TECHNOLOGY DEVELOPMENT FOR WASTE RETRIEVAL AND WASTE PROCESSING THROUGH INTEGRATED DEMONSTRATIONS

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ABSTRACT

In response to environmental mandates, waste retrieval and waste processing technologies will be developed and advanced through Integrated Demonstrations and other demonstrations that involve one or more of the following:

- excavation or removal of contaminated material from the site or tank, by remote or direct contact techniques;
- treatment and disposal of retrieved waste or waste arising from operations;
- processing of contaminated material into a suitable form for shipping and/or disposal;
- decontaminating and decommissioning of materials, equipment, and facilities.

These technologies will minimize the toxicity and volume of waste; accomplish faster, better, cheaper, and safer remediation of waste problems; and produce waste within regulatory guidelines for safe, permanent disposal. This paper will focus on Office of Technology Development activities for addressing the waste retrieval and waste processing technology needs through Integrated Demonstrations which are applicable to DOE sites.

BACKGROUND

The Department of Energy (DOE) is committed to a goal of environmental compliance and cleanup by the year 2019 through the Office of Environmental Restoration and Waste Management (EM). EM is responsible for the management of waste from past and current DOE nuclear programs and for the sites which generate these waste. This waste consists of radioactive materials in four categories: (1) high-level waste; (2) low-level waste; (3) transuranic waste; and (4) uranium mill tailings. In addition, nuclear materials production activities also generate hazardous, mixed, and sanitary waste. Environmental restoration, waste operations, corrective activities, and technology development are currently being addressed at DOE sites.

INTEGRATED DEMONSTRATIONS FOR WASTE RETRIEVAL AND WASTE PROCESSING

A number of Integrated Demonstrations and Integrated Programs are currently underway or in the planning stages. They include buried waste, underground storage tanks, robotics, newly generated mixed waste, RCRA waste disposal, combustible waste treatment, in situ vitrification, decontamination and decommissioning of metal and concrete structures and materials, and advanced processing . Each Integrated Demonstration will use discriminating cradle-to-grave considerations to assemble, test, and evaluate related and synergistic technologies. These considerations will define an integrated system based on prototypic performance, safety, costs, and regulatory and social acceptability to remediate or manage the Department of Energy's environmental and waste management programs.

Buried Waste Integrated Demonstration

The buried waste integrated demonstration will focus on buried transuranic waste at Idaho. The objective of this integrated demonstration will be to compare an array of technologies for in-situ remediation and retrieval, separation and concentration, treatment, and disposal of mixed wastes from buried waste sites. The approach will span all phases involved in an actual cleanup and provide for technical performance comparisons of different available technologies under actual field conditions for potential use at other DOE facilities. Specifically, treatment technologies for radionuclides, toxic metals, and organic contaminants on rags, laboratory glassware, used test equipment, and other trash materials will be evaluated. Processing techniques to separate contaminants will also be demonstrated. The rationale for the project is based on the need for improved separation/concentration technologies to separate mixed waste into its radioactive and hazardous components, allowing treatment and disposal consistent with EPA/NRC below regulatory control standards. The program is designed to contribute to meeting DOE/Idaho State commitment for RWMC remediation. Additional benefits include technology transfers to the Hanford, Los Alamos, Rocky Flats,Oak Ridge, and Savannah River installations.

Underground Storage Tanks Integrated Demonstration

The underground storage tanks integrated demonstration will focus on the Hanford waste tanks. The objective of this integrated demonstration, once it is established, will be to identify, develop, test, evaluate, and transfer technologies required to remediate radioactive and mixed waste in underground storage tanks. The approach will span all phases

involved in an actual cleanup and provide for technical performance comparisons of different available technologies for potential use at other DOE facilities. Information on the reduction in operating exposures to radiation by use of new technologies, for example, robotics, will be acquired. Tank remediation is one of the top three DOE cleanup issues. The 149 single shell tanks at the Hanford site in particular are a primary concern. Success there will make possible the (1) meeting of Hanford's commitment to the state of Washington; (2) remediating underground storage tanks at other major DOE production sites; (3) transferring the technology to the Fernald Materials Production Complex to address silo problems; and (4) to the Savannah River and Oak Ridge installations to meet regulatory commitments.

Robotics

The Office of Technology Development plans to demonstrate robotic technologies in a wide variety of applications. The approach will span all hazardous phases involved in an actual cleanup and provide for technical performance comparisons of different available technologies. Potential applications to be demonstrated include remote sensing and characterization, underground storage tanks waste retrieval, and other heavy waste removal operations, automated laboratory analysis, machining of plutonium and uranium components,and glovebox operations. The rationale for the program is the need to reduce the potential for exposing personnel to hazardous and radiological materials and to conduct waste-generating and waste-handling operations better and less expensively. The benefits of this demonstration will be the comparison and evaluation of different technologies under actual field conditions for potential use at many DOE facilities.

ADDITIONAL INTEGRATED DEMONSTRATIONS AND PROGRAMS

Separation Technologies for Mixed Waste

Planning is being started to deal with the many facets of mixed hazardous and radioactive wastes. Technologies for characterization, treatment, and disposal of mixed hazardous and radioactive waste streams produced by current operations will be tested. The approach will span all phases involved in actual cleanups and provide for technical performance comparisons of different available technologies. The technologies will be demonstrated for mixed waste component sensing and analytical capabilities; constituent separation to reduce the volumes of mixed waste and produce waste forms that are easier and less expensive to handle; and RCRA constituent destruction, volume reduction, and immobilization. The rationale for the program is based on the need for technologies to destroy RCRA components of mixed waste to allow for land disposal. The benefits include the comparison and evaluation of different technologies under actual field conditions for potential use at other DOE facilities. Information on the reduction in operating exposures to radiation by use of new technology; for example, robotics, will be acquired.

Destruction of Combustibles

Technologies are also needed to provide EPA acceptable methods for treating combustible waste of a remedial mixed radioactive/hazardous waste streams. Specifically, thermal and alternative technologies will be tested and evaluated. Systems testing will include gas train cleanup and residue (ash) collection systems to capture radioactive and noncombustible components. The rationale for the program is the need to develop EPA-acceptable thermal treatment technologies, which reduce the costs of waste management and provide alternatives to incineration. The benefits will be development of a technology needed for successful operation of the TSCA incinerator at Oak Ridge and for implementing thermal treatment at Idaho's WERF and PREPP installations.

In Situ Vitrification

In situ vitrification (ISV) processes for the destruction of hazardous components and the immobilization of hazardous and radioactive wastes in various buried waste forms will be demonstrated. These include underground structures, such as cribs, pits, and disposal trenches. ISV will be tested and demonstrated for use as a barrier construction technique for long-term isolation of contaminated subsurface structures and soils. The rationale for this project is based on the need to develop technology to permanently contain hazardous and radioactive waste at present locations to reduce handling risk and reduce costs. The benefits of this demonstration will be the comparison and evaluation of different technologies under actual field conditions for potential use at other DOE facilities. The initial ISV demonstration will involve buried wastes at Hanford and Idaho and, as the technology develops, with wastes at Oak Ridge. Technology transfer to Savannah River, Los Alamos, Hanford, and Rocky Flats will be achieved when the demonstration is completed successfully.

Decontamination and Decommissioning (D&D) of Concrete and Metal Structures and Materials

Technologies and techniques to decontaminate concrete and metal structures and materials contaminated with radioactive and/or hazardous materials will be pursued. The approach will span all phases involved in an actual cleanup and provide for technical performance comparisons of different available technologies. Technologies demonstrated will include: contaminant detection and quantification; cleaning and other surface treatment processes; and sec-

ondary waste collection, treatment, storage, and disposal. The rationale for this technology is the necessity to prepare current and former operating facilities for renovation and modernization, containment and cleanup of spills, and to safely and legally decommission inactive facilities. There are many inactive DOE facilities currently awaiting D&D. The benefits from potential demonstrations will be the comparison and evaluation of different technologies under actual field conditions for potential use at other DOE facilities.

Advanced Processing

The objective of this work is the development and testing of technologies and techniques for high-level radioactive wastes that may also have hazardous components. All phases involved in an actual cleanup will be included to provide for technical performance comparisons of different available technologies. The program involves demonstrating technologies for characterization, retrieval, chemical component separation, and treatment. A waste form package meeting acceptance criteria for transportation, storage, and disposal will also be developed. There is a need for high pay off programs. The rationale for this project is based on the need for high-risk, high payoff programs to develop innovative waste treatment technology for high-level waste. The benefits of these demonstrations will be the comparison and evaluation of different technologies under actual field conditions for potential use at several DOE facilities.

CONCLUSIONS

The end objective of these technology development activities is to transfer new and improved waste retrieval and waste processing technologies to Environmental Restoration, Waste Operations, and Defense Programs which will minimize the toxicity and volume of waste; manage unavoidable waste more efficiently and safely; accomplish faster, better, cheaper, and safer remediation of waste problems; effectively D&D materials and facilities; and produce waste within regulatory guidelines for safe, permanent disposal. New cleanup and waste management technologies must be continually developed, demonstrated, and implemented to achieve and maintain regulatory compliance. Success is implementation.