Tracking Technology Maturity in DOE's Environmental Management Science and Technology Program

Introduction and Purpose

The Office of Science and Technology (OST) is committed to tracking the maturity of technology development projects and making them ready for implementation and subsequent deployment. Since 1995, OST has used a linear maturation model adapted from Robert G. Cooper's *Winning at New Products: Accelerating the Process from Idea to Launch*, 1993. The "Gate" (Paladino and Fox, 1995) model spans from basic research to implementation (deployment) through seven defined stages of maturity. Without minimizing the explanatory power of such a model, OST recognizes (as did the original authors) that technology maturation is not always strictly linear and that there may be backtracking to earlier development stages when problems are encountered. For any given project, information relevant to Gate criteria changes in time. In addition, some projects are initiated at advanced maturity stages. Nevertheless, the model is a useful tool to focus managers' attention on the deployment goal, to identify projects whose advancement has stalled, and to encourage or discourage these stalled projects as situations warrant.

OST Refines its Gate Model: An Interim Guidance document (Department of Energy (DOE), 1997) defined tests for six criteria that would be used to assign a project to one of the stages. This guidance resulted in an attempt to implement a highly prescriptive and somewhat cumbersome review procedure that saw limited and inconsistent use. The National Research Council (*Decision Making*, 1999) has recommended that **"OST should use the minimum number of stages and gates needed to track a project and should use peer reviews (NRC, 1997b; 1998b) at key decision points (gates), especially in the selection of a new project."**

OST agrees with this recommendation and will apply a simplified Gate model in which Headquarters/OST will focus on three stages—research, development, and demonstration. Focus Areas may continue to use the original Gate model for specific project-level management (OST Management Plan, 1999). The six criteria from the Gate model will be expanded to seven by separating the original criterion dealing with user needs into two—technical need and user involvement. This expansion addresses the increased emphasis on user participation described in the *Environmental Management (EM) Strategic Plan for Science and Technology* and *the EM Research and Development (R&D) Program Plan*. Users (cleanup project field managers) are essential participants in all OST decision making, including reviews.

Traditionally, discussions of science and technology programs have referred to "research," "development," and "demonstration" (RD&D) as maturity stages. Research, either "basic" or "applied," is the acquisition of new knowledge or data and enables the identification of potential solutions to problems. Development brings the solution to bear on a specific problem and generates the technical, cost, and engineering data required for a demonstration. Demonstration

shows the performance of a solution, its complete implementation cost, and reveals any scale-up issues that may exist. In principle, completion of a demonstration provides a potential user with enough information to decide whether or not to deploy the solution. Cost effectiveness and performance data for each demonstrated OST technology are documented in an "Innovative Technology Summary Report," also known as a "green book," which enables a potential user to compare alternative technologies to one another or to a baseline.

While all Focus Areas apply the same criteria in reviewing progress, the relative importance of specific criteria depends on the nature of the problem area. For example, because the role of private industry in performing deactivation and decommissioning is greater than in high-level waste management, emphasis on commercialization and early involvement of private companies is adapted accordingly. Some technologies may never be commercialized, but will actually be deployed by the user. In every case, however, the Gate model criteria require planning to ensure that an appropriate vendor will be able to deliver the right technology or service to EM users.

This document is intended to describe the application of the Gate model in the context of the overall review program of OST. It will also describe a simpler, streamlined Gate model that loses none of the rigor of the original and responds both to OST management thinking and the recommendation of the National Research Council. Finally, a procedure for implementing the simplified model is presented.

Overview of OST Review System

OST uses a system of reviews to aid decision making at all levels of program organization and throughout the technology maturation process. Internal and external review by peers and sponsors is generally recognized in the science and technology community as an important adjunct to decision making. In accordance with this recognition, OST has established a system of reviews to ensure that project selection and evaluation decisions are made as wisely as possible.

Components of the OST Review System

Needs Identification and Prioritization: The technology development program is user needs driven, and the earliest Focus Area reviews are applied to clarifying and identifying technology "gaps" in the statements of need. The following steps are part of this process and are carried out before program development and prioritization: 1) needs clarification. 2) customer design requirements, and 3) schedule requirements.

Focus Areas then develop technical responses to identified user needs. Technical response documents are submitted for technical and user review. The results of the technical response review lead to an improved set of technical responses that address the needs of the user with a quality technical approach. Final technical responses are then evaluated by users against an agreed set of criteria resulting in the prioritization (user agreement is monitored by acceptance of the technical response in IPABS) and development of a technical program that provides the

basis for near-term project identification (used to develop Program Execution Guidance) and out year budget requests.

Basic and Applied Research Project Selection Reviews: The project selection review procedure varies only slightly between the basic and applied research phases and the development and demonstration phases. Reviews at all stages combine judgments by technical peers and by potential users of the results. "Users," in this context, must be persons who will make decisions to deploy a solution, i.e., cleanup project managers. For basic and applied research, the Environmental Management Science Program (EMSP) solicits pre-proposals, which are reviewed by a committee of technical, FA and user representatives. The results of this review are used as the basis for encouraging full proposals. When full proposals are received they are first peer reviewed for technical merit by external review panels selected by the Office of Science and then for potential applicability to EM problems (relevance) by review panels comprised of end users and EM Focus Area members.

Prior to funding, all basic or applied research projects funded by the Focus Areas (Gates 0 or 1) are be reviewed for technical merit by the Office of Science, and then for potential applicability to EM (relevance) by review panels comprised of end users, and EM Focus Area members.

Development and Demonstration Project Selection Reviews: New Focus Area technology development projects are identified in the work package prioritization process and performers are selected based on an objective and credible process. First, Focus Area apply "make or buy" decisions, utilizing where possible solutions that already exist or are readily adaptable. On the other hand, some problems are unique to DOE and, therefore, require unique solutions. While the proportion of already available solutions is different from one Focus Area to another, and the balance of "make" vs. "buy" decisions differ accordingly, the rule of "buy-before-make" is consistently observed where appropriate solutions exist. The FA then determines if it is necessary to compete the performer selection among the entire Laboratory/M&O/M&I system, a selected subset of Laboratory/M&O/M&Is, other government laboratories, industry or universities. The resulting proposals are reviewed externally for technical merit and by FA representatives, and by users for relevance.

New proposals are externally reviewed for technical merit. The Institute for Regulatory Science /American Society of Mechanical Engineers (RSI/ASME) conducts technical peer reviews for OST at the request of the Focus Areas. Normally, new proposal reviews are conducted by mail (Type III review). Focus Areas may request panel reviews (Type I or II) of proposals for very large or complex projects. However, studies and small scale demonstrations or deployments will not require ASME peer reviews, and ASTD or other deployment projects at least partially funded by users will not be ASME peer reviewed. In addition to peer reviews, all new projects are subject to a rigorous relevancy review by the Focus Area and their site users.

In some cases, carrying out peer reviews may be unproductive or counterproductive. Peer reviews may be omitted in such cases provided that appropriate justification for such omission is placed in the project file in lieu of the requirements specified in Table 3. Specific examples of suitable justification are: 1) demonstration of commercially available technologies in which

further development is not expected, 2) activities that provide technical support directly to the end users, 3) studies designed solely to collect and analyze information, 4) ASTD deployments or deployments for which the end user is contributing at least partial funding, and 5) activities that provide only administrative support; 6) private industry procurements conducted under Federal Acquisition Regulations (FARs), 7) activities managed by University Programs. Under special circumstances, other exceptions may be requested by the Focus Areas and approved by the Peer Review Coordinator and the Headquarters Review Manager. Focus Areas may elect to conduct peer reviews on any of these excepted activities on a case-by-case basis.

Peer Reviews: Ongoing projects are externally reviewed for technical merit. The Institute for Regulatory Science/American Society of Mechanical Engineers (RSI/ASME) conducts technical peer reviews for OST at the request of the Focus Areas. OST requires technical peer reviews for all ongoing projects at least every three years, and at the decision points for transition from research to development or development to demonstration.

OST requires external peer reviews for all projects except as noted above. There is, however, a considerable backlog of projects that have not been peer reviewed and it is unreasonable to aim to review them all at once because: 1) resource demands would be excessive; 2) some projects are at or near deployment stage and users will make the decisions as to whether or not they advance; 3) projects may be identified for termination without a full scale peer review if, for example, there is no user support for their continuation. In FY 1999, OST implemented a temporary project screening approach ("Implementation Guidance for the Technical Peer Review Process" Version 3.0, DOE/CH/CRE-2-1999) to eliminate the backlog.

> Project screening provides consistent pre-screening of OST technology projects to support FA/CC Program Managers' identification of projects for peer review that maximize benefits from the application of limited peer review resources.
>
> The results obtained from the project screening analysis provides the Program Managers the tool to:
>
> - Screen and identify projects suitable for
> - continuation without peer review,
> - detailed evaluation through peer review, and
> - programmatic decisions;
> - Reduce backlog of peer reviews; and
> - Verify technology documentation sources.

Projects are identified for peer review based on a set of priorities. These are (from highest priority to lowest):

1. Projects that are proposed for transition from research to development or development to demonstration would be reviewed before advancement.

2. Newly proposed projects would be reviewed so as to prevent growth of the backlog.

3. Projects that have been supported for three years or longer without peer review would be reviewed.

Not reviewed would be projects identified as near the end of OST support, either because they are ready for deployment or because they are being completed or terminated.

Programmatic Reviews: Midyear Reviews: Although Focus Areas may conduct programmatic reviews as needed, the most important programmatic reviews are those required at midyear because of their role in the annual budget cycle. Midyear reviews combine the attributes of independent, end user technical evaluation, programmatic status reviews, and forward-looking vision. Each Focus Area conducts annual midyear reviews according to consistent general guidelines adapted to its goals and methods. The principal focus of midyear reviews is user endorsement and progress toward meeting user requirements. Midyear reviews also expose ongoing work to other potential users, and guide current year adjustments. Progress and readiness of each project for advancement in maturity stage are identified and documented. Gate reviews that will be documented with the Midyear review report will be performed by the Focus Area Staff, principally the lead laboratory.

Other Reviews: Reviews that address issues of broad program initiatives and help guide OST in addressing problems of greatest significance to EM and DOE are initiated on an *ad hoc* basis by individual Focus Areas or Headquarters. Major program areas, specific technologies, or technology clusters (e.g., thermal treatment, subsurface barriers) may be reviewed. Major system and subsystem reviews are conducted by the solution development laboratory at the request of the Focus Area and also because it is good engineering design practice. The Mixed Waste Focus Area, for example, has conceptual, preliminary, final, and readiness reviews for major projects. These reviews are chaired and have independent review personnel.

DOE requires that all reviews culminate in written documentation, and may require an action plan to delineate steps to correct deficiencies and take advantage of new opportunities. Program and line managers consider information acquired from reviews in selecting or continuing projects for funding, for developing new areas of investigation, and for evaluating programmatic progress. Such information is also used to document the progress and productivity of OST programs in reports to DOE senior management, Congress, and the public.

Purpose and Principles of Reviews

The overall purpose of OST reviews is to secure knowledgeable counsel on the attributes of an ongoing or proposed activity or program and to document both the review and the actions taken in response to the review. While the exact goals, methods, and emphases of different review system components are somewhat different, certain attributes are consistently important in all reviews:

- endorsement by potential EM users;
- importance of the problem being addressed and the solution cost vs.

benefit performance compared to baseline;
- solving problems for which no baseline exists or delivers a step improvement over baseline;
- solution has scientific and technical merit (it is good science);
- readiness for a technology to advance to a later development stage;
- avoiding redundancy;
- feasibility and likelihood of technical and economic success; and
- past performance record of the proposing institution and investigators.

Reviewers are briefed in advance regarding the purpose and criteria against which projects are to be evaluated. In addition to these attributes, reviewers are expected and encouraged to address additional issues deemed pertinent to the overall program.

Review actions must be founded upon principles of scientific ethics. Particularly important are issues of confidentiality and appropriate use of privileged information.

1. Reviewers have documented expertise and experience in the area being reviewed.

2. Reviewers must be free from any direct interest in the outcome resulting from decisions that draw upon their advice or comments. In addition, integrity on the part of the reviewers is demanded to ensure that they not improperly use information contained in confidential or privileged documents.

3. Individual members of review teams, and specific review comments are matters of record and are to be available, but the identity of reviewers making particular comments is strictly confidential.

4. Where a team recommendation is formulated through discussions among reviewers, the review team must be constituted under the rules of the Federal Advisory Committee Act (FACA). Non-FACA reviews reflect only the comments of individual reviewers.

5. Review comments and recommendations are formally directed to the next higher level of authority than the one being reviewed. For example, reviews of specific projects are reported to Focus Area management but reviews of the Focus Areas themselves are reported to the Directors of the Offices of Basic and Applied Research, Technology Development and Demonstration, and Technology Applications.

6. Reviewers do not have authority for making decisions and are not responsible for their outcome. Such authority and responsibility belong to the appropriate Federal Program Manager and OST management.

7. The official record of the review is documented in written comments and recommendations.

Gate Model Criteria

Seven criteria are used to assess the maturity of each project. Some criteria, such as technical need and technical merit, are essential at every stage of maturity; others, such as end user involvement and cost-effectiveness, become increasingly important at later stages. Table 1 shows the importance of the different criteria as a function of maturity. The relationship between the HQ Oversight and the original Gate model decision points is also indicated.

Minimum entrance requirements for the Research, Development and Demonstration stages are shown in Table 2. Completion of a demonstration is expected to result in all information that a potential user requires to decide whether or not to deploy the solution. Normally, as previously stated, it is expected that this information will be documented through publication of an ITSR. In some situations, however, a user may decide to deploy the solution without an ITSR. For example, a demonstration may transition directly into an operating solution, particularly where the demonstration is jointly funded and a single technology need has been addressed.

Procedure for Making Focus Area Midyear Reviews Responsive to Office of Science and Technology (OST) Oversight Needs

Focus Area midyear reviews allow all interested and affected parties to track the progress of active projects at all stages of maturity. Because it must report to Congress, Government Accounting Office, and others both regularly and on demand about the status of its projects, OST needs a certain minimum level of information, as suggested below.

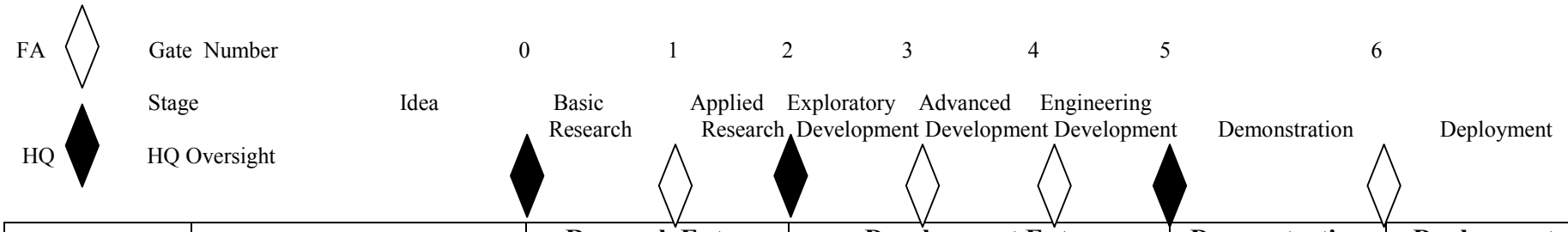
It is not expected that all peer reviews and gate/stage evaluations will be conducted during the midyear review, although the Focus Areas may sometime find it convenient to do so. The midyear review report should, however, include reports on all review activities whether or not they are carried out at the midyear review.

1. To be most useful at both the Field and Headquarters levels, midyear reviews should occur between February 1st and April 30th. However, if a Focus Area has a compelling reason to schedule its midyear outside this window, that will be acceptable.

2. In addition, Table 3, **"Evidence Demonstrating that Entrance Requirements are Met,"** should form the basis of a record for each project, which will contain the Focus Area-specific documents required to verify that the entrance requirements are met. These records should be available at the midyear review and upon request.

3. A copy of the tracking sheet, Table 4, "**Product Maturity Status Determination,"** with the checked boxes to reflect current status should be available for each active project. This sheet shows at a glance which attributes of which maturity criteria have been satisfied. OST tracks projects at three gates only. Focus Areas may track at the level of any or all of the original gates and stages.

Table 1: Requirements to Satisfy Gate Criteria as a Function of Technology Maturity



Criterion	Test	Research Entry Requirements	Development Entry Requirements	Demonstration Entry Requirements	Deployment User-Determined
User Need	Does the activity address a documented EM need?	Essential	Essential	Essential	Essential
Technical Merit	Is the activity technically sound? Is it likely to change a baseline?	Essential	Essential	Essential	Essential
End User Involvement	Is there an end user signed up to strongly support and deploy the product?	Desirable	Essential	Essential	Essential
Cost Effectiveness	Does it appear likely that the solution will save money relative to the baseline?	Desirable	Likely	Must be in demonstration plan	Essential
ES&H and Risk Tolerability	Are ES&H or risk issues that affect deployment dealt with?		Likely	Must be in demonstration plan	Essential
Regulator/ Stakeholder Acceptance	Are stakeholder or regulatory issues that affect deployment mitigated?		Started	Must be in demonstration plan	Essential
Commercial Viability; Viability of DOE Application	Is there a plan to ensure that a technology vendor or other provider will be available?		Essential	Essential	Essential

Table 2: Entrance Requirements for Maturity Stages

MATURITY STAGE	TECHNICAL NEED	END-USER INVOLVEMENT	TECHNICAL MERIT	COST	ES&H RISK	STAKEHOLDER, REGULATORY, TRIBAL ISSUES	COMMERCIAL VIABILITY
Research	Relevant to high-priority need		Highly meritorious				
Development	Need still exists	Addresses performance requirements Available when needed	Improved solution (enabling or significantly more effective) Favorable peer review rating	Improved solution (enabling or significantly less costly) Demonstration and operating costs estimated	Improved solution (enabling or significantly lower risk) Favorable peer review rating	Peer review finds data valid for use with regulators and stakeholders	Potential vendor identified
Demonstration	Need still exists	Demonstration cost-sharing	Demonstration plan Favorable peer review	Demonstration plan Favorable peer review	Demonstration plan Favorable peer review	Demonstration permits completed	Vendor participates in demonstration
⇒ **Deployment requires the information that Focus Areas collect during Demonstration and issue as an ITSR.** ⇐							

Table 3. Physical Evidence Demonstrating that Entrance Requirements are Met

MATURITY STAGE	TECHNICAL NEED	END-USER INVOLVEMENT	TECHNICAL MERIT	COST	ES&H RISK	STAKEHOLDER, REGULATORY, TRIBAL ISSUES	COMMERCIAL VIABILITY
Research	• OST relevancy review rating; need identified in IPABS		• Office of Science merit review rating				
Development	• Need still in IPABS	• End-user validates technical response as shown in IPABS	• Peer review report confirms advantage over baseline, meeting user performance requirements, and design and engineering adequacy	• Peer review report confirms cost-benefit estimate	• Peer review report confirms risk-benefit analysis	• Peer review report confirms probability of acceptance	• Make/buy analysis
Demonstration	• Need still in IPABS	• ASTD project # or financial plan entry showing cost sharing	• Performance section of demonstration plan signed by FA lead office & PBS representative • Peer review report confirms claims[1]	• Performance section of demonstration plan signed by FA lead office & PBS representative • Peer review report confirms claims[1]	• Performance section of demonstration plan signed by FA lead office & PBS representative • Peer review report confirms claims[1]	• Approved demonstration permits	• Commitment by potential vendors to participate in demonstration

[1] See Text for exceptions

Table 4: Product Maturity Status Determination

Tech ID _____ Title:_____ Last Gate: _____

MATURITY STAGE	TECHNICAL NEED	END-USER INVOLVEMENT	TECHNICAL MERIT	COST	ES&H RISK	STAKEHOLDER, REGULATORY, TRIBAL ISSUES	COMMERCIAL VIABILITY
Research	☐ Relevant to high-priority need		☐ Highly meritorious				
Development	☐ Need still exists	☐ Addresses performance requirements ☐ Available when needed	☐ Improved solution (enabling or significantly more effective) ☐ Favorable peer review rating	☐ Improved solution (enabling or significantly less costly) ☐ Demonstration and operating costs estimated	☐ Improved solution (enabling or significantly lower risk) ☐ Favorable peer review rating	☐ Peer review finds data valid for use with regulators and stakeholders	☐ Potential vendor identified
Demonstration	☐ Need still exists	☐ Demonstration cost-sharing	☐ Demonstration plan ☐ Favorable peer review	☐ Demonstration plan ☐ Favorable peer review	☐ Demonstration plan ☐ Favorable peer review	☐ Demonstration permits completed	☐ Vendor participates in demonstration

Date: _____ PL/TI/WP Manager:_____

1. “Focus Area Project” as used in 2, above, is understood in terms of the “Focus Area-centered approach” concept and thus includes projects from the Environmental Management Science Program (EMSP) that are selected by the Focus Area as relevant.

2. Progress reviews will be given to all active projects. An active project is one that is receiving funding from the Focus Area in the fiscal year of the review and that has been underway for at least three months, i.e., has gone through at least one quarterly review. Attachment A contains eight questions that should be addressed. An example template (in PowerPoint) originally designed for use by the Subsurface Contaminants Focus Area is available on request.

3. Reviewers must include end users. In addition, and as appropriate, Focus Area managers are encouraged to include representatives of other Federal agencies.

4. The format of the midyear review report to Headquarters should follow the March 2, 1999, guidance (Attachment B).

Attachment A: Status Questions to be Addressed by Progress Reviews (minimum) and OST Peer Review Core Criteria

1) Has the project been reviewed for advancement through a gate during the past year? If yes, what was the result?

2) Has an end user made at least a conditional commitment to implement the technology?

3) Has a technical peer review been completed and is the work highly rated?

4) Has a cost-benefit analysis been performed for this technology and does it show potential savings compared to baseline? Are user requirements for cost data identified and satisfied?

5) Will this technology meet or exceed current environmental, safety, and health (ES&H) protection levels and/or reduce the risk to the public, workers, and the environment compared to baseline? Are user requirements for ES&H and technological risk identified and satisfied?

6) Briefly discuss any activities and/or interaction with stakeholders, regulators, and tribal organizations relative to the continued research and utilization of this technology. Are user requirements for stakeholder, regulator, and tribal concerns identified and satisfied?

7) Have invention disclosure and intellectual property issues been addressed? Briefly discuss the measures taken to include private industry in the development and application of the technology.

8) Has an appropriate vendor (or other provider) for this technology been identified?

DOE Peer Review Core Criteria[1]

Core Technical Peer Review Criteria

The success of the peer review of a technology depends primarily upon the careful identification of the review criteria. In effect the reviewers are being asked to respond to a question expressed in a review criterion. Furthermore, the selection of review criteria relevant to each technology requires the consideration of its uniqueness.

The following general categories for assessing the value of a technology development activity may result in one or more specific review criteria.

1. Technical Validity

The technical validity of a project is the core of peer review. The Project Team must demonstrate that it is aware of the state of the art of science and engineering as related to the project under review, and that the project is technically valid. The technical validity can thus be demonstrated by the following criteria:

- Is the Project Team aware of the relevant published scientific and engineering information as well as practices of the relevant industry?
- Is the design of the project consistent with established scientific and engineering principles and standards?
- Is the execution of the project consistent with established scientific and engineering principles and standards?
- Does the Project Team have adequate technical documentation such as publication of results in peer-reviewed journals?

2. Relevancy

All projects supported by OST must be able to demonstrate that they directly respond to an identified need by the various segments of EM, particularly the Offices of Waste Management and Environmental Restoration. The process should consist of documentation clearly indicating that a need has been identified, and the identified need is being addressed by the project under review. The relevancy can thus be demonstrated by the following review criteria:

- Does the project meet an identified EM need?
- Is the project superior to existing technologies that address an identified EM need?

3. Overall Assessment

In many cases, the DOE decision-maker needs a more specific answer as expressed, both in the

1 "Implementation Guidance for the Technical Peer Review Process" Version 3.0, DOE/CH/CRE-2-1999

Findings and Recommendations of the Review Panel. In effect, the decision-maker is asking for assistance to make a decision. The appropriate criteria are as follows:

- Based on the technical merit of the project, is the likelihood of its broad deployment reasonably high?
- Based on the DOE-identified needs, is the likelihood of the deployment of the project reasonably high?
- Based on the overall assessment of the project, should it be continued?

Whereas the general criteria apply to essentially all projects, there are projects that require additional review criteria as follows:

4. Economics

Many projects may be technically sound and applicable to DOE needs and yet may be economically unacceptable. Ideally, life cycle costs should be the guiding data and thus the appropriate criterion would be as follows:

- Is the project cost effective as demonstrated by life cycle assessment or other appropriate quantitative methods?

5. Risk and Related Topics

Much of the U.S. regulatory system is driven by human health risk. Furthermore, ecological risk, regulatory issues, and stakeholder participation often drive the applicability of a technology. Thus, the relevant criteria are as follows:

- Have human health risks been adequately addressed?
- Have ecological risks been adequately addressed?
- Have occupational health and safety issues been adequately addressed?
- Has the Project Team collected sufficient data to respond to regulatory and stakeholder concerns?

6. Personnel and Facilities

The qualifications of the PIs and the availability of the necessary facilities are normal review criteria for grants awarded by many federal agencies. However, projects that have already been funded and are in progress are based on an inherent assumption that these requirements were considered during the initial funding. Therefore, the criteria related to personnel qualifications and facilities apply only to new starts as follows:

- Is the Project Team qualified to initiate and conduct the proposed project?
- Does the Project Team have access to facilities that are appropriate to initiate and conduct the project?

Technology-Specific Peer Review Criteria

The core technical peer review criteria are used to develop technology-specific criteria. This responsibility lies with the FA/CC Program Managers requesting the review. Clearly, not all review criteria apply to all projects. Furthermore, experience shows that any one of the above criteria may result in many project-specific criteria. In particular, the technical validity of a project may result in a rather large number of project-specific criteria.

The process for preparation of technology-specific review criteria is as follows:

- Among the technical core criteria, those dealing with relevancy and technical validity require identification of technology-specific criteria. Therefore, the primary focus of development of technology-specific criteria must be devoted to relevancy and technical validity.

- Criteria on economics and risk apply to most technologies. Accordingly, unless there is a compelling reason, technology-specific criteria must be provided for these criteria

- Criteria on Personnel and Facilities apply only to new starts particularly those covered in Type IV reviews.

Once technology-specific criteria have been identified, they are provided to the Technical Secretary of the Review Panel who ensures their consistency with the core technical peer review criteria as well as the requirements on style and format. Subsequently, they are submitted to ASME/PRC in conjunction with approval of Review Panels.

Attachment B: Format for

Midyear Review Report and Supporting Documentation

Cover Page

Introduction:

- Purpose of the reviews;
- Format of the reviews;
- Makeup of the review panel(s); and
- Direction to the review panel.

Overview of the Program (State of the Program):

- State the key goals of the program as described in the Multiyear Program Plan (MYPP) and the Annual Performance Plan (APP) and discuss the progress toward those goals and objectives;
- Progress with key issues in the program e.g., transition of the Mixed Waste Focus Area to transuranic activities;
- Progress with the incorporation of Environmental Management Science Program (EMSP) projects;
- Deployment successes; and
- Key publications.

Results of the Review:

- This section should highlight the results of the review panel for each project or groups of projects and provide brief overviews of all projects to demonstrate that the requirements provided in the guidance documents are addressed. The report should highlight those projects that have significant issues or recommendations. The results should be presented by product line and work package to facilitate easy comparison to the MYPP and the APP.

EXAMPLE

[Project(s) title, TTP Number, TMS ID, brief description and need:] **Seismic Detection of Dense Non-Aqueous Phase Liquids (DNAPLs, TTP NUMBER, TMS ID**: Innovative approach for locating DNAPL pools in the subsurface using shallow seismic methods. Project is in its second year and is scheduled to be tested at the Savannah River Site (SRS) in July 1999, in conjunction with the cone penetrometer, LIFI, and hydrophobic sampler. If successful, it will be deployed by SRS and Oak Ridge in FY 2000.

Reviewers' Comments or Recommendations: Project is well established for the location of DNAPLS in sandy soils, but has been shown to be unreliable in inter-bedded clays similar to

those at the SRS to be used as the test bed. The Principle Investigator needs to more fully explore the capability of the seismic method in different soil types. Recommend that the Principle Investigator get in touch with Dr. Smith from the United States Geological Survey (USGS). Dr. Smith has been working on a similar project, both projects may benefit from collaboration. Also, there are several projects in the EMSP that have similar scope.

Corrective Actions: Focus Area Product Line Manager will facilitate a meeting between Dr. Smith of the USGS and Dr. Green, of the SRS to discuss their respective projects and results by April 15, 1999. If it is determined to be of benefit, collaboration will be established with Dr. Green. The scope of the project will be expanded to include a study of the applicability of the seismic process in all major soil types.

Appendices

Review Panel:

- Name, title, affiliation, address, and phone; and
- Resume or vitae.

Review Panel response forms and worksheets:

- Individual project comments/recommendations from reviewers.

Any other review information from prior reviews during the year:

- Review by a separate technical panel;
- Reference, but do not include American Society of Mechanical Engineers reviews; and
- End user reviews.