



ENVIRONMENTAL MANAGEMENT

# *Strategic Plan*

FOR  
**SCIENCE  
&  
TECHNOLOGY**

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*U.S. Department of Energy  
November 1998*



## INTRODUCTION: Goals and a Strategy

The DOE Assistant Secretary for Environmental Management (EM) has responsibility for the largest environmental management program in the world—the cleanup of the legacy of 50 years of U.S. government nuclear operations and weapons production. The goals of this program include cleaning up and transitioning to safe, acceptable conditions, the majority of operating sites before the year 2006, expediting cleanup of remaining sites, and solving the complicated and intractable problems encountered in cleanup activities. The cleanup activities required to achieve these goals are described in *Accelerating Cleanup: Paths to Closure* (June 1998). That document identifies hundreds of needs for new enabling technologies, additional data,

**Recognizing a need for change in the traditional thinking about the role of science and technology investments in the overall Environmental Management cleanup mission, we the undersigned, endorse this Strategic Plan and support its acceptance and adoption.**

November 1998

### James Owendoff – EM-1

*We have to make the correct investments now and in the future if we are going to achieve what we have set out to do in our "Paths to Closure" strategy plan.*



*James M. Owendoff*



*Jim Fiore*

### Jim Fiore – EM-40

*"Bringing new technologies into restoration," Fiore's final priority, is key to accomplishing the ER program's goal, and therefore the goal of the EM program itself, because of the need, and now the commitment, to achieve closure faster and cheaper. And Fiore says, "everyone wins when cleanup is done faster."*

### Barry Clark – EM-10

*"The monetary and human resources available to the Environmental Management mission have become increasingly constrained over the past few years. The EM Science and Technology Program holds the key to leveraging these resources to efficiently expedite cleanup of the Cold War legacy."*



*Barry Clark*



*Gerald Boyd*

### Gerald Boyd – EM-50

*We are redefining the role of science and technology in the cleanup business. It must include full integrated partnerships between OST and each of the EM user organizations.*

### Dan Berkovitz – EM-20

*To reduce the cost of cleanup - and in some cases to allow cleanup - EM must identify, develop, and apply science and new technologies aggressively.*



*Dan M. Berkovitz*



*Dave Huizenga*

### Dave Huizenga – EM-60

*EM-60's responsibilities entail needs for science as well as technology. Huizenga says, "We have two thousand tons of fuel at Hanford to move from the K basins to the Canister Storage Building. Can that fuel go to the repository, or does it need to be repackaged or treated to avoid pyrophoricity? There's a science aspect to this issue."*

### Mark Frei – EM-30

*"One of the areas that the EM program must improve is to better assess programmatic/technological risk and then use this risk information to help formulate a better-prioritized science and technology program. This improvement will help ensure that technology solutions are available to allow completion of a critical activity on the way to site cleanups."*



*Mark W. Frei*



*Gene Schmitt*

### Gene Schmitt – EM-70

*EM will develop its science and technology budget based on the data from *Accelerated Cleanup: Paths to Closure*. Such highly focused investments will help achieve challenging enhanced performance goals and reduce the technological risk associated with projects that are on the critical path to site completion.*

and additional knowledge and understanding needed to develop alternative approaches that can reduce programmatic risk for EM cleanup activities.

EM has identified four critical objectives that science and technology investments must attain in order to support successful completion of the cleanup mission:

- meet the highest priority cleanup project needs, including those on the critical path to site closure and those representing major technology gaps in project completion,
- reduce the cost of EM's costliest cleanup projects,
- reduce technology risk (i.e. the programmatic risk that critical cleanup activities will not be completed on time or within budget due to a technology deficiency), and,
- accelerate and increase technology deployment by bridging the gap between development and use.

To attain these objectives EM science and technology investments must be planned and managed in an interactive, coordinated, participatory relationship with EM cleanup project managers and stakeholders.



***EM Science and Technology investments will yield fully developed, deployable solutions to EM cleanup and stewardship challenges.***

## ***VISION AND MISSION: Focus and Purpose for Science and Technology Investments***

### ***Vision for EM Investments in Science and Technology***

EM science and technology investments, functioning as an integral part of the EM Programs, will provide the scientific foundation, new approaches, and new technologies that bring about significant reductions in risk, cost, and schedule for completion of the EM mission. The strongest advocates of EM science and technology activities will be the EM cleanup project managers, regulatory agencies, and community groups.

### ***Mission of EM Investments in Science and Technology***

Provide the full range of science and technology resources and capabilities, from basic research to development to demonstration and deployment to technical assistance, that are needed to deliver and support fully developed, deployable scientific and technological solutions to EM cleanup and long-term environmental stewardship problems.

***Science and technology contributions are foundational and critical keys to the success of the EM cleanup mission***



### ***BACKGROUND: The Need for the New Strategy***

EM management of science and technology investments has evolved through three identifiable stages. Knowledge of these three stages is important to understand the changes EM is currently making in both the range of investments and the way those investments are determined and managed.

#### ***Early Investments were Diverse and Distributed: FY 1991–93***

When EM was formed it was recognized that technology development would be needed to successfully complete the EM mission. The Office of Technology Development (OTD), currently known as the Office of Science and Technology, was established to meet this need. Because cleanup baselines did not exist, EM's science and technology investments were focused on technology development activities in areas deemed appropriate by subject matter experts. This was a period of rapid growth for both the EM program and OTD. The growth led to an OTD organization that was diverse and distributed. Investments went beyond technology development activities and included education, emergency management, transportation, and laboratory construction. Technology development activities were managed separately through over two dozen individual programs. The average annual budget during this period was \$200 million.

#### ***Improved Coordination and a more Focused Investment Portfolio: FY 1994–96***

In 1994 the need to focus the technology development efforts on the emerging EM baseline was recognized. To achieve this focus, DOE/EM developed a new approach [A New Approach to Environmental Research and Development at the U.S.

***Dumping practices of the past have created a problem of national scope.***



Department of Energy—Action Plan, 1/25/94, U.S. Department of Energy] through the formation of Focus Areas and Site Technology Coordinating Groups (STCG). The Focus Areas were established to provide a management approach to unifying EM's distributed technology development activities under a single umbrella and to focus the investments on the major cleanup areas identified by EM. The STCGs were established to ensure that site needs were identified and addressed and that developed technical solutions were implemented. During this period, the New Approach served to focus EM's science and technology investments on four major problem areas did not adequately engage the cleanup project managers in the program. This inadequacy resulted in an incomplete understanding of the needs at a period when funding for OTD peaked at \$400 million a year.

### **Expanding Investments to include Science and Deployment: FY 1996–Present**

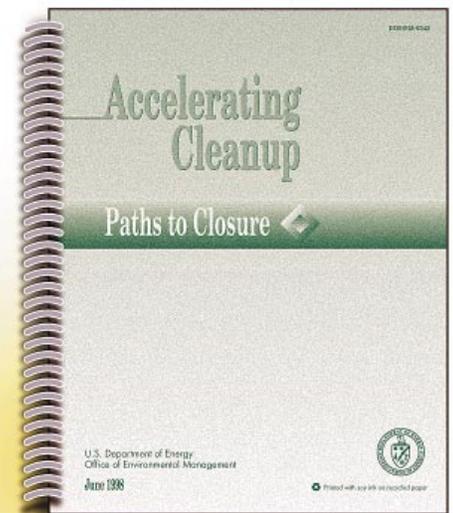
In 1996, it was recognized that EM's site remediation and waste management efforts were going to extend well into the 21st century and that the Department needed a better scientific understanding of the complexity of the problem being addressed. EM changed OTD's name to the Office of Science and Technology (OST). In FY 1996, Congress directed that EM, in partnership with the Office of Science, establish a Science Program. The goal of the EM Science Program was to identify and invest in basic research that directly supported the development of knowledge and technology necessary to complete the EM cleanup mission. During this same period it became apparent that too few of the technologies developed by OTD were being deployed. In an effort to accelerate the use of new technology, EM funded the Technology Deployment Initiative, now known as the Accelerated Site Technology Deployment program. These programs extended the original function of OTD in two directions, adding basic research and deployment. This was done during a period when EM's investments in science and technology dropped by over 40% down to \$250 million a year. The significant reduction in funding made it imperative that EM make highly focused investments, which required additional coordination on the part of the Focus Areas.

### **Paths to Closure: Further Impacts to EM's Science and Technology Investments:**

EM recently completed and published *Accelerating Cleanup: Paths to Closure* (June 1998), a document which provides a site-by-site, project-by-project, projection of the technical scope, cost and schedule required to complete the EM mission. To achieve the aggressive approach to cleanup described in the document, EM initiated a complex-wide analysis to determine how to achieve this scope, schedule and cost, and to identify programmatic risks and barriers that exist. This analysis used systems engineering methodologies to define the set of requirements to reach the endstates for each site. It provided the framework for an integrated view of the entire cleanup mission. For each cleanup project, sites identify specific science and technology needs that must be met to enable or to improve cleanup, accelerate the schedule, or reduce cost.

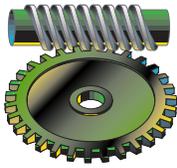
### **Focus-Area-centered approach and Program Integration: FY98 to the Present:**

In 1998, EM reviewed the focus area approach and decided it was the correct management approach but that it needed to be both strengthened and better integrated with the cleanup project manager. The Focus-Area-centered approach places full responsibility for all investments, science through deployment, under the management of the Focus Areas. However with that additional responsibility comes the requirement that the Focus Areas make the cleanup project manager an integral part of the Focus Areas' management and requires cleanup project manager approval of all projects. The intent of the Focus-Area-centered approach is to make EM's science and technology investments solution oriented and an integral part of the cleanup. The focus will be to provide the scientific and technical assistance that cleanup projects need to define and defend cleanup end states, challenge the technical baselines, solve operational problems, and reduce operational risks. Integrating the science, technology, and deployment activities and cleanup projects, is the next step to creating a seamless program that provides solutions needed to complete the EM cleanup mission.



***Accelerating Cleanup: Paths to Closure* reflects the most recent evolution of DOE's efforts to accurately project the cost, schedule and scope of its massive cleanup effort (available at [www.em.doe.gov](http://www.em.doe.gov)).**

*Solution-Driven*



*Fully Integrated*



*Comprehensive*



*Credible Decision Process*



**EM investment philosophy is founded on four values: solution-focused activities, direct linkage with cleanup goals, full scope from research through demonstration, and positive and purposeful direction.**

## **OPERATING PRINCIPLE AND VALUES: Foundation of the New Strategy**

The fundamental operating principle and single objective of the EM investments in science and technology is to provide, in a timely manner, to cleanup project managers the technologies and support they require to complete the EM mission. EM science and technology activities will continually be evaluated against the following values to ensure the program remains focused on the primary operating principle.

**Solution Driven:** Activities will be focused to support implementation decisions, to create solutions to difficult problems, to enable actions that significantly reduce the cost and duration of cleanup while maintaining or enhancing safety, or to fundamentally transform the nature of the problem.

**Fully Integrated with Cleanup Programs:** Activities will be linked directly to cleanup program goals, with financial accountability transitioning from the science and technology funding to the cleanup projects as technologies move toward implementation.

**Comprehensive in Scope:** Activities will cover the full range of science and technology; i.e., from basic research to technology development to technology demonstration to technical assistance supporting implementation.

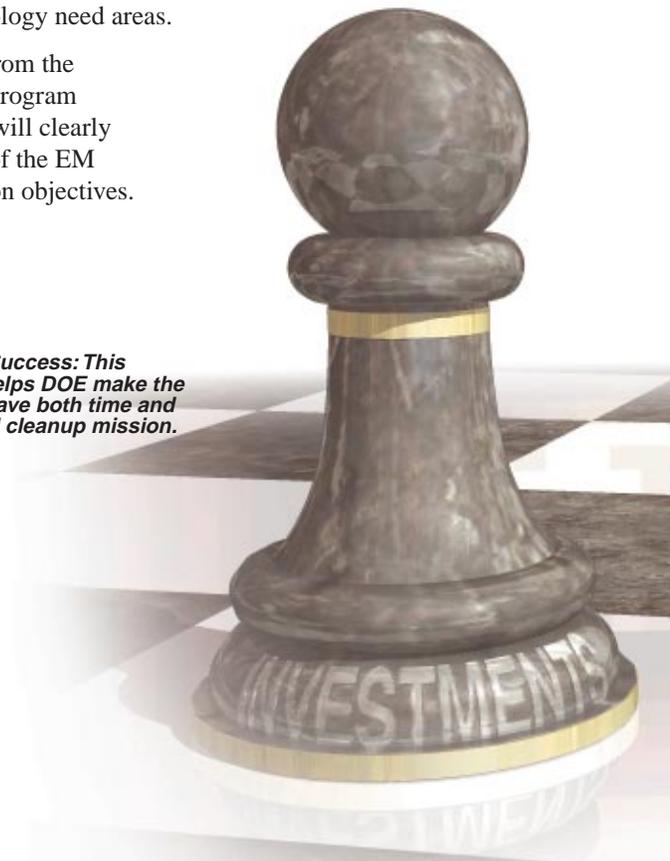
**Credible Decision Process:** Processes used to establish priorities, set program and project direction, allocate funding, and select project teams are based on a clear set of criteria and are applied in an open, transparent manner.

EM will use the disciplines of systems engineering and roadmapping to implement the operating principle and achieve the operating values:

- systems engineering to identify and define technology requirements and establish performance measures;
- program and technology roadmapping to establish priorities, set program and project direction, and identify the high-priority science and technology need areas.

Performance measures will be derived from the requirements necessary to achieve EM program objectives. The performance measures will clearly describe the contribution each element of the EM program must make to satisfy the mission objectives.

**Positioning for Success: This Strategic Plan helps DOE make the right moves to save both time and money in the EM cleanup mission.**



## ***Positioning for Success: Evolution of the New Strategy***

### ***Strategy***

EM science and technology activities function as a fully integrated partner and contributor in the execution of the EM Mission. They are solution-driven and demonstrate a full partnership with the cleanup program at all levels. The cleanup programs also reflect this partnership by a commitment in the program schedule and budgets to incorporate new knowledge, data, technologies, and/or technical assistance as the science and technology activities provide them.

### ***Tactics***

The defining and fundamental objective of the EM investments in science and technology is the development and deployment of knowledge and technology that enables successful completion of the cleanup mission. The following tactics will be used to help implement the strategy for integration of science and technology projects with the cleanup programs.

- EM Program Integration, will apply systems engineering methodologies to the input from the sites, provided by cleanup project managers, to identify and define the activities and technology requirements needed to complete the EM mission. The FAs and STCGs assist the cleanup project managers by analyzing and validating technology gaps and barriers in the baseline identified by the cleanup project managers.
- Technology roadmaps will be prepared for the highest priority technology need areas to provide a robust and credible basis for the formulation of a science and technology investment portfolio that will optimize the return on investment.
- Science and technology investments will be in the high-priority need areas identified by the disposition maps and cleanup project managers. Though these technology development projects are funded primarily through Focus Areas, the goal is deployment of the technology in cleanup activities with a transition to funding by the cleanup project. To ensure that science and technology projects will meet identified needs, science and technology projects must have cleanup project manager endorsement and commitment to apply scientific information to make decisions and to deploy the technology in order to receive science and technology funding.
- The operational and indirect costs of a technology demonstration will be provided by the cleanup project. Science and technology investments will provide the technical assistance needed to implement the technology and verify technical performance. Cost-sharing demonstrates the mutual commitment to develop and implement solutions to EM cleanup problems.

### ***EM's strategy for science and technology:***

- ***Be an integrated partner and contributor***
- ***Be solution-driven***
- ***Add value and knowledge***
- ***Provide technical assistance***
- ***Implement solutions***

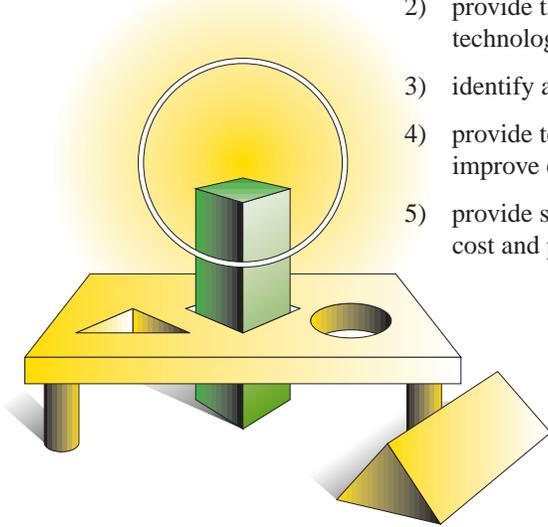
- Investments in basic research will be focused primarily on the complex problems that will remain after the year 2006. The Office of Science will conduct peer reviews to ensure the research is scientifically meritorious. Subsequently, EM will ensure that the research is relevant by developing basic research requirements from the identified technology gaps and barriers on the pathway to defined end states. Research proposals and progress reports must satisfy both sets of requirements to receive funding.
- EM will actively seek to collaborate with relevant programs in other agencies and industry to access technologies appropriate to DOE needs and to assess and communicate the impact of regulatory and cleanup requirements. EM will maintain a low-cost/low-maintenance information network that allows cleanup project managers to access relevant available expertise and leverage the results from other sources.

### ***Expected Outcomes***

The focus of EM investments in science and technology will be shifted from technology development to a solution-oriented approach, directed toward cleanup project objectives for cleanup and designed to support cleanup project science and technology needs. This change in focus will:

- 1) provide the scientific and technical foundation to support definition of end state cleanup requirements,
- 2) provide the scientific and technical basis for cleanup project justification of the technology baselines,
- 3) identify and provide alternative cleanup approaches and/or technologies,
- 4) provide technical assistance to cleanup projects to help solve operational issues and improve efficiencies, and
- 5) provide solutions that transform the nature of EM problems and provide dramatic cost and performance benefits.

***The focus of EM investments in science and technology will become solution-oriented***

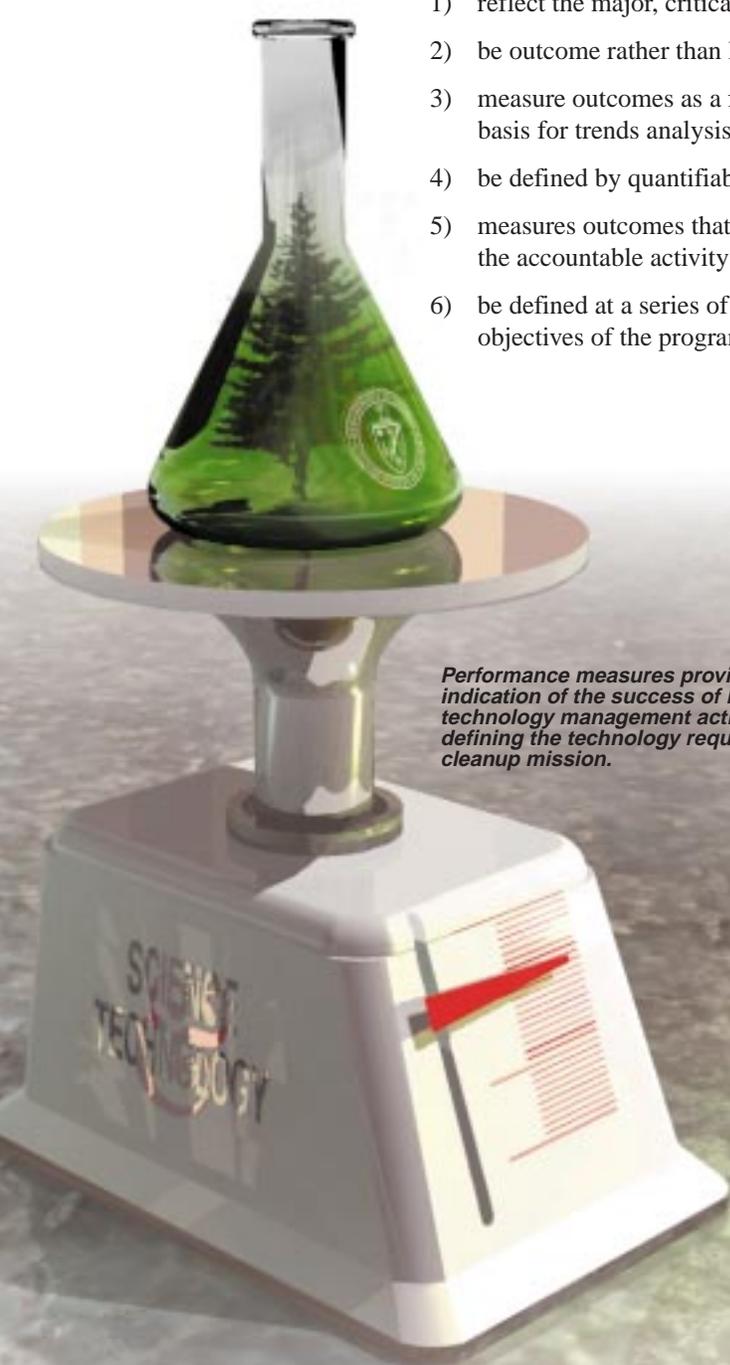


### ***Measuring Performance — Managing Toward Success***

An important tool in defining and demonstrating the success of any activity is the definition of performance measures. The Government Performance and Results Act (GPRA) requires all Federal agencies to develop strategic goals and performance which will be used as the basis for Federal budgeting. If science and technology activities are not measurably related to cleanup activities it is very difficult to determine and demonstrate the value-added provided by science and technology investments. Two parameters define a set of cleanup program and technology performance measures: 1) the requirements for cleanup activities — *what must be done* — and 2) the performance requirements a technology must meet — *how well it must be done* — to support the cleanup activity. These performance measures provide a quantifiable indication of the success of EM science and technology management activities by clearly defining the technology requirements of the cleanup mission. These performance measures will:

- 1) reflect the major, critical organizational objectives;
- 2) be outcome rather than level-of-effort focused;
- 3) measure outcomes as a function of time —providing a basis for trends analysis for use as a management tool;
- 4) be defined by quantifiable parameters;
- 5) measures outcomes that are within the span of control of the accountable activity;
- 6) be defined at a series of levels, appropriate to the objectives of the program at the given level.

***Two parameters define performance measures:  
– what must be done,  
– how well it must be done.***



***Performance measures provide a quantifiable indication of the success of EM science and technology management activities by clearly defining the technology requirements of the cleanup mission.***

### ***SUMMARY: The New Strategic Focus***

This EM Strategic Plan for Science and Technology represents a significant shift in focus from technology development to solution-oriented science and technology activities. This strategy is based on integration with the cleanup program by the direct participation of the cleanup project managers in defining science and technology needs, oversight of the technology development activities, and incorporation of the results into cleanup projects. The EM Research and Development Program Plan (November 1998) describes the details of this strategy and provides a basis for planning and managing EM investments in science and technology.



***E**nvironmental Management gratefully acknowledges the contributions of over a hundred Departmental, contractor and other personnel who have participated in the numerous discussions, composition, reviews and editing that has resulted in this Strategic Plan. The willingness of each participant to engage in dialogue to present, clarify, and develop a consensus of the ideas and vision that comprise this plan are truly appreciated. The underlying concepts of integration, partnering and full participation that this plan embodies were demonstrated in its development by each contributor. The plan reflects the corporate vision of EM for science and technology.*

## Environmental Management



## ***Strategic Plan for Science and Technology***