

**PEER REVIEW PROGRAM
FOR THE U.S. DEPARTMENT OF ENERGY**

FINAL TECHNICAL REPORT

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PEER REVIEW PROGRAM FOR THE U.S. DEPARTMENT OF ENERGY

EXECUTIVE SUMMARY

The Institute for Regulatory Science (RSI) and the American Society of Mechanical Engineers (ASME) jointly established a peer-review program. While a committee established by the ASME oversees the peer-review process, the RSI manages the day-to-day operations of peer review panels. The program consists of various specific elements:

Peer Review Committee

The Peer Review (Oversight) Committee (PRC) was a standing committee of ASME formed in cooperation with other relevant professional societies, to oversee peer review for a particular program. The PRC included an Executive Panel (EP) responsible for the day-to-day operations of the PRC. Except for the EP, membership in ASME was not required for appointment to the PRC. In order to ensure a rapid and smooth operation, the DOE appointed a Peer Review Coordinator who was the link between the DOE and DOE contractor managers, and the peer review activities performed by the ASME/RSI team. A key responsibility of the PRC was to appoint Review Panels (RPs) to perform review of specific projects. The approach was so successful that it became a model for other agencies.

Administrative Management of the Peer Review Program

Consistent with the structure of the ASME/RSI cooperation, the employees of the Center for Research and Technology Development of the ASME located in Washington, DC provided the staff support for the PRC.

The Administrative Manager of the Peer Review Program (AMPRP), a senior staff member of the RSI, oversaw the day-to-day operations of the program and interacted with the Peer Review Coordinator. The AMPRP also oversaw the copyediting and rapid distribution of the *Technical Review Reports*, including their *Reports of the Review Panels*. The Manager of Review Panel Operations ensured that all logistical needs of the review panel meetings were met. Each RP was provided with a Technical Secretary (TS), an individual whose qualifications would be generally equivalent to a peer reviewer who participated in the executive sessions of the respective RP and ensured that the *Report of the Review Panel* was prepared in a timely manner.

Review Panels

The review of a project, a document, a technology, or a program was performed by an RP consisting of a small group of highly knowledgeable individuals. Typically, RPs consisted of three or more reviewers who had expertise in the area being reviewed. The selection of reviewers was based on the competencies required for the specific review assignment. The number of individuals in an RP depended upon the complexity of the subject to be reviewed. The relevant criteria were: 1) education; 2) experience in the area that is being reviewed; 3) Peer recognition demonstrated by election to an office of a professional society, serving on technical committees of scholarly organizations, and similar activities; and 4) contributions to the profession including publications in peer-reviewed journals and patents. A key issue in the selection of members of RPs was independency interpreted as having no conflict of interest. The guiding principle for conflict of interest is as follows: *An individual who has a personal stake in the outcome of the review may not act as a reviewer or participate in the selection of reviewers.*

As the program evolved, four types of review were established: Type I) RPs established for this type consisted of five or more individuals to review complex projects; Type II) consisted of at least three

individuals to review one technology; Type III) consisted of at least three individuals who performed the review of a document without the need for a physical meeting; and Type IV) was established to review competing submissions such as grant proposals. The number of individuals constituting a Type IV RP depended upon the number and nature of submissions. However, each submission had to be reviewed by at least three individuals.

Peer Review Criteria

Initially, the PRC established peer review criteria that were used virtually in all peer reviews. In October 1999, new and significantly improved core peer review criteria were developed. Typically, the number of review criteria for each project was about 10 but could be significantly higher. The practicability of the process can be readily demonstrated by the fact that virtually in all cases, the process did not require intervention of the PRC. Furthermore, during the entire program covering about 300 peer reviews only one review—and in that review only one criterion—was contested and had to be resolved by the PRC.

Peer Review Reports

A large number of reports resulted from this grant. The reports resulting from this grant can be categorized into report of a single project consisting of the *Technical Peer Review Report* with the subtitle *Report of the Review Panel*. The Annual Report included the results of peer review for a specific fiscal year. The *Technical Peer Review Report* contained the results of the peer review and was often prepared in three consecutive phases with the subtitles *Report of the Review Panel*, *Interim Report*, and *Final Report* respectively. The Annual Report included Findings and Recommendations of the PRC.

Other Aspects of the Peer Review Program

Type I and Type II reviews followed a common structure and provided for stakeholders to participate in all parts of the review meeting except that part when the RP met and wrote its report. The PRC met annually with the participation of DOE officials and reported the results of the peer review program for that year.

RECOGNITION OF THE ASME/RSI PEER REVIEW PROGRAM

The ASME/RSI program was established, at least partially, due to the criticism of the technology development at the DOE by a number of organizations, including various Congressional Committees and the National Research Council. As the program evolved, several organizations reviewed the ASME/RSI peer review program. For example, the National Research Council used the ASME/RSI peer review program as an example for others to follow. Another recognition of the program occurred when the Office of Management and Budget published its peer review guide. Again here, the ASME/RSI program was highlighted and the 2002 Annual Report was referenced. Subsequent to the publication of the OMB guide, a thorough review of the ASME/RSI program was initiated. The result was a minor modification of the program.

PEER REVIEW DOCUMENTS

In addition to the reports resulting from peer review of specific projects, several documents were prepared to facilitate the review process. The RSI website at www.nars.org includes detailed information on the results of this grant and other information.

Keywords: Peer Review; review panel; stakeholder participation; review report; conflict of interest; review criteria; peer review process; peer review committee.

PEER REVIEW PROGRAM FOR THE U.S. DEPARTMENT OF ENERGY

As stated in the submission of this grant, peer review constitutes the core of acceptability of scientific and engineering information. Therefore, virtually all-professional societies of scientists and engineers have instituted formal procedures for peer review for their activities. The Institute for Regulatory Science (RSI), in cooperation with the American Society of Mechanical Engineers (ASME), also known as ASME International, has established a peer-review program devoted to the review of activities of the U.S. Department of Energy (DOE) and other government agencies. Numerous reports of the peer reviews resulting from this program have been published. Briefly, while the ASME oversees the peer-review process, the RSI manages the day-to-day operation of panels that are established to peer review specific projects.

THE PEER REVIEW STRUCTURE

The structure of the peer review process established by the ASME/RSI team consisted of a tiered system. The elements of the program included the following:

1. Peer Review Committee
2. Executive Panel of the Peer Review Committee
3. DOE Peer Review Coordinator
4. Administrative Management of the Peer Review Program
5. Technical Secretary
6. Review Panels (RPs) including their selection and appointment
7. Peer Review Reports

Peer Review Committee

The Peer Review (Oversight) Committee (PRC) was a standing committee of ASME formed in cooperation with other relevant professional societies, to oversee peer review for a particular program. Its members were chosen on the basis of their education, experience, peer recognition, and contribution to their respective areas of competency. An attempt was made to ensure that all needed technical competencies and diversity of technical views are represented in the PRC. The PRC included an Executive Panel (EP) responsible for the day-to-day operations of the PRC. Except for the EP, membership in ASME was not required for appointment to the PRC. Specific functions of the PRC included the following:

1. As the overseer of the entire peer review process, the PRC enforced all relevant policies of professional societies, notably ASME, including compliance with professional and ethical requirements.
2. It approved the appointment of members of RPs. However, it authorized the EP to provide a provisional approval to be reviewed and approved at its next meeting.
3. It reviewed and approved the *Report of the Review Panel* to ensure compliance with professional requirements. However, the PRC may not change the technical content of the report.

4. It reviewed and approved the Annual Report.

Normally, the PRC met several times during the year. However, some of its approval functions were performed by mail or electronic communication.

Executive Panel

The EP played a critical role in the management of the peer review program by overseeing the day-to-day operation of the program and acted on behalf of the PRC between its meetings. It consisted of three to five ASME members who typically had been elected as division chairs, vice presidents, or presidents of the ASME. The EP met at least quarterly, but most of its operations were performed by correspondence (mail, fax, e-mail, teleconference).

DOE Peer Review Coordinator

In order to ensure a rapid and smooth operation, the DOE appointed a Peer Review Coordinator who was the link between the DOE and DOE contractor managers, and the peer review activities performed by the ASME/RSI team. The approach was so successful that it became a model for other agencies.

Administrative Management of the Peer Review Program

The management of the peer review program required the inclusion of several key functions as follows:

Administrative Support for the PRC: Consistent with the tradition of ASME, the staff support for the PRC was provided by the employees of the Center for Research and Technology Development of the ASME located in Washington, DC.

Administrative Manager of the Peer Review Program: The Administrative Manager of the Peer Review Program (AMPRP), a senior staff member of the RSI, oversaw the day-to-day operation of the RPs. The AMPRP interacted with the Peer Review Coordinator, and ensured that deadlines for nomination and approval of members of the RPs were met. The AMPRP also oversaw the copyediting and rapid distribution of the *Technical Review Reports*, including their *Reports of the Review Panels*. In addition, the AMPRP attended to tasks that were not specifically assigned to others.

Manager of Review Panel Operations: The logistics and related activities of the RP operations were managed by the Manager of Review Panel Operations (MRPO). In that capacity, the MRPO interacted with members of the RP; ensured that all logistical needs of the review panel meetings were met; and attended to all other logistical issues associated with RP operations.

Technical Secretary

Each RP was provided with a Technical Secretary (TS), an individual whose qualifications would be generally equivalent to a peer reviewer. The TS was responsible for preparing the summary of each project for submission to the PRC and for inclusion in the *Report of the Review Panel*. The TS was also responsible for coordination of activities related to preparation of project-specific peer review criteria. The TS participated in the executive sessions of the respective RP and ensured that the *Report of the Review Panel* was prepared in a timely manner. However, the TS did not provide opinions on the merits of a project and did not participate in the discussions of the RP except in procedural issues or with respect to the content of submitted materials.

Review Panels

Due to the multidisciplinary nature of technology development, rapid identification of qualified peer reviewers and their availability to participate in the review process were key ingredients for the success of the program. The review of a project, a document, a technology, or a program was performed by an RP consisting of a small group of highly knowledgeable individuals. Upon the

completion of their tasks, the RPs were disbanded. Typically, RPs consisted of three or more reviewers who had expertise in the area being reviewed. Their selection was based on the competencies required for the review. The number of individuals in any RP depended upon the complexity of the subject to be reviewed. As the program evolved, four types of review were established as follows:

Type I: RPs established for this type consisted of five or more individuals who met and performed a multi-technology review that was of a complex nature and could require a site visit.

Type II: RPs established for this type consisted of at least three individuals who met and performed an in-depth review of a technology and could require a site visit.

Type III: RPs established for this type consisted of at least three individuals who performed the review of a document without the need for a physical meeting.

Type IV: These RPs were established to review competing submissions such as grant proposals. The number of individuals constituting a Type IV RP depended upon the number and nature of submissions. However, each submission had to be reviewed by at least three individuals.

Criteria for Selection of RPs: While the Administrative Manager of the Peer Review Program (AMPRP) received recommendations from a wide range of sources, RSI maintained the independence in the selection of the RP members. The selection of reviewers was based on the competencies required for the specific review assignment. The number of individuals in an RP depended upon the complexity of the subject to be reviewed.

Although the selection of reviewers was based on the totality of that individual's qualifications, there were several generally recognized and fundamental criteria for assessing their qualifications. The relevant criteria were:

1. **Education:** A minimum of a B.S. degree, preferably an advanced degree in a relevant scientific or engineering field.
2. **Experience:** Significant experience in the area that is being reviewed.
3. **Peer recognition:** Election to an office of a professional society, serving on technical committees of scholarly organizations, and similar activities were indications of peer recognition.
4. **Contributions to the profession:** Publications in peer-reviewed journals, patents, presentations at meetings where the papers were peer-reviewed, and similar activities.
5. **Independency:** Independency was interpreted as having no conflict of interest. One of the most complex and contested issues in peer review is a set of subjects collectively called conflict of interest. The ideal reviewer is an individual who is intimately familiar with the subject and yet has no monetary interest in it. Despite this apparent difficulty, the ASME and similar organizations have successfully performed peer review without having a real or apparent conflict of interest. The guiding principle for conflict of interest is as follows: *An individual who has a personal stake in the outcome of the review may not act as a reviewer or participate in the selection of reviewers.*

Composition of RPs: Due to the nature of projects that were reviewed during the operation of this grant, it was necessary to identify reviewers from a variety of scientific and engineering disciplines. The diversity of the educational degrees of the peer reviewers indicated that virtually all scientific and engineering disciplines were included in the list of peer reviewers. In order to select qualified reviewers, an assessment of their areas of competency was necessary. Therefore, the areas of competency of the reviewers were categorized as follows:

Category I: Broad areas of knowledge
Category II: Areas of general knowledge and experience
Category III: Areas of direct and sustained knowledge and experience

Example I: A chemical engineer, who has been involved with various aspects of hazardous waste management. For the last 10 years, she has been involved with assessing the treatment technologies for many hazardous waste streams. However, she has specialized in chlorinated solvents. In this case, her competencies would be categorized as follows:

Category I: Chemical engineering involving management of hazardous waste
Category II: Hazardous waste treatment
Category III: Chlorinated hydrocarbons

Example II: Similarly, a mechanical engineer may have worked in heat transfer of heterogeneous systems. For the last few years, this engineer worked in thermal processes involving combustion with special interest in fluid bed combustion. In this case, his competencies would be as follows:

Category I: Heat transfer in mechanical systems
Category II: Combustion
Category III: Fluid bed combustion

A typical RP might include one individual from category III, one individual from category II, and one from category I. However, it was not always possible to find individuals with competency in the correct category, were available at a given date, and had no conflict of interest. This was particularly critical in reviews where broad areas of subjects were being reviewed. In these cases, it was attempted that the RP included one individual in Category II.

Peer Review Reports

The large number of reports resulted from this grant. The program was organized to accommodate the needs of various offices, National Labs, and other organizations within DOE. Although each reviewed project required attention to its specific requirements, the reports resulting from this grant can be categorized into two specific groups:

Report of a Single Project: The *Technical Peer Review Report* contained the *Report of the Review Panel* and several other parts. It was designed to ensure that the primary readers of the report would not need to consult other documents to understand the results of the review. Typically, the *Report of the Review Panel* included the following parts:

1. The Introduction describing activities that led to the preparation of the report
2. Peer Review Process
3. A summary of the project that was reviewed
4. Peer Review Criteria and Findings of the RP consisting of shortcomings and meritorious aspects of the project
5. Recommendations of the Panel

6. References
7. Biographical summary of members of the RP and others involved in the process
8. Appendix containing significant comments of one reviewer which were not shared by others, or those that were considered to be beneficial to the Project Team, but were not important enough to be included in the main body of the report.

Annual Report: The Annual Report included the results of peer review for a specific fiscal year. The *Technical Peer Review Report* contained the results of the peer review and was often prepared in three consecutive phases with the subtitles *Report of the Review Panel*, *Interim Report*, and *Final Report* respectively. The content of the *Report of the Review Panel* as prepared for the single project was similar to that included in the Annual Report. Typically, members of the Project Team consisting of investigators, managers, and others were provided with items 4 and 5 of the *Report of the Review Panel*. A summary of the response containing the salient features of the response was combined with items 1, 2, 3, 4, and 5 of the *Report of the Review Panel* in preparing the *Interim Report*. During the review of the *Interim Report*, the PRC could add to it substantive, explanatory, clarifying, or supplementary comments and recommendations. The *Interim Report* was issued as a *Final Report* after the PRC reviewed and approved the *Report of the Review Panel* and accepted the DOE Response. The Annual Report typically contained the following parts:

1. The introduction or preface describing the peer review process; listing of individuals involved in the process; changes in the program during the year; and other relevant information
2. DOE response to previous year's Findings and Recommendations of the PRC
3. Findings and Recommendations of the PRC
4. *Final Reports*
5. *Interim Reports*
6. *Reports of the Review Panel*
7. Biographical summaries of members of the RP, the Oversight Committee, and others who participated in the review

These reports were widely distributed to Congress, regulators, libraries, stakeholders, and commercial entities that were actively involved in using and developing technologies.

THE PEER REVIEW PROCESS

The peer review process relied upon the tradition of professional societies. It included the following elements:

1. Request for Peer Review
2. Peer Review Criteria
3. Identification of Review Panels
4. Peer Review Meeting
5. Public and stakeholder Participation
6. Peer Review Publications
7. Annual meeting

Request for Peer Review

The request for peer review was provided to the AMPRP about 45 calendar days prior to the date of the proposed review. Typically, the request included a summary of the project and proposed project-specific peer review criteria. Technical background documents were provided to the TS about 30 calendar days in advance of the review.

Peer Review Criteria

Initially, the PRC established peer review criteria that were used virtually in all peer reviews. In October 1999, new and significantly improved core peer review criteria were developed. These criteria became the basis for project-specific criteria that were provided by Project Managers. Typically, these latter criteria were evaluated by the TS and revised to comply with the policies developed by the PRC and agreed upon by the DOE management. Provisions were made to ensure that in case of disagreement between the TS and Project Managers, the PRC made the ultimate decision.

Typically, the number of review criteria for each project was about 10 but could be significantly higher. The practicability of the process can be readily demonstrated by the fact that virtually in all cases, the process did not require intervention of the PRC. Furthermore, during the entire program covering about 300 peer reviews, only one review—and in that review only one criterion—was contested and had to be resolved by the PRC.

Identification of Review Panels

The ASME/RSI team was fortunate to be able to utilize a large number of peer reviewers from academia, industry, various government agencies, and others with exceptional technical qualifications. Due to the multidisciplinary nature of many projects reviewed by the ASME/RSI team, rapid identification of qualified peer reviewers and their availability to participate in the review process were key ingredients for a successful program. The process used for the identification of reviewers included recommendations from sources within ASME; previous members of the RP; sister societies; other organizations and individuals; the DOE; DOE contractors; and others. However, the selection of peer reviewers was entirely based on criteria identified by the PRC.

Peer Review Meeting

Type I and Type II reviews followed a common structure. Prior to the meeting, members of the RP were called together and were given instructions for the conduct of the review. Consistent with ASME/RSI policies, the review meetings (except executive sessions of the RP) were open to the

public. However, those who desired to attend were required to register and observe rules common to meetings of professional societies. The meetings normally started with an introduction by a representative of the PRC describing the ASME/RSI review process and a presentation on DOE peer review requirements. Members of the RP, as well as others in attendance were instructed that technical discussions between the RP members and other attendees were restricted to the official sessions of the program. Subsequently, members of the project team were provided reasonable time and opportunity to describe the program under review. During this first part of the session, all participants were permitted to address questions to presenters and participate in the discussion. Following this session, the RP met to identify unresolved issues and areas requiring further clarification. In the subsequent open session, only members of the RP could pose questions to the project team. Finally, the RP met and wrote the draft *Report of the Review Panel* with the assistance of the TS. The draft Report was copy-edited prior to its distribution.

Public and Stakeholder Participation

Public participation is a legally-mandated process and often requires a public hearing where every entity, individual or corporate, can participate. In public hearings, members of the public can express their views; air their grievances; and talk about any subject they desire. In contrast, stakeholder participation is somewhat differently structured than public participation. Meetings with stakeholder participation must follow a process that: 1) identifies concerns that stakeholders have about the issue at hand; and 2) ensures that stakeholders comments clearly address concerns related to the issue at hand. The need for a systematic assessment of stakeholder participation became apparent during several peer reviews. The process developed by RSI was used in a number of peer reviews and, based on the written responses from participants, proved to be successful. The foundation of the RSI process was:

1. Categorization of stakeholders as: 1) personally impacted, 2) administratively impacted, 3) generally concerned, and 4) process concerned stakeholders. All other individuals and organizations were placed in a category “general public”.
2. Providing a structure to ensure that scientific issues raised by all stakeholders were given appropriate consideration.
3. Personally impacted stakeholders received appropriate consideration in dealing with non-scientific issues.

Annual Meeting

An annual meeting of the program was convened in conjunction with one of the meetings of the PRC. During this meeting, specific RP reports of particular interest may be presented and discussed.

PEER REVIEW DOCUMENTS

In addition to the reports resulting from peer review of specific projects, several documents were prepared to facilitate the review process. The RSI website at www.nars.org includes detailed information on the results of this grant and other information.

Peer Review Reports

The RSI website includes a list of about 300 reports resulting from peer reviews and related documents. Note that in every case, the sponsor of the report is identified.

Manual for Peer Review

The first draft of the *ASME Manual for Peer Review* was prepared in October 1996, reviewed by the PRC, and published in January 1997. Subsequent revisions resulted in a manual of general applicability to other organizations choosing to use ASME services for peer review (5).

Procedures Manual

In addition to the *ASME Manual for Peer Review*, from the beginning of the peer review program, the need for more detailed procedures was recognized. The current list includes 19 procedures covering various aspects of peer review operations (7).

Questionnaires

Effective March 1998, questionnaires covering various aspects of the peer review were distributed to members of each RP. The RP members were asked to fill out the questionnaires anonymously, using a numeric rating, and provide comments covering various aspects of the project they reviewed. The topics covered by these questionnaires were as follows:

1. Quality of written information
2. Quality of presentation
3. Potential for utilization of technology
4. Administrative support

RECOGNITION OF THE ASME/RSI PEER REVIEW PROGRAM

The ASME/RSI program was established at least partially due to the result of criticism of the technology development at the DOE. For example, the National Research Council (NRC) was critical in its report in 1995 in describing that program. Upon the establishment of the ASME/RSI program, the NRC report was no longer critical of the DOE. Even more interesting was a subsequent report by the same organization recommending an approach similar to that of ASME/RSI for other agencies.

Another recognition of the program occurred when the Office of Management and Budget published its peer review guide. Again here, the ASME/RSI program was highlighted and the 2002 Annual Report was referenced. Subsequent to the publication of the OMB guide, a thorough review of the ASME/RSI program was initiated. The result was a minor modification of the program.

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