THE EM LEAD LABORATORY: PROVIDING THE RESOURCES AND FRAMEWORK FOR COMPLEXWIDE ENVIRONMENTAL CLEANUP-STEWARDSHIP ACTIVITIES

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ABSTRACT

The Office of Environmental Management (EM) has designated the INEEL as the EM Lead Laboratory. The major responsibilities associated with this designation are to:

- Initiate an assessment of capabilities required to complete the EM mission,
- Lead development of a science and technology program for long-term stewardship,
- Champion complex-wide integration and planning, and
- Manage national programs assigned to the INEEL.

These responsibilities fall into two areas— 1) facilitating and integrating the application of resources across the DOE complex to support completion of the EM mission, and 2) developing and applying INEEL resources and expertise to INEEL-specific EM activities. The other papers in this session provide details of INEEL-specific and assigned national programs that address the latter aspect of our lead laboratory activities.

This paper provides the complex-wide perspective necessary to fulfill the other aspect of our EM lead laboratory responsibility. This paper discusses the EM network of core laboratories and the leadership role of the EM lead laboratory in accessing and integrating the expertise and strength across the entire DOE complex to facilitate the most efficient and effective development and application of science and technology resources.

INTRODUCTION

The EM program is responsible for cleanup and long-term stewardship of the environmental legacy of nuclear research, production, and testing and of DOE-funded nuclear energy research in the United States. These activities collectively produced large volumes of nuclear materials, spent nuclear fuel, radioactive waste, and hazardous waste, resulting in contaminated facilities, soil and groundwater at 113 sites across the country. EM manages some of the most technically challenging and complex work of any environmental program in the world.

EM has approached the cleanup mission by defining, as completely as possible, the pathway to well-defined, agreed-upon end states for every waste, site, material or facility. This information was documented in *Accelerating Cleanup: Paths to Closure* (1998). This document provided, for the first time, a site-by-site, project-by-project projection of the technical scope, cost and schedule required to complete the cleanup mission. In many instances, either programmatic or technical gaps or barriers are encountered along the path to an end state. Programmatic barriers include regulatory and compliance issues as well as insufficient capacity or lack of facilities to perform required processes. Technical gaps include the lack of the scientific or technical basis to completely characterize wastes and lack of technologies to process or prepare wastes for disposition or to remediate contaminated sites.

In addition to comprising the environmental legacy that EM is responsible to clean up, the complex-wide network of sites and laboratories also represents the resource of knowledge, processes and facilities available to EM to perform the cleanup activities. EM initiated a complex wide integration activity, led and facilitated by the INEEL, to identify all the functions and capabilities required to complete the cleanup, the facilities and process capabilities currently available and the interdependencies in the cleanup activities. The EM integration activity provided a basis for identifying redundant functions and for potentially sharing facilities and processes across the complex to maximize the use of existing capabilities.

A major outcome of the integration activities was the preparation of disposition maps, which graphically displayed the cradle-to-grave pathway for each waste stream at each site. An illustrative disposition map is displayed in Figure 1. The disposition maps also identify barriers or gaps in the pathway to the end state for each stream. The analysis of the gaps and barriers provides a set of needs (programmatic or scientific and technological) that must be met in order to successfully complete the cleanup activities. The complexity and uniqueness of the EM cleanup activities present many very challenging scientific and technological gaps and barriers.

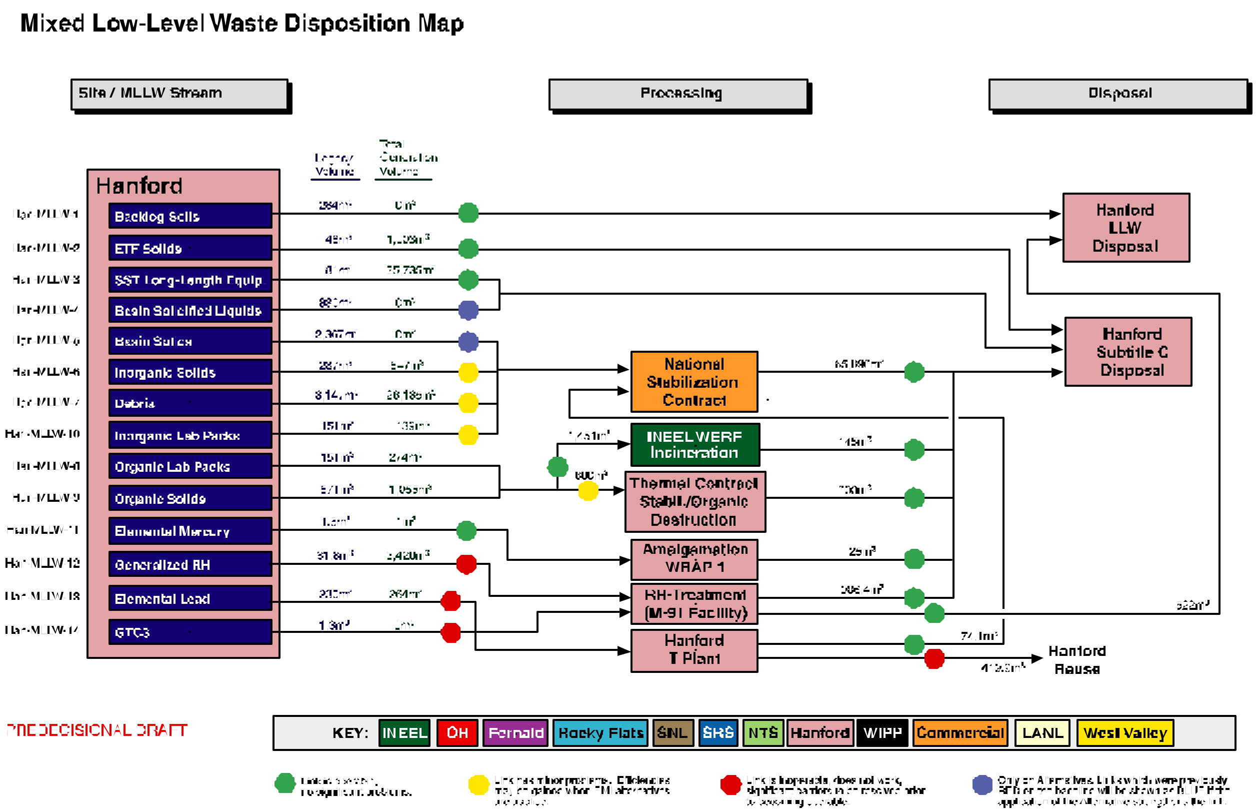

Fig. 1. A disposition map graphically displays the cradle-to-grave program for each waste stream at each site.

Within EM, the Office of Science and Technology (OST) manages the development of science and technology to provide solutions to problems encountered in completing the cleanup-stewardship mission. EM's research and development program spans basic science to implementation and deployment. EM has identified four critical objectives that research and development investments must attain in order to support successful completion of the cleanup-stewardship mission. These objectives, described in the *EM Strategic Plan for Science and Technology* (1998), are:

- **Meet the high-priority needs** identified by cleanup project managers, including those on the critical path to site closure and those that represent major technology gaps in project completion.
- **Reduce the cost** of EM's costliest cleanup projects by aligning science and technology investments with EM's major cleanup problems.
- **Reduce technological and programmatic risk** so those critical cleanup projects will be completed on time and within budget.
- **Accelerate and increase technology deployments** by closing the gap between development and use.

To achieve a comprehensive, integrated approach to developing and providing science and technology solutions, EM has separated the site cleanup needs into a set of five problem areas. A focus area has been established to plan and manage EM's research and development investments to develop solutions for each problem area. This focus area centered approach provides the basis for making EM's science and technology investments solution-oriented and an integral part of the cleanup-stewardship mission. Each focus area manages national research and development activities that will provide solutions for the problem area with which they are associated. The site at which a focus is located is typically a site that owns a major portion of the problems within the problem area of that focus area. The five problem areas, focus areas, and the associated sites are identified in Figure 2.

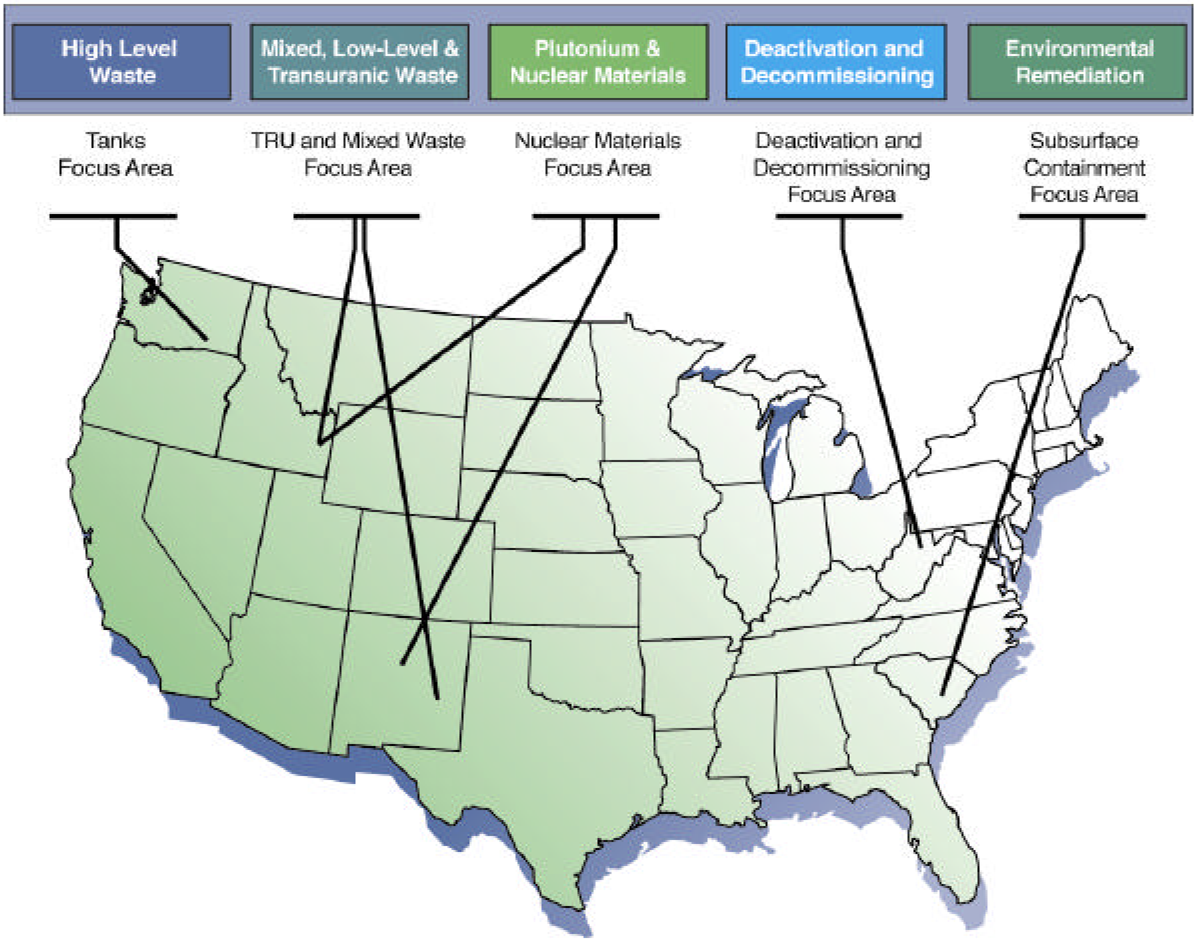

Fig. 2. The problem areas and related focus areas across the DOE Complex

The coordination and integration of the program integration, research and development activities and the EM system of laboratories is a formidable challenge. EM has determined to use a lead laboratory to provide the necessary coordination and integration of the EM network of core laboratories and research and development resources and activities. The INEEL has been designated to perform the EM lead laboratory function.

The EM Lead Laboratory

The EM Lead Laboratory charter signed by Carolyn Huntoon, assistant secretary of EM, directs that the EM lead laboratory will:

- Initiate an assessment of EM's capability requirements,
- Lead the development of a science and technology program for long-term environmental stewardship,
- Champion complex-wide integration and planning, and
- Manage assigned national programs.

As a basic operating principle, the EM Lead Laboratory will reach out to the other DOE laboratories to ensure their involvement in key science and technology issues. The INEEL recognizes the responsibilities and authorities of the focus areas and their lead laboratories and will work closely with them to support their continued success. As the EM Lead Laboratory, and in partnership with the focus areas, national laboratories, academia, and industry, the INEEL will:

- Reduce the risk, cost, and time required for cleanup activities by encouraging the consideration of alternatives and innovative technologies,
- Enhance integration across the DOE complex,
- Provide unbiased, open, and expert technical assistance on key issues,
- Improve the defensibility of program decision making, and
- Enhance the integration and alignment of the Office of Science and Technology activities with the rest of the EM program.

Scientific and technical innovation must be maintained and applied to ensure that world-class technical capabilities enable DOE to fulfill its missions and strategic objectives and accomplish the above responsibilities. The laboratories within the DOE complex that support EM programs represent specific areas of expertise and capability. The lead laboratory must have sufficient awareness and knowledge of these areas of expertise to ensure that they are communicated and integrated into activities across the complex.

The EM Lead Laboratory provides a technical and scientific framework to ensure a proper focus on present and future environmental quality challenges, so solutions to what are now intractable problems hindering the EM mission are developed. A major responsibility is to facilitate the development of a research and development portfolio that utilizes the resources of the system of laboratories to provide both near-term solutions and the longer-term focus on scientific knowledge that will provide the foundation for solutions in the future. The lead laboratory acts as an impartial catalyst to ensure that the best available resources address environmental quality issues through the introduction of critical new science and technology. Through facilitating a consistent, scientifically defensible long-term cleanup and stewardship strategy, the lead laboratory will advance the EM cleanup program.

INTEGRATION—A COMPLEX-WIDE EFFORT

The EM Lead Laboratory will build upon the complex-wide integration activities already in place. In what has been described as "the single most comprehensive environmental planning project ever attempted and successfully completed on a nationwide scale for the $6 billion per year EM program," the INEEL conducted an unprecedented cooperative integration effort among EM sites designed to save billions of dollars and accelerate cleanup by as much as 30 years.

The basic planning process is illustrated in Figure 3.

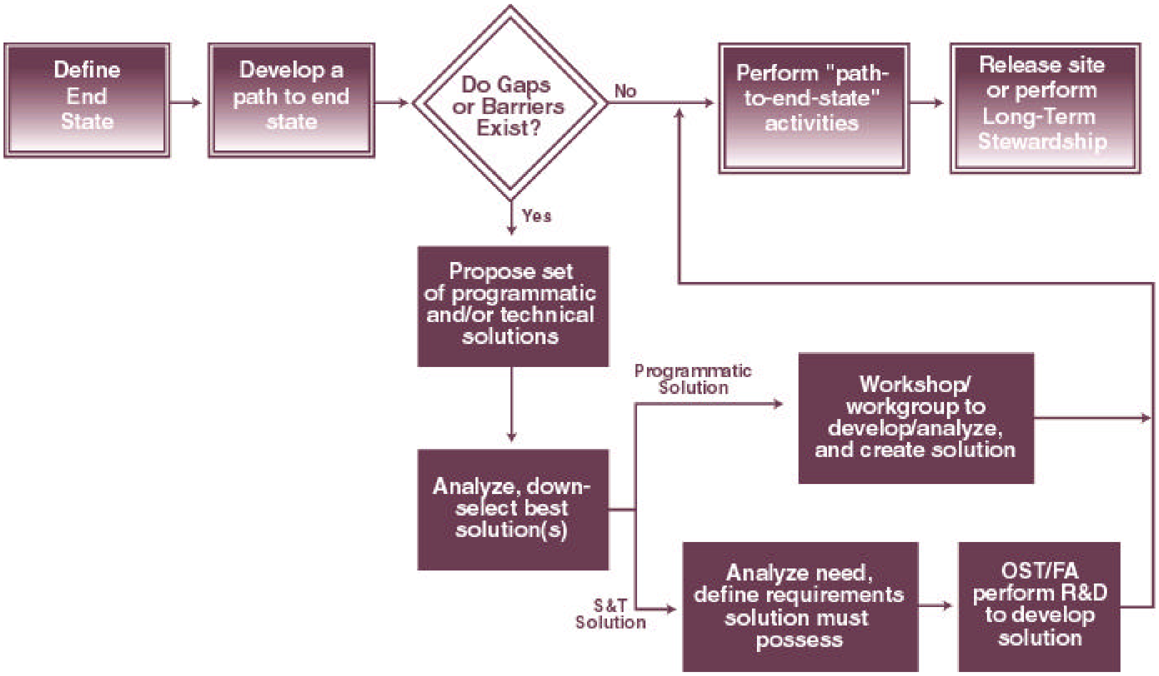

Fig. 3. The EM cleanup planning and execution process

The first phase of this process—developing the plans to reach the end state for each waste stream, material or remediation site—is essential to understanding the full magnitude of the cleanup-stewardship mission. A major contribution of the EM integration activities has been the completion of these pathways (disposition maps) to the end state. The development and evaluation of solutions to barriers in the pathway is the step upon which cleanup mission success rests. The integration program will continue to (1) validate the current baselines and complete the environmental remediation disposition maps and the deactivation and decommissioning life cycles maps, (2) identify barriers to these baselines, (3) develop solutions, and (4) implement the solutions into an executable baseline.

Ownership of the disposition maps by the programs and personnel responsible for actual cleanup is essential for accurately identifying and defining the requirements a solution to a gap or barrier must meet. And, their continued involvement is necessary to ensure that the solutions that are developed will actually solve the problem and that the solutions are utilized in the cleanup activities.

Often the solution to resolve a gap or barrier involves developing a new technology. The DOE laboratories are a major resource for developing this new science and technology. The focus areas and their operational counterparts plan, conduct and implement research and development of new technologies.

However, in many instances a programmatic solution may be better than a technical solution. Barriers may also be removed by addressing schedule, funding, integration, or regulatory issues. A relatively simple "regulatory" change, for instance, may be better than an expensive "technical" solution. A significant aspect of integration activities includes challenging the validity of long-standing requirements, eliminating many of them and focusing on those truly *mandatory* for cleanup and ensuring the environmental integrity. Through this process it has been possible to identify, combine, eliminate, and simplify activities across the EM complex.

This planning and implementation process has produced a solid technical and programmatic database upon which careful, defensible budgets can be developed and implemented. This process has enabled EM to formulate more credible budgets to support the cleanup mission.

This approach is not revolutionary. It exists in part in almost all project and management theory and literature. What is unique is its application in the enormous and complex nationwide cleanup program involving widely different regional interests. The undertaking has received national recognition by being awarded the Superior Achievement Award by the American Academy of Environmental Engineers, a Government Technology Leadership Award, and the National Environmental Excellence Award by the National Association of Environmental Professionals.

The EM Lead Laboratory will direct work to the entity best suited to its accomplishment, whether the entity be a national laboratory, focus area, university, or business.

Along with integration activities, the EM Lead Laboratory will address environmental stewardship, which focuses on coordinating investments in science and technology that result in significant risk and cost reductions, while protecting human health and the environment following cleanup.

Path Forward to Implement the EM Core Laboratories

The magnitude and complexity of the EM cleanup-stewardship mission requires the optimal utilization of the laboratory and cleanup site resources. These resources must be fully leveraged through coordination and collatoration. The INEEL has initiated communication and a series of workshops to define and establish a virtual network of laboratories, referred to as the EM Core Laboratories. The Core Laboratories will work together to ensure that the best solutions are achieved and that capabilities are utilized from the individual component laboratories in a focused, national collaboration. The Core Laboratories are comprised of the DOE laboratories for which EM has Cognizant Secretraial responsibility (Environmental Measurement Laboratory, Idaho National Engineering and Environmental Laboratory, Radiological and Environmental Sciences Laboratory, and Savannah River Technology Center) and the national laboratories that provide focus area lead laboratory support to EM (Los Alamos National Laboratory, National Energy Technology Laboratory, and Pacific Northwest National Laboratory.)

The Core Labs provide support to the EM cleanup-stewardship in two major areas. The first area is providing scientific and technical assistance to sites for specific problems. The lead laboratory serves as a point-of-contact for those needing technical assistance who have not been able to directly identify appropriate resources to assist them.

The second area is a collaboration to provide the joint leadership in developing a scientifically defensible basis for cost effective, timely EM site cleanup and long-term stewardship. Specifically, the EM Core Labs intend to cooperate in the following:

1. Provide the leadership to drive and the commitment to support the EM agenda for cleanup and long-term stewardship,
2. Develop recommendations for long-range programmatic direction,
3. Strengthen the scientific credibility for DOE's cleanup-stewardship decisions, and
4. Provide input for suture facillity planning and development.

The process being developed and used by the Core Labs to achieve these objectives is illustrated in Figure 4. The process is initiated by the identification of programmatic or technical issues that have a major impact on completion of the EM mission. These issues are collected from all sources. The Core Labs working group performs an initial screening of these issues to identify which issues the Core Labs should address and prepares an initial problem statement and scope. These may be stated as Major Impact Goals (MIGs). These are presented to an "executive" team, comprised of the Laboratory Directors and the EM Deputy Assistant Secretaries. The "executive" team prioritizes and selects the MIGs that it will charge the Core Labs working group to address.

The Core Labs working group assesses the scope of the MIG and identifies the available resources to address the MIG. They also identify appropriate MIG working team members and enlist the team leader and a DOE champion for the team. The MIG working team then performs the task of developing an evaluation and recommendation of how to address the MIG. The task includes:

- Formal definition of the problem,
- Identification of the goals and absolute requirements of a solution,
- Identification of possible alternative solutions and definition of criteria by which to evaluate alternatives,
- Evaluation of alternatives against the established criteria and selection of proposed recommendation, and
- Validation of proposed recommendation against the problem statement.

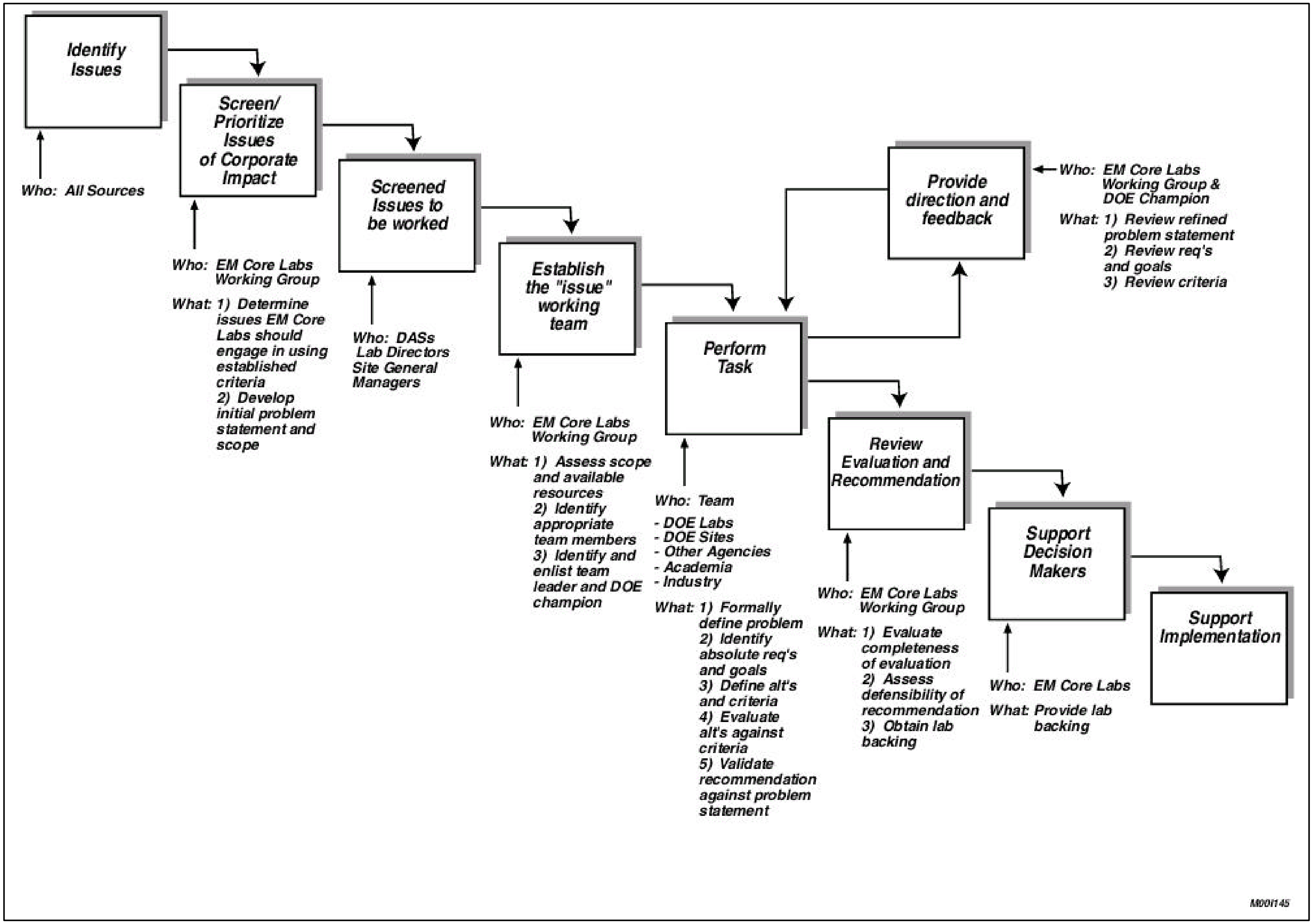

Fig. 4. The EM Core Laboratory functional model.

The Core Lab working group and the DOE champion provide direction and feedback to the MIG working team through review of the problem statement, requirements and goals and review/evaluation criteria. When the MIG working team completes it task, the Core Labs working group evaluates the report and recommendation for completeness, assesses the defensibility of the recommendation and secures the approval and backing of the Core Labs. The Core Labs then provides "corporate" support to the decisionmakers in decisions to select and implement a particular approach to achieving a MIG.

The EM Core Laboratories has identified the problem of scaling in the subsurface science area as the first MIG to be addressed. This is a major problem in subsurface science. Because the subsurface is not homogeneous, subsurface phenomena must be characterized using space and time scales consistent with the phenomena—ranging from molecular to pore size to inches to yards to field sites and from milliseconds to minutes to days to seasons to years to millenia. The challenge of scaling is how to extrapolate results from one time-space scale to another—from small-scale (including laboratory) experiments to field-scale. The Core Laboratory working group has prepared a white paper entitled "Understanding the Risks of DOE's Environmental Legacy – EM Subsurface Science and Technology Initiative" as the first step in the Core Lab process. Additional MIGs are currently being evaluated and characterized in preparation for presentation the executive team for consideration.

CONCLUSION

The virtual network of laboratories created by implementing the EM Core Laboratories model will provide to EM new, corporate-level support for planning, decisionmaking and implementation functions. As the EM Lead Laboratory, INEEL will facilitate the development and functioning of the EM Core Laboratories to enhance EM's ability to complete its cleanup-stewardship mission. The lead lab/core lab concept presents a significant opportunity to dramatically impact the effectiveness and efficiency of the EM program. Implementation of this concept lays the foundation to establish a long-term operating model that will align the efforts and resources of headquarters, the field, contractors and the labs. This "corporate" approach ensures that all elements of the program are focused and synchronized on achieving the same mission goal and objectives.