

Collaboration is the Key Strategy for the Department of Energy Environmental Management Program's Headquarters and Field Offices

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ABSTRACT

This paper outlines the Office of Environmental Management (EM) Office of Deactivation and Decommissioning and Facility Engineering's (D&D/FE) program to developing and implementing innovative technologies and technical approaches, and providing technical assistance to the EM-complex. Utilizing a collaborative process, Headquarters staff, Field Federal Project Directors, and other personnel work hand-in-hand to develop a dual approach to meeting mission priorities.

INTRODUCTION

The key strategy and focus of the recently reorganized Office of Environmental Management (EM) is to reduce technical uncertainty and risk in the EM-complex site baselines. The Program's overarching goals are threefold: (1) Improve EM project performance to 90%; (2) Better account for cleanup project unknowns/uncertainties; and (3) Improve use of risk management. Accordingly, as part of the Office of Engineering and Technology, the D&D/FE is charged with implementing safe, cost effective, efficient and timely deactivation and decommissioning of facilities, while optimizing EM real property assets for supporting ongoing operations.

EM's second highest cost center is the D&D area, estimated at approximately \$20.3 Billion. EM's current D&D inventory comprises 332 nuclear, 471 radiologically contaminated facilities and nearly 2000 industrial facilities including a variety of nuclear production reactors, over 100 test and research reactors, huge, multiple-football field size gaseous diffusion plants, chemical processing plants, fuel and weapons component fabrication facilities, canyons/radionuclide separations facilities, hundreds of miles of buried pipelines, and laboratories as well as a myriad of other process contaminated and non-process contaminated facilities. Many of the non-radioactively contaminated facilities contain asbestos, lead based paint, PCBs and other hazardous substances. Although D&D has already been completed for a number of facilities, including all/most of the highly complex and contaminated facilities at Rocky Flats, Ohio Fernald and Mound sites, and additional facilities at other sites, these represent only the tip of the iceberg with the bulk of EM's D&D scheduled for completion through the 2035 timeframe.

Current experience indicates that D&D can and has been completed with relatively few new technical approaches and technology insertions, but are these activities conducted in the most cost effective and safe manner? Although at least some D&D can be accomplished without significant technology insertions, some of this work can be accomplished faster, cheaper and safer with more innovative or advanced technologies and technical practices. Moreover, the more complex D&D scheduled in the out years will require technical improvements and advancements just to meet EM's current cost and schedule expectations.

MANAGEMENT APPROACH TO TECHNOLOGY DEVELOPMENT AND APPLICATION

With a significant number of D&D projects scheduled for completion between 2007 and 2035 at the Idaho National Laboratory, Richland, Savannah River, and Oak Ridge/Y-12 sites, one of EM's key initiatives is to shift technology application and development to projects that will result in increased cost effectiveness, reduction in technical risk, and enhancement to safety performance of D&D activities. This shift is away from the past emphasis on primarily applying alternative/innovative technology to D&D projects where the work could not be completed without such technology.

There are numerous different models such as "oversight", "inspection", "audit", and "technical review" for Headquarters interaction with the Field Offices. The D&D/FE office has decided on a collaborative approach to identify and advance technology development and deployment, and extracting lessons learned from successful processes and best practices. Headquarters and Field Federal Project Directors and other personnel will work hand-in-hand recommending, selecting, adapting, developing, and deploying technology to meet mission objectives.

The purpose of this paper is to describe the D&D/FE management and implementation approach to use of technology for D&D projects. Utilizing the HQ-Field collaborative process centers on a two-fold approach:

1. Identify and implement alternative/innovative or enhanced technologies, methodologies, and/or approaches that can be forcing functions for advancements in solving D&D challenges.
2. Identify and provide technical assistance tools such as subject matter experts, workshops utilizing technical experts, proactive independent reviews, and a suite of D&D approaches/tools, all aimed at improving baseline cost, schedule, and safety.

An important aspect of increasing EM's technical understanding in D&D is working with the national laboratories and universities to identify critical and emerging issues and needs, analyze technical gaps, conduct applied research, and to provide long-term oversight and guidance. Outside of DOE, there is considerable D&D expertise residing in other Federal agencies, commercial sector (nuclear utilities and commercial D&D contractor firms), and the international community. One of our key objectives is to partner with these organizations to exchange lessons learned and best practices, identify subject matter experts, and/or to develop a leveraged applied research program that meets the site's technical needs.

ENGINEERING AND TECHNOLOGY INTEGRATION

A key aspect of the DD/FE approach is to work with the site federal project directors, project managers, and prime contractors to identify technical needs and priorities, select technical approaches in which to invest; and, most importantly, to estimate the benefits, costs, and time frames of the selected technologies. This field-focused approach determines the logical insertion points for technology, adapts state-of-the-art technologies to short-term needs, and sponsors development for mid-to-long term needs where the return on investment is promising based on comparison with the projected cost of using current methods.

An EM Technical Integration Workshop was held in October 2006 to identify and prioritize EM's technical needs for the next ten years. Participants included EM Headquarters (HQ) and field sites (both federal and contractor staff), other DOE programs, National Laboratories, the National Academy of Sciences (NAS), the Consortium for Risk Evaluation with Stakeholder Participation, and others. A key feature of the workshop was the sites demonstrating how their technical needs are linked to project baselines, critical decisions, or other major milestones. The results of this workshop will provide input to EM's Ten-Year Technology Roadmap being developed in FY 2007. The roadmap will lay out what technologies will be needed and the bases for the need as well as when they will be developed.

EM has requested the NAS to conduct a second technical integration workshop and a study that will solicit input from key external groups such as the Nuclear Regulatory Commission, Defense Nuclear Facilities Safety Board, Environmental Protection Agency, and state regulators. Also, to support EM's roadmap development and implementation efforts, the NAS will summarize its previous work advising the EM Program over the last 10 years and input will be solicited from other external groups. Specifically with regard to the latter, a recently formed D&D subgroup of the Energy Facilities Contractors' Group (EFCOG) has many individuals with substantial field project experience. The interaction with this group will serve two purposes: a) to recommend areas of technology needs from the perspective of those on the front line of D&D operations, and b) to identify lessons learned and best practices that can be used at DD/FE projects across the DOE complex.

IMPORTANT TECHNOLOGICAL CHALLENGES

A National Research Council report¹ identified four broad areas of research where technologies could make significant contribution to solving D&D problems, decreasing lifecycle costs, and improving safety performance. These are: 1) characterization of contaminated materials; 2) decontamination of equipment and facilities; 3) remote intelligent systems; and 4) end state definition for facility D&D. A second report, the DOE Research and Development (R&D) Portfolio – Environmental Quality Report² indicates that “site problem holders for facility D&D activities have identified 180 active needs that must be met to accomplish the current baseline.” The broad categories of problem areas/needs identified generally match those recommended by the National Research Council, with added specificity (e.g., underwater characterization related to spent nuclear fuel pools and remote/robotic capabilities for hot cells/glove-boxes), and the inclusion of technology needs related to D&D of graphite reactors and entombment end states.

Based on current understanding and perspectives, the EM Engineering and Technology Program Plan for FY 2007 identifies the following as some of the technological challenges that need to be addressed:

- Underwater and confined space characterization, video inspections, sample collection, radiological surveys, sizing, handling, packaging and decontamination problems associated with fuel storage pools and associated facilities.
- Methodologies capable of characterizing and detecting hazardous species to release limit levels for treatment and recycle of contaminated scrap metal.
- Identification of the quantity and location of radioactive contamination, and control and containment of aerosols and airborne contamination generated by demolition operations during the D&D of graphite reactors.
- Remote characterization, decontamination and dismantlement technologies for tritium and/or plutonium contaminated facilities and highly radioactive environments.
- Remote characterization of chemical reprocessing facilities (canyons) to enable possible end states to be assessed and appropriate disposition path(s) to be developed.
- Remote and/or alternative technologies to detect/quantify liquids, sludges, and other "holdup" in processing systems, associated piping, including ventilation and filtration systems.
- Remote and/or robotic technologies for D&D of hot cells and glove boxes which are contaminated with high levels of radioactivity and which are often confined spaces.

¹ National Research Council report: *Research Opportunities for Deactivating and Decommissioning Department of Energy Facilities, 2001*

² DOE Research and Development Portfolio, Volume II, *Environmental Quality*, February 2000

- Evaluation of the option of disposing of canyons by removing all contaminants above the TRU threshold, filling the structure with low level waste, and entombing the canyon as a permanent LLW disposal facility.
- Lack of historical knowledge of past operations and contamination in old facilities, many not having been entered for over thirty to fifty-years, indicates a potentially high need for remote and robotic systems with the ability to enter and characterize these old facilities in direct support of D&D planning; resulting in greatly reduced radioactive, chemical, industrial, and bio-risks to the workforce.

This list is far from representing the entirety of opportunities for technology application and development. It is expected that the integration effort described above will expand and prioritize this list to focus the technology needs for specific D&D projects as identified through collaboration between HQ and the Field Sites.

TECHNOLOGY DEVELOPMENT AND DEPLOYMENT

Adapted, enhanced and/or alternative technologies must be delivered in time for implementation during the life-cycle of a site cleanup schedule. For those technology needs and priorities identified by the sites, but not provided by the prime contractors, EM headquarters can establish priorities and funding profiles for the mid- to long- term. Cleanup technologies are often developed at national laboratories, universities, other academic institutions, and commercial providers; but it must stand on its own merits, be safe, cost effective, and offer significant and desired advantages over other approaches without introducing unacceptable technical risk. Although technical needs will exist until cleanup is completed in the future, specific technology planning for the long-term becomes more difficult due to uncertainty of cleanup progress, delays with design and construction of already approved facilities/plants, and uncertain regulatory outcomes for certain disposal pathways. Three specific activities identified are:

- The first activity to developing and deploying enhanced and new alternative technologies to meet common & site-specific needs is to evaluate common EM-complex technical risk(s) identified in the 2006 Engineering and Technical Integration Workshop.
- Bridging the gap between technology development and deployment by testing, engineering, and demonstrating an advanced technology to meet site needs. A candidate opportunity is to demonstrate and test newly developed TCE and Beryllium Real-Time Identification Warning Systems for sites.
- Review and evaluate the FY 2007 scope of work for various contractors and laboratories to ensure their work is aligned with EM mission priorities.

TECHNICAL ASSISTANCE

The Office of Engineering and Technology provides technical assistance to sites to reduce the technical uncertainty and risk of site cleanup. DD/FE provides rapid response to address current technical problems impeding site cleanup that will result in significant cost savings or have a major improvement to the waste disposition pathway. An important point that particularly applies to technical assistance is that technology is not only hardware development, but also includes processes, methods and practices for planning and conduct of D&D. One objective is to provide a standardized, flexible D&D “Toolbox” of technologies and methods. In addition, technical assistance and specialized expertise will be made available for D&D projects, including advising as to the appropriate insertion of innovative technologies into the site baselines.

Technical assistance includes activities such as: baseline and project reviews, technical workshops with experts on specific crosscutting issues, engineering consultation, site troubleshooting, cost estimation support, scientific or engineering problem solving, technical analyses and studies, assistance with technology demonstrations, mockups, testing of alternative approaches, tech transfer and integration activities for the complex, and contract and acquisition support.

One set of currently planned activities in the area of technical assistance is to establish a team of subject matter experts from DOE, national labs, commercial nuclear industry, and the international nuclear community for the following challenge areas along with their targeted completion time frame:

- Brookhaven Graphite Research Reactor (BGRR) D&D: technical workshop on international best practices and lessons learned in removing graphite from reactors. 2nd quarter CY07
- West Valley: Technical assistance on remote sampling equipment for tank wall and bottom residue. 2nd quarter CY07
- Paducah: Participate on radiological protection review team to conduct radiological surveys, and release of property from radiological control. 2nd quarter CY07
- Savannah River Site: Hardened Facilities D&D Concept Review - characterization and impact on site performance assessment. 4th quarter CY07
- Oak Ridge Decontamination and Demolition of Structurally Unsound Facilities (over 200 facilities, mostly wooden): assistance with plan development, technologies selection, technical approaches, identifying lessons learned, demonstrations onsite with a cold or slightly contaminated facility, cost and performance data collected, and deployment. 2nd quarter CY08

SUMMARY

EM's DD/FE office approach to developing an investment portfolio of technology development and technical assistance is heavily focused on a collaborative approach of needs determinations from the field projects. Of importance is that "Technology" is more than hardware application and development. It also encompasses processes, methods and practices for planning and for implementation of deactivation and decommissioning. Some activities through calendar year 2008 to implement this approach have been identified. More specific identification and selection of technologies for deployment will be decided during 2007.