INEEL/EXT-01-01627

Large-Scale Demonstration and Deployment Project for Decontamination and Decommissioning of Fuel Storage Canals and Associated Facilities at INEEL

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Idaho National Engineering and Environmental Laboratory
Bechtel BWXT Idaho, LLC

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Idaho Falls, Idaho 83415

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ABSTRACT

The Department of Energy (DOE) Office of Science and Technology (OST), Deactivation and Decommissioning Focus Area (DDFA), sponsored a Large Scale Demonstration and Deployment Project (LSDDP) at the Idaho National Engineering and Environmental Laboratory (INEEL) under management of the DOE National Energy Technology Laboratory (NETL). The INEEL LSDDP is one of several LSDDPs sponsored by DOE.

The LSDDP process integrates field demonstrations into actual decontamination and decommissioning (D&D) operations by comparing new or improved technologies against existing baseline technologies using a side-by-side comparison. The goals are (a) to identify technologies that are cheaper, safer, faster, and cleaner (produce less waste), and (b) to incorporate those technologies into D&D baseline operations.

The INEEL LSDDP reviewed more than 300 technologies, screened 141, and demonstrated 17. These 17 technologies have been deployed a total of 70 times at facilities other than those where the technology was demonstrated, and 10 have become baseline at the INEEL. Fifteen INEEL D&D needs have been modified or removed from the Needs Management System as a direct result of using these new technologies.

Conservatively, the ten-year projected cost savings at the INEEL resulting from use of the technologies demonstrated in this INEEL LSDDP exceeds $39 million dollars.

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FIGURES

TABLES

ACRONYMS

ALARA	as low as reasonably achievable
Am	americium
ANL-W	Argonne National Laboratory-West
ARA	Auxiliary Reactor Area
ARMF	Advanced Reactivity Measurement Facility
CFA	Central Facilities Area
CFRMF	Coupled Fast Reactivity Measurement Facility
CD	compact disc
Co	cobalt
CPP	Chemical Processing Plant
Cs	cesium
Cu	copper
D&D	decontamination and decommissioning
DDFA	Deactivation and Decommissioning Focus Area
DNAPLS	Dense Non-Aqueous Phase Liquids
DOD	Department of Defense
DOT	Department of Transportation
DOE	Department of Energy
EPA	Environmental Protection Agency
ETRC	Engineering Test Reactor Critical Facility
EM	Environmental Management
EMR	Electromagnetic Radiography
Excel	Excel automatic locking scaffolding
GLD	Gamma Locator Device
GPRS	Global Positioning Radiometric Scanner

HUD	Department of Housing and Urban Development
IC	integrating contractor
IETF	Initial Engine Test Facility
IFR	ISOCS for free release
IID	Isotopic Identification Device
INEEL	Idaho National Engineering and Environmental Laboratory
INTEC	Idaho Nuclear Technology and Engineering Center
ISOCS	In Situ Object Counting System
ISUGS	In Situ Underwater Gamma Spectroscopy
ITSR	Innovative Technology Summary Report
LMITCO	Lockheed Martin Idaho Technologies Company
LPA	Lead Paint Analyzer
LSDDP	Large Scale Demonstration and Deployment Project
MTR	Materials Test Reactor
NaI	sodium iodide
NETL	National Energy Technology Laboratory
NIKIMT	Russian Research and Development Institute of Construction Technology
NRF	Naval Reactor Facility
OST	Office of Science and Technology
PBF	Power Burst Facility
PCB	polychlorinated biphenyls
PPM	parts per million
RCRA	Resource Conservation and Recovery Act
R/h	roentgen per hour
RUCS	Remote Underwater Characterization System
RWMC	Radioactive Waste Management Complex

SAMS	Surveillance and Monitoring System
S&M	surveillance and maintenance
Spectro Xepos	PCB Analyzer (trade name)
SSWPS	Soft-sided Waste Packaging System
STP	Sewage Treatment Plant
TAN	Test Area North
TSF	Technical Support Facility
TRA	Test Reactor Area
XRF	X-Ray Fluorescence

Large-Scale Demonstration and Deployment Project for Decontamination and Decommissioning of Fuel Storage Canals and Associated Facilities at INEEL (Draft)

1. BACKGROUND

The Department of Energy (DOE) Office of Science and Technology (OST), Deactivation and Decommissioning Focus Area (DDFA), sponsored a Large Scale Demonstration and Deployment Project (LSDDP) at the Idaho National Engineering and Environmental Laboratory (INEEL) under management of the DOE National Energy Technology Laboratory (NETL). The INEEL LSDDP is one of several LSDDPs sponsored by DOE.

As one of five major technology development Focus Areas in the DOE Office of Science and Technology (EM-50), the DDFA is responsible for developing, demonstrating, and implementing cost-effective and safe technologies to deactivate approximately 7,000 contaminated buildings and to decommission approximately 700 contaminated buildings that are currently on DOE's list of surplus facilities. Deactivation involves ceasing facility operations and placing the facility in a safe and stable condition to prevent unacceptable exposure of people or the environment to radioactive or other hazardous materials while the facility awaits decommissioning. The deactivation effort typically entails removing fuel, removing stored radioactive and other hazardous materials, and draining fluid from canals, piping, and other systems. Decommissioning is the process of decontaminating or removing contaminated equipment and structures to achieve the desired end state for the facility. Possible desired end states include complete removal and remediation of the facility, facility entombment, release of facility for unrestricted use, or release of facility for restricted use.

In general, sufficient baseline technologies exist to deactivate and decommission DOE surplus buildings, structures, and their contents. However, these technologies are often labor intensive, time consuming, and expensive, and they can cause excessive exposure of workers to radioactive and other hazardous materials. Additionally, many baseline technologies generate secondary waste beyond what is constituted in the building materials and contents.

To address these problems, the DDFA launched the LSDDP initiative and sponsored several LSDDPs at various DOE laboratories (including the INEEL) to develop, demonstrate, and facilitate deployment of technologies that generate less secondary waste, require less labor, cost less money, reduce exposure of personnel to radioactive and other hazardous materials, and improve worker safety. These innovative technologies address several processes and issues, including characterization of contamination, decontamination of buildings and materials, dismantlement of buildings and equipment systems, reuse or recycle of materials, waste minimization, and worker protection and safety.

Since the goal of any technology development program is to commercialize the resulting technology, a key step in the development process is the demonstration to potential end users. An important focus of the DDFA's LSDDP initiative is to conduct demonstrations at multiple DOE facilities at a scale and duration that will provide sufficient information to convince potential end users of the superiority of the technology. Primary end users for DDFA technologies are the DOE Office of Site Closure (EM-30) and Office of Project Completion (EM-40).

2. INEEL LSDDP

The DDFA has recognized that D&D operations throughout the DOE complex are often unwilling to accept the risk and liability associated with the first-time use of a new technology. The DDFA's LSDDP initiative addresses this concern by sponsoring LSDDPs that evaluate the cost and performance of new technologies. Specific projects implement and evaluate innovative D&D technologies in on-going projects so that the benefits can be determined and demonstrated.

Technologies are evaluated and selected for demonstration based on need and on the likelihood that they will provide an improvement over baseline technologies. Selected technologies are demonstrated side-by-side with baseline technologies, and data collected during the demonstration/comparison are sent to an independent agency for cost and benefit analysis. Comprehensive cost and benefit data from the demonstration are reported in Innovative Technology Summary Reports (ITSRs).

Performance measures for an LSDDP include the total number of demonstrations, the number of technologies transferred to the baseline, and the number of technologies deployed, along with improvements in worker safety, dose reduction, schedule acceleration, and waste minimization.

The INEEL LSDDP began in FY-98 with a scheduled completion in FY-00. Due to delays in shipment of equipment from Russia to the U.S. for the final demonstration, the project was extended through FY-01. The INEEL LSDDP was managed in much the same manner as earlier LSDDPs conducted at other DOE facilities, with the added benefit of lessons learned. The project was established and managed in accordance with the Large-Scale Demonstration Program Implementation Guide, Revision 0, October 31, 1997.

An Integrating Contractor (IC) Team managed the INEEL LSDDP and evaluated technologies for demonstration. This interdisciplinary team consisted of Parsons Engineering, British Nuclear Fuels Limited (BNFL), TLG Services Inc., Florida International University, Idaho State University, and Lockheed Martin Idaho Technologies Company (LMITCO), which was replaced by Bechtel BWXT Idaho LLC (BBWI) in October 2000. DOE Idaho Operations Office (DOE-ID) co-managed the project with the DDFA. Parsons Engineering served as the IC Team leader.

2.1 Technology Needs

The first step in technology selection was to define the technology needs for INEEL facilities scheduled for D&D (facilities are listed and described in the next subsection of this report). The list of needs was routinely modified and updated to reflect the current state of the facility. The technology needs are currently recorded and managed by the INEEL Site Technology Coordination Group (STCG). The needs list can be viewed at http://www.inel.gov/st-needs.

2.2 INEEL LSDDP D&D Facilities

The INEEL LSDDP was implemented at INEEL facilities where D&D activities were already scheduled or ongoing, for example, the Initial Engine Test (IET) Facility, the Advanced Reactivity Measurement Facility and Coupled Fast Reactivity Measurement Facility (ARMF/CFRMF), and the Filter Pits at the Test Reactor Area (TRA).

2.2.1 Initial Engine Test (IET) Facility

The IET facility is a massive underground concrete structure located at the INEEL's Test Area North (TAN). IET was the control center for aircraft nuclear propulsion testing performed at the INEEL in the 1950s and 60s. Little or no radioactivity remains; however, there are possible asbestos, mercury, and lead hazards to be encountered during D&D of this facility. The building walls, floors, and ceiling are constructed with heavily reinforced concrete.

2.2.2 Advanced Reactivity Measurement Facility (ARMF) and Coupled Fast Reactivity Measurement Facility (CFRMF)

The ARMF and CFRMF are located in building 660 (Figures 1 and 2) at the INEEL's Test Reactor Area (TRA). ARMF and CFRMF were underwater test reactors used for reactivity insertion experiments. These reactors achieved criticality in 1960 and 1962. The fuel rods have been removed, and the reactors have not been operated since 1991. The reactors are aluminum structures (Figure 3) located 15 feet apart in a 30,000 gallon common water canal measuring approximately 8 ft. x 28 ft. x 18 ft. deep.

2.2.3 TRA Filter Pits

The TRA Filter Pits are a network of underground buildings, structures, and tunnels at the INEEL's TRA (Figures 4 and 5). The filters are charcoal-activated filters located underground in very restricted entry pits, such that inspection, characterization, and disassembly will have to be done in confined spaces or remotely. The facilities are contaminated with lead, radioisotopes, and deteriorating asbestos.

Figure 1. Test reactor pool at TRA-660 (ARMF and CFRMF).

Figure 2. ARMF/CFRMF Reactors.

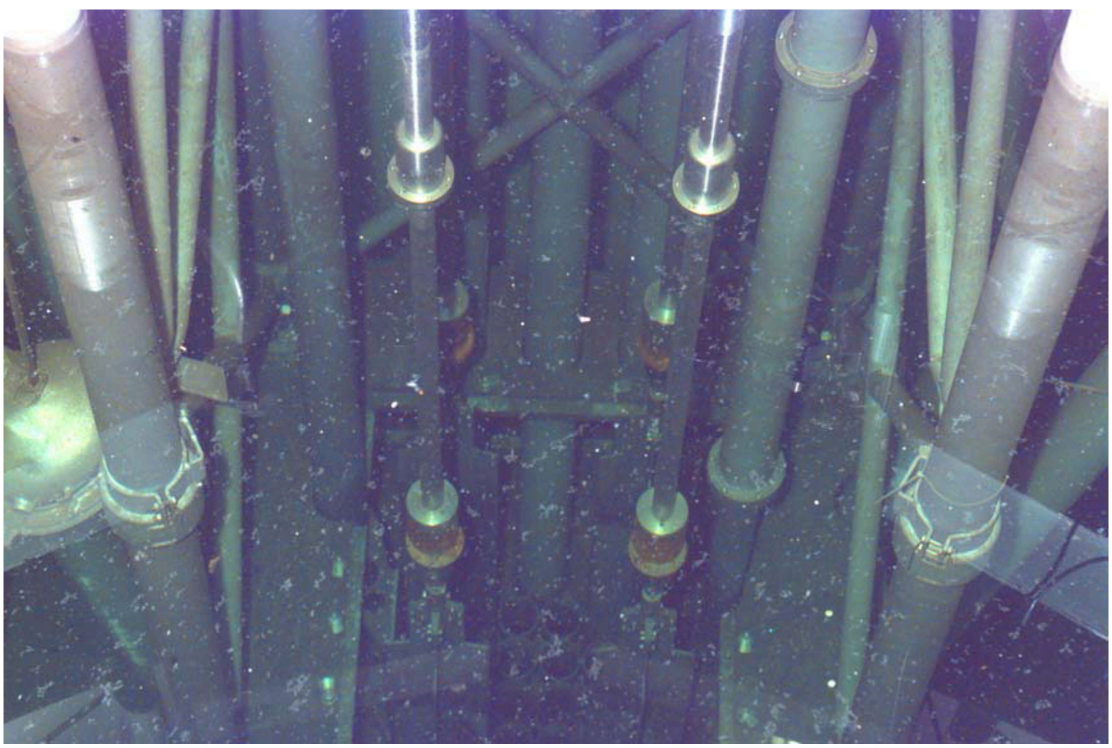

Figure 3. Underwater reactor structure.

Figure 4. Shielded entry hatches to the filter pits.

Figure 5. Vent stacks from the filter pits.

2.3 Technology Selection Process

The goal of the LSDDP at INEEL was to select, demonstrate, and deploy new or improved technologies that will make D&D activities at the INEEL and other DOE sites safer and more cost effective. Before a technology can become a candidate for demonstration or deployment, it must meet all of the following minimum criteria:

- It must address an existing INEEL technology need
- It must be ready for field deployment without further development
- It must be new or improved, or be a new application of an existing technology
- It cannot have a previous history of demonstration at other LSDDPs for the same application
- It must show a potential for benefit with respect to reduced cost, worker safety, secondary waste minimization, schedule acceleration, and reduction in worker exposure to radioactive or hazardous contaminants.

The selection of technology needs was managed by the STCG. Needs were identified in the field during D&D operations or planning activities. These needs were documented and submitted to the STCG, and then entered into a needs database until such time that the need changed or no longer existed.

All technologies meeting the minimum criteria were considered candidates for demonstration. After a candidate technology was identified, a one-page screening form (Appendix A) was completed and presented to the IC Team. This form facilitates screening of a technology to ensure that it meets the minimum requirements. If a technology was disapproved, it was entered into the database as such and no further action was taken. If the technology was approved it was assigned to a test engineer for a detailed evaluation.

The test engineer investigated the technology and completed a detailed evaluation addressing in more detail the same requirements found in the screening form, plus technology provider interest, demonstration cost, technology provider cost sharing, and applicability across the DOE Complex (Appendix B). The detailed evaluation was then presented to the IC Team for discussion and approval by formal vote.

Upon approval, a technology was wait-listed until the INEEL D&D Operations schedule identified an opportunity for demonstration. Approval of a technology by the IC Team was no guarantee the technology would be demonstrated. After approval by the IC Team, a technology could be rejected for budgetary reasons, inability to achieve acceptable contractual agreements with the technology provider, no fit with the schedule of D&D activities at the INEEL, low potential benefit to the DOE Complex, and others.

2.4 Demonstration Process

Once a technology was identified for demonstration, a test engineer was assigned. The test engineer immediately began working with D&D Operations to set a schedule and make arrangements to do a side-by-side demonstration of the new technology and the baseline technology. After establishing a demonstration date, the procurement process was put into place to buy, rent, borrow, or lease the necessary equipment and have it shipped to the INEEL. A test plan was developed, reviewed, and approved by the IC Team and D&D Operations. The new technology was received at the INEEL and deployed at the demonstration site along with the baseline technology. The two were not always operated on the same day but were always demonstrated on like-for-like activities. An assistant recorded all the data, including cost, man-hours, equipment used, laboratory, and other ancillary costs for both the new technology and the baseline technology. The technologies were demobilized, decontaminated, and returned to their source. The data were then forwarded to the U.S. Army Corps of Engineers for an independent cost/benefit analysis.

Within ten working days, the test engineer distributed a one-page fact sheet on each technology demonstration. The fact sheet was followed by an Innovative Technology Summary Report (ITSR) issued within 90 working days of completion of the demonstration. A short video was made of each technology. The fact sheets, ITSRs, and videos are available on CDs. (Figure 6).

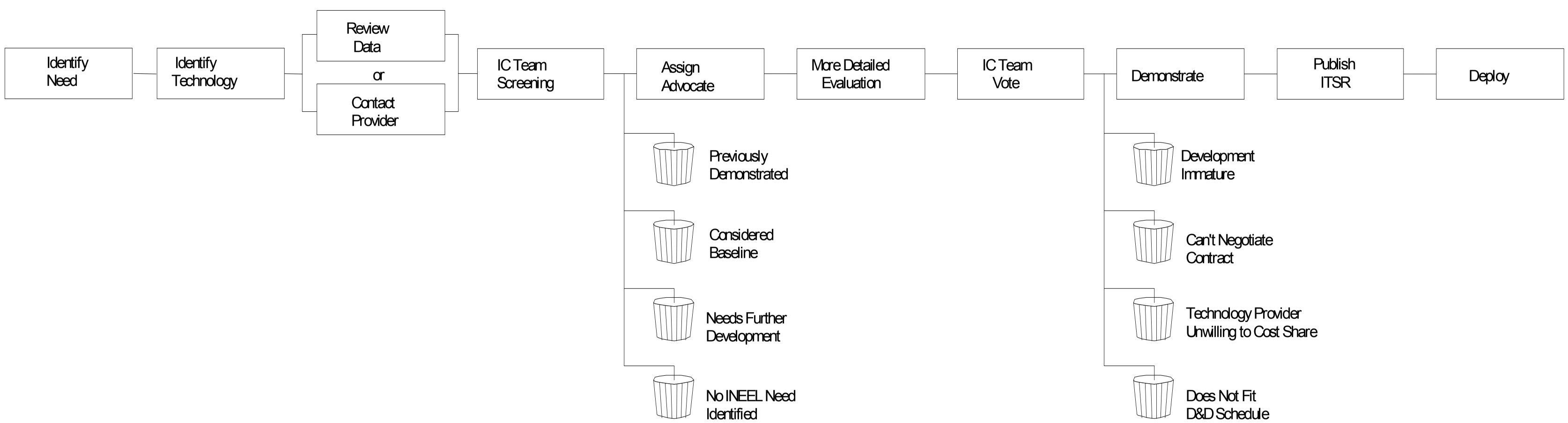

Figure 6. Technology Selection Process

2.5 Technologies Demonstrated

Table 1 identifies the technologies that were demonstrated in the INEEL LSDDP and includes a summary of the demonstration and the results. More detailed information can be obtained from the ITSRs or fact sheets for each technology. (No ITSRs were issued for the EMR or the Ultra Lift.) The following discussion presents information regarding each of the technologies and their demonstrations.

2.5.1 RUCS

The Remote Underwater Characterization System (RUCS) is a small, remotely-operated submersible vehicle that provides visual and gamma radiation detection and characterization. The unit was developed in Canada by Inuktun Services Ltd. and was modified by the Robotics Crosscutting Program at the INEEL to provide radiation detection, orientation, depth monitoring, and control. The unit was easy to maneuver and control, and provided data previously unavailable due to inaccessibility. The RUCS was demonstrated August 25, 1998 to characterize the reactor and canal components in the ARMF/CFRMF canals; it was deployed again in June 1999 in the ARMF/CFRMF canals for dismantlement planning.

2.5.2 SSWPS

The Soft-sided Waste Packaging System (SSWPS), a product of Transport Plastics Inc., is a soft-sided waste container chosen specifically for its ability to store or transport low-level D&D bulk waste such as metal and concrete without puncturing the bags (punctures do occur, but rarely). SSWPS is used routinely for soil disposal, but desposal of D&D debris is a rather new application that is gaining acceptance. The SSWPS demonstration began in August 1998 and concluded on November 12, 1998. The containers have an interwoven 40-mil high-density polyethylene inner liner and a 25-mil interwoven polypropylene outer shell with web closure straps. Each container has a capacity of 260 cubic feet, compared to 96 cubic feet for the baseline (4ft x 4ft x 8ft plywood boxes and 25B metal boxes), and has a 24,000-pound capacity, at a cost of $380, compared to $750 for metal boxes. The containers are approved by the Department of Transportation (DOT). They are strong tight containers that are easily stacked and make much more efficient use of storage space. The SSWPS is currently being deployed at all D&D sites at the INEEL and is now considered baseline.

2.5.3 LPA

Demonstration of the Lead Paint Analyzer (LPA), a product of the Niton Corp., was completed in February 1999 at TAN and at Idaho Nuclear Technology and Engineering Center (INTEC). The vendor provided the equipment as their contribution to cost sharing. The demonstration was a great success; INEEL's D&D Operations has procured a lead paint analyzer and uses it routinely. A lead paint analyzer is a hand-held, battery-operated unit that uses X-ray fluorescence spectrum analysis to perform in situ, near-real-time detection and quantification of lead and 17 other elements (including all eight RCRA metals) in paint. The EPA regulators for homes and buildings, under HUD jurisdiction, have approved these units for use. The Lead Paint Analyzer has since been deployed at other INEEL locations.

Table 1.Technology reference data.

Technology Demonstrated	Need Addressed	Demonstration Date	Technology Category	Country of Origin	Baseline Technology	Benefit Area	Cost Savings Million $	Savings Category	Deployments
SSWPS	ID-7.2.36	01/06/1999	Waste Disposal	USA	4 x 8 Boxes	Cost	$2	Cost	7
RUCS	ID.7.2.20	08/25/1998	Dismantlement Characterization	Canada	Manual Survey	Cost Dose Safety	$1	Cost Dose	3
LPA	ID-7.2.15	02/09/1999	Waste Disposal Decontamination Characterization	USA	Laboratory Analysis	Cost Schedule Dose 2nd Waste	$6	Labor Schedule Dose 2nd Waste	6
Alloy Analyzer	ID-7.2.05 ID.7.2.27	06/29/1999	Recycle/Reuse Dismantlement Characterization	USA	Laboratory Analysis	Cost Schedule 2nd Waste	$1	Labor Schedule 2nd Waste	1
PCB Analyzer	ID-7.2.15 ID-7.2.17	11/18/1999	Waste Disposal Decontamination Characterization	Germany	Laboratory Analysis	Cost Schedule 2nd Waste	$8	Cost Schedule 2nd Waste	11
EXCEL Scaffold	ID.7.2.03	04/09/1999	Decontamination Dismantlement	USA	Manual Scaffold	Labor Safety	$4	Cost	3
Paint Scaler	ID.7.2.15	09/22/1999	Waste Disposal Decontamination Characterization	USA	Manual Scraper	Labor Dose	$1	Cost Dose	5
SAMS	ID.7.2.16	03/30/2000	Recycle/Reuse Characterization	USA	Laboratory Analysis	Labor Dose 2nd Waste	$9	Cost Dose 2nd Waste	6
ISUGS	ID.7.2.20	05/25/2000	Characterization	USA	Laboratory Analysis	Safety Schedule Dose	$1	Cost Schedule Dose	

Table 1. (continued).

Technology Demonstrated	Need Addressed	Demonstration Date	Technology Category	Country of Origin	Baseline Technology	Benefit Area	Cost Savings Million $	Savings Category	Deployments
GPRS	ID.7.2.19	09/29/1999	Recycle/Reuse Characterization	USA	Manual Survey	Schedule Safety Dose	$1	Schedule Dose	22
Envac	ID-7.2.03	04/04/2000	Decontamination Recycle/Reuse	Japan	Handheld Scabbler	Labor Schedule Dose	$2	Cost Schedule Dose	1
EMR	ID.7.2.19	06/28/1999	Characterization	USA	Laboratory Analysis	Labor Schedule Dose		Labor Schedule Dose	
GLD	ID.7.2.19 ID.7.2.06 ID.7.2.39	07/26/2000	Characterization	Russia	Manual Survey Laboratory Analysis	Schedule Dose		Schedule Dose	1
IID	ID.7.2.19 ID.7.2.06 ID.7.2.39	07/26/2000	Characterization	Russia	Laboratory Analysis	Schedule Dose		Schedule Dose	1
IFR	ID.7.2.19	08/30/2000	Characterization Recycle/Reuse	USA	Manual Survey	Cost Schedule	$2	Cost Schedule	
Copper Recycle	ID-7.2.23	11/19/1999	Waste Disposal Recycle/Reuse	Germany	None	Cost	$2	Cost	
Ultra Lift	ID.7.2.19	07/26/2000	Dismantlement	USA	Manual Lifting	Labor	$1	Labor	1

2.5.4 Excel

Excel automatic-lock scaffolding (Excel), provided by Bartlett Services Inc., was demonstrated at the Security Training Facility from January 18, 1999 through April 9, 1999. Large areas required scaffolding, including tanks, extensive piping requiring asbestos removal, and some areas that were access-limited. This is a modular system with a trigger release mechanism designed for quick assembly and disassembly in the field. It reduces the number of parts required by 40%, reduces labor costs by 60% to 70%, reduces radiation exposure times by 60% to 70%, and meets year 2000 OSHA handrail requirements. D&D operations has purchased the Excel and is currently deploying it at other job sites.

2.5.5 Alloy Analyzer

The Alloy Analyzer is a hand-held battery-operated unit that is 8 in. x 3 in. x 2 in. and weighs approximately 2 ½ pounds. This unit, manufactured by the Niton Corp., is designed to take into the field for characterization and elemental analysis of metals. The detector uses x-ray fluorescence to analyze and identify the metal alloy and elemental composition within seconds, with numerous possible applications in recycling, characterization, and quality control efforts. Use of the Alloy Analyzer will allow segregation of metals during D&D operations with little impact to baseline operations.

The conventional practice at the INEEL has been to randomly pile metals in the excess yard before selling it as scrap metal. Because of the DOE moratorium on recycling, there is no apparent cost benefit to the INEEL for segregating metals at this time. However, use of the Alloy Analyzer did provide an opportunity to demonstrate the potential cost benefit of salvage or recycling. The commercial nuclear industry can and does recycle metals to the commercial scrap market.

This technology was demonstrated June 15-29, 1999 at Power Burst Facility (PBF) to characterize the piping in the facility before D&D.

2.5.6 EMR

Electromagnetic radiography (EMR) is a non-destructive characterization technology that uses ultra-high impulses operating in the radio-frequency spectrum to provide subsurface characterization. The technology is available as a service from Mission Research Corp. EMR quantifies underground solids, liquids, chemicals, dense non-aqueous phase liquids (DNAPLS), heavy metals, etc., and provides a three-dimensional map of their geometry and location. The EMR was demonstrated at the INEEL to characterize the railroad base at IET for mercury and to characterize underground plumes of fuel at the IET refueling station and underground hazards and obstructions around buildings under D&D at INTEC. The new technology was demonstrated on April 27 and 28, 1999 at IET and INTEC.

The baseline method consists of comparing data from ground penetrating radar with as-built drawings. The baseline method was performed at INTEC on June 28, 1999, and the results of the baseline method were compared to the results from the EMR. Based strictly on this comparison and the time it takes to get the results, the EMR does not appear to be of significant benefit for locating underground piping, solids, and utilities. However, with further validation, its ability to identify and map contamination plumes within DOE sites could have a tremendous impact on budgets and schedules.

2.5.7 GPRS

A demonstration of the Global Positioning Radiometric Scanner (GPRS) system was completed at the IET on September 29, 1999. GPRS provides 100% coverage of gamma radiation characterization of large areas, such as contaminated soils around a facility. The detection equipment is mounted on a fourwheel drive HUM-V and includes a global positioning system, computer and software, and two plastic scintillators. The system was developed by the INEEL and TSA Systems for use at the INEEL. The system provides radiometric data (in counts per second), geographical data (latitude and longitude), altitude, and time. The baseline method consisted of hand-held surveys conducted on a grid.

This demonstration took place over an old trench where a lightly contaminated stack was felled and covered with soil as a radiological barrier. The area was surveyed with the baseline and considered to be within release limits. When the GPRS went over the same area it identified an area of subsidence with elevated radiation levels above background. In response to these results, that area was backfilled and resurveyed. The GPRS has since been deployed at other locations at the INEEL.

2.5.8 Paint Scaler

A paint-scaler demonstration was performed September 22, 1999 at TRA. This unit is a battery-operated, hand-held tool with interchangeable bits, operating very similar to a jackhammer or electric chisel. The unit replaces manual chisel and scraping hardware (the baseline method), and it can be used to remove paint samples for lead analysis. If the bit becomes contaminated it is simply removed and replaced. The demonstration was very successful; sampling time was reduced by as much as five times, and samples were cleaner and more consistent. The paint scaler currently in use at the INEEL is a Bosch Rotary Hammer Drill. It has since been deployed at several sites at the INEEL.

2.5.9 Spectro Xepos

The PCB analyzer called Spectro Xepos XRF was developed in Germany and is marketed domestically by ASOMA SPECTRO Analytical Instruments. The Spectro Xepos is an x-ray fluorescence spectrometry technology designed for direct interfacing to a standard computer. It can perform analysis of powders, liquids, slurries, granules, films, and coatings with little or no sample preparation. This technology does not identify PCBs directly; rather it identifies the presence or absence of chlorides in the sample. Because chlorides are present in all PCBs, their absence indicates the absence of PCBs. The instrument detects elements of atomic weights from sodium to uranium in concentrations down to parts per million (PPM).

The demonstration started June 2, 1999 with collection of samples for both the baseline and the new technology. Samples for the baseline method were collected and sent to a contracted laboratory for analysis. Samples for the new technology were analyzed at the INEEL with the Spectro Xepos, and the results of the two methods were comparable . This demonstration was completed on November 18, 1999.

This screening tool allows D&D operations to make immediate determinations for dispositioning rooms and facilities, rather than waiting the typical 30 to 90 days for lab analysis. This will provide significant savings by shortening D&D schedules. The PCB analyzer has since been deployed at several different projects around the INEEL.

2.5.10 Copper Recycling

A copper recycling technology was demonstrated by the INEEL LSDDP on November 15 through 19, 1999. The German-based technology, distributed domestically by NUKEM Nuclear Technologies, was demonstrated in support of a NETL-sponsored and funded Program Opportunity Notice. For the demonstration, 13-½ tons of insulated copper wire, both uncontaminated and surrogate contaminated, were processed to obtain uncontaminated copper for recycling.

After pre-sizing and sorting, the contaminated wire is fed into the system, where it is granulated. The granulated copper and insulation are mechanically sorted and collected for disposal. The bulk of the contamination is contained in the dust collection system. Any remaining contamination is fixed to the insulation. The copper is recycled, and the insulation disposed of as dunnage or filler in low-level waste disposal packages. For this demonstration a surrogate of cobalt, cesium, and fluorescein was applied to the insulated wire to provide post-demonstration evidence of the efficiency of the system for separating and collecting contaminated materials and for ensuring that the copper separated for recycling was in fact uncontaminated. The recycling process reduced the waste volume by 80% and provided 8 ½ tons of recyclable copper.

The baseline method is to dispose of all contaminated or potentially contaminated cable in INEEL low level waste landfills. Therefore no comparison can be made.

2.5.11 SAMS

A surveillance and measurement system (SAMS) demonstration was completed March 30, 2000 at the INEEL's TAN. This technology, a product of Berkeley Nucleonics, is a field-portable sodium iodide (NaI) spectroscopy system using a proprietary quadratic compression conversion technique to identify multiple isotopes and quantify the radiation levels all within one second. A bar graph displays the radionuclides and the intensity. The SAMS can be used on moving targets with one to two second time slices. The baseline technology is the traditional Geiger-Muller pancake probes that are used all over the world today. The SAMS not only quantifies the radioactivity but also identifies the isotopes. This $8,000 instrument provides this information in situ in less than five minutes. By way of comparison, the baseline method can cost $150 per sample with delay of up to two days for the lab analysis. Since the initial demonstration, the SAMS has been used in two additional deployments at other locations at the INEEL.

2.5.12 En-Vac

The En-Vac wall scabbler is a Japanese technology marketed by MAR-COM, Inc. The technology uses abrasive steel grit blasting to decontaminate metal and concrete surfaces. The mobile robotic unit operates as it moves along the work surface, adhering to the surface with the help of a high vacuum suction created at its base. It can climb walls and move over inverted surfaces. It functions equally well on floors or slopes. Mobility is provided with individually motor controlled wheels. The complete system consists of the En-Vac Robot, Recycling Unit, Filter Unit, and Vacuum Unit. This technology was demonstrated at the TAN 607 Decon Shop on April 4, 2000 with a deployment at the TAN 607 North Gallery immediately following the demonstration.

2.5.13 ISUGS

The In Situ Underwater Gamma Spectroscopy system (ISUGS) provides the ability to gather spectral data underwater. Instrumentation is housed in a submersible unit located in a low background area of an underwater pool or canal. Objects to be scanned are transported to the detector and positioned at the required elevation and distance from the detector using underwater video equipment. Typical scan times range from 90 seconds, to 300 seconds for high activity sources. The number of scans required varies depending on the size of the object; smaller objects will be repositioned at least three times. The unit can operate at depths as great as 35 feet. An umbilical from the detector to a control station transmits data and vents gases generated by the liquid nitrogen. The baseline for this work is to remove the object from the pool, package it in a shielded container, and transport it to a permanent counting station for characterization. The object is then returned to the pool for storage.

The demonstration of this technology was completed on May 25, 2000 at the Materials Test Reactor Canal at the Test Reactor Area. In response to the success of the technology during the demonstration, the contract with the vendor was extended by D&D Operations to characterize everything in the canal. The system is available as a commercial service from FRAMATOME Technologies. The new technology worked very well and proved cost-effective.

2.5.14 IFR

The In Situ Object Counting System (ISOCS) was used at the INEEL as a tool to free release rooms, buildings, or facilities for re-use. The ISOCS for Free Release (IFR) demonstration was completed on August 30, 2000 at the old laundry facility at the Central Facilities Area (CFA). ISOCS is available from Canberra Instruments.

The IFR uses ISOCS to do a large area survey after a facility has been decontaminated. It is used for 100% survey inspection of buildings or rooms using a long count to allow detection of low levels of contamination. If the room is clean, it is ready for free release and re-use. If contamination is detected, the ISOCS, through a series of shielded surveys, isolates the location of the contamination. The location can then be decontaminated and surveyed again. Baseline for this technology is to grid off the walls, floors and ceilings based on statistical analysis and perform a series of hand surveys. Using the IFR resulted in 75% savings in labor. It eliminated the physical demands of hand surveying and provided 100% inspection, not available with gridding and surveying.

2.5.15 GLD

The 3D-Gamma Locator Device (GLD) is a Russian technology provided by the Research and Development Institute of Construction Technology (NIKIMT) in Moscow, Russia. The GLD provides three-dimensional characterization of radioactivity in areas of extremely high activity. It is a robotic unit that provides feedback to a computer-based control system. The sensor is mounted on a tracked vehicle and operated remotely using a camera mounted in a vehicle.

This technology is unique for several reasons. First, it operates on radio frequencies, completely non-tethered, and can maneuver and transmit around walls and corners. Second, it has a broader range of sensitivity (i.e., 60 KeV to 6 MeV compared to 100 KeV to 2 MeV with conventional detectors). And third, it has a broader scanning angle (i.e., 330° horizontal and 125° vertical compared to 73° horizontal and 55° vertical).

This technology was demonstrated at the TAN 616 facility on July 25, 2001, followed by a deployment at Power Burst Facility (PBF) Cubicle 13 on July 31, 2001. Preliminary data from the TAN-616 demonstration shows the GLD data replicates the data obtained manually with surveys and smears. In addition, the GLD found elevated levels in several locations not identified in the manual gridded surveys of the same area.

2.5.16 IID

The Isotopic Identification Device (IID), another Russian technology provided by NIKIMT, was demonstrated at TAN-616 at the same time as the GLD. The IID identifies the isotopes that are generating the radioactivity that is being characterized by the GLD. The IID was programmed to identify Cs-137, Co-60, and Am-241 and can be modified to identify other isotopes as well. The IID uses computer software to analyze the signal and identify the isotope. A robot was provided and operated by the INEEL Robotics Crosscut Program to mobilize the GLD and the IID. The robot, the GLD, and the IID all operated remotely and untethered, making this unique from other technologies.

Based on the successful demonstration at TAN-616, the technologies were deployed at PBF Cubicle 13 on July 31, 2001. From the last entry made in 1985, records show Cubicle 13 had extremely high contamination, with hotspots as high as 900 R/h. These high radiation fields prohibit personnel entry into the cubicle. The deployment of the Russian GLD/IID at the PBF was completed without incident and provided the characterization information necessary to plan future D&D work in the cubicle. As it turned out, the extremely high activity levels recorded from the last entry 17 years ago were from short lived isotopes, and the levels encountered during this entry were on the order of 24 mR/h, an outcome that came as no surprise. However because of the unknown, unverifiable conditions, equipment like this is necessary for situations where the possibility exists.

2.5.17 Ultra Lift

The Ultra Lift is a battery-operated equipment-moving dolly that can mechanically step heavy loads up and down stairs. The Ultra Lift uses a screw drive system to lift objects weighing up to 1500 lb to a vertical height of 36 in. The Ultra Lift is approximately the same size as a standard equipment dolly of the same load rating.

The technology was demonstrated at the INEEL to transport a robot with a Gamma Locator Device (GLD) down a flight of stairs in the TAN-616 facility. The Ultra Lift assembles in a matter of minutes and requires only two operators, as opposed to four, to guide and run controls. All lifting and moving is performed mechanically by Ultra Lift, eliminating the risk of back injury while improving the efficiency of loading objects in and out of a pickup truck and moving heavy items up and down stairs. It also reduces the number of people needed for the task from four to two, one to operate the equipment and the other to steady the load.

2.6 Technologies Deployed

Seventeen technologies were demonstrated during the 2-½ year project. Of those seventeen technologies, sixty percent have become baseline at the INEEL including the RUCS, LPA, SSWPS, Excel, GPRS, Spectro Xepos, Paint Scaler, Ultra Lift and SAMS. Deployments are listed below by technology and location of the deployment:

Table 2. Summary of deployments.

Technology	Date Deployed	Location	Total
Alloy Analyzer	3/25/00	Connecticut Yankee	1
Envac	3/17/00	TAN Hot Shop	1
Excel Scaffolding	8/98	TRA	3
	1/99-12/99	STF	
	4/99-5/99	STP	
GLD	8/28/00	PBF Cubicle 13	1
GPRS	6/99	ARA-23	22
	9/99	ANL-W	
	4/3/00-4/17/00	TAN	
	5/2/00	INTEC	
	5/17/00	INTEC	
	5/18/00	INEEL ROADS	
	5/22/00-5/25/00	ARA I&II	
	5/30/00-6/13/00	RWMC	
	6/14/00-6/15/00	INEEL ROAD AREAS	
	6/20/00-6/26/00	INTEC	
	6/27/00	TRA	
	6/27/00	CFA	
	6/28/00	INTEC	
	6/29/00	ARA I&II	
	7/8/00	TRA	
	7/10/00	CFA	

Technology	Date Deployed	Location	Total
	7/13/00	TAN	
	7/17/00-7/19/00	RWMC	
	8/7/00	TRA	
	8/7/00	CFA-08	
	8/24/00-8/30/00	TAN	
	9/5/00-9/19/00	RWMC	
IID	8/28/00	PBF Cubicle 13	1
ISUGS	5/26/00	MTR	1
LPA	1/24/00	TAN DECON SHOP	6
	1/24/00	TAN HOT SHOP	
	2/00	ETRC	
	2/1/00	MTR	
	4/00	CPP 603	
	4/00	CFA RAD LAB	
Paint Scaler	12/14/99	TRA GAMMA BLDG	5
	1/5/00	TRA641	
	2/00	ETRC	
	3/2/00	TAN	
	4/00	CPP 603	
RUCS	1998	TRA-660	3
	5/99	TRA-660	
	2/1/00	MTR Canal	
SAMS	4/4/00	TAN TSF-26	6
	6/1/00-6/30/00	TAN	
	7/1/00-7/26/00	TAN	
	7/1/00-7/26/00	ARA II	

Technology	Date Deployed	Location	Total
	7/26/00-8/2/00	ARA II	
	8/2/00-8/10/00	ARA II	
Spectro Xepos	12/13/99	STP	11
	12/13/99	STP	
	12/15/99	TRA GAMMA BLDG	
	1/10/00	TRA-641	
	1/26/00	IET	
	1/26/00	IET	
	2/00	ETRC	
	2/00	OLD FIRE STATION	
	3/2/00	TAN 607	
	4/00	STF	
	4/00	STF	
SSWPS	7/98	CFA	8
	1/99-9/99	STP	
	2/99-9/99	ARA I	
	2/99	NRF	
	6/99-8/99	STF	
	4/26/00	TAN	
	12/14/00	ARA-25	
	FY98	Pantex	
Ultra Lift	8/21/00	TAN-616	1
		Total	70

2.7 Origin of the Technologies

Based on suggestions from the DDFA and lessons learned from previous LSDDPs, we investigated foreign countries and non-D&D industries for technologies that might have applications in DOE D&D operations. The effort turned out to be quite successful, with six technologies originating from four foreign countries (Figure 7), and nine from non-D&D industries (Figure 8).

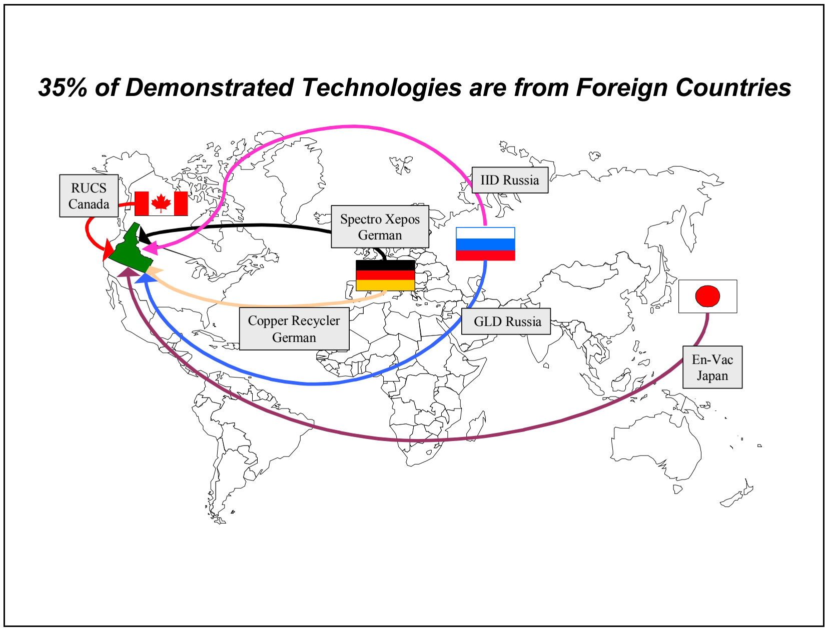

Figure 7. Technology Distribution by Origin.

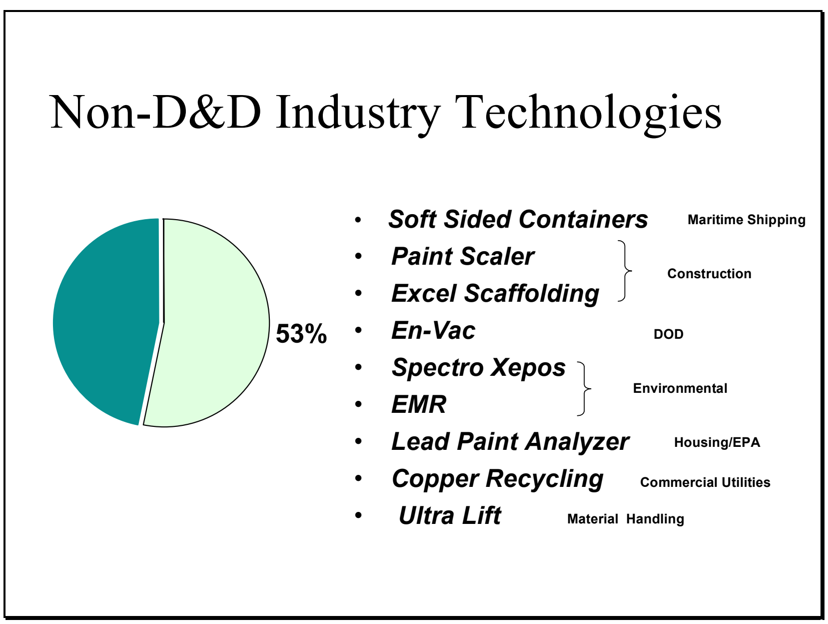

Figure 8. Non-D&D Industry Technologies.

2.8 Technology Distribution

Many of the technologies demonstrated can be used in more than one D&D activity. For example, the LPA can be used in characterization, decontamination, and waste disposal. The distribution is fairly evenly split between decontamination, dismantlement, waste disposal, and recycle/reuse, but 12 of the technologies can be used in characterization activities (Figure 9).

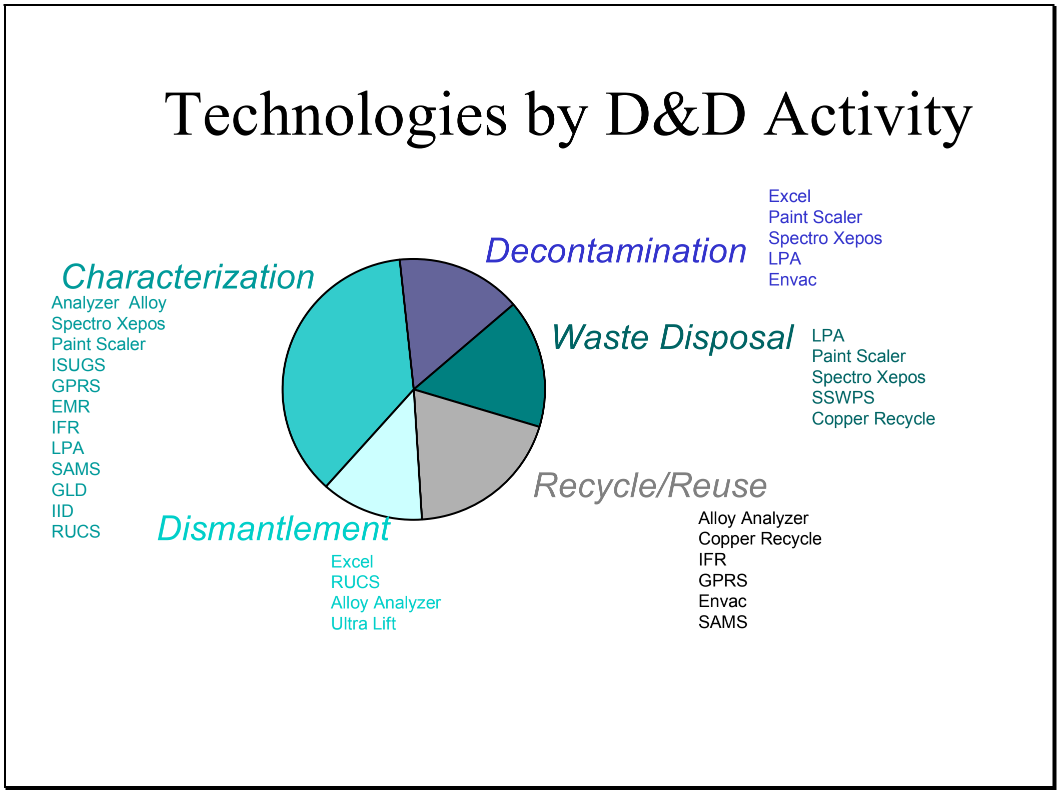

Figure 9. Technology Distribution by D&D Activity.

2.9 Cost Savings

The ten-year projected cost savings at the INEEL, based on using these new technologies in future D&D work, is in excess of $39 million. Figure 10 presents the cost saving from 13 demonstrated technologies.

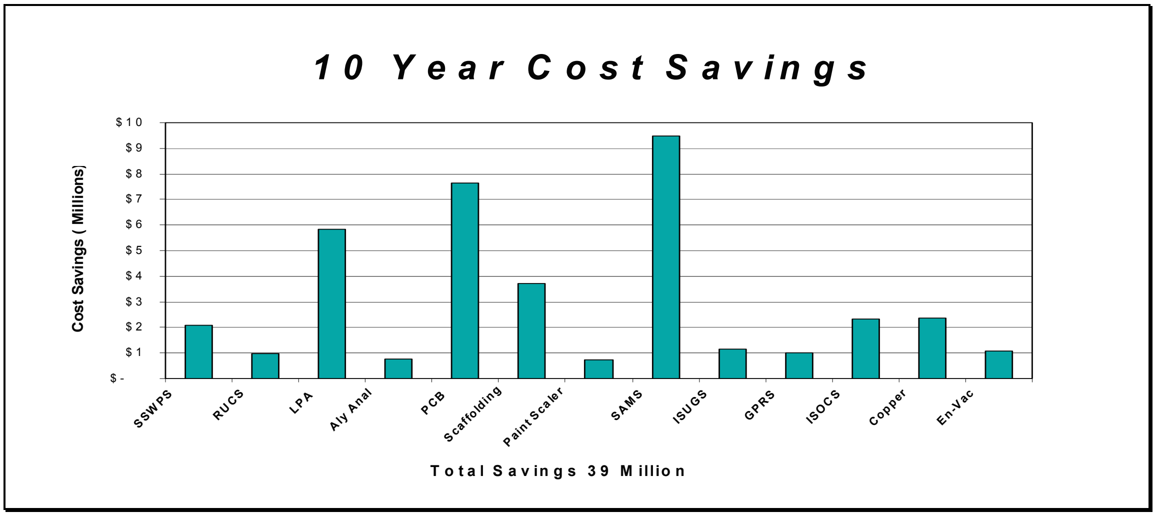

Figure 10. Ten Year Cost Savings.

These savings are derived from the cost/benefit analysis data provided by the U.S. Army Corps of Engineers for each technology, applied to the ten-year projected schedule for INEEL D&D Operations. These savings include dollars saved on equipment and labor costs for performing the D&D operation, savings related to reduced exposure, reduction in secondary waste handling and storage, reduced or eliminated delays in performing D&D operations, and reduced or eliminated surveillance and maintenance (Figure 11).

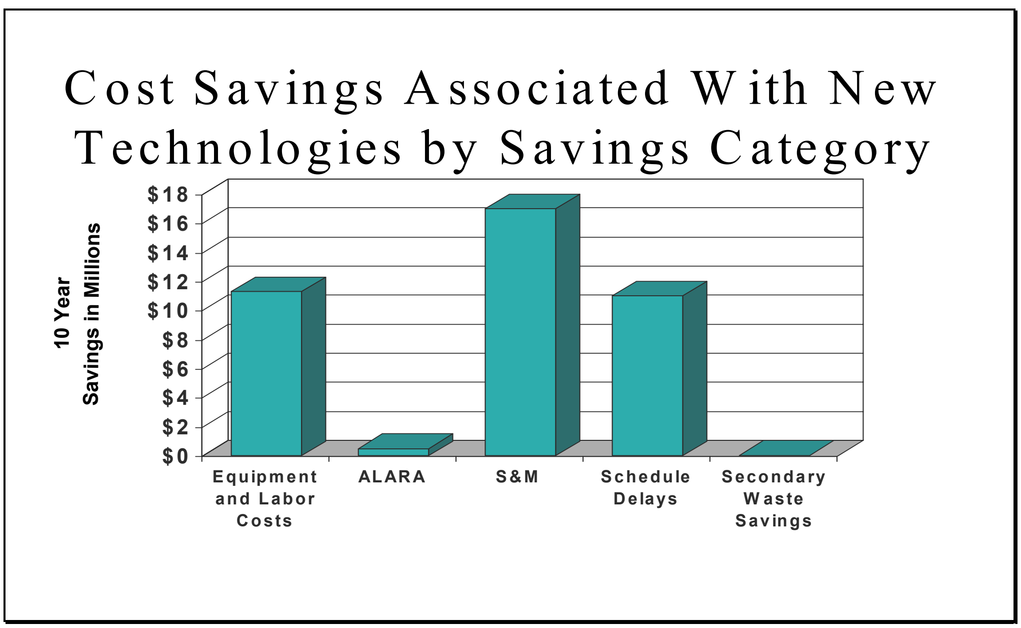

Figure 11. Savings Distribution by Savings Category.

In some cases the benefit gained in cost savings is insignificant compared to the benefits gained from more intangible factors. For example, although the paint scaler shows a very small cost savings per incident of use, there is a much greater benefit that becomes obvious when you observe the ease of sampling and the quality of samples compared to the baseline. Because it is so physically demanding to get paint samples using hammers, chisels and scrapers; sampling personnel typically collect samples from areas where the paint is easier to remove such as an area where there is peeling and bubbling paint. This is usually a result of such things as rust, moisture, or oil, which tend to contaminate the sample. With the paint scaler the sample team collects a more representative uncontaminated sample. Where a sample team collected three samples in the past from peeling and bubbling paint they now are willing take more samples and larger sample volumes.

Big cost savers are typically in the area of characterization, where large savings can be made by eliminating expensive and time-consuming sample analysis at off-site laboratories. By providing the same data in situ and in real-time, the new technologies offer significant savings in shortened surveillance times, reduced maintenance costs, and elimination of delays for the D&D crew (Figure 11).

2.10 Communicating The Results

Fact sheets were issued for all demonstrations, and Innovative Technology Summary Reports (ITSRs) were issued for all except the Ultra Lift and EMR. Data from EMR were considered inconclusive, so any benefit that might be gained cannot be quantified. The Ultra Lift was demonstrated at the close of the project when remaining time and budget were insufficient to complete an ITSR.

Short videos were created for each technology, and CDs are available that include fact sheets, ITSRs, and videos of each demonstration. A web site at http://id.inel.gov/lsddp, developed and maintained as part of the INEEL LSDDP, identifies all the technologies evaluated and provides all the technology reports and needs statements. Photos, forms for requesting information, and links to related sites, are also available at the web site. ITSRs and fact sheets for this and other LSDDPs can be found on the Office of Science and Technology web site at http://apps.em.doe.gov/ost/index.asp under Publications.

In addition to the above, papers and presentations were given to promote these technologies in an effort to create additional deployment opportunities (Appendix C).

2.11 Safety

Safety was a prime concern during the project. There were no safety incidents or accidents as a result of any activities related to this project.

During the period of performance of the INEEL LSDDP, a safety-related accident occurred that resulted in a stop-work order on all facilities, maintenance, and utilities work at the INEEL. The accident and stand-down were unrelated to the LSDDP, but the stand-down caused a work delay that made one of the milestone deadlines impossible to meet.

3. LESSONS LEARNED

The project benefited a great deal from the lessons learned from previous projects, and generated some lessons learned of its own. Listed below are a few of the lessons learned during the INEEL LSDDP.

1. Identify an expert within operations

As part of the turnover process it is important to transfer ownership from the test engineer to operations and establish an expert within operations to whom others can turn with questions and requests. Without this, the LSDDP test engineers are the experts and it becomes extremely difficult for them to separate themselves from the technology and move on to the next demonstration.

2. Provide sufficient training

To make it desirable for people to use the new technology, they must be aware of its existence, and they must know how to access it and operate it. Equipment will end up sitting on the shelf if no one knows how or has the confidence to use it. In future projects, after the demonstration of a successful technology, several people from around the site who might use the technology in the future should be trained. In addition, as part of demonstration closure, a training refresher should be provided to remain with the equipment.

3. Foreign technologies cost more and take longer

When demonstrating foreign technologies where foreign languages are involved and where technologies must pass through customs and international shipping, it is important to note that the rigor and detail must be more intensive in the early stages of the project. Even under the best conditions and using the utmost caution, there will be miscommunications because of the language barrier. In some cases these miscommunications can be significant.

As a rule of thumb, assume that the cost of the demonstration will be at least triple that of a domestic technology. In addition, the schedule will usually double, if all goes well. However, it should be remembered that much of what controls schedule is out of the control of the project, and flexibility is crucial.

4. Simpler and cheaper are best

The less expensive technologies are more readily accepted by D&D operations managers, since these managers are typically on a tight budget. D&D managers cannot spend large sums of money on a technology that performs a very specific task with limited application, especially if there are alternatives available.

Technologies that are simple and easy to use are appealing to the operators and technicians and therefore get used more often. Technologies that are complicated or not used on a daily basis tend to intimidate the users. Rather than spend the time to become familiar with the technology, they typically fall back to using the baseline.

Technologies that are inexpensive, simple to use, and easy to operate sell themselves and very quickly become the tool of choice.

5. Too much cost sharing is not always best

When a vendor is willing to provide hardware for the demonstration at no cost to the project, remember that when the vendor leaves he takes his technology with him. If the end-user has no funds to procure the technology, any future benefit to be gained from using the new technology is gone. It is better to get cost sharing to go toward travel, training, field support, reduced cost, etc., and make provisions to buy and keep the technology.

6. Regulatory acceptance of new technologies

Although some technologies perform well, they might fail to receive regulatory acceptance, and their full capability and benefit are never realized. This is particularly true with characterization tools such as the LPA and the Spectro Xepos. The real benefit and cost savings potential of these technologies will not be fully recognized until site personnel and the regulators accept them.

7. Em-40 support of new technologies is essential

The support of D&D operations personnel for using new/improved technologies is essential to the success of the LSDDP. Without the support of D&D operations in identifying needs and in selecting, demonstrating, and deploying new technologies, it would be an impossible task to integrate new technologies into D&D operations. Fortunately, here at the INEEL, EM-30 and EM-40 have been very cooperative and enthusiastic about new technologies and reducing the cost of D&D activities.

8. Word is very slow in getting out

After a demonstration is complete and the results have been documented and communicated, word needs to spread so people at other facilities and other laboratories can start using the new technology. It is something like the pyramid effect, and it generally takes approximately three years for the positive benefits of a new technology to really start showing up.

Appendix A

Technology Evaluation Pre-Screening Form

Technology Evaluation Pre-Screening Form

Evaluator: Date:

Technology Title:
(This will be the name by which this technology will be referred in the future and should be descriptive of the technology such that when the name is heard there is little doubt as to what technology is being addressed.)

Technology Provider:
(Include the Vendor Name, mailing address, phone number, fax, e-mail address, and point of contact)

Technology Description:
(Provide a brief description of the technology, whether it is a piece of equipment, a service, or a complete system; what does it do, how does it do it, what is the potential benefit, approximate cost, etc.)

What INEEL need is addressed/met:
(List all need areas that may be suitable for this technology in as much detail as possible. As a minimum list the needed areas e.g.. Inspection, characterization, dismantlement, recycling, etc.)

What is new or improved about this technology:
(New/improved is defined as any new technology, any technology that is new to D&D, any new application for an old technology, any technology that shows a potential for a cost benefit but is not currently being used as a baseline within DOE, or any improvement to an existing technology)

Has the technology been demonstrated previously:
(Has the technology been demonstrated or selected for demonstration at any of DOE's Large Scale Demonstration Projects, demonstrations of different types such as mockup testing, lab testing, development testing, comparison testing, etc are not considered previously demonstrated unless they fit within the scope of the LSDDP with side by side comparison and independent cost benefit analysis)

What is the maturity of the technology:
(Only technologies that are beyond R&D, and are ready for field deployment without further testing and development can be considered for this project. If a technology does not meet this requirement however shows high potential, note that it should be reviewed again at a later date.)

Is this technology being used as the baseline in any other D&D related areas:
(Only technologies that are considered baseline at the INEEL are automatically eliminated, however serious consideration should be given to technologies that are baseline for other D&D areas and whether or not they are intuitively better and should replace the INEEL baseline without demonstration.)

What baseline does this technology replace:

What are the Benefits of this technology:
(Briefly describe the benefit associated with using this technology, include cost benefit, schedule, safety, personnel exposure, or secondary waste, if no cost benefit is provided by the technology, so state and describe what other benefits off-set the lack of cost benefit.)

Sites that would benefit from this technology:
(CFA-STP CFA Sewage Treatment Plant, TRA-660 Filter Pits at TRA-660, IET Initial Test Engine Facility, ETR Experimental Test Reactor, ARMF/CFRMF Advanced Reactor Measurement Facility/Coupled Fast Reactor Measurement Facility, ARA-1 Advanced Reactor Area 1)

Which category(ies) does this technology fall under?
(Characterization, Decontamination, Dismantlement/Removal, Other, Stabilization for asbestos, Stabilization for contamination, Stabilization for roof)

Would you recommend this technology to the IC Team for further evaluation:

Appendix B

Detailed Technology Evaluation Form

Technology Evaluator: ___________________________

Evaluation Date: ______________________________

1. **<u>Generic Technology Name</u>**:

---

2. **<u>Vendor-Specific Technology Name</u>**:

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3. **<u>Technology Provider (i.e., vendor</u>)**:
(include name, address, phone, fax, email, and contact name – Note if more than one technology provider is available)

---

4. **<u>Technology Description</u>**:
(include discussion of typical application and application planned for INEEL. Provide a brief description of the technology; what is does; how it does it; how big it is; is it a system, equipment, or service; approximate cost; etc.)

---

5. **<u>Technology Category</u>**:
(put check in the appropriate technology category)

CH Characterization ( )
DC Decontamination ( )
ST Stabilization ( )
STC [for contamination] ( )
STR [for roof] ( )
STA [for asbestos] ( )
DR = Dismantlement/ Removal ( )
OT = Other ___________________ ( )

---

6. **<u>Facility proposed for use (IET, Filter Pits, ARMF/CFRMF, other</u>):**

---

7. **<u>Baseline technology against which this technology will be evaluated</u>:**

---

8. **<u>Improvement over the baseline technology the new/improved technology provides</u>:**

---

9. **<u>Technology Evaluation Go -- No Go Section</u>**:
(*put check next to correct answer and fill in description*)

*** All responses to a, b, c, and d must be "yes" to continue the evaluation. ***

a) Technology meets New/Improved Technology Definition. Y(__) N (__)

DESCRIBE:

---

b) The technology is mature enough for demonstration. Y(__) N (__)

DESCRIBE:

---

c) The technology meets INEEL D&D needs. Y(__) N (__)

DESCRIBE:

---

d) The technology has not been previously demonstrated. Y(__) N (__)

DESCRIBE:

---

10. **<u>Further Evaluation of the Technology</u>**:

♦ **The following criteria (a-e) are of <u>highest priority</u> and must be satisfied [with 3's or above] before this technology could be considered a serious candidate for implementation (put check next to score):**

---

a) *<u>State of Maturity:</u> The technology must be "field test ready" for a large-scale demonstration. The LSDDP should serve as one of the few remaining steps in commercializing the technology (or using it for a new application) and achieving broad acceptance across the DOE complex and the commercial sector. Technologies requiring substantial additional research and development are not considered candidates for demonstration. Schedule constraints should be considered if there are potential conflicts.*

State of Maturity Score: 1 (__) 2 (__) 3 (__) 4 (__) 5 (__)

Numerical Evaluation:	1 =	*Not ready for demonstration*
	5 =	*Used commercially for identical or similar purposes. Fully developed and readily implemented.*

JUSTIFICATION:

---

b) *<u>Solution to INEEL Need:</u> The technology must be able to address a need for the remaining scheduled deactivation activities at INEEL.*

Solution to INEEL Need Score: 1 (__) 2 (__) 3 (__) 4 (__) 5 (__)

Numerical Evaluation:	*1 =*	*Technology does not address a INEEL D&D need*
	5 =	*Technology meets one or more INEEL D&D needs*

JUSTIFICATION: *[identify the need(s) and to what degree the technology addresses the need(s)]*

---

c) *<u>Performance is Measurable:</u> It must be possible to develop quantitative performance measures by which the technology can be evaluated during a demonstration.*

Performance is Measurable Score: 1 (__) 2 (__) 3 (__) 4 (__) 5 (__)

Numerical Evaluation:	*1 =*	*Difficult to establish measures that define success of*
	5 =	*Demonstration has clearly defined performance*

JUSTIFICATION: *[identify the performance measure(s) and describe how it will be measured]*

---

d) *<u>Improvement Over Baseline:</u> This technology should be able to improve upon the current industry or DOE D&D technologies and processes, which constitute the INEEL baseline. Successful demonstration of this technology should provide the opportunity for overall cost savings or cost avoidance relative to the INEEL baseline.*

Improvement Over Baseline Score: 1 (__) 2 (__) 3 (__) 4 (__) 5 (__)

Numerical Evaluation:	*1 =*	*Cannot make significant improvement in the progress of the deactivation at INEEL*
	5 =	*Improvement is obvious and makes significant contribution to D&D progress and/or safety (i.e., in terms of radiation dose, generation of waste, schedule reductions, cost savings, cost avoidance, production rate, etc.)*

JUSTIFICATION:

---

e) *<u>Cost/Benefit:</u> This technology should have applicability across a wide range of DOE facilities and commercial plants with an associated overall cost savings (or cost avoidance).*

Cost/Benefit Score: 1 (__) 2 (__) 3 (__) 4 (__) 5 (__)

Numerical Evaluation:	*1 =*	*Cost to deploy and use does not realize a tangible benefit*
	5 =	*Cost to deploy and use realizes significant benefits*

JUSTIFICATION: *[This must be completed even if there is no cost benefit. Identify it as such and provide an explanation of what benefit is realized and its value to the end user. If a cost benefit is anticipated then provide a rough order of magnitude cost benefit analysis against the baseline technology.]*

The following criteria (f-g) are of high importance to ensure this technology demonstration provides maximum benefit to the LSDDP (put check next to score):

f) *Application to DOE D&D Complex: This technology should be capable of being applied across the DOE Complex and should be able to resolve multiple problems.*

Application to DOE D&D Score: 1 (__) 2 (__) 3 (__) 4 (__) 5 (__)

Numerical Evaluation: at	1 =	*Only applicable at one DOE site or facility and not useful others*
	5 =	*Applicable at any DOE site or facility*

JUSTIFICATION:

---

g) *Waste Generation: Will the technology generate any waste streams that are problematic to treat and dispose of. The treatment/disposal options, cost of waste disposition, quantity of waste generated, opportunities for waste minimization/reduction/recycling all should be evaluated.*

Waste Generation Score: 1 (__) 2 (__) 3 (__) 4 (__) 5 (__)

Numerical Evaluation:	1 =	*The technology generates significant volumes of waste and/or wastes with no (or costly) waste treatment and disposal options.*
	5 =	*The technology provides for reuse/recycle of waste, minimizes waste generated and existing cost effective treatment/disposal methods are available.*

JUSTIFICATION:

The following criteria (h-k) are of medium importance to ensure this technology demonstration provides maximum benefit to the LSDDP (put check next to score):

h) *<u>Demonstration Cost:</u> The overall demonstration cost should be considered. The willingness of technology providers to cost-share and the percentage of that cost share will be important factors in the technology selection.*

Demonstration Cost Score: 1 (__) 2 (__) 3 (__) 4 (__) 5 (__)

Numerical Evaluation:	*1 = All costs are passed to the LSDDP; none are absorbed by the vendor* *5 = No cost to the LSDDP for any aspect of the demonstration*

JUSTIFICATION:

Was this discussed with the technology provider? Y (__) N (__) *[if other than the vendor contact previously identified, identify contact]*____

---

i) *<u>Baseline Compatibility:</u> This technology demonstration should be able to fit within the remaining scheduled D&D activities at INEEL.*

Baseline Compatibility Score: 1 (__) 2 (__) 3 (__) 4 (__) 5 (__)

Numerical Evaluation:	*1 = INEEL schedule has to be adjusted to accommodate the* *5 = Demonstration provides an activity that fits the INEEL previously identified in the INEEL baseline*

JUSTIFICATION:

---

j) *<u>Technology Provider's Interest:</u> The technology provider should demonstrate enthusiasm, support, and willingness to demonstrate at INEEL. In addition, the provider should demonstrate a willingness and ability to commercialize the technology following a successful demonstration.*

Technology Provider's Interest Score: 1 (__) 2 (__) 3 (__) 4 (__) 5 (__)

Numerical Evaluation:	*1 = LSDDP must perform a large coordination role in the demonstration and provider displays minimal willingness to work with the LSDDP/INEEL personnel.* *5 = Provider performs all tasks and supplies all consumable for the demonstration and displays a strong make-happen attitude.*

JUSTIFICATION:

---

k) Transportability: The technology must be capable of being transported to the INEEL.

Transportability Score: 1 (__) 2 (__) 3 (__) 4 (__) 5 (__)

Numerical Evaluation:	*1 =*	*Difficult or impossible to transport technology*
	5 =	*Minimal effort to transport to INEEL.*

JUSTIFICATION:

---

12. Similar Technologies:

Discuss similar technologies.

Describe any advantages or disadvantages that the evaluated technology has relative to a similar technology.

---

13. Contacts Section:

Identify the other vendors for the same technology, any associated contacts, any references, and other contacts made during this evaluation.

	Name	Company	Telephone	Fax	e-mail	Address
1						
2						
3						
4						

14. Specific Technology Information Section:
(additional information and attachments)

Provide a brief discussion of the resources used to formulate this evaluation:

---

15. Recommendation of the Technology Evaluator:
(put check next to technology evaluation result and state why technology is/is not recommended)

Accept Technology ( )
Do Not Accept Technology ( )

Reason why the technology is recommended/not recommended to the IC Team:

Appendix C

PAPERS AND PRESENTATIONS

D&D at Idaho National Engineering and Environmental Laboratory
Ohio Field Offices, Ohio Cost Savings Group
Larry Whitmill
August 8, 2001

Cost Benefit at INEEL 2001
Larry Whitmill
August 2001

D&D at the Idaho National Engineering and Environmental Laboratory
ANS Executive Conference: Nuclear Facility Decommissioning and Used Fuel Management
R. H. Meservey
July 8-11, 2001

INEEL Experiences and New Technology Deployment.
ANS Nuclear Facility Decommissioning and Used Fuel Management Conference
R. H. Meservey
July 8-11, 2001

Safety Enhancing Technology and Practices at Idaho National Engineering and Environmental Laboratory Decommissioning Projects
American Nuclear Society Summer Meeting, Milwaukee, WI
Richard H. Meservey
June 2001

D&D at the Idaho National Engineering and Environmental Laboratory
R. H. Meservey
May 2001

D&D Technologies at the INEEL
NDIA 27th Environmental Symposium and Exhibition
Neal Yancey and Julie Lynn Tripp
April 26, 2001

Cost Saving Characterization Technologies for Environmental Cleanup
NDIA 27th Environmental Symposium and Exhibition
Larry Whitmill, Neal Yancey
April 26, 2001

Bechtel Program Review
Decontamination and Decommissioning Large Scale Demonstration and Deployment Project
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