U.S. Department of Energy

REPORT TO THE

ENVIRONMENTAL MANAGEMENT ADVISORY BOARD

DOE-EM Technology Development and Deployment Program

Submitted by the EMAB Science & Technology Subcommittee

Introduction:

This report provides a summary of the work of the Science and Technology Subcommittee of the Environmental Management Advisory Board (EMAB), since its inception in December 2012.

In Fiscal Year 2013, the Acting Assistant Secretary, David Huizenga, U.S. Department (DOE) Office of the Environmental Management (EM) tasked EMAB to provide EM leadership with observations and recommendations as to how best to leverage science and technology investments.

Specifically, the Subcommittee was asked to provide insight as to how EM could best structure, manage and communicate its existing Technology Development and Deployment (TDD) program, in order to be most successful in a fiscally constrained environment. The Subcommittee was asked to compare the advantages and disadvantages of centralizing versus decentralizing at the sites. Additionally, the Subcommittee was asked to review the EM Technology Development Governance [Corporate] Board Charter.

Background

The Subcommittee reviewed EM/Office of Science's Primers entitled, "*Progress in Partnership: EM and the Office of Science Jointly Address DOE's Mercury Contamination Challenges"* and Advanced Simulation Capabilities for Environmental Management (ASCEM)'s "*Scientific Opportunities to Resolve Major Legacy Waste Challenges;"* the budge narrative for the Technology Development and Deployment/Science and Technology section in EM's *FY 2013 Congressional Budget Request;* EM's *"Technology Development Governance [Corporate Board Charter;"* the draft for the "*Program Plan for the National Laboratories' [SRNL/PNNL] Engagement in the EM Program*;" the National Academy of Public Administrations reports on "*Positioning DOE's Labs for the Future: A Review of DOE's Management and Oversight of the National Laboratories;"* discussions with EM officials; and teleconferences.

In addition, the Subcommittee found objectives of the *US DOE Strategic Plan 2014-2018* helpful in their research. Especially the following:

- Continued cleanup of radioactive and chemical waste resulting from the Manhattan Project and Cold War activities [Goal 3, Strategic Objective 8]

- Manage assets in a sustainable manner that support the DOE mission [Goal 3, Strategic Objective 9]
- Effectively manage projects, financial assistance agreements, contracts, and contractor performance [Goal 3, Strategic Objective 10]
- Operate the DOE enterprise safely, securely, and efficiently [Goal 3, Strategic Objective 11]
- Attract, manage, train, and retain the best federal workforce to meet future mission needs [Goal 3, Strategic Objective 12]

Findings and Observations:

This EM program addresses many technical challenges including:

- Remediation of Mercury and Industrial Contaminants;
- Deep Vadose Zone Remediation; and
- Facility Decommissioning.

In the United States and other countries, governments and industries have handled major waste and contamination problems, including, chromium, mercury, carbon tetrachloride, and radioactivity, which are relevant to several of DOE's environmental challenges.

The Subcommittee found that EM's National Laboratory RD&D programs do not adequately engage outside agencies and industry, nationally or OCONUS. The associated risks of this are that "Best Industry Practices", experience, and "Lessons Learned" from relevant and similar environmental restoration projects may not be brought to bear to EM Research, Development and Demonstration (RD&D) programs and clean-up projects.

DOE's Comprehensive Inventory of Manhattan Project era contaminated facilities and sites were designed and built with limited or no provision for cost-effective and efficient deactivation and decommissioning (D&D) and clean-up. This fact, coupled with the subsequent upgraded Environmental, Health and Safety requirements, has resulted in the nation's largest clean-up challenge – DOE's Heritage sites. The DOE complex continues with major facilities construction projects. Strong design criteria and specifications are being put into place to ensure sustainability and energy efficiency objectives are met. However, DOE has yet to put in place aggressive criteria and requirements that would ensure that DOE's future hazardous and radioactive waste handling and processing facilities and sites will end its past legacy of creating facilities that have higher decommissioning costs than costs for the original construction.

The DOE's missions have always been challenging. From the beginning, DOE has reached out to educational institutions to gain access to some of the best minds at hand. For example, the DOE's Breeder Reactor program established a program to educate and train "R&D Interns" to bring to bear young, smart, innovative and optimistic men and women into their program and revitalize the DOE's reactor development program. Similar programs worked successfully for the DOE Fusion Energy program and the DOE Operational Safety program (HP Fellowship program).

While DOE's Clean-up program started 40 years ago, the RD&D challenges are as strong as ever, and the laboratory populations are aging. It is important to have young, fresh minds to reinvigorate and accelerate DOE's RD&D and clean-up programs.

In the past, DOE-EM's TDD programs have been impacted or redirected by changed technical, safety, or regulatory guidance. These shifts of guidance, particularly after a project has already started, are disruptive and costly. DOE could take lessons in approaches from Nuclear Regulatory Commission (NRC) licensed facilities. The utility typically has a single Licensing Group to ensure they have a unified, coordinated and consistent approach for interacting with their regulator. This is not the case with DOE, where each management and operating contracts (M&O) and DOE site offices have their own interface group, with Defense Nuclear Facilities Safety Board (DNFSB) and Federal and State Regulatory organizations. Whereas, each utility has well defined "Rules of Engagement" and communications channels to interface, communicate and negotiate with NRC, it is not the case with DOE. This creates problems for DOE's major EM projects and difficulty in finding RD&D and technical solutions for each project.

DOE-EM's TD&D program is rightly seeking "innovative and transformative scientific and technological solutions" to their challenging waste treatment, remediation and D&D problems. Past national laboratory R&D programs have been criticized for not having strong relevancy to bringing solutions to the table. This is further complicated by the project approval process; numerous and continuing "project features" are added to meet "additional objectives' throughout the approval process. All of this is in the name of "better technology," and "comprehensive facility capability." The result can be facilities with shifting R&D requirements, major cost overruns, and schedule slippages.

DOE-EM's waste treatment, waste disposal, and D&D projects contain some of the nation's most challenging technological issues. These projects have often received strong criticism based on the following root causes:

- DOE and other stakeholders agree upon a project scope, cost and schedule before the technology is tested, and before the facility is definitely designed.
- DOE and their M&O contractors often add facilities features/project technical objectives during design, resulting in technology issues, large cost increases, and schedule slippages.
- Unlike other DOE major projects which are accompanied by a large, discretionary R&D program; DOE-EM has limited R&D resources to deploy to resolve unanticipated technological issues that often arise in DOE's higher technology facility construction projects. The result is usually that there are no discretionary contingency or R&D funding to address the problem, therefore, the project baseline cost and schedule is not met, and DOE is criticized.

EM has been in operation since the 1980s's. The successes and maturity of the legacy cleanup has been based on state of the art technology and best industry practice. Needless to say, the EM program is a mature program with much of the challenges completed. Research & Technology

within EM should be "end game oriented" with a well defined scheduled, and consistent with the application need and the risk of technology modifications. R & D should be cost justified based on Performa application, reductions of risk, and high value return on investment.

Recommendations:

Recommendation 2014-01:

It is recommended that TD&D program mechanisms be put into place to actively search out and engage industry and agencies, domestically and abroad, who have similar / relevant environmental restoration problems and associated regulatory and project management challenges.

Recommendation 2014-02:

It is recommended that EM be chartered with testing, evaluating and demonstrating technologies, technical approaches, design approaches / innovations, siting approaches, and regulatory innovations which will minimize the future DOE clean-up costs associated with current and future construction activities at DOE.

Recommendation 2014-03:

The Subcommittee recommends that a DOE Fellowship program be put into place which strengthens DOE's present piecemeal, limited programs for University students. Features should include summer Internships at DOE's National Laboratories, and adequate two and four fellowship tenures to attain advanced degrees.

Recommendation 2014-04:

DOE EM should establish a single interface organization for regulatory authorities. This organization should negotiate clear "Rules of Engagement" for all interactions and negotiations with DNFSB and other regulatory stakeholders to ensure all information and communications are mutually understood and known. The result should be timely, non-political resolution of DOE-EM project R&D needs, requirements, and features.

Recommendation 2014-05:

The DOE-EM TDD program, in collaboration with EM project representatives, conducts periodic RD&D and project technology reviews, which address the following:

- Whether multi-faceted, complicated technical problems can be "de-bundled" to create better solutions; and
- How existing technologies can be adopted in innovative/transformational ways to reduce technical risks, costs, or schedules?
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Recommendation 2014-06:

DOE should find a way to substantially increase project related R&D funding to ensure that unanticipated technological issues can be expeditiously addressed, thus minimizing project overruns and avoiding external criticism associated with having a limited R&D program, which is too small to adequately accompany DOE-EM's large projects.

Recommendation 2014-07:

Newly funded R & D should only be invested in programs that:

1. Current technology is not cost effective in complying with cleanup standards.
2. Risk of current technology or technical approach is excessive.
3. The programs have sufficient schedule that new technology would be able to impact the results (short term success).
4. Return on investment is cost effective.