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Title: FY RESULTS FOR THE LOS ALAMOS LARGE SCALE DEMONSTRATION AND DEPLOYMENT PROJECT

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FY00 Results for the Los Alamos Large Scale Demonstration and Deployment Project

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The Los Alamos Large Scale Demonstration and Deployment Project (LSDDP) in support of the US Department of Energy (DOE) Deactivation and Decommissioning Focus Area (DDFA) is identifying and demonstrating technologies to reduce the cost and risk of management of transuranic element contaminated large metal objects, i.e. gloveboxes. DOE must dispose of hundreds of gloveboxes from Rocky Flats, Los Alamos and other DOE sites. Current practices for removal, decontamination and size reduction of large metal objects translates to a DOE system-wide cost in excess of $800 million, without disposal costs.

In FY99 and FY00 the Los Alamos LSDDP performed several demonstrations on cost/risk savings technologies. Commercial air pallets were demonstrated for movement and positioning of the oversized crates in neutron counting equipment. The air pallets are able to cost effectively address the complete waste management inventory, whereas the baseline wheeled carts could address only 25% of the inventory with higher manpower costs. A gamma interrogation radiography technology was demonstrated to support characterization of the crates. The technology was developed for radiography of trucks for identification of contraband. The radiographs were extremely useful in guiding the selection and method for opening very large crated metal objects. The cost of the radiography was small and the operating benefit is high. Another demonstration compared a Blade Cutting Plunger and reciprocating saw for removal of glovebox legs and apurtenances. The cost comparison showed that the Blade Cutting Plunger costs were comparable, and a significant safety advantage was reported.

A second radiography demonstration was conducted evaluation of a technology based on WIPP-type x-ray characterization of large boxes. This technology provides considerable detail of the contents of the crates. The technology identified details as small as the fasteners in the crates, an unpunctured aerosol can, and a vessel containing liquids. The cost of this technology is higher than the gamma interrogation technique, but the detail provided is much greater.

INTRODUCTION

The objective of the Los Alamos LSDDP is identification and demonstration of technologies that reduce the cost and risk for large metal object processing in the Decontamination and Volume Reduction System (DVRS), LANL's processing system for crated large metallic waste. DVRS processes include crate assay, crate opening, metal object decontamination and size reduction, compaction, and packaging for disposal. To date, the Los Alamos LSDDP focussed demonstration activities on DVRS "front end" technologies, those associated with initial characterization or disassembly of gloveboxes after initial crate opening. This includes two technologies for imaging the contents of crates, one for facilitating transuranic survey of crates and one for removal of small appurtenances from gloveboxes. A demonstration of a technology for documentation of disposal crate loading is currently in process, and a demonstration of an improved Continuous Air Monitor is in planning.

Vehicle and Cargo Inspection System (VACIS™)for imaging large crates (US DOE, July, 2000)

The Vehicle and Cargo Inspection System (VACIS™) was developed by Science Applications International Corporation (SAIC) for imaging of cargo containers and vehicles at US border crossings. VACIS™ uses a 1.6-Curie collimated source (Cesium-137) aimed at a linear detector to create an image as the VACIS™ unit passes by the crate. In the mobile unit tested at LANL, the source and detector are mounted on a boom truck, with the source positioned in a shielded box at the end of the boom and the detector mounted on the truck. As the crate passes between the source and detector, a composite image of the contents is constructed from the linear image by VACIS™' on board computer.

The mobile VACIS™ unit was demonstrated in June 1999 at LANL's Solid Waste Operations Area, Technical Area 54, Area G. Waste containers consisting of fiber-glass reinforced plywood (FRP) crates and standard waste boxes (SWBs) were loaded onto flatbed trucks, driven to the demonstration area, and imaged using VACIS™' mobile unit. Once positioned, the driver exited the truck and the VACIS™ unit drove along the flatbed, compiling an image. Personnel from the US Army's Thunder Mountain Test and Evaluation Center (TMEC) operated VACIS™, along with representatives from the developer, SAIC. This demonstration was done under a Memorandum of Agreement between LANL and TMEC.

During the two day test period, over 40 images of crates, boxes, and miscellaneous truck cargos were obtained. These images clearly showed the contents of each FRP crate or SWB including glove boxes, debris inside glove boxes, equipment, tanks, and filter media. Comparison of the image with the inventory description will greatly enhance inventory knowledge. Knowledge of the orientation of objects within the FRP crate as well as equipment inside the glovebox will enhance crate disassembly and object re-sizing. Lead shielded objects appear opaque on the VACIS™ image, allowing the user to ascertain the presence of lead. Knowledge of lead contents is critical for mixed waste classification and scheduling of crate opening in the DVRS process.

Figure 1 shows the VACIS™ image of two waste crates on a flatbed trailer. One crate contains a drill press in a glovebox as well as a mill in a glovebox. The second, smaller crate contains a glovebox in which shielding around the gloveports is clearly visible. LANL solid waste operations personnel were able to use this data to determine that the lead shielded glovebox will be staged for later processing when DVRS can address mixed waste. They also identified that machining tools in the larger crate are not amenable to volume reduction in the shear/baler. Therefore, those gloveboxes will be managed separately.

Figure1
VACIS Images of Two Crates Containing Gloveboxes

The costs of implementation of the VACIS™ was developed based on the experience of the demonstration. Table 1 summarizes cost calculations performed by the US Army Corps of Engineers. The cost was based on imaging 100 crates in a week, which was the demonstrated rate. The costs range from $630 per crate when only 100 crates are imaged, but drops to less than $400 if larger numbers are imaged.

One of the lessons learned from the demonstration was the rate of crate imaging is totally dependent on the rate that crates can be surveyed and staged on trucks. The VACIS™ unit can image a vehicle at approximately 5 mph, which is much faster than crates can be staged.

Table I
VACIS™ Deployment Costs for 100 Crates

Deployment Activity	Cost for 100 crates
Mobilization	$20,050
Imaging	33,672
Decontamination	6,734
Demobilization	2,948
Total	$63,404

VACIS™ is an enabling technology, as the potential for imaging was not known during baseline development. As an enabling technology it provides additional information for DVRS process operations. Since DVRS operation requires a staff of approximately 12, the labor costs alone exceed $30,000 per week. Without VACIS it is likely that crate opening will lead to unexpected items, such as mixed waste, and such an incident is likely to shut down DVRS for more than a week. Therefore, the additional cost of VACIS imaging is easily supported as a cost avoidance.

Mobile Characterization Services Large Box RTR System (LANL March, 2000)

Mobile Characterization Services (MCS) Large Box RTR system was designed and constructed by VJ Technologies for x-ray imaging the contents of DOE waste storage crates and containers. The unit is similar to drum RTR systems for certification of waste packages for DOE's Waste Isolation Pilot Plant (WIPP). The Large Box RTR system is housed in a semi-trailer that weighs approximately 45,000 kg (100,000 lb.). To image a waste crate, it is loaded onto a turntable trolley conveyor system attached to the semi-trailer and moved inside the trailer's lead-shielded x-ray vault. The combination of the moving trolley conveyor and elevation control on the x-ray system facilitates detailed imaging of the entire container from top to bottom and end to end. The maximum container size accepted is 3 m long by 2 m wide and 2 m tall. Figure 2 shows the trailer.

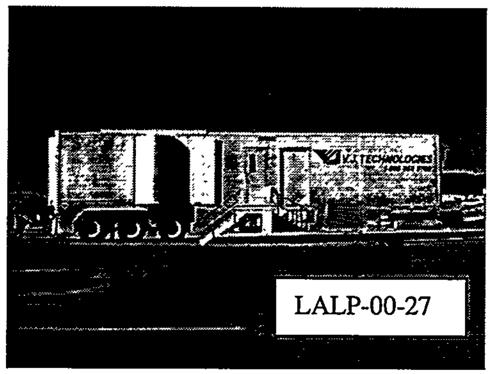

Figure 2
MCS Real Time Radiography Trailer for Large Boxes

The MCS Large Box RTR system was demonstrated at LANL's Solid Waste Operations area in January 2000. A total of 19 crates and standard waste boxes (SWB) were radiographed during the one-week demonstration. The system proved its value in identification of crate contents and in particular its ability to identify small items such as electrical connectors and aerosol cans. It was also successful in identification of a vessel containing liquid. This capability alone could provide substantial benefit to the baseline process as it avoids a potential spill of liquid during crate processing. A cylinder of unknown contents was radiographed for LANL waste operations. It was determined to contain a source.

Table II
MCS Large Box RTR Deployment Costs for 120 Crates

Deployment Activity	Cost for 120 crates
Mobilization	$19,996
Implementation Plans	13,672
Imaging	83,575
Decontamination	2,487
Demobilization	10,466
Total	$130,166

Several crates imaged by the MCS system were previously imaged by VACIS™. This comparison clearly showed the capabilities of the two units. VACIS provides a rapid "gross" image of crate contents and is very instructive for crates with identifiable gloveboxes and equipment. The MCS system provides a detailed image of the container contents, and can identify small items from a heterogeneous pile of trash. The potential savings from RTR imaging is similar to the VACIS, except that the per-crate cost is higher and the MCS system is constrained by the crate size that can be accepted.

AeroGo Air Lift Pallets

The AeroGo, Inc., air pallet system includes air casters, an air hose, and a pressure manifold distribution control box to "float" loads on a virtually frictionless film of air. The reduced friction and omni-directional movement allow the operator to precisely place and align the load in a limited workspace. The low profile of the Aero-Caster Load Module requires less than 76 millimeter (3 inches) of clearance for positioning. Lifting capacity is dependent upon the design and air pressure and can range from a few hundred kg to hundreds of tons. Loads can be accurately positioned as needed for non-destructive assay analysis or for dismantlement.

Figure 3
Technicians move 2500 kg crate through LINC counter

AeroGo's air-caster system was first demonstrated for moving fiberglass-reinforced plywood crates and Standard Waste Boxes in June 1999. Packages weighing up to 2500 kg (5600) pounds were moved and accurately positioned in a non-destructive assay system, as well as easily maneuvered through a 30 m. maze to demonstrate system flexibility. Subsequently, a second phase demonstration was conducted in March 2000 where an improved AeroGo "pallet" type system was demonstrated and evaluated. Data from the second phase of the demonstration was used to develop a time scenario for deployment of air casters vs. the baseline carts

Table III
Cost of Deployment of Baseline and AeroGo Air Lift Pallets for One Year of Operation

(US DOE September, 2000)

WBS Activity	AeroGo Air Casters	Wheeled Carts
Assembly and Setup	$9,308	$388
Planning Sessions	4,034	6,553
LINC Counting	228,425	422,280
Demobilization	4,320	4,323
Total	$246,087	$433,544

The time saved in use of the air pallets is almost $200K per year of operation of the DVRS. This cost savings does not address the fact that the baseline, wheeled carts, does not work for large crates.

Mega-Tech Blade Cutting Plunger for Cutting Legs and Appurtenances from Gloveboxes (US DOE, September 2000)

Mega-Tech's Blade Plunging Cutter (BPC-4) and Porter Cable's Tiger Saw® model # 9737 were demonstrated for metal cutting of glovebox legs and appurtenances. The demonstration took place at Florida International University's Hemispheric Center for Environmental Technology (FIU-HCET) testing facilities to compare the innovative BPC-4 to the baseline technology, the reciprocating saw. Both 41 mm (1 5/8") Unistrut and 3" diameter steel pipe legs were removed from a glovebox mockup during the demonstration.

BPC-4 is a portable hydraulic power cutting tool. It has a 10 cm (4") blade and is a piston-forced plunging cutter that operates through a recess in an anvil, severing metal in a guillotine fashion during the eight second stroke. The cutter weighs approximately 13 kg (28 lbs) and is 70 cm (28 inches) in length. It has a "dead man" switch for safe operations. It can be supported with a tension device when working from scaffolding, a lift, or a ladder. The HPU-12 Hydraulic Power Unit is mounted on a cart and powers the tool and can be located remotely from the cutter in a non-contaminated area.

The baseline technology was a Porter Cable variable speed Tiger Saw, a handheld general purpose-reciprocating saw with quick-change blade clamp. The saw weighs 4 kg (9 lbs), and is 43 cm (17") long.

The demonstration was conducted at the FIU-HCET facility simulating a radioactive environment typical of operation in LANL's Solid Waste Operations area. The cutting took place in a PermaCon with technicians in personal protective equipment (PPE) and respirators, as expected in operation at DVRS at LANL. A mockup of a two station glovebox was constructed with options for two types of legs; Unistrut and three inch pipe. The mockup legs were positioned to be inconvenient, as common and expected in LANL's crated waste project. The tools were demonstrated by experienced waste management technicians from LANL. Data was taken on times to cut legs, any secondary wastes, and utility requirements.

Figure 4
LANL Technicians Cut Pipe Legs from Glovebox Mockup

Table II tabulates the speed comparison of Mega-Tech's BPC-4 against the reciprocating saw for cutting Unistrut and Pipe legs. In general, BPC-4 cut the items in 60% of the time required for the reciprocating saw. In addition, the lower speed of the BPC-4 and elimination of secondary waste (saw blades and saw chips) are secondary benefits that could be considered of value.

Table II
Comparison of Average Cutting Times (LANL 2000)

Type of Leg	Average time to cut a leg (seconds)	
	BPC-4	Reciprocating Saw
Unistrut	18.4	29.3
Pipe	70.4	116.6

US Army Corps of Engineers provided a cost estimate of deployment of both BPC-4 and the baseline technology based on the data from the demonstration. The results for one year of operation are shown in Table III. Table III shows that cost savings from reduced technician time balances the additional cost of BPC-4. Therefore, deployment of BPC-4 is essentially a no-cost deployment with reduced waste and improved safety benefits.

Table III
Cost of Deployment of Baseline and BPC-4 for One Year of Operation
(US DOE September, 2000)

WBS Activity	Mega-Tech BPC-4	Reciprocating Saw
Assembly and Setup	$9,183	$8,881
Planning Sessions	22,481	22,481
Cutting	6,122	8,881
Demobilization	6,122	5,921
Total	$43,908	$46,165

FY01 Demonstrations

The Los Alamos LSDDP is continuing to evaluate technologies for demonstration as a part of DVRS operation in FY01. Tentative selections have been made for technologies to improve waste records management, improved air monitors, and improved decontamination technologies. Selections will be finalized as DVRS operation starts.

CONCLUSIONS

The Large Scale Demonstration and Deployment Project has provided the Los Alamos DVRS project several viable options for cost reduction and risk reduction as they come on-line in FY01 and potential cost savings exceed $200K per year and a likelihood of considerably higher savings when the impacts of improved characterization and safety aspects are considered.

The LSDDP is continuing to review technologies and demonstrate cost/risk reduction technologies in FY01.

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