# 3
# CHAPTER 3
# IMPLEMENTATION OF PRESENT-DAY SEISMIC REGULATORY GUIDANCE FOR THIS STUDY

This chapter describes the implementation of the SSHAC process for this study consistent with present-day NRC guidance for updating an accepted existing PSHA model. As summarized in Sections 1.1.2 and 1.1.4, present-day NRC guidance for updating an accepted existing PSHA model is primarily contained in two NRC guidance documents:

- NUREG/CR-6372, *Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts* (Budnitz et al., 1997).
- NUREG-2117, *Practical Implementation Guidelines for SSHAC Level 3 and 4 Hazard Studies* (U.S. NRC, 2012b).

The SSHAC Guidance in NUREG-6372 defines four process levels for conducting a SSHAC study depending on the complexity of the technical assessment and significantly, on the intended use of the product of the study. Considering recommendations contained in NUREG-2117 for updating an accepted existing hazard model as described in the Project Plan (EPRI, 2012) and summarized in Section 1.1.4 and Section 1.2, a Level 2 process was selected for this study, along with additional activities consistent with a Level 3 process. Selection of the study level took into consideration that the purpose of the study was to review the existing EPRI (2004, 2006) GMM considering up-to-date data, GMPEs, and modeling advances and, if needed, to update the model for use by nuclear plant licensees in responding to the 50.54(f) Request for Information regarding the NTTF recommendation 2.1: Seismic.

For a Level 2 process study, the SSHAC Guidance tasks the Technical Integrator (TI) with thoroughly evaluating present-day relevant data, and technical knowledge, together with uncertainties in both data and technical interpretations. Importantly, the guidance prescribes interactive process and technical review by a designated PPRP. The TI Team and Project Manager document the process as implemented in a draft project report, which is reviewed by the PPRP and revised as needed considering PPRP recommendations. As discussed in Section 2.2.10, this project also developed an Intermediate Document describing the preliminary updated model, and obtained PPRP review. The PPRP review identified the need for additional evaluations in order to strengthen the bases for some assessments. The TI Team addressed the PPRP recommendations for development of the draft project report.

## 3.1 Goals and Activities of a SSHAC Assessment Process

As described in Section 1.1.2 of this report, independent of the SSHAC level selected for a study, the fundamental goal of a SSHAC process is to capture uncertainty in both present-day technical knowledge and available data and to properly represent the uncertainty in the PSHA model. Drawing on more than 10 years experience with implementation of the SSHAC process, the NRC recast the goal in NUREG-2117 in terms of the two core activities of any SSHAC study and the manner with which uncertainty is assessed and captured in a seismic hazard model (U.S. NRC, 2012b), as follows:

> The fundamental goal of a SSHAC process is to carry out properly and document completely the activities of evaluation and integration, defined as:
>
> *Evaluation:* The consideration of the complete set of data, models, and methods proposed by the larger technical community that are relevant to the hazard analysis.
>
> *Integration:* Representing the center, body, and range (CBR) of technically defensible interpretations (TDI) in light of the evaluation process (i.e., informed by the assessment of existing data, models and methods).

In practical implementation of a Level 2 or Level 3 process the TI Team evaluates each element of the hazard model considering the complete present-day relevant data, models, and methods proposed by the larger technical community. Informed by the evaluations, the TI Team assesses the CBR of TDI. The elements of the hazard model are then integrated in order to properly capture the CBR of TDI in the integrated hazard model. This implementation process is independent of whether the purpose of a study is to update an accepted existing SSC model or an accepted existing GMC model. Considering recommendations for updating an accepted existing hazard model provided in NUREG-2117, a Level 2 process with additional activities drawn from a Level 3 process was selected and implemented for performing the update study and for updating the EPRI (2004, 2006) GMM, as is described in this report. The following sections of this Chapter describe how the implementation was carried out.

## 3.2 Project Organization

This section explains the organization of the EPRI (2004, 2006) GMM Review Project, including the responsibilities of the project participants. Lines of communication between the participants are described in Section 3.3. The roles that various participants have in a SSHAC assessment process are important and are defined specifically in the SSHAC Guidance and in NUREG-2117. The EPRI (2004, 2006) GMM Review Project was conducted in accordance with the SSHAC Guidance, which explicitly defines the roles of project participants in the study. Beginning with the review of the roles prior to the Kick-Off Conference Call on March 8, 2012, all project participants were informed of their roles, and they were reminded of their roles during the Kick-Off Conference Call, at working meetings and, as required, at other opportunities throughout the project. The involvement of all participants, including Observers, is shown in Table 2.2.13-1, which identifies the technical meetings and working conference calls conducted during the course of the project, the participants, and dates.

The project organization is shown in chart form on Figure 3.2-1; participant roles and responsibilities are summarized below.

### 3.2.1 Project Sponsor: EPRI Management

EPRI sponsored the EPRI (2004, 2006) GMM Review Project. EPRI Management included an Executive Director and a Senior Project Manager, as shown on Figure 3.2-1. The primary responsibility of the EPRI Management was to define the sponsor expectations, share the Sponsor's expectations with the Project Manager, and, with the support of the Project Manager, keep EPRI members abreast of project activities and progress. Additional responsibilities are listed below:

- Securing funding for the project and awarding a contract to obtain shear-wave-velocity measurements at 33 recording stations.
- Assuming responsibility for contract management and providing the fundamental interface for contracts.
- Monitoring spending and adherence to the project plan.
- Working with the Database Manager to resolve copyright issues.
- Defining the level of transparency to use for products developed during the study.
- Providing support for the PPRP Closure Briefing at EPRI offices in Palo Alto, California.
- Establishing publication requirements for the project plan and report.
- Reviewing and giving approval of the EPRI (2004, 2006) GMM Review Project draft and final report.

### 3.2.2 Project Manager

The primary responsibilities of the Project Manager were to serve as the point of contact between the project and the Sponsor and ensure adherence to scope, schedule, budgets, and contractual requirements. The Project Manager was ultimately responsible for the delivery of all technical products. Additional responsibilities included the following:

- Interfacing with PPRP, Technical Integration (TI) Team, Senior Technical Advisors, Sponsor, and Observers.
- Serving as the point of contact to keep the Sponsor, PPRP, Senior Technical Advisors, and Observers apprised of project activities and progress.
- Reviewing technical products provided by the TI Team.
- Working with the TI Lead to organize working meetings.
- Working with the EPRI Executive Director and the EPRI Senior Project Manager to communicate information to the project team regarding contractual requirements and the publication requirements established for the project plan and report.

- Assisting the EPRI Executive Director and the EPRI Senior Project Manager in establishing and maintaining budgets and schedules.
- Working with Norm Abrahamson, Yousef Bozorgnia, Christine Goulet, and Charles Mueller to share information about the project and to obtain input from the NGA-East Project and the U.S. Geological Survey (USGS) National Seismic Hazard Mapping Project.
- Leading the TI Team's efforts to obtain shear-wave-velocity profiles at 33 recording stations, and additional profiles from the USGS obtained at 24 recording stations.
- Serving as the principal spokesperson to the external community, including the NRC, Defense Nuclear Facilities Safety Board (DNFSB), and stakeholder observers.

### 3.2.3 Participatory Peer Review Panel

Participatory peer review is an essential activity of a SSHAC study. The SSHAC Guidance defines *participatory peer review* as an ongoing or continuous process that provides the peer reviewers with full and frequent access throughout the entire project. In contrast, a late-stage peer review occurs when a project has almost been completed, typically when the draft final report has been completed in a basic Level 2 study. The principal benefit of a participatory peer review is that if problems are discovered, the opportunity exists for a mid-course correction without the need for work to be substantially redone at the end.

PPRP participation in the EPRI (2004, 2006) GMM Review Project fulfilled all the basic responsibilities recommended in NUREG-2117 for a Level 3 study, as follows:

- Review of the Project Plan.
- Participation in working meetings and workshops and participation in working conference calls to observe the process and monitor progress of the project.
- Occasionally interacting individually with the Project Manager and TI Team as a resource expert, if requested.
- Providing written review comments—in the form of a single consensus letter report—on the project plan, the decision to update the EPRI ground-motion model, and the Intermediate Document and draft and final versions of the project report.
- Providing oral and written review comments, as required, on interim technical assessments or other products made by the TI Team at key points during the project.
- Participating in the PPRP Closure Briefing in Palo Alto, California.
- Providing a written PPRP final report to the Project Manager for inclusion in the final project report.
- Performing other tasks, as feasible, requested by the Project Manager (e.g., reviewing the list of Resource and Proponent Experts invited to the workshop to interact with the TI Team).

### 3.2.4 Technical Integration Team

The TI Lead was responsible for ensuring that all TI Team members knew their roles as evaluators and that they maintained those roles throughout the course of the project. The TI Team members were responsible for developing and documenting the technical basis for all project evaluations, assessments, and products. Additional responsibilities for the entire TI Team included the following:

- Implementing the SSHAC Level 2 assessment process throughout the project, including all key assessment steps of evaluation and integration.
- Working with the Project Manager to develop the project plan.
- Maintaining scope, schedule, and budget.
- Developing the project database.
- Compiling post-2002 ground-motion-prediction equations (GMPEs).
- Conducting working meetings and other project meetings, as required.
- Participating in conference calls.
- Facilitating the requisite expert interactions.
- Communicating with the Project Manager and the PPRP and responding to reviews, as required.
- Providing technical products and technical assessments and justification for their bases.
- Documenting all process and technical aspects of the study and decisions in a project report.

### 3.2.5 Database Manager

The primary responsibility of the Database Manager was retrieving and compiling applicable data for use by the TI Team. Additional responsibilities included the following:

- Retrieving and compiling applicable data, such as data sets from the USGS National Seismic Hazard Mapping Project and the NGA-East Project.
- Providing data sets in appropriate formats for use in the TI Team deliberations.
- Providing an FTP site for the project team to share information.
- Participating in conference calls.
- Providing support for resolving copyright issues and facilitating working meetings and PPRP and Sponsor briefings, as required.
- Providing support and assistance for report preparation, including preparing figures.

### 3.2.6 Senior Technical Advisors

The primary responsibility of the Senior Technical Advisors was providing their technical knowledge and experience on the implementation process, as well as on specific topics of discussion regarding ground motion, to the TI Team and Project Manager throughout the study. Additional responsibilities included the following:

- Providing insights, data, and viewpoints at the request of the Project Manager and TI Team.
- Providing current data, models, and methods to keep the TI Team abreast of ground-motion developments since the 2002 workshops for EPRI (2004).
- Providing advice relevant to technical assessments and corresponding uncertainties, based on familiarity with recent and ongoing ground-motion-related studies in the technical community.
- Attending working meetings, participating in conference calls, and attending the PPRP Closure Briefing at the end of the project.
- Reviewing and providing comments on the draft and final project reports to the Project Manager and TI Team as part of the report preparation process.

### 3.2.7 Observers

Observers from industry and government were invited to share information with the TI Team and Project Manager throughout the study, including their technical knowledge and experience on specific topics of discussion regarding ground-motion modeling. Observers were not members of the project team, but they were kept abreast of project activities, decisions, and progress. Observers attended project meetings at their option and provided oral comments that were documented in meeting highlights.

### 3.2.8 Other Project Participants: Experts and Specialty Contractors

Three types of experts are identified in the SSHAC Guidance by their distinctive roles in a study, namely, Resource Experts, Proponent Experts, and Evaluator Experts. Resource Experts and Proponent Experts participate by sharing their knowledge and experience on specific topics, as requested by the Project Manager and TI Team. A Resource Expert is a technical expert with specialized knowledge of a particular data set, model, or method relevant to the hazard study whose expertise may be in the form of site-specific experience or knowledge of particular methodologies or procedures. A number of Resource Experts participated in the workshop and in interviews outside the workshop environment during this study (Table 2.2.6-1).

A Proponent Expert is an expert who advocates a particular hypothesis or technical interpretation. At the October 17, 2012, workshop, several Proponent Experts presented their ground-motion models, explained the physical characteristics of the models' parameters, and discussed uncertainties in the parameter values. The workshop provided the opportunity for the

TI Team to question the Proponent Experts about the technical support and uncertainties associated with their models.

Evaluator Experts make up the TI Team, which is charged with evaluating the relative credibility of the many alternative interpretations considering present-day available data. Informed by the evaluations, the Evaluator Expert assessed uncertainties considering technically defensible present-day interpretations and represented the CBR of TDI in the Updated GMM. In the assessment process, the Evaluator Experts challenged proponent's interpretations and probed their technical basis as a means of gaining insight into the uncertainties. The members of the TI Team were charged with fulfilling the roles of Evaluator Experts in this study. Additionally, members of the TI Team served as Specialty Contractors for performing specific analyses and providing specific products to support the TI Team's evaluations and assessments.

## 3.3 Project Lines of Communication and Points of Contact

The lines of communication and points of contact are shown on Figure 3.3-1; the figure illustrates the flow of information between members of the project team that kept them aware of project developments and communications in a timely manner. The Project Manager was the point of contact for transmitting correspondence and work products to and from the TI Team, PPRP, Senior Technical Advisors, Observers, and Sponsor. With the assistance of the TI Team, the Project Manager informed the Chairman of the PPRP and Sponsor of process and technical developments. The Project Manager and TI Team ensured that the Specialty Contractors and the Resource and Proponent Experts had the required information to support their participation in the project. The Project Manager was copied on all correspondence and work products.

## 3.4 Evaluation and Integration Activities

The Project Plan for the EPRI (2004, 2006) GMM Review Project was structured around a set of tasks and activities that would fulfill the requirements of a SSHAC Level 2 project, as described in detail in Chapter 2. The key evaluation and integration activities that define the EPRI (2004, 2006) GMM Review Project are described in detail in Chapter 2 and more generally in this section.

### *3.4.1 Development of the Project Database*

The project database is a fundamental resource developed as part of the EPRI (2004, 2006) GMM Review Project. The present-day database provided information for the TI Team to use in its evaluation and integration processes. The database consists of new ground-motion recordings provided by the NGA-East Project and obtained from publications from the literature, shear-wave-velocity profiles developed from field measurements at 33 seismic recording stations during this study, and shear-wave-velocity profiles obtained at an additional 24 seismic recording stations provided to this project by the USGS Seismic Hazard Mapping Project (Kayen et al., 2013). A summary of the project database is given in Appendix A and a description of the data is provided in the metadata files.

### 3.4.2 Identification of Significant issues

The experience of the TI Team members as developers and end users of ground-motion models greatly facilitated identifying resource and GMPE experts and defining significant issues. In addition, resource and GMPE experts shared experience gained from the NGA-West 1 and NGA-West 2 Projects, the ongoing NGA-East Project, and the ongoing USGS Seismic Hazard Mapping Project through interviews by the TI Team and during working meetings. Appendix E provides highlights from the working meetings. The productive cooperation with the ongoing NGA-East Project and the ongoing USGS Seismic Hazard Mapping Project provided valuable insights and perspectives for defining the current GMM practice, identifying critical new data, and defining significant issues to be addressed.

### 3.4.3 Workshop

A one-day ground-motion workshop was held on October 17, 2012. The goal of the workshop was to present and discuss the preliminary Updated EPRI (2004, 2006) GMM (herein referred to as the "Updated GMM") in a public forum and obtain feedback from resource and proponent experts from the technical community. The Project Manager and TI Team developed objectives and an agenda for the workshop, which were reviewed by the PPRP, specifically identifying GMPE proponents representing the range of existing models in order to ensure that technical discussions for workshop participants would fulfill the project's feedback goals. The feedback gained at this workshop ensured that no significant issues had been overlooked and allowed the TI Team to receive the reaction of the community to the preliminary Updated GMM. This feedback provided the basis for the draft Updated GMM that was discussed at the February 13, 2013, Closure Briefing.

The focus of the workshop was a roundtable discussion. A Project Overview was sent to the resource and proponent experts prior to the workshop. The TI Team provided the results from Task 5 (Section 2.2.5), which developed the preliminary Updated GMM, and a focused discussion followed. The TI Team presented the preliminary Updated GMM, with particular emphasis on how alternative viewpoints and uncertainties were captured. The technical bases for the assessments and weights were described in order to facilitate a reasoned discussion of the constraints provided by the available data. Feedback from the resource and proponent experts, the PPRP, and Observers (NRC, USGS, DNFSB, DOE, and NGA-East Project) was obtained during the workshop. The Project Manager invited resource and proponent experts to provide post-workshop comments and to continue the dialogue with the TI Team that began with the interviews (Appendix C). The PPRP provided PPRP Report #3 regarding the workshop and the preliminary Updated GMM on October 23, 2012 (Appendix H).

### 3.4.4 Working Meetings

Although the workshop provided an opportunity for the TI Team to consider and discuss a variety of topics, much of the actual SSHAC assessment activities of evaluation and integration occurred during the working meetings that took place before the workshop. The PPRP, Senior Technical Advisors, Observers (NRC staff and outside resource experts), and Proponent Experts

participated in working meetings. Except for Working Meeting #1, which was a conference call, the working meetings were held in a conference room with handouts available to all participants during the meeting. Each working meeting focused on evaluation of one or more significant technical issues by the TI Team. Each working meeting was documented; Appendix E provides the agendas and highlights for the five working meetings held during the project. The Project Manager distributed the highlights to all meeting participants soon after each working meeting. Information about each working meeting is shown in Table 2.2.13-1.

### 3.4.5 Development of the Preliminary Updated Model

Prior to the October 2012 workshop, described in Section 3.4.3, the TI Team developed the preliminary Updated GMM using the results from Task 2 (Section 2.2.2). Activities included establishing (1) the technical bases for updating the EPRI (2004, 2006) GMM, including technically defensible GMPEs identified by reviewing the literature, conducting interviews, and holding a workshop with ground-motion experts; and (2) the analytical approach for adjusting ground motions to reference conditions. Computation of GMPE weights using empirical site-class factors was also part of the study, along with an update of the EPRI (2006) aleatory variability model.

### 3.4.6 Completion and Review of Draft and Final Versions of the Updated Ground-Motion Model

Between October 2012 and January 2013, the TI Team continued working on improving the preliminary Updated GMM as part of Task 5. Evaluations resulted in revising the characteristics of GMPEs in three of the four clusters based on similarity of seismological characteristics, and in reassessing weights that were in the preliminary Updated GMM. The draft Updated GMM was then completed. As prescribed in the SSHAC Guidance, it was based on a systematic evaluation of the data, models, and methods identified by the larger technical community and on the TI Team's assessments representing the CBR of TDI. The draft Updated GMM was documented in a provisional Hazard Input Document (HID) that was provided to the project hazard analyst for use in initial work on Task 7 (Section 2.2.7) and in an Intermediate Document, which is discussed next.

To facilitate discussion at the PPRP Closure Briefing held on February 13, 2013, the draft Updated GMM (with accompanying text to explain the model) was provided to the PPRP and Observers, including the NRC staff, in the form of an Intermediate Document dated January 18, 2013. An NRC public meeting to discuss the draft Updated GMM was held in Washington, D.C., on January 23, 2013. The Intermediate Document provided documentation of the draft Updated GMM and was intended to support (1) the review, discussion, and resolution of any identified outstanding issues, and (2) the acceptance of the Updated GMM during the PPRP Closure Briefing. The Closure Briefing identified the need for refinement of the draft Updated GMM.

Following the PPRP Closure Briefing, the TI Team implemented recommendations received during and after the meeting. PPRP concurrence with the final Updated GMM was documented in PPRP Report #5, dated April 5, 2013, following the activities summarized below:

- PPRP Closure Briefing (February 13, 2013)
- PPRP Report #4 to Project Manager requesting further actions by the TI Team regarding the draft Updated GMM presented at the PPRP Closure Briefing (March 6, 2013)
- Draft TI Team presentation to PPRP responding to PPRP Report #4 action items for the TI Team (March 14, 2013)
- PPRP, TI Team, and Project Manager Conference Call (March 15, 2013)
- Final presentation to PPRP regarding PPRP Report #4 action items (March 16, 2013)
- TI Team and Project Manager responses to PPRP comments, with PPRP comments appended (March 23, 2013)
- Hazard Input Document (HID) for Mid-Continent and Gulf regions to PPRP, specifying details of the final Updated GMM (March 28, 2013)

On March 19, 2013, the PPRP orally provided its concurrence with the TI Team's revision of the draft Updated GMM, and the PPRP formally documented its concurrence with the final Updated GMM in PPRP Report #5, dated April 5, 2013. A public meeting with the NRC was held in Washington, D.C., on March 26, 2013, to discuss changes made to the draft Updated GMM as a result of the SSHAC review process. On April 11, 2013, NRC staff briefed the full Advisory Committee on Nuclear Safety (ACRS) regarding the EPRI (2004, 2006) GMM Review Project.

## 3.5 Documentation

The final Updated GMM is documented in a corresponding HID, which was provided to the hazard analyst for completing the performance of Task 7, and for inclusion in the draft and final project reports. Proper and sufficient documentation is an important component of any SSHAC study. The steps involved in this documentation are summarized below.

### *3.5.1 Development of the Hazard Input Document*

Upon completion of the final Updated GMM, the essential elements of the model were documented in the HID for the project (Appendix G). The HID, the key deliverable of the project, can be used for hazard calculations in the future. Specifically, this document is meant for the hazard analyst—providing clarity about implementation of the model and obviating the need to distill the model from the full report. The HID helps ensure that the model is implemented as intended. The technical assessments that constitute the final Updated GMM are not justified or discussed in the HID; rather, the technical justifications for the assessments in the HID are documented in this project report.

### *3.5.2 Development of the Draft Project Report*

Section 2.2.9 and Section 3.4.6 refer to the Intermediate Document. This section focuses on the draft project report that was completed during April and early May 2013, *after* the Updated GMM was finalized considering feedback on the Intermediate Document.

The draft project report documented all the assessments made by the TI Team associated with the final Updated GMM. The report was provided to the PPRP in nearly complete form on April 26, 2013, with some parts provided in early May 2013. All members of the TI Team, along with a Senior Technical Advisor and the Project Manager, developed the draft report.

The draft report summarized all the key process steps involved in achieving the final Updated GMM, discussed their consistency with a SSHAC Level 2 assessment process, summarized the methodology that was used to make the assessments, provided a description of project deliverables, and provided a technical discussion documenting all elements of the final Updated GMM. The appendices to the report provided project-specific documentation of key products such as the final HID, literature review tables and interview summary tables, project database, summaries of the working meetings and the feedback workshop, and key project written communications. The goal of both the draft and final project reports was to provide a self-contained, complete description of all aspects of the project such that future readers of the report understand the methodology, the technical elements of the final Updated GMM, and the technical bases for all assessments. The draft and final project reports include the following important components:

- A description and justification for the methodology followed, including justification for the SSHAC study level used.
- The database used in the analysis.
- A description of the final Updated GMM, including the technical basis for all assessments and the data that were relied upon.
- The seismic hazard results at the seven test sites, including a comparison of the hazard using the EPRI (2004, 2006) GMM and the final Updated GMM developed by this project, in both cases applying the new CEUS SSC model (EPRI/DOE/NRC, 2012).

The documentation in the draft and final reports provides the fundamental basis for the acceptance of the final Updated GMM and its subsequent use by other parties.

### *3.5.3 Review of the Draft Project Report*

The goal of the review process for the draft project report was to obtain comments from the PPRP as to whether the TI Team's technical assessments for the final Updated GMM had been adequately justified and completely documented, and whether that documentation was clear and consistent. In accordance with their prescribed roles within a SSHAC process, the PPRP provided written comments in PPRP Report #6 pertaining both to the documentation of the process followed in the project and to the technical assessments. In revising the draft project report, the TI Team fully addressed the PPRP comments. The TI Team duly considered all reviewer comments, as well as comments made by Observers at the PPRP Closure Briefing. Appendix D documents PPRP and Observer review comments, together with TI Team responses, associated with the draft Updated GMM presented at the PPRP Closure Briefing.

### 3.5.4 Development of the Final Project Report

The fundamental bases for revisions to the draft report were the written comments provided by the PPRP. To ensure that all the PPRP comments were addressed, the TI Team responded to each one following a systematic process that included a final PPRP check of the final project report.

## 3.6 Participatory Peer Review Panel

### 3.6.1 Roles and Responsibilities

The SSHAC Guidance emphasizes the crucial need for a strong peer review process if a PSHA project is to be successful. The members of the PPRP met the SSHAC criterion that peer reviewers "must be 'peers' in the true sense: recognized experts on the subject matter under review" (Budnitz et al., 1997, p. 48). The purpose of peer review is to provide assurance of the following:

- A proper SSHAC Level 2 process with additional steps (attributes) has been followed.
- The diversity of views prevailing within the technical community has been considered.
- Knowledge and uncertainties have been properly quantified and incorporated into the analysis.
- Documentation is clear and complete.

The EPRI (2004, 2006) GMM Review Project used a *participatory* peer review process, which involved continuous review throughout all phases of the project. The use of a participatory peer review process exceeds guidelines for a SSHAC Level 2 assessment process. As recommended by the SSHAC Guidance, the PPRP was responsible for reviewing both the technical and process aspects of the project. The peer reviewers interacted frequently with the TI Team, provided written comments at prescribed intervals, and reviewed and approved the project report.

### 3.6.2 Reviews and Feedback

The purpose of a participatory peer review process, as opposed to a "late-stage" process in the guidelines for a SSHAC Level 2 assessment, is to provide recommendations during the course of the study and not just near the end of the study. Such feedback is valuable to the TI Team and improves the completeness and quality of the evaluation and integration processes. For example, early in the project, the PPRP reviewed the project plan and provided its comments and recommendations on the planned work activities. PPRP review comments were instrumental in the TI Team's developing documentations that included literature review tables and interview summary tables (Appendix B and Appendix C), which will benefit future users of the study. The PPRP technical reviews also greatly assisted the team by ensuring complete definition of key technical issues, as well as thorough evaluations of all applicable data, models, and methods.

To assist in the monitoring and review of the project, the PPRP was invited to attend all working meetings and the workshop and to participate in project conference calls (Table 2.2.6-1). These

technical meetings and conference calls served as opportunities for the PPRP to ask clarifying questions and make recommendations during the evaluation and integration process. Representatives from the PPRP were present as Observers at all five working meetings of the TI Team. These technical meetings and conference calls provided the PPRP with additional perspective on the technical assessments being made by the TI Team.

In terms of written review of the project report, the PPRP provided a set of comments on the draft report that addressed both technical issues and process issues. The PPRP comments on the draft report were defined as either "mandatory," meaning the review comments must be addressed by the TI Team in its final documentation of the project report, or "non-mandatory," meaning that the comments are intended solely to help improve the final report. The TI Team considered all comments. After the draft report was revised in light of comments from the PPRP, a final report, which included the PPRP final report, was issued to EPRI for publication.

### 3.6.3 PPRP Review of Both Technical and Process Issues

The SSHAC Guidance stipulates that a SSHAC study include participatory peer review and that the review include both the technical and process aspects of the study (Budnitz et al., 1997, p. 50). The participatory peer review process for the EPRI (2004, 2006) GMM Review Project exceeded the guidelines for a SSHAC Level 2 process. The technical aspects include the TI Team's complete identification of the present-day applicable data, models, and methods that exist within the larger technical community as well as the evaluation and integration process that support the Team's representation of the CBR of TDI. Review of the technical aspects required the PPRP to have technical expertise in the areas of ground-motion modeling and seismological issues important to ground-motion prediction, while review of the process aspects required the PPRP to have knowledge of and experience in the application of SSHAC assessment processes. Process aspects include carrying out all methodological steps for implementation of the assessment process selected for this study. The PPRP for this study had the requisite expertise and experience to fulfill both aspects of their charge. Individual members of the Panel have extensive experience in the technical fields related to ground-motion modeling, as well as considerable project experience implementing SSHAC studies (Appendix F).

The final product of the SSHAC peer review process is a final closure report from the PPRP providing its conclusions as to whether the TI Team successfully implemented the study consistent with present-day regulatory requirements, and whether, as a result, the technical assessments are technically defensible and adequately documented. The final activity conducted by the PPRP was the development of this closure report, which is included in this report as PPRP Report #7.

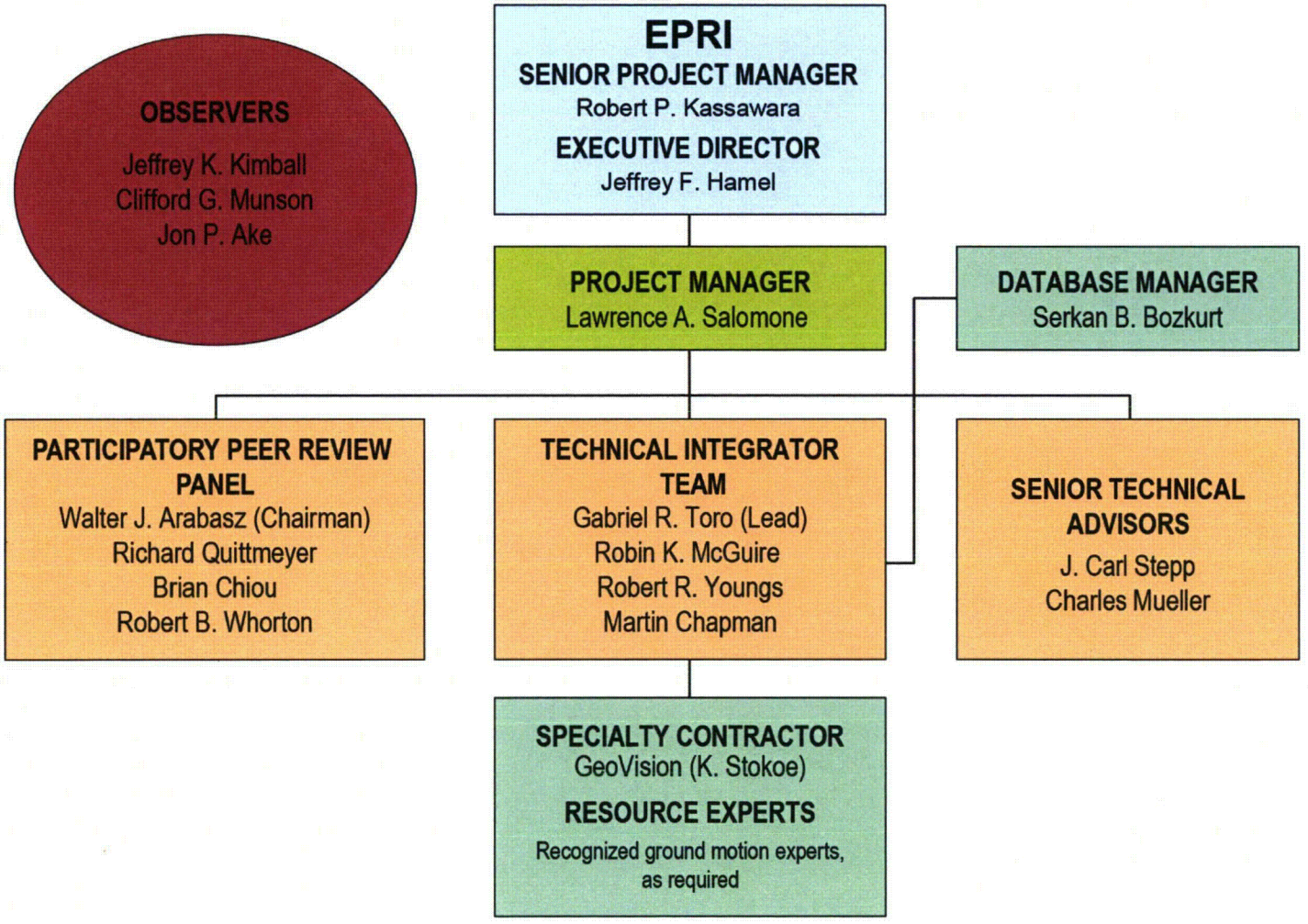


**Figure 3.2-1**
**EPRI (2004, 2006) GMM Review Project organization chart**

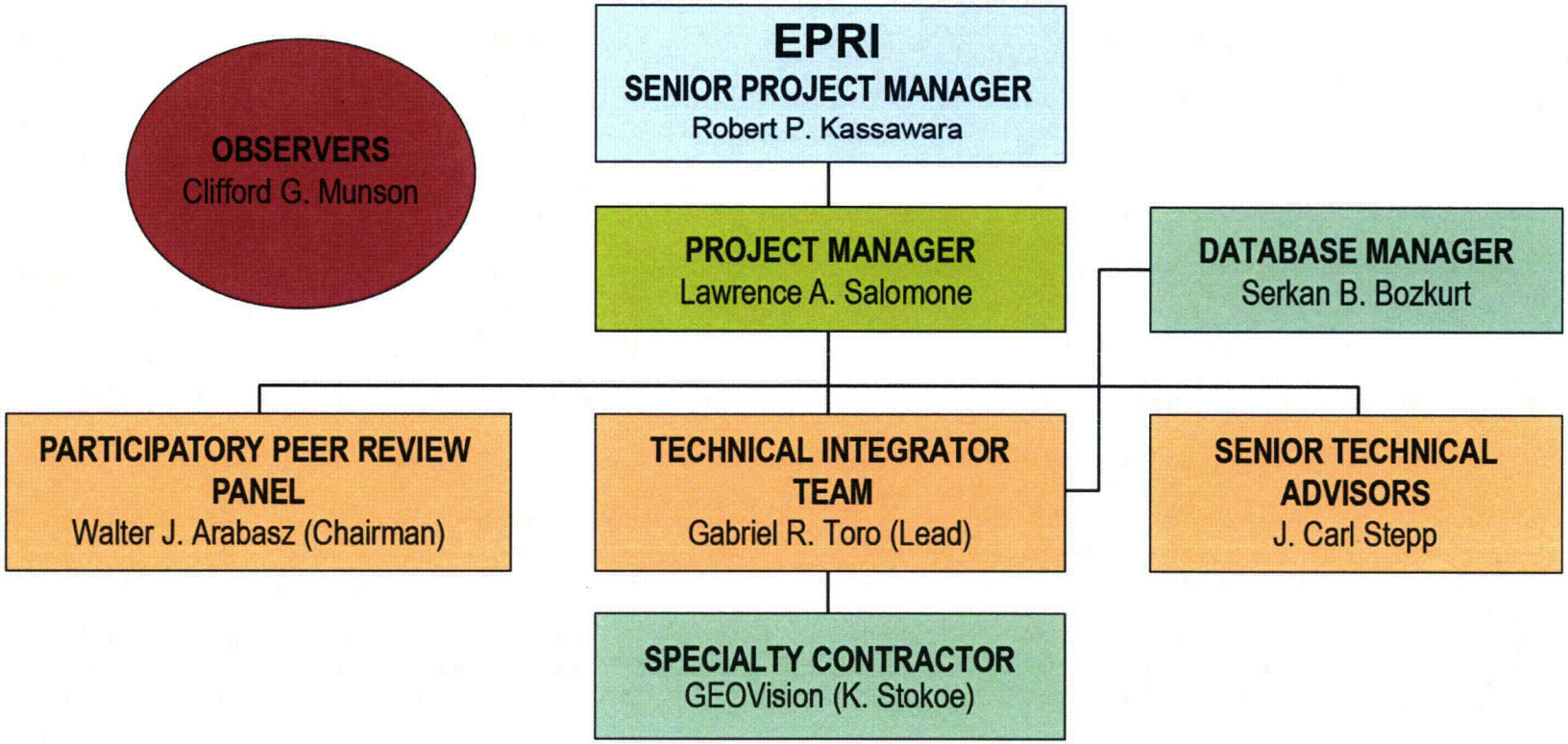


**Figure 3.3-1**
**Chart showing lines of communication and points of contact**