# A TRIAGE APPROACH TO PRIORITIZING ENVIRONMENTAL MANAGEMENT TECHNOLOGY REVIEW

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## ABSTRACT

Evaluating technologies in terms of their capabilities for meeting remediation end points and long-term stewardship options is a major requirement of the U.S. Department of Energy's Environmental Management Program. The ability to conduct timely, independent peer review is a key element in meeting this requirement. This paper provides an overview of a triage approach for screening individual projects based on quantitative indicators of investment, relevance, and availability. The provides an integrated decision support tool for assembling, synthesizing, and communicating information needed to support the allocation of peer review assets.

## INTRODUCTION

The U.S. Department of Energy's (DOE) Office of Science and Technology (OST) develops technical solutions to environmental management problems at sites within the DOE nuclear weapons complex. OST's mission is to provide the full range of science and technology (S&T) resources and capabilities that are needed to improve or facilitate remediation and long-term stewardship. The technology development activities within OST, ranging from basic research to demonstration and deployment, are managed by five Focus Areas (FA), each specializing in a specific problem area, and four crosscutting programs (CC) that develop technologies applicable to one or more FA problem sets. The FAs are Decontamination and Decommissioning (DDFA), Mixed Waste (MWFA), Nuclear Materials (NMFA), Subsurface Contaminants (SCFA), and Tanks (TFA). The crosscutting programs are Characterization, Monitoring, and Sensor Technology (CMST), Efficient Separations (ESP), Industry/University Programs (INDP), and Robotics (RBX).

Annually, OST requests funding for projects that the FAs and crosscuts plan to conduct. These projects are chosen for continuation or initiation based on a technology selection process that uses the results of a variety of reviews. Several National Research Council (NRC) and General Accounting Office (GAO) reports have evaluated OST's project selection process. Both the NRC and GAO have recommended that an independent, external peer review be included as part of the overall technology development selection process (1,2,3,4).

In response to these recommendations, OST instituted a peer review program in 1997. OST's peer review program is intended to provide the Focus Area and crosscutting program managers with credible, independent evaluations of the scientific and technical merit of technology projects. Figure 1 illustrates OST's peer review process which uses the American Society of Mechanical Engineers (ASME), with administrative and technical support from the Institute for Regulatory Science (RSI), to conduct peer reviews of projects recommended by the FA and CC managers (5). DOE's Center for Risk Excellence (CRE) is responsible for scheduling and coordinating the peer review effort. The ASME peer reviews typically focus on individual projects. ASME's peer reviews potentially provide OST with an effective tool for generating high-quality information that can serve as an input for improving the ongoing research effort and making decisions about allocating and prioritizing resources within its research and development (R&D) portfolio.

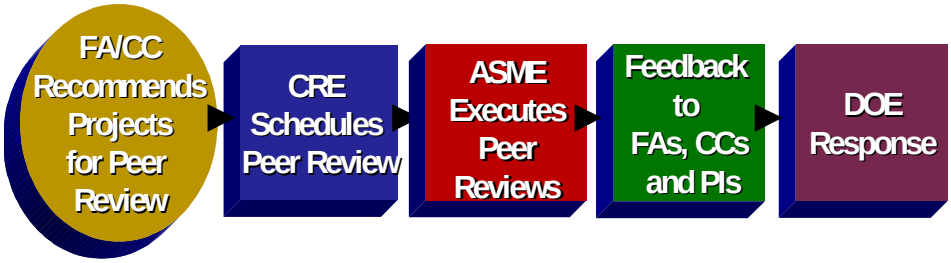


**Figure 1 Office of Science and Technology Peer Review Process**

In a recent report, the NRC noted that there have been marked improvements in the procedures for conducting peer reviews of OST projects since FY 1997. However, the committee also noted that a large "backlog" of OST projects have never been subjected to peer review (6). As a result, the NRC committee recommended that OST consider implementing a formal prescreening of projects prior to extensive peer review. The objective of the prescreening would be to allow OST program managers to identify those projects that should receive a more detailed external evaluation, including presentations by the project team and question-and-answer sessions.

The senior management of OST assigned the responsibility for designing and implementing a project screening approach to support OST's peer review process to DOE's Center for Risk Excellence, whose director functions as the Peer Review Coordinator. Under the direction of the Peer Review Coordinator, a team consisting of personnel from CRE, Tulane University Medical Center (TUMC), and Argonne National Laboratory (ANL) was formed and began its effort in late FY 1999. The initial application of the project screening approach concentrates on active technology projects managed by the Focus Areas. The output from the project screening approach will be used to support FA managers' recommendations of projects for peer review in the FY 2000 peer review cycle.

Adoption of the project screening approach will allow OST to focus its peer review assets, especially important under conditions of constrained funding and time, on those projects within its R&D portfolio that might benefit most from an independent, external review by technical experts. The project screening approach provides a consistent appraisal of OST technology projects. The output generated by the project screening approach supports FA managers' identification of new or continuing active projects that maximize benefits from the application of limited peer review resources. The screening approach integrates information about project status into the overall peer review process while maintaining existing responsibilities. Figure 2 illustrates the relationship of project screening to OST's peer review program.

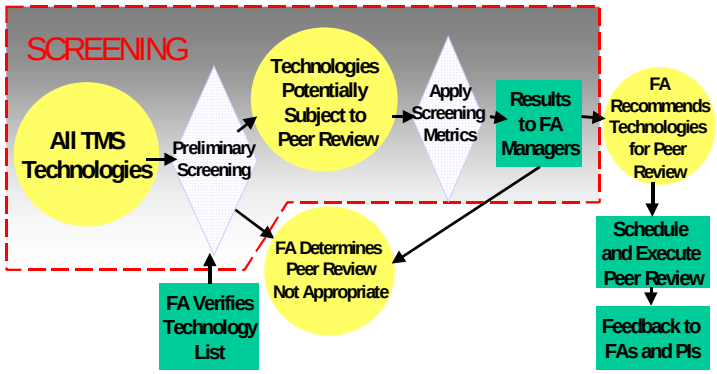


**Figure 2 Project Screening Relationship to Peer Review**

Applying screening for peer review to OST projects requires the recognition of priority needs within DOE by Focus Area. It also requires consistent screening of projects for each FA. The approach has three primary objectives:

- Screen projects to support FA managers' identification of projects for peer review
- Characterize, manage, and reduce the "backlog" of projects for peer review
- Verify project documentation contained in OST management information systems

Implementing the approach is an iterative process involving a series of steps, including periodic interaction with senior OST personnel at DOE Headquarters and the Focus Area managers. A list of all technology projects arrayed by FA is generated from OST's Technology Management System (TMS). The FA managers are responsible for verifying those projects that currently are active within their FA in order to identify the "pool" of projects for the screening process. Incorporating this preliminary screening into the approach characterizes and reduces the perceived "backlog" of projects for peer review because inactive or non-technology projects are not appropriate candidates for peer review. A set of metrics for screening active projects based on

information in the TMS and OST's Needs Management System (NMS) is developed in parallel to generation of the verified list of active technology projects. All active technology projects within a FA are then scored and ranked on three metrics – investment, relevance, and availability – that are used to screen projects to support FA managers' identification of candidates for peer review.

## RATIONALE FOR THE APPROACH

The approach provides consistent screening of OST technology projects to support Focus Area managers' identification of projects for peer review that maximize benefits from the application of limited peer review resources. While OST has initiated a number of actions to enhance the value of its external reviews, Figure 3 offers clear evidence of why the NRC and GAO have concluded that screening of technology projects is needed.

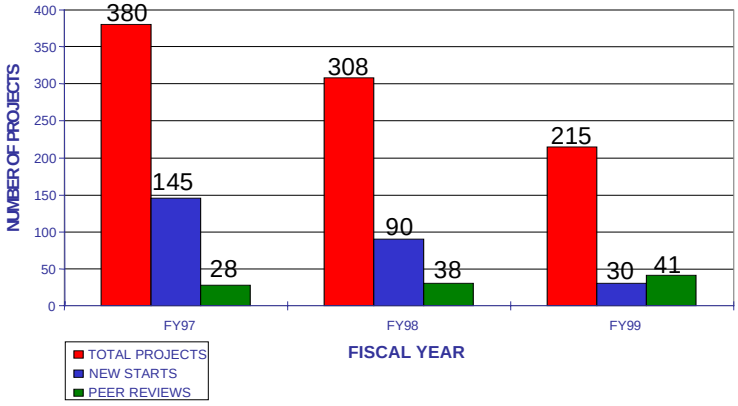


**Figure 3 Why Project Screening is Needed**

The data in Figure 3, which are derived from the TMS, demonstrate that it is not realistic to assume that all of OST's projects can be peer reviewed within a reasonable timeframe given available resources. As a result, the conventional wisdom assumes the existence of a substantial "backlog" of projects for peer review. The magnitude of the "backlog", however, is not necessarily the difference between the total number of projects and the target number for peer reviews. All OST projects do not necessarily require a detailed external evaluation, which include presentations by the project team and question-and-answer sessions, using the ASME format. Other projects may be better suited for internal programmatic or other technical reviews. The project screening approach can assist OST managers in selecting projects that would benefit most from an independent peer review. As a result, the actual "backlog" would be the difference between the total number of projects for which peer review is theoretically appropriate and the target number for peer reviews. Systematically applying project screening to OST projects fosters identification of the actual "backlog" and helps identify those projects that should receive a priority in terms of scheduling peer review.

## PROJECT INTEGRATION ACTIVITIES

The ability of the project screening approach to support selection of OST technologies for peer review requires continuous interaction with senior OST personnel and the Focus Area managers to ensure that the project screening approach meets OST's needs and is analytically credible. The CRE team maintained a working relationship with both groups through a combination of briefings, weekly conference calls, and site visits. The CRE team also provided briefings to the ASME during the project.

At the start of the project, the CRE team also presented an overview of the project screening approach, including information sources and metrics, to ASME and RSI. After generating scores on the metrics for the individual projects in each FA, a follow-up meeting was held with ASME and RSI. The second briefing provided an overview of the role of the project screening approach in the selection of projects for peer review in FY 2000, the source of the information used, and the methods for summarizing the data. In addition, the conceptual design and metrics utilized for the screening approach weres subjected to an independent, technical peer review. Members of the committee possess expertise in nuclear physics, environmental engineering, risk assessment, occupational health and safety, environmental medicine, and environmental management

## OVERVIEW OF THE APPROACH

Project screening supports optimizing the allocation of a limited resource. In the case of OST's R&D portfolio, there are many more projects that might be peer reviewed every year than there are available peer review resources. As a result, the project screening approach was developed to assist in the identification of projects that will be selected by the individual FA's for peer review. The approach provides consistent, documentable screening of projects for each Focus Area. The approach as depicted in Figure 4, uses quantifiable indicators based on information in existing OST databases to assemble, synthesize, and communicate information to support ASME's peer review of environmental technology projects.

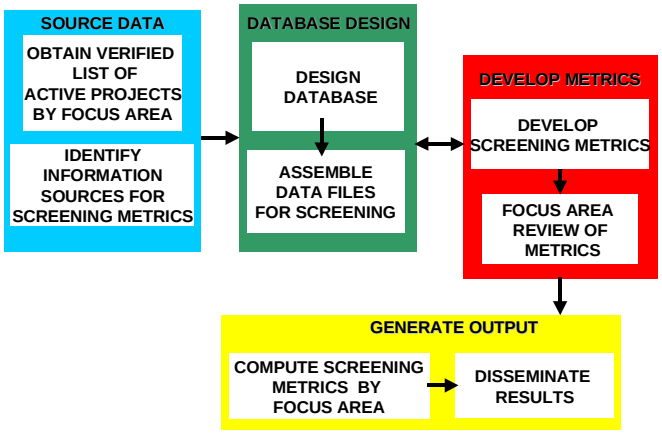


**Figure 4 Process Flowchart for the Project Screening Approach**

Data from existing OST management information systems—the TMS and the NMS—are used to generate scores for individual projects by Focus Area. The two databases define the research projects identified as being part of each Focus Area's program and the technology needs identified by the sites within the DOE nuclear weapons complex. The TMS contains individual project "Technology Overviews" which provide descriptive, maturity, funding, benefit, and application information. The NMS provides information about the timing and priority on a site-specific basis for technical solutions that support environmental remediation or long-term-stewardship requirements. The resulting database for the application of the project screening approach was developed by both converting data sheets downloaded from the two systems to a DBF format using Access97 and manually entering other required data. Seven database tables were created that contained information on an individual project basis:

- Technology Projects (Tech ID, Tech Title, Tech Sponsor, Tech Focus Area, Tech Gate)
- Work Package Information (Work Package ID, Work Package Title)
- Technology Needs (Tech ID, associated Need ID)
- Need (Need ID, Early Need Date, Late Need Date, Priority)
- Funding (Tech ID, Source ID, Fiscal Year)
- Composite Inflation Rate (Fiscal Year, Composite Inflation Rate (CIR))
- Funding Source

Tables were related ("linked") to each other by the Tech ID and/or the Need ID, depending on the nature of the database construction or project scoring requirements.

The project screening approach uses three metrics—investment, relevance, and availability—to assess individual projects. Investment indicates the level of financial commitment by DOE through FY 1999 expressed in constant 1999 dollars. Relevance indicates the ability of an individual project to address the needs identified by the sites for the specific Focus Areas. Availability indicates the schedule compatibility of an individual project within the timeframe for deployment at sites in the DOE complex.

Investment data are obtained from the TMS. Scores for each project are computed using the following equation:

$$F_t = \sum_{1989}^{1999} F_n CIR_n \qquad \text{(Eq. 1)}$$

Where:

$F_t$ = Total Doe funding (constant 1999 dollars)
$F_n$ = DOE funding in FY-n (current year dollars)
$CIR_n$ = Composite inflation rate for Yr-n (based on CPI-Urban, 1984-00)

By using constant 1999 dollars, the investment score reflects the overall level of funding adjusted for inflation since the project was initiated. Calculating the investment score for each project permits comparisons of the magnitude of DOE's financial commitment across projects within a Focus Area.

The relevance index is computed using the following equation:

$$R_t = \left[ \frac{3N_{t1}+2N_{t2}+N_{t3}}{3N_{fa1}+2N_{fa2}+N_{fa3}} \right] X\ 100 \qquad \text{(Eq. 2)}$$

Where:

$R_t$ = % relevance of technology project

$N_{tm}$ = # of needs a technology addresses by priority, n

$N_{fan}$ = total # of needs identified for a focus area by priority, n

The resulting score for a project allows each group of projects within a FA to be evaluated based on their contribution towards meeting site-identified priorities for technical solutions. The absolute values of this indicator can range from zero to 100. Data to compute scores on the relevance index are derived from the NMS.

Availability provides a measure of schedule status. Projects are scored based on a comparison of the site needs schedule and technology status using the following categories:

**Calculate by comparing needs schedule and technology availability status:** (Eq. 3)

Where:

5 = available on or before earliest needs date
4 = available after earliest but on or before latest needs date
3 = indeterminate, only needs dates known
2 = indeterminate, only technology availability known
1 = indeterminate, needs dates and technology availability unknown

The earliest and latest dates associated with a group of needs represent a "window of opportunity" for a technical solution to impact problems within the complex. Conversely, if a technology is not available prior to the latest needs date, the project is unable to contribute significantly to problem solving. Data for the availability score are derived by comparing information in the NMS for needs dates and the TMS for project schedule status.

## PILOT APPLICATION

This pilot application was conducted during the fourth quarter of FY 1999 to support selection of projects for peer review in the FY 2000 cycle. Initially, 238 projects were identified in the TMS database as of July 31, 1999. Individual projects were identified by OST Tech ID and OST Tech Title. After the initial preliminary screening, 123 projects were identified as being active technology projects directly under one of the FAs. All active technology projects that could be

related to a FA through a work package to document site-specific needs were included in the FY 1999 project screening. As a result, the pilot application of the project screening approach generated scores for 79 active technology projects managed by the DDFA, MWFA, SCFA, or TFA in FY 1999. NMFA projects were excluded because FY 2001 will be the first fiscal year that it will be fully operational, although one of its three active projects in FY 1999 was peer reviewed in late June 1999.

Evaluating technologies in terms of their capabilities for meeting remediation end points and long-term stewardship options is a major requirement of the U.S. Department of Energy's Environmental Management Program. The ability to conduct timely, independent peer review of technology development projects is a key element in meeting this requirement. The triage approach for screening individual projects based on quantitative indicators of investment, relevance, and availability offers a consistent methodology for helping to identify those projects that benefit most from peer review. As a result, it provides an integrated decision support tool for assembling, synthesizing, and communicating information needed to support the allocation of peer review assets.

## ACKNOWLEDGEMENTS

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