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DISCLAIMER

IMPLEMENTATION OF THE BURIED WASTE INTEGRATED DEMONSTRATION[a]

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ABSTRACT

The Department of Energy (DOE), Office of Technology Development (OTD) has initiated the Buried Waste Integrated Demonstration (BWID) to resolve technological deficiencies associated with the remediation of radioactive and hazardous buried waste. The BWID mission is to identify, demonstrate, and transfer innovative technologies for the remediation of DOE buried waste.

To accomplish the mission, BWID is using a systems approach which supports the development of a suite of advanced and innovative technologies for the effective and efficient remediation of buried waste. This systems approach includes technologies for the entire remediation cycle. Specifically, BWID sponsors technology development in the following technology categories: site and waste characterization, retrieval, preprocessing, ex situ treatment, packaging, transportation, storage, disposal, and post-disposal monitoring.

The BWID will accomplish its objectives by involving participants and technology sponsors from throughout the DOE Complex, private industry, and universities. This collaborative effort has been implemented to reduce duplication of effort, accelerate technology demonstrations, improve the remediation process baseline schedule, and leverage DOE technology development funding.

PROBLEM (*Buried Waste Remediation*)

Numerous facilities throughout the United States have been operated by the DOE and its predecessor agencies for nuclear research, development, and production. As a result of these operations, there are locations throughout the DOE Complex where waste has been buried in the ground for storage or disposal. These locations include the Idaho National Engineering Laboratory (INEL), the Hanford Site, the Oak Ridge National Laboratory (ORNL), the Savannah River Laboratory (SRL), the Los Alamos National Laboratory (LANL), the Lawrence Livermore National Laboratory (LLNL), Sandia National Laboratory (SNL), the Fernald Materials Processing Center (FMPC), and the Nevada Test Site (NTS).

Much of the waste buried throughout the DOE Complex is contaminated with hazardous and radioactive materials. This buried waste, disposed of during the 1950s and 1960s, is classified as transuranic (TRU) waste, low-level radioactive waste (LLW), hazardous waste per 40-CFR-261, mixed TRU waste, mixed LLW, and greater-than-class-C (GTCC) waste per 10-CFR-61.55. Because previous disposal practices did not require waste classification segregation much of the waste buried is commingled.

Various waste containers and disposal practices have complicated the DOE remediation efforts. For example, waste containers used at the INEL have included steel drums, cardboard cartons, wooden boxes, and concrete casks.[1] Many of these containers have degraded significantly resulting in contamination of the immediate surrounding soil. Disposal practices have also varied. Practices have included both orderly stacking, as well as random dumping.

The assessment and ultimate cleanup of all DOE facilities, including burial sites, is the responsibility of the DOE, Office of Environmental Restoration (ER). The ER mission is to ensure that risks to the environment and human health are either eliminated or reduced to prescribed, safe levels. The ER goal is to accomplish this assessment and cleanup effort by 2019.[2]

SOLUTION (*Buried Waste Integrated Demonstration Implementation*)

ER has identified technological deficiencies within the present baseline remediation strategy. From this, the DOE, Office of Technology Development (OTD) has initiated a comprehensive program to develop and demonstrate advanced technologies. To resolve the specific technological deficiencies associated with the remediation of burial sites throughout the DOE Complex, OTD has initiated the Buried Waste Integrated Demonstration (BWID).

BWID is coordinated for the DOE by the Waste Technology Development Department (WTDD) of EG&C Idaho, Inc., at the Idaho National Engineering Laboratory (INEL). The INEL is the host site for BWID because the buried waste located at the INEL contains a significant portion of the DOE Complex's TRU waste and INEL buried waste is representative of other DOE waste sites. Although hosted at the INEL, BWID involves participants from throughout the DOE Complex, universities, and private sector to advance technologies for remediation of buried wastes.

Presently, ER baseline technologies do not exist for treatment of a broad spectrum of buried waste. It is the ultimate goal of BWID to establish and improve remediation capabilities in the

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DOE Complex while maintaining a vigorous schedule as defined by ER.

The BWID mission is to develop, demonstrate, and validate a suite of technologies for the effective and efficient remediation of buried waste.[3] The specific focus of the BWID is the technology needs identified by ER for buried waste remediation.[4] These needs include:

- Non-intrusive characterization of radioactive, chemical, and mixed burial sites
- Remote measurement and characterization methods
- Remote sampling/retrieval methods and excavation equipment
- Real-time analytical methods, including field analysis techniques
- In situ isolation techniques for contaminated soils and burial sites
- Contamination control techniques
- Ex situ treatment techniques of contaminated soils and mixed wastes.

Following the successful demonstration and evaluation of each technology, BWID will transfer each technology to private industry, universities, other government agencies, and ER for implementation at applicable buried waste sites. Data derived from BWID activities are also available to the International Community through official administrative channels. Industrial, academic, and DOE Complex-wide participation is used to ensure multidirectional technology transfer.

APPROACH (*BWID Systems Analysis*)

The BWID is approaching technology development by defining remediation system requirements for TRU-contaminated burial sites at the INEL. A system is defined as a top-level "cradle-to-grave" remediation configuration involving subsystems and individual processes. Processes within potential system configurations include: site and waste characterization, retrieval, thermal treatment, packaging, transportation, storage, and disposal. The BWID focus is for a retrieve and ex situ treatment system. Process requirements have been defined within this system and potential technologies are being identified and tested to satisfy the requirements. Figure 1 illustrates potential technologies for a retrieval and ex situ thermal process system. To date BWID has focused on the front end of this system and has field demonstrated a number of innovative characterization, retrieval, and ex situ treatment technologies. Outyears will see activities and technology demonstrations proceeding throughout this remediation system.

ACCOMPLISHMENTS (*Demonstrated Technologies*)

The BWID has completed technology demonstrations for various processes within the retrieval and ex situ treatment process system. These activities include a suite of geophysical characterization, contamination control, and preprocessing techniques.

During August 1991, a robotic platform was used to deploy a geophysical sensor package. This package included ground-penetrating radar, magnetic sensors, electromagnetic sensors, a sodium iodide gamma detector, and a photo-ionization organic vapor detector. Results from this demonstration have furthered the advancement in remote system controls, as well as the linkage of several data streams from various geophysical sensors to one

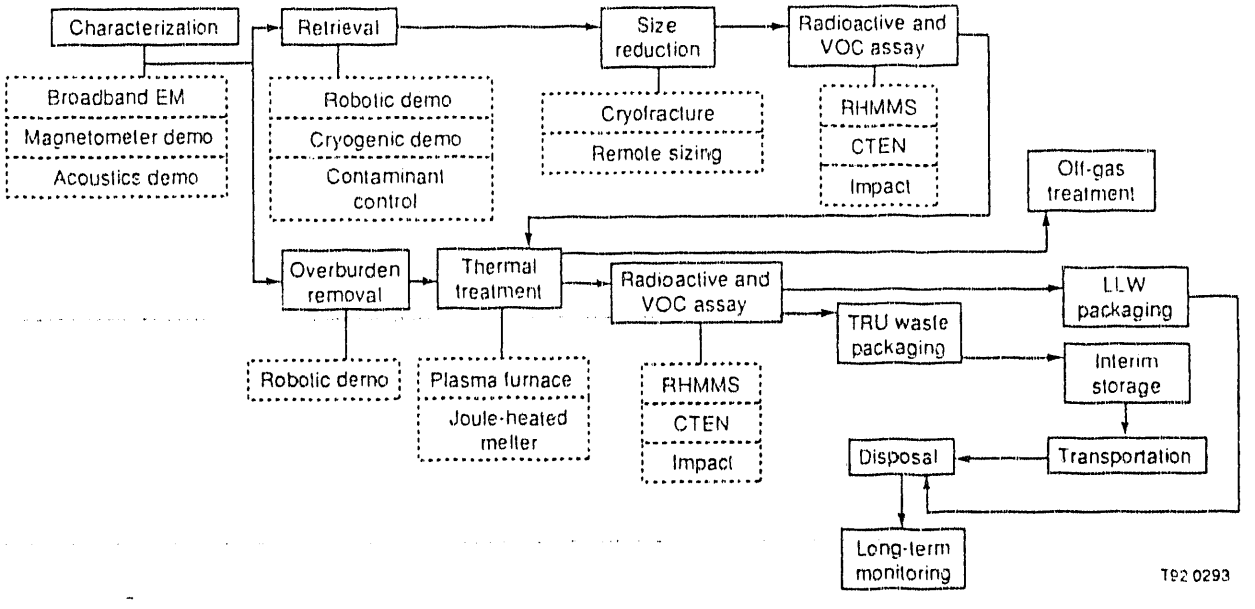

Figure 1 – BWID retrieval and ex situ thermal treatment process system.

package.[5] Two aerial surveillance demonstrations were performed at the INEL in October and November 1991. These demonstrations involved thermal infra-red, electromagnetic, and magnetic sensors. These demonstrations located fragmented ordnance casings and buried waste pit boundaries. These techniques proved useful for screening large areas quickly and potentially identifying problem areas where further ground surveys could be directed.[6,7,8]

Contamination control is a necessity for any retrieval efforts at DOE buried waste sites. BWID has supported the development and testing of several contamination control techniques. Included within these efforts have been ventilation studies to optimize dust flow during retrieval efforts, dust suppression techniques to minimize dust generation, realtime monitoring methods to detect airborne contaminants, and electrostatic curtains to attract airborne contaminants.

BWID has completed a detailed evaluation of various ex situ treatment technologies. Several thermal treatment projects are being supported to address various technical issues associated with the processing of radioactive waste streams. These technologies include plasma-arc furnaces and Joule glass melters.[9,10,11,12] Preprocessing techniques have also been conducted to support waste treatment. A cryofracture method, used by the military for destruction of ordnance, was demonstrated for waste sizing. The BWID demonstration involved simulated buried waste contained in steel barrels and wooden boxes. These containers were frozen using cryogenics, then remotely transferred to a press for sizing. The distinct advantage of cryofracture is volume reduction, thus minimizing the volume of waste requiring disposal as well as a pretreatment size-reduction technique.

OUTYEAR PLANS (*Proposed Technology Development*)

The BWID is continuing technology development in a number of technical areas. During the remainder of Fiscal Year 1992, BWID will continue to demonstrate a number of geophysical characterization, retrieval, and treatment techniques. The characterization efforts will include the field demonstration of a broadband electromagnetic technique for three-dimensional imaging and a full-view Cesium magnetometer demonstration for improved positioning accuracy.

A cryogenic retrieval demonstration will be demonstrated at a non-radioactive simulated buried waste pit (INEL Cold Test Pit). The advantage that this technology offers is its contamination control capabilities during a buried waste retrieval effort. The objectives are to freeze simulated buried waste in situ and then retrieve it without significant dust generation. A remote sizing demonstration will also be completed to assist with retrieval efforts. Large unearthed objects encountered at a digface will need to be sized for packaging and disposal. This technology reduces the worker exposure and fatigue while increasing productivity.

Outyear efforts for BWID will support the remediation schedule of ER. These efforts will remain on characterization and retrieval support techniques during Fiscal Year 1993. During 1993 two robotic technologies will be demonstrated. An advanced remote characterization system will be fielded, as will a remote excavation system. Emphasis will then shift towards the remaining areas of interest, namely preprocessing, treatment, and packaging.

SUMMARY

The BWID is supporting the DOE ER objectives of assessment and clean-up. Technology development is being sponsored by BWID for technology deficiencies and needs identified by the ER and Waste Management. Specific categories of technology development for BWID include: site and waste characterization, retrieval, thermal treatment, packaging, transportation, storage, and disposal. Representatives from throughout the DOE community, private sector, and universities are participating in this effort to improve the existing baseline remediation capabilities. Technologies, once demonstrated and evaluated, will be transferred to the ER and private sector for full-scale implementation.

The BWID has demonstrated several characterization, retrieval support, and treatment technologies. These efforts have included aerial surveillance techniques, geophysical characterization techniques, contamination control methods, and sizing demonstrations. Support for technology demonstrations will continue as a means of improving existing baseline processes.

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