technologies, provided by the private sector, were first demonstrated under OST's Deactivation and Decommissioning Focus Area (DDFA) Large-Scale Demonstration Program. Cost and performance data were obtained during the demonstrations. These data have been utilized to encourage larger-scale and more widespread deployment, as DOE sites are sharing lessons learned. Some of the technologies were originally funded under DOE's Small Business Innovative Research and Industry Programs. Many of the new technologies have now replaced the old baseline operations and some are enabling technologies that are filling a need where no previous solution existed.

Several case studies of D&D technologies provided by commercial vendors demonstrate the keys to successful deployment of new technologies to accelerate cleanup and reduce costs: 1) the technology must demonstrate a significant improvement in cost and/or performance, so that the end user is willing to take the risk of trying something new, 2) the vendor must work closely with the DOE end user to ensure that the technology meets the end user's needs, and 3) a DOE champion can accelerate the widespread deployment through enhanced communication between sites.

THE NEED

To support the defense mission of the United States (U.S.), the U.S. Department of Energy (DOE) and its predecessor created large industrial complexes at many sites across the country to produce nuclear materials and weapons. Like many industrial operations, these facilities generated waste materials, which were hazardous or in this case also radioactive due to the nature of the materials being produced. These wastes were handled using industrial standards of the time. However, as a result of the forty to fifty years of

production operations, widespread contamination of the environment and the production facilities themselves has occurred.

Since 1989, DOE's Office of Environmental Management (EM) has been responsible for environmental restoration, waste management, and nuclear material and facility stabilization at the nuclear weapons complex. The complex is comprised of over one hundred sites in 30 states and Puerto Rico. Over the last ten years, EM has focused on identification of its problems and development of solutions, but much more work remains to be done.

Through its *Accelerating Cleanup: Paths to Closure* document (DOE/EM-0362) published in 1998, the EM program is now accelerating efforts to clean up these sites, while ensuring worker safety and health protection. Significant progress has been made: sixty sites have been cleaned up and fifty-three sites (353 projects) remained at the beginning of 1998 (DOE/EM-0362, 1998). The estimate for this cleanup, to be completed in 2070, is \$147 billion (in 1998 dollars). Some of the current problems can only be solved using today's existing baseline technology, which may require years of treatment to remediate a site. Some of the problems currently have no solutions.

SOLUTION

Because there is a need for less expensive and more efficient solutions, DOE established the Office of Science and Technology (OST) to investigate better methods and approaches to solving EM's problems. DOE's EM directed OST to establish an Accelerated Site Technology Deployment (ASTD) Program to meet site needs to accelerate cleanup schedules, work within budget constraints, and fill gaps where current technologies do not exist to accomplish specific cleanup actions. The ASTD Program, originally known as the Technology Deployment Initiative (TDI), was initiated in fiscal year (FY) 1998 to provide a means and incentives to promote multi-site deployment of new technologies and processes that can accelerate cleanup throughout the weapons complex.

ASTD is a leveraged program that encourages the deployment of newly proven technologies to accelerate DOE EM's schedules for site cleanup, while reducing costs for cleanup. ASTD projects are *customer driven* (supported by the DOE Site Managers for EM) and thus *meet site needs* for improvements to the baseline. ASTD acts as a *catalyst* for site managers to work closely with technology owners to provide innovative solutions that can expedite their cleanup program. The DOE Site Managers share the risk of trying a new technology with OST. Barriers to trying new technologies are broken down through information transfer and sharing. Multiple site deployments of DOE-supported technologies improve DOE's *return on investment*.

Over the last three years, ASTD projects have been selected based upon a competitive call-for-proposals process. DOE site cleanup managers submit proposals to deploy technologies to expedite their cleanup program, saving money and accelerating schedules. They manage the selected projects by working in close cooperation with the

appropriate OST Focus Area. Over seventy projects focusing on deployment of over 100 technologies have been initiated since 1998. Technologies cover the following problem areas:

- characterization, deactivation, and dismantlement of DOE facilities contaminated with radioactive materials (D&D Focus Area);
- monitoring, retrieval, conditioning, and treatment of high-level radioactive waste in underground storage tanks (Tanks Focus Area);
- characterization, sampling, monitoring, remediation, and long-term stewardship of groundwater and soils contaminated with organics, metals, radioactivity, and explosives (Subsurface Contaminants Focus Area);
- characterization and packaging of mixed radioactive and hazardous waste (TRU and Mixed Waste Focus Area); and
- characterization and stabilization of special nuclear materials (Special Nuclear Materials Focus Area).

The project-selection process has required the end-user to prepare a proposal detailing the scope, schedule and cost of the proposed project; other information required in the proposal include the regulatory and stakeholder approval status and projected cost savings to DOE as a result of the deployment. Most of the calls have required support for subsequent deployments from other DOE sites and support from the Focus Areas. The proposals have been reviewed against published criteria and then ranked against others to develop a prioritized list for funding. The following flowchart (Figure 1) shows this process.

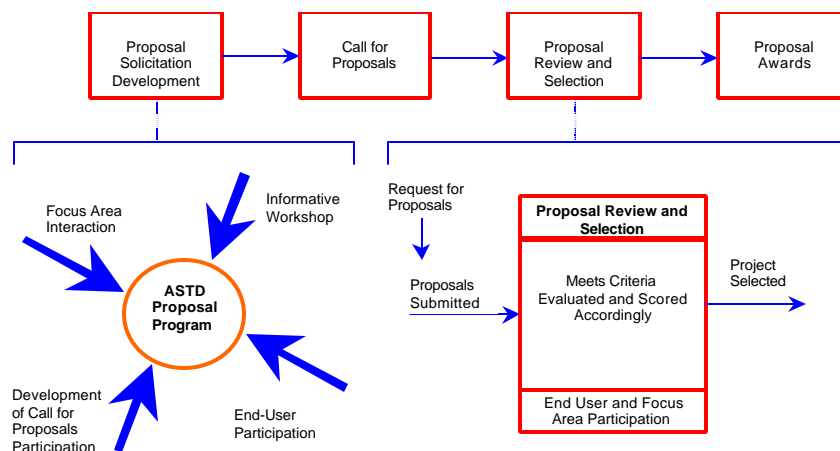


Fig. 1. ASTD Proposal Selection Process

As of September 2000, ASTD has supported over 110 deployments of technologies at sites throughout the DOE Complex. Due to the multi-site support requirement for ASTD projects, a number of technologies have been deployed at multiple sites, thus enhancing DOE's return on their investment in either developing and/or demonstrating the technology. Twenty-four of the over sixty projects have initiated deployments; of those,

nine have deployed technologies at multiple sites. The number of sites involved in multi-site deployments range from two to fifteen. As these more cost-effective technologies are broadly deployed across the DOE complex, DOE saves more money and gets a better return on their development and/or demonstration budget.

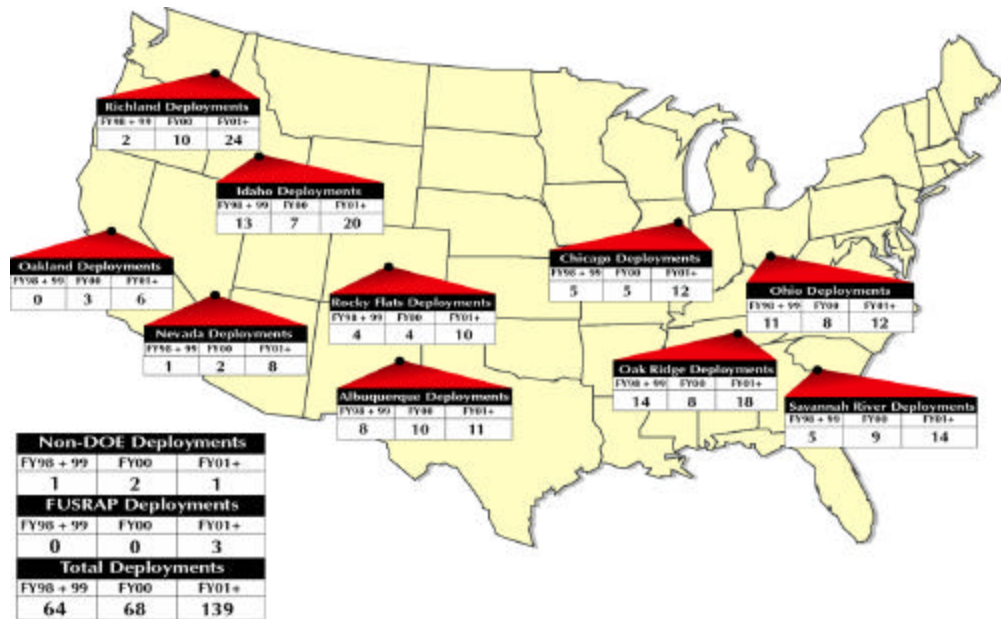


Fig. 2. Map Showing ASTD Deployments by DOE Field Office as of 9/30/00

DEACTIVATION AND DECOMMISSIONING FOCUS AREA

Nine D&D projects deployed 24 technologies in 51 deployments from 1998 through 2000. One hundred forty-nine potential or planned deployments have also been identified related to these projects. These D&D projects have deployed the following categories of technologies:

- characterization of radionuclide-contaminated surfaces, using various gamma, beta, and alpha detection tools and better approaches to data analysis;
- characterization of surfaces for metals, such as lead;
- decontamination and dismantlement of radioactively contaminated materials (e.g., various cutting tools);
- miscellaneous technologies that provide better access to the contamination, enhance worker safety, and improve packaging of waste generated by D&D activities.

Many of these technologies are commercially available, but may have required some modification for the DOE applications. Many of the technology vendors, located throughout the U.S., are small businesses. The following discussion provides

information on two of the ASTD D&D projects, describing three technologies deployed most successfully and broadly across the DOE complex

Integrated D&D Project

The Integrated D &D Project has developed a toolbox of technologies that have been deployed in various combinations or alone. This toolbox includes:

- Characterization tools such as the Gamma Cam Radiation Scanning Device, the Pipe Explorer, the Lead Paint Analyzer, the Niton 800 Multi-element Spectrum Analyzer, the Surveillance and Measurement System, and the In Situ Object Counting System;
- Demolition tools such as the BROOKK 250 Demolition Robot with Scabbler, Hammer, Grapple, Bucket and Hydraulic Shears, the Hand-held Shear, the Oxy-Gasoline Torch, the Track-Mounted Shear
- Miscellaneous tools related to packaging, access, inventory, and health and safety such as the Personal Ice Cooling Suit (PICS), DDROPS, Soft-Sided Waste Container, Snap Together Scaffolding, and En-Vac.

A brief description of each of the Integrated D&D technologies is shown in Table I.

Table I. Integrated D&D Project Technology Descriptions

Technology Name	Description
Brokk BM 250	Small, remote-controlled robot with a hydraulic boom extending 15 feet, to which multiple end effectors may be attached
Oxy-gasoline Torch	A faster, less expensive tool for cutting carbon steel
DDROPS	A pre-planning tool that helps project managers organize projects in such a way that waste packaging is optimized according to a variety of factors
GammaCam	A characterization device that imposes a visual display of radiation on a real-time black and white image of the area
Personal Ice Cooling System (PICS)	A suit with tubing through which ice-cold water is circulated by a battery-powered pump to keep workers cool when wearing Personal Protective Equipment
Excel Modular Scaffolding	Versatile scaffolding that snaps together so workers do not need to tighten clamps by hand or spend time leveling scaffolding
Soft-sided Waste Containers	Flexible Low Level Waste containers that hold 3-4 times as much waste as a box and cost half as much; flexibility of the containers reduces landfill subsidence
Lead Paint Analyzer	Handheld device for real-time detection of metals in paint
Paint Scaler	A handheld, battery-operated drill with chisel attachments for rapid sample collection
PCB Analyzer	Bench-top characterization equipment that detects several elements in samples, including chlorine, a possible indicator of PCBs
Surveillance and Measurement System (SAMS)	A characterization device that provides isotopic information using a thallium-activated sodium iodide detector
Global Positioning Radiometric Scanner System (GPRS)	Detectors attached at a height of 3 feet to the front of a 4-wheel drive vehicle to rapidly survey large areas for radioactive contamination
En-Vac	Robotic abrasive grit blasting scabbling system that removes contamination from concrete or metal walls; attaches to the wall with high vacuum suction

This project has deployed thirteen technologies at six DOE sites. At the Idaho National Engineering and Environmental Laboratory these technologies have been utilized at 25 different sites for a total of sixty-six deployments. All of the technologies have replaced the baseline at INEEL. Estimated cost savings for these technologies over the next ten years are \$25 million. The DOE sites involved in this project have shared lessons learned to promote widespread use.

One of the technologies most widely deployed from the Integrated D&D toolbox is the PICS personal ice cooling suit provided by Delta Temax, Inc. The PICS, introduced in 1990, is designed to relieve worker heat stress, while workers perform environmental cleanup activities in hazardous environments by reducing elevated core body temperature. Thus, a safer and more comfortable work environment is created, thereby extending worker stay-times.



Fig. 3. The Personal Ice Cooling Suit

The PICS suit is applicable to every DOE site in the complex. The large numbers of tasks to be performed in high-temperature work areas (primarily non-air-conditioned spaces) warrant its use as a more cost-effective and safe means of performing environmental cleanup work. It has already been deployed at over 15 sites across the DOE Complex (1). Outside the DOE, the PICS has been deployed in construction, industrial, de-mining (UXO), bomb disposal, pulp and paper, petrochemical, HAZMAT, steel plants, smelters, spray-painting, sandblasting, and mining applications.

The keys to PICS widespread deployment include the following factors:

- PICS has a proven performance (mature technology) and is easy to understand;
- PICS fills a specific DOE need;
- ASTD leveraged funding was provided to specifically “market” the technology to multiple DOE sites; and
- technology vendor worked closely with a DOE champion to identify specific DOE customers in need of the technology.

The Oxy-Gasoline Torch, provided by Petrogen International, Ltd., is another example of a cost-effective technology from the Integrated D&D toolbox. A mixture of gasoline and oxygen delivered to the torch by hoses from pressurized tanks fuels the torch, which can quickly, safely, and cost-effectively cut and segment carbon-based steel structures and materials. The Oxy-Gasoline Torch has proven performance and safety as compared to

the baseline oxy-acetylene torch. The enhanced safety, due to the 100% oxidation of the carbon resulting in a granular slag with a lower thermal capacity than molten steel, is a primary benefit of the technology. Danger to the operator is reduced as there is significantly less “popping” and reduced risk of fire in the work place.

The Oxy-Gasoline Torch is applicable to all DOE Sites performing D&D operations. Petrogen International LTD has provided over 300 units to DOE Site customers. The Oxy-Gasoline Torch has provided superior performance, particularly in the areas of productivity, cost, and worker safety (2). The keys to successful widespread deployment of the Oxy-Gasoline Torch are the same as described above for the PICS technology.

Position-Sensitive Radiation Monitoring System Project

Shonka Research Associates, Inc. (Shonka), through their service provider Millenium Services, Inc., has provided the Surface Contamination Monitor (SCM) and Software Information Management System (SIMS) for deployment at both the Nevada Test Site (NTS) and the Rocky Flats Environmental Technology Site (RFETS). At NTS, the innovative, computer-controlled SCM was used to survey 3735 square meters of surface for both alpha and beta activity. The SIMS technology captured and analyzed the data, providing both color surface maps and 3-dimensional images of the areas mapped. This technology replaced hand-held counters that required direct access, and thus radiation exposure, by personnel. The cost savings for this single deployment at NTS saved an estimated \$47,000 over a period of about 6.5 days (3).

Shonka has also provided this technology at NRC- licensed facilities and at U.S. Corps of Engineers (FUSRAP) program sites. The technology was used to obtain release of the Forked River Site (adjoining the Oyster Creek Nuclear Plant) from NRC license, at the Point Beach Nuclear Plant, and at the Oak Ridges U-25 Site in Tennessee (4).

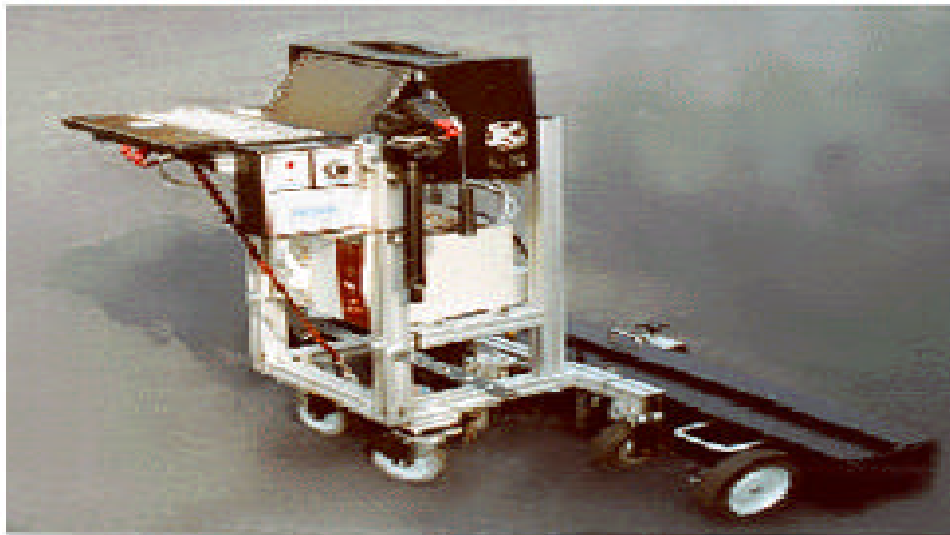


Fig. 4. The Surface Contamination Monitor

Keys to Shonka's success include: 1) an initial proposal from the company to develop a technology that meets a DOE need within the required timeframe, 2) a Small Business Innovative Research grant from DOE as a response to the proposal, 3) a company commitment to then commercialize the technology developed by the SBIR activities, 4) a technology with a proven performance that is superior to the baseline, and 5) an opportunity to deploy the technology at two sites using leveraged funding provided by ASTD.

ASTD D&D CLEANUP ACCOMPLISHMENTS

Cleanup accomplishments from ASTD D&D projects at four DOE sites (Idaho National Engineering and Environmental Laboratory, the Fernald Environmental Management Project, the Savannah River Site, and the Nevada Test Site) through April 2000 include:

- 30,000 square feet of metal cut and buildings removed;
- 3.8 million pounds of waste contained;
- 37,000 square meters of floor surface surveyed;
- nine buildings removed; and
- 7500 linear feet of pipe inspected.

Many more ASTD successes are ongoing as the first twelve projects are continuing to deploy technologies and seven new projects were initiated late in FY00. DOE sites are sharing their successes and communicating lessons learned so that the new technologies can replace the baseline at DOE sites, thus expediting cleanup and saving money.

THE FUTURE

In Fiscal Year 2000 and 2001 more D&D related ASTD projects have been initiated. These projects are targeted for initial deployments at DOE closure sites, Rocky Flats Environmental Technology Sites and Fernald Environmental Management Project. Deployments resulting from these projects are anticipated in 2001 and 2002, while subsequent deployments from the 1998 and 1999 projects are continuing. Technologies are being utilized broadly across the DOE complex, reducing the OST return on investment. DOE D&D activities have been accelerated and money has been saved due to the application of these alternative technologies. ASTD has proven to be an effective approach to ensure application of alternative technologies to solve DOE problems.

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