U.S. DEPARTMENT OF
ENERGY

TECHNOLOGY DEVELOPMENT FRAMEWORK

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U.S. DEPARTMENT OF ENERGY
OFFICE OF ENVIRONMENTAL MANAGEMENT

APPROVALS

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Program Objective

Develop, manage and operate a world-class applied research program that capitalizes on investments and expertise across the DOE complex to advance technologies that assist EM in selecting approaches to resolve the difficult technical challenges facing the EM cleanup mission. The overarching focus of the Technology Development (TD) program is to target technology development and address activities that are critical to DOE-EM needs, where solutions will support the EM cleanup mission through enhanced worker safety or reduce risks, schedule, and/or costs of cleanup and have a significant impact on site closures.

EM Mission

The EM mission is to complete the safe cleanup of environmental legacy waste and contamination resulting from five decades of nuclear weapons development and testing, and government-sponsored nuclear energy research during the Manhattan Project and the Cold War eras. This represents the largest cleanup program in the world. EM manages treatment and immobilization of large volumes of liquid high-level waste stored in large underground tanks, disposal of solid transuranic and low-level wastes, and cleanup of the soils and groundwater at DOE sites leading to facility deactivation and decommissioning and site closure. Priorities for the EM cleanup are defined in the document "EM Strategic Vision: 2021-2031" that describes the key focus areas for the next ten years as well as the cleanup scope remaining after 2030.

DOE-EM Technology Development Mission

The mission of the DOE-EM TD program is to advance, accelerate, and assist the EM cleanup mission.

Advance – The EM TD program will mature viable technologies in support of completion of the EM mission.

Accelerate – The EM TD program will accelerate cleanup activities by supporting emerging and viable technologies for insertion into baseline work.

Assist – The EM TD program will assist with studies and selection of emerging technologies and approaches that address the difficult challenges facing the EM mission.

DOE-EM supports a wide range of applied research activities including scientific studies; technology evaluation, selection, and maturation; scale-up activities; and technical issue resolution efforts to support the EM cleanup mission. Technology development efforts supported directly by site cleanup projects through DOE site offices or contractor-directed activities typically address near-term needs for site-specific remediation technology down-selection, technology risk

reduction, design support, or technical issue resolution associated with the baseline cleanup programs. Frequently, the site-directed studies target critical technical risks and emerging issues that require near-term resolution.

The EM HQ TD program is designed to complement site-specific investments, with a goal of focusing on EM mission needs that are not being addressed by the near-term, site-specific science and technology investments by the cleanup sites. The HQ TD program has the following critical attributes:

- Engagement with and input from EM sites to identify programmatic needs;
- Flexibility to address emergent issues and evolving priorities;
- Strategic focus on critical DOE-EM issues that reduce mission time and cost and capitalize on high risk/high rate of return research in collaboration with DOE's Office of Science, as well as site closure transition work in cooperation with DOE's Office of Legacy Management initiatives;
    - Focus on advancing technologies between Technical Readiness Levels 3-5 that address technology needs within the EM complex
    - Development and deployment of Technical Assistance Teams and Test Beds
- Objective and transparent project evaluation and selection process;
- Application of rigorous program review, reporting and continuous improvement processes;
- Leveraging relevant advances and expertise in other technology development programs in academia, commercial companies/contractors, National Laboratories and other technology providers;
- Development of DOE-EM workforce pipeline and university capability through leveraging programs (e.g., Minority Serving Institution Partnership Program (MSIPP), Florida International University (FIU) Cooperative Agreement); and
- Open and frequent communication on program progress with DOE-EM management and key stakeholders.

TD Program Portfolio Arrangement

The TD Program Director routinely assesses the potential impact of directed institution and site-sponsored TD against the entire EM cleanup program. The funding for the TD program is dependent on Congressional appropriations, thus the size and scope of the TD effort will vary dependent on the available funds. Priorities between the various program areas are determined in alignment with the EM Vision that defines the overall priorities for EM as well as the specific priorities for each EM site.

Focus Areas

The TD program portfolio is comprised of four major focus areas and program enablers:

(1) Tank Waste Treatment
- Treatment – retrieval, pretreatment, and immobilization processes
- Wasteform development – final wasteform loading and performance
- Radionuclide separation processes – e.g., Cesium removal

(2) Soil and Groundwater Remediation
- Groundwater plumes and cleanup criteria
- Monitoring

(3) Facility Decontamination and Decommissioning
- Tank, facility and infrastructure closure
- Characterization and monitoring

(4) Spent Fuel and Nuclear Material Disposition
- EM Spent Nuclear Fuel disposition and storage

(5) Program Enablers - represent TD portfolio activities that improve one or more of the four focus areas, and may include activities with focus on:
- Analytical – sample collection, laboratory and in-situ analysis
- Robotics and remote systems
- Artificial intelligence/machine learning

Portfolio Elements

Flexibility in an evolving environment is recognized, as well as the desire to include a balance of long-term and short-term projects. The TD program includes the following strategically focused elements:

- **Technical Assistance.** The TD program supports the formation of Technical Assistance Teams (TAT) in order to fulfill requests by the field for assistance in various technical activities. Activities have included the evaluation of technical options for waste treatment, facility decontamination and site closure activities. The TAT is comprised of individuals (typically National Laboratories) with appropriate experience to the issue of concern.

- **Test Bed Program.** The TD program provides identification of test bed opportunities, and strategies for implementation and oversight where field testing under like-conditions (e.g., test beds) facilitate the application or deployment of relatively mature technology for key site closure needs, which are often technically complicated by the need for one-of-a-kind solutions that have not been tested in a nuclear environment.

- **Research and Development (R&D) Projects.** R&D projects under the TD portfolio reflects a balance of longer-term TD investments, as well as short-term and medium-term projects over a set of need areas informed by EM site mission priorities and EM's strategic direction.

- **Program Leveraging**. The TD portfolio is leveraged with other research and technology venues accessible to EM:

    - DOE Offices of Science and Legacy Management;

    - Directed institutions and programs (e.g., FIU, MSIPP, Mississippi State University-Institute for Clean Energy Technology, CRESP, Robotics/Artificial Intelligence, and Spent Nuclear Fuel initiatives); and

    - Other DOE programs that contribute directly and indirectly to addressing EM mission needs including the Office of Science Small Business Innovative Research (SBIR) program, DOE's Office of Artificial Intelligence, and other interagency programs such as the Department of Defense SERDP/ESTCP, EPA's Adaptive Management Initiative, and international cleanup endeavors.

TD Program Administration

The EM TD Program Director will have overall management and oversight responsibilities for the TD program, and for focusing the program to address technology needs. Information and requests from sites, program offices and knowledge of the cleanup mission are used to define technology needs. Savannah River National Laboratory (SRNL) staff will support the EM TD program as needed in execution, and will also serve as an interface between the TD Program Director and the National Laboratory Network. An EM TD Program Plan will describe the management and organization of the program, and processes for determining program priorities, project selection, project reviews, and reporting requirements.

Overall coordination and project selection will be supported by a Technical Group. The Technical Group does not have a standing membership, but is an ad hoc group assembled on an as-needed basis to advise on relevant aspects of the TD program, such as priorities for a particular site or program area. It may be comprised of technical DOE staff (field and HQ), National Laboratory, contractor and consultants with interests and expertise in the relevant area. The Technical Group is a resource for program integration, review, and communication.

The TD portfolio enables DOE-EM staff to oversee responsibilities of the work performed and can be supported by SRNL and other laboratories staff based on various tactical areas of concentration.