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2.0 Project Organization

This chapter presents an overview of how the Hanford PSHA project was organized, beginning with the selection of the Senior Seismic Hazard Analysis Committee (SSHAC) Level 3 framework for the study. The second section contains an overview of the project structure, its teams and their interactions. The individuals involved in the study are listed in these sections; brief biographies of key participants are provided in Appendix A.

A key part of the organization and implementation of a SSHAC process is consistency and adherence to existing standards, requirements, and guidance documents. During the time that the Hanford PSHA was being planned in 2011, the SSHAC Guidelines document (Budnitz et al. 1997) was in existence, as were the ANSI/ANS Standard 2.29-2008, *Probabilistic Seismic Hazard Analysis*, and a draft version of NUREG-2117 (to be issued as final guidance later [NRC 2012a]). These documents provided the framework for the selection of the SSHAC process and study levels, the organization of the project, and the key tasks and activities undertaken. In the following discussion of the project organization (Chapter 2.0) and key tasks and activities (Chapter 3.0), reference will be made to the requirements provided in the guidance documents followed by an explanation of the manner in which the Hanford PSHA was implemented to be consistent with that guidance.

To ensure consistency with all applicable SSHAC guidance and to provide a vehicle for the proper planning and implementation of the Hanford PSHA, a Work Plan was developed early in the process. The Work Plan has evolved with the issuance of NRC guidance and other experience gained from the conduct of other SSHAC Level 3 projects. The current document (included as the final appendix [L] to this Hanford PSHA report) is titled, *Work Plan for a SSHAC Level 3 Site-Wide Probabilistic Seismic Hazard Analysis (PSHA) of the Hanford Site – Revision 4*, dated May 17, 2013. It describes in detail the justification for the selection of a SSHAC Level 3 process, the project organization, the roles and responsibilities of all participants, the scope of work conducted by all participants, and the project schedule. Rather than repeat all of that information in this document, only the details pertaining to the actual implementation of the project are included here in Chapters 2.0 and 3.0.

2.1 Choice and Implementation of the SSHAC Level 3 Process

The SSHAC Guidelines (Budnitz et al. 1997; NRC 2012a) define four SSHAC study levels for conducting a PSHA. The levels increase in complexity from Level 1 to Level 4 as the process becomes more elaborate and the project more resource-intensive. The SSHAC Guidelines have seen frequent use for NRC-regulated nuclear facilities, as well as international nuclear facilities that follow similar regulatory requirements. The guidance provided in ANSI/ANS-2.29-2008 refers to the SSHAC Guidelines and outlines a comparable methodology. The Standard refers to “PSHA Levels” and is consistent with the SSHAC Guidelines in intent and application. Because the SSHAC terminology for study levels (e.g., “SSHAC Study Level 3” or simply “SSHAC Level 3”) is readily recognized by the seismic hazard community, it is used in this document.

2.1.1 Decision to Conduct SSHAC Level 3 Project

The SSHAC Guidelines (Budnitz et al. 1997) provide a series of decision criteria for selecting the SSHAC Level that is appropriate for addressing a given technical issue. Because Budnitz et al. 1997 is a guidance document and not a prescriptive procedure, the criteria that should be considered when assigning SSHAC Levels are discussed but the relative weight that should be given to the criteria is left to the specific application. The criteria, which are based largely on the attributes of technical issues that the PSHA needs to address, are as follows:

- **Significance to hazard result.** This is the importance of a technical issue relative to its impact on mean hazard (i.e., ranges in possible values or models for this issue lead to the largest variations in the calculated mean hazard). Depending on the site of interest, the assessment of hazard significance can vary with the ground-motion measure (e.g., peak ground acceleration, long-period spectral accelerations) and the annual frequency of exceedance (AFE) of interest. It is assumed that this is a very important criterion for evaluating technical issues.
- **Technical complexity and level of uncertainty.** This criterion evaluates the degree to which a technical issue is sufficiently uncertain and complex to warrant a higher or lower level of study. Generally, the elements of a PSHA are relatively well-understood and, despite a growing trend toward physical realism and complexity in many aspects, variation in complexity is not a particularly useful criterion for distinguishing among issues. However, the level of uncertainty can be both a useful screening criterion (i.e., technical issues that are known with high levels of certainty would not be considered in the first place) as well as a way of discriminating among technical issues. For example, some technical issues that have high levels of uncertainty and importance to hazard can be very difficult to quantify completely because of conceptual model uncertainties.
- **Contention in the technical community.** This criterion is a measure of the level of disagreement regarding an issue within the technical community. Such disagreements are common within the earth sciences community and tend to come and go over time. History has shown that contentious issues commonly attract the attention of regulatory groups that are interested in stable hazard assessments that will stand the test of time. Almost by definition, contentious technical issues are also highly uncertain, but they are not necessarily issues that are important to hazard.
- **Non-technical considerations – budgetary, regulatory, scheduling, or other concerns.** These considerations can have overriding importance when deciding on the SSHAC Level for a hazard analysis. If time and money are not available to conduct a higher SSHAC Level analysis, then the other criteria become largely academic. On the other hand, for many hazard analyses for critical facilities, management will look to the evaluation using the other criteria before deciding if the time and cost issues are dominant. For many nuclear projects, the need for high levels of regulatory assurance can be a strong determinant of future actions. For example, the NRC has made its preferences known for the SSHAC Level required to address the directive included in the 10 CFR 50.54(f) letter (NRC 2012b).

Building on the experience gained from the application of the SSHAC methodology during several actual projects, NUREG-2117 (NRC 2012a) defines a two-step approach to deciding on the SSHAC Level for any given project. The first step involves the generic consideration of the various attributes associated with all four SSHAC Levels. These generic (non-project-specific) attributes for each SSHAC Level include the number of participants, amount of interaction among participants, peer review, ownership of the results, transparency of the process, amount of regulatory assurance provided, cost, duration, and management challenges. The second step entails the consideration of project-specific

factors for any given project, including the safety significance of the facility (e.g., nuclear power plant, high-consequence dam, bridge, conventional building), technical complexity and uncertainties in hazard inputs, regulatory oversight and requirements (e.g., quality assurance requirements, regulations and regulatory guidance in place, monitoring and audit), amount of contention within the technical community, degree of public concern and oversight, and resource limitations (e.g., time and money).

Based on consideration of the generic attributes of the various SSHAC Levels and the project-specific factors and issues, a decision was made by DOE to conduct the Hanford PSHA as a SSHAC Level 3 project. The decision included consideration of a broad range of technical issues, their potential hazard significance, levels of technical contention that existed at the time, levels of uncertainty, the regulatory framework, and resources available. Given the importance of the technical issues, the associated significant uncertainties, and the need for higher levels of regulatory assurance for nuclear facilities, a higher SSHAC Level was deemed to be appropriate. As noted in NUREG-2117 (NRC 2012a), the NRC makes no distinction between SSHAC Levels 3 and 4 from the standpoint of regulatory assurance. Hence, the additional resources required to conduct a Level 4 study and the associated management challenges were not judged to be cost-beneficial relative to any perceptions of additional rigor that might come with a Level 4 study.

Nearly 1 year after DOE's decision to proceed with the Hanford SSHAC Level 3 PSHA, Energy Northwest (EN) made the decision to collaborate and jointly sponsor the project. As stated by the NRC (2012a), all western U.S. nuclear plants are required to conduct PSHAs using a SSHAC Level 3 methodology and to compare the results of those studies to their existing seismic design bases. Because the Hanford PSHA had been planned to be fully compliant with existing NRC guidance, no changes in approach, implementation, or schedule were required.

2.1.2 Goals of the SSHAC Process

The fundamental goal of the SSHAC process, regardless of study level, is to carry out properly and document completely the activities of *evaluation* and *integration*, defined as follows:

- **Evaluation:** The consideration of the data, models, and methods proposed by the larger technical community that are relevant to the hazard analysis.
- **Integration:** Representing the center, body, and range of technically defensible interpretations in light of the evaluation process.

These two activities that define a SSHAC process are conducted in a SSHAC Level 3 process by expert evaluators and integrators that compose a Technical Integration (TI) Team. The TI Team members objectively examine available data and diverse models, challenge their technical bases and underlying assumptions, and, where possible, test the models against observations. All SSHAC studies begin with the identification and compilation of available data, models, and methods. These are then evaluated by the team in an objective manner for their quality and consistency with all available information within the larger technical community.

Informed by their consideration of the data, models, and methods during the evaluation phase, the TI Team members then build models that capture the center, body, and range of technically defensible interpretations. The models are typically logic trees that capture the knowledge and uncertainties in key SSC and GMC conceptual models and parameter values. Significant interaction occurs among the team

members during their model building to ensure that all expressions of knowledge and uncertainty are adequately supported and defended given the available data.

An important aspect of the SSHAC process that provides high levels of regulatory assurance is *peer review*. The SSHAC Guidelines place great emphasis on the importance of peer review and strongly recommend that this be participatory and continuous throughout the project, rather than late-stage involvement only. This means that the Participatory Peer Review Panel (PPRP) is engaged from the beginning of the project and interacts with the TI Team members at regular intervals rather than simply receiving a draft final report to review. The advantage of ongoing participatory review is that any required corrections can be made early in the study before the models are finalized and the hazard calculations executed. The successful execution of the evaluation and integration phases of the project is confirmed by the written conclusion by the PPRP that the TI Teams have provided adequate documentation of the technical bases for its conclusions, and has adhered to the SSHAC assessment process.

2.2 Organizational Structure for the Hanford PSHA

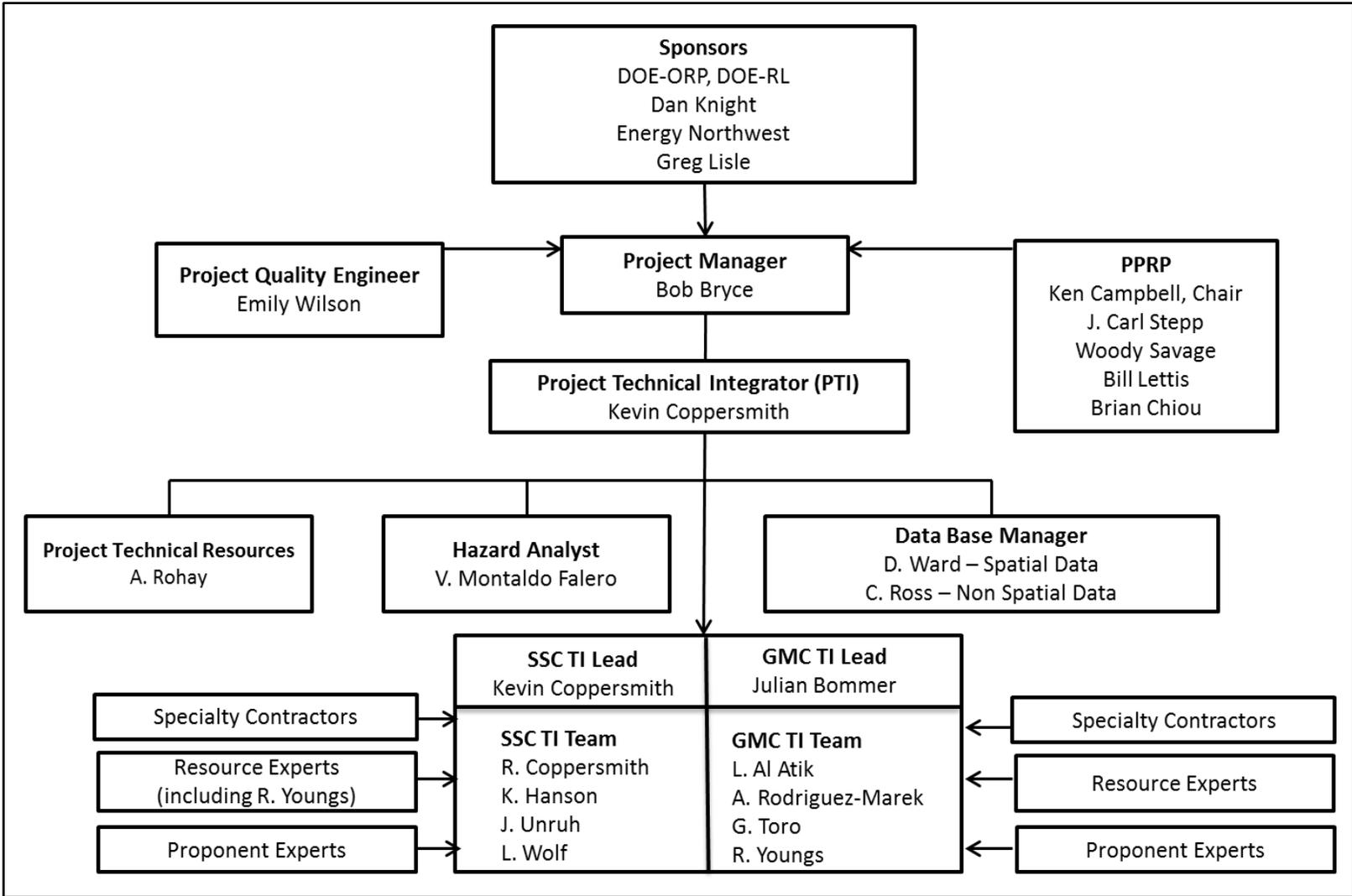
Recommended aspects of the organizational structure and management of a SSHAC Level 3 project are given in Section 5.2 of NUREG-2117 (NRC 2012a). The organizational structure developed and implemented for the Hanford PSHA project is presented in Figure 2.1.

2.2.1 Sponsors and Project Manager

Daniel Knight from the DOE's Office of River Protection (ORP) was the DOE Program Manager for the project; he also was the representative of the project sponsors and oversaw all of the activities of the Hanford PSHA project. Greg Lisle (EN) provided input to the project team through the DOE Program Manager.

The Project Manager (PM), Bob Bryce, played a central role in project implementation; he provided overall coordination and was responsible for all organizational and administrative aspects. A key responsibility of the PM is providing liaison with the sponsors (DOE and EN) to ensure that they are able to exercise oversight of the project; kept informed of progress in terms of scope, budget, and schedule; and have a clear single point of contact through whom to channel communication to project participants. The PM was also the point of contact with the Project Technical Integrator (PTI) and, in turn, the technical participants in the project.

The PM was responsible for ensuring adherence to scope, schedule, and budget, as well as delivery of all products within the framework of the applicable quality assurance requirements. Therefore, the PM had access to project resources including quality assurance, project controls, contracts and procurement, geographic information systems, and the administrative support necessary to document project results (Figure 2.1). Administrative support to the PM also was necessary to support other resources such as the project website and logistical support for project meetings, workshops, and working meetings.



2.5

Figure 2.1. Organizational structure of the Hanford PSHA.

In consultation with the PTI and TI Leads, the PM developed the technical aspects of contracts with all technical personnel and subcontractors, and ensured fulfillment of contractual obligations. The PM was also responsible for resolving contractual issues that arise during the course of the project, including any changes in scope and budget.

The PM was also the official point of contact with the PPRP, receiving panel comments and observations, communicating them to the PTI and TI Leads, and ensuring that the PTI and TI Leads followed through on the resulting actions.

2.2.2 Project Technical Integrator

The PTI role is effectively that of overall technical leader of the project. The PTI has the ultimate responsibility for the delivery and defense of the technical results of the PSHA as embodied in the final project report. The PTI for the Hanford PSHA was Kevin Coppersmith. The PTI closely coordinated with the PM to ensure that the technical and administrative aspects of the project execution were aligned and jointly contributed to the successful completion of the project. As required, the PTI and the GMC TI Lead Julian Bommer assisted the PM in communicating with the sponsor to provide clarification of and responses to all technical questions raised regarding the project. The PTI, who was also the SSC TI Lead, worked with the GMC TI Lead to ensure that all interface issues between the SSC and GMC subprojects were highlighted and addressed early in the project. In turn, they ensured that the output from these activities provided coherent and compatible input to the PSHA calculations, and that the output from the PSHA satisfies all of the requirements of the potential users.

The PTI coordinated with the GMC TI Lead and the Hazard Analyst to ensure that the hazard input documents (HIDs) were produced on time and approved, and provided adequate information for the hazard calculations to be executed. As requested by the PM, the PTI communicated with outside review groups (e.g., the Defense Nuclear Facilities Safety Board and the NRC) regarding any technical issues.

2.2.3 TI Teams and Leads

As shown in Figure 2.1, there were two TI Teams for the Hanford PSHA, one each for SSC and GMC. The TI Leads were also members of the TI Teams and for the Hanford PSHA were Kevin Coppersmith and Julian Bommer, respectively. The TI Teams were responsible for developing the SSC and GMC models, which together define the input to the PSHA calculations. As explained in Section 2.1, this was achieved through a process of evaluation followed by integration. Therefore, members of the TI Teams serve both as expert evaluators and expert integrators.

The TI Team members had possibly the most important role in the SSHAC process for the Hanford PSHA. They were responsible for objectively examining available data and diverse models, challenging their technical bases and underlying assumptions, and, where possible, testing the models against observations. The process of evaluation included identifying the hazard-significant issues and the applicable data to address those issues, compiling the available data into a project database, evaluating the data relative to their quality and relevance for constructing SSC and GMC models, interacting among the experts (challenging other evaluators and proponent experts and interrogating resource experts [defined later]), and considering the strengths and weaknesses of alternative models and proponent viewpoints. Team members are identified in Figure 2.1. Brief experience summaries are presented in Appendix A.

The TI Teams were responsible for identifying a range of data, models, and methods that exist within the technical community, and then evaluating them according to their consistency and viability in characterizing the SSC and GMC components of the PSHA. As evaluators, they identified applicable data sets and resource experts with knowledge of those data sets to discuss them during the first workshop (WS1), which focused on identifying significant issues and available data. Alternative models and methods were presented by proponent experts at the second workshop (WS2), which focused on database review and discussion of alternative models, and the evaluators were responsible for probing the alternative interpretations to examine their consistency with the available data and their uncertainties. This evaluation process began at the workshops and continued as the TI Teams conducted working meetings to evaluate data, models, and methods.

TI Team members also assumed the roles of technical integrators during the integration phase of the project during which they developed SSC and GMC models that reflect their assessments of the center, body, and range of technically defensible interpretations. In light of their evaluations of the data, models, and methods in the larger technical community, they built models that captured their assessments of current knowledge and uncertainties. Much of the interaction with other members of the TI Teams during the project occurred during working meetings at which the team members considered available information, discussed model components, and assessed the weights of logic-tree branches. Once the preliminary SSC and GMC models had been developed, hazard calculations were conducted along with sensitivity analyses to understand the relative contributions that various model components make to the hazard. The bases for the assessments made in the preliminary models as well as the sensitivity analyses were discussed as feedback during the third workshop (WS3).

Following the feedback received at WS3 from hazard sensitivity analyses and comments made by the PPRP, the TI Teams finalized the SSC and GMC models. The final models reflect each team's assessment of the center, body, and range of the technically defensible interpretations for the Hanford PSHA. Importantly, the record of the teams' assessments and technical bases was documented in the final PSHA report.

The TI Leads serve as technical leaders of their respective teams and were responsible for a number of duties. These included selecting the experts that composed their TI Teams (according to the selection criteria given in NUREG-2117 [NRC 2012a]), working with their teams to identify suitable resource experts and proponent experts, and providing them with clear instructions regarding the issues to be addressed by their presentations. TI Leads ran workshop sessions and ensured that all participants clearly understood the workshop objectives, their individual roles, the required output from the workshops, and the implications of the issues under discussion for the seismic hazard analysis. The TI Leads also convened and organized working meetings of the TI Teams and ensured that all members had full access to all of the available data and information. The TI Leads also assumed the key responsibility of ensuring that the project documentation was complete and comprehensive.

2.2.4 Participatory Peer Review Panel

The PPRP is a key and indispensable element of a SSHAC Level 3 study and the panel is charged with conducting both a technical and a process review. In the technical review, the PPRP ensures that a full range of data, models, and methods has been duly considered in the evaluation phase and that the center, body, and range of the technically defensible interpretations have been captured in the integration phase of the project. Importantly, the PPRP also ensures that all technical decisions are adequately

justified and documented. As part of the process review, the panel ensures that the process followed by the project conforms to the requirements of SSHAC Level 3.

The PPRP was selected based on the selection criteria identified in NUREG-2117 (NRC 2012a). Throughout the Hanford PSHA, the PPRP members provided clear and timely feedback to the PTI and TI Leads, through the PM, to provide their reviews of key activities and milestones. The PPRP was present at all three workshops and submitted a consensus report containing comments and suggestions to improve the project. Consistent with current regulatory guidance, the PPRP members attended WS1 and WS2 as observers; they participated more actively in WS3 by asking the TI Teams questions about their preliminary SSC and GMC models. In addition, a representative from the PPRP attended each of the four working meetings held by each of the TI Teams.

The specific duties of the PPRP were as follows:

- Review workshop agendas and lists of invited resource experts and proponent experts.
- Attend all three workshops and submit written reports in a timely fashion.
- Review the preliminary SSC and GMC models and participate actively in WS3 to provide feedback to the TI Teams.
- Review the Draft Project Report and submit written review comments for consideration in the finalization of the report.
- Upon review and acceptance of the Final Report, issue a PPRP Closure Letter.

As required in SSHAC regulatory guidance, the PPRP is a fundamental means of ensuring the quality of the project activities and the associated documentation. The members of the PPRP for the Hanford PSHA fully executed their recommended roles and provided timely and expert advice throughout the course of the project.

2.2.5 Project Technical Resources

The work of compiling the databases was led by the two TI Leads and considerable effort and support was provided by the members of the SSC and GMC teams. The work of identifying data developed at the Hanford Site and in the region, including geologic and geotechnical data, seismicity data, and strong-motion records, was aided by PNNL staff (labelled “Project Technical Resources” in Figure 2.1). George Last, Bruce Bjornstad, and Paul Thorne provided access to the extensive data sets gathered over the years for particular facility sites as well as regional studies conducted for a variety of site characterization purposes (Bjornstad et al. 2012; Last 2014; Last et al. 2012; Thorne et al. 2014). Alan Rohay provided access to historical and instrumental seismic monitoring data and insight into the history of seismicity and geophysical studies at the Hanford Site, the basis for historic monitoring decisions and past seismic hazard studies. The work was carried out by PNNL staff who compiled, or processed, specific data sets, documenting the source of their information, the methods used, and any limitations and caveats that apply to the data. PNNL staff familiar with geographical information systems (GISs) and other database tools assisted in the development of the project database that was made readily available to the TI Teams for their use.

As needed, specialty contractors were identified and contracted to provide particular available data or to gather new data that could assist the TI Teams in their assessments. The responsibilities of the specialty contractors and PNNL staff members engaged in data collection, compilation, and processing tasks were to ensure that all accessible sources of information were exhausted, that the work was comprehensively documented, and that data were delivered on time to allow the TI Teams to make full use of the data, with knowledge of its origins and limitations. In many cases, the project technical resources and specialty contractors were required to present summaries of their tasks and data at a workshop, and respond to questions from members of the TI Teams.

2.2.6 Database Management

For the Hanford PSHA, the role of the Database Manager(s) was to establish and manage the necessary systems to ensure that all of the data collected by the TI Team members, by PNNL staff, and by specialty contractors were accessible to authorized project participants through a password-protected web-based portal. Two individuals performed this function: a Database Manager for spatial data and a Database Manager for non-spatial data. Spatially referenced data were converted to a GIS format for ease of visualization and to facilitate overlaying of different data sets to explore interactions and spatial correlations. The GIS model development and maintenance was carried out at PNNL. In addition, the GIS Database Manager and support staff provided GIS and spatial database support during formal PSHA workshops and SSC TI working meetings.

Non-spatial data include a variety of data types and the non-spatial Database Manager provided access to these data through the Hanford PSHA SharePoint® site. Access accounts and permissions for the SharePoint site were maintained by the non-spatial Database Manager. The non-spatial Database Manager was also responsible for working with the SharePoint developers and PNNL Collaborations Team to ensure SharePoint tools and features were maintained and/or created as needed to support the TI Teams. The non-spatial Database Manager was also responsible for leading the SharePoint Support Team, which was available to help trouble-shoot problems or provide assistance to any users of the SharePoint site.

The Database Manager was charged only with gathering, storing, and making available the data identified as needed for the project by the TI Teams. The Database Manager worked closely with the data sources and TI Team members to capture and record relevant information about the origin and quality of the data.

2.2.7 Resource Experts and Proponent Experts

Resource experts have specific knowledge of particular data and provided those data to the TI Teams either through presentations at WS1 and WS2 or outside of the workshop process. Resource experts were asked to provide their data in an impartial manner to the TI Teams and to not provide any interpretations or models that might result from the evaluation of the data. The resource experts who participated in the Hanford PSHA in WS1, WS2, or otherwise are listed in Table 2.1 and Table 2.2. Presentation materials used by these experts are included in workshop reports prepared for each workshop (PNNL 2013a, 2013b).

Table 2.1. Resource experts who participated in Workshop 1 or outside of the workshops.

Individual	Affiliation
Workshop 1 Resource Experts – GMC	
Walt Silva	Pacific Engineering & Analysis
Carl Costantino	Consultant
Norm Abrahamson	University of California, Berkeley
Tuna Onur	Onur Seemann Consulting
Rob Graves	U.S. Geological Survey
Art Frankel	U.S. Geological Survey
Tom Hearn	New Mexico State University
Workshop 1 Resource Experts – SSC	
Alan Rohay	Pacific Northwest National Laboratory
Tom Pratt	U.S. Geological Survey
Brian Sherrod	U.S. Geological Survey
Rick Blakely	U.S. Geological Survey
George Last	Pacific Northwest National Laboratory
Harvey Kelsey	Humboldt State University
Rex Flake	Central Washington University
Erick Burns	U.S. Geological Survey
Other Resource Experts	
Paul Thorne	Pacific Northwest National Laboratory
Bruce Bjornstad	Pacific Northwest National Laboratory

Table 2.2. Resource experts and proponent experts who participated in Workshop 2.

Individual	Affiliation
Workshop 2 Resource Experts [REs]/Proponent Experts [PEs] GMC	
Walt Silva [RE], [PE]	Pacific Engineering & Analysis
Carl Costantino [RE]	Consultant
Norm Abrahamson [PE]	University of California–Berkeley
Art Frankel [PE]	U.S. Geological Survey
Alan Rohay [RE]	Pacific Northwest National Laboratory
Suzette Payne [RE]	Idaho National Laboratory
Yousef Bozorgnia [RE], [PE]	University of California–Berkeley
Paul Spudich [RE]	U.S. Geological Survey
Jennifer Donahue [RE]	Geosyntec Consultants
Dave Boore [RE]	U.S. Geological Survey
Olga Ktenidou [PE]	ISTerre, Université Joseph Fourier – CNRS
Gail Atkinson [PE]	University of Western Ontario
Nick Gregor [PE]	Consultant
John Zhao [PE]	Institute of Geological and Nuclear Sciences, New Zealand
Workshop 2 Resource/Proponent Experts – SSC	
Al Rohay [RE]	Pacific Northwest National Laboratory
Tom Pratt [PE]	U.S. Geological Survey
Brian Sherrod [PE]	U.S. Geological Survey
Rick Blakely [PE]	U.S. Geological Survey

Table 2.2. (contd)

Individual	Affiliation
Workshop 2 Resource/Proponent Experts – SSC	
Marcia McLaren [RE]	Pacific Gas and Electric Co.
Steve Reidel [PE]	Washington State University
Judy Zachariassen [RE]	URS Corporation,
Tyler Ladinsky [PE]	Humboldt State University
Craig Weaver [RE]	U.S. Geological Survey

Proponent experts are known advocates of particular models and methods and they were asked to present their proponent viewpoints at WS2; other proponent experts provided their views outside of the workshop process. In some cases, the proponent viewpoints were provided to the TI Teams through publications or other written pre-publication materials. The proponent experts who participated in WS2 and outside of the workshop process are listed in Table 2.2.

2.2.8 Hazard Analyst

The Hazard Analyst is responsible for executing all PSHA calculations and disaggregations both for sensitivity studies and for final results. For the Hanford PSHA, the Hazard Analyst, Valentina Montaldo-Falero, performed three main sets of PSHA calculations, namely:

- sensitivity studies to identify hazard-significant features for WS1
- preliminary hazard calculations using preliminary SSC and GMC models developed after WS2, including disaggregations and sensitivity runs to be presented at WS3
- final hazard calculations, including construction of uniform hazard spectra and disaggregations, after WS3 for inclusion in the final project report.

The second and third sets of hazard calculations were executed in accordance with the HIDs prepared by the TI Leads. In order for the Hazard Analyst to understand the technical components of the SSC and GMC models, she attended all three workshops (as well as some sessions of the working meetings) and interacted frequently with the TI Leads. During the Hanford PSHA, the Hazard Analyst worked closely with the TI Leads to capture and display hazard results and sensitivity analyses to provide the maximum amount of information of use to the TI Teams.

2.3 Quality Assurance

The Hanford PSHA was performed to provide information that can be used to establish the seismic design of new facilities and perform safety reviews of existing facilities. To ensure that the results are appropriate for these uses and that processes are in place to eliminate errors, the Hanford PSHA was performed in accordance with a Work Plan, Quality Assurance (QA) Plan, and QA procedure developed to meet the requirements for the project identified by DOE and EN. These documents were developed to meet the requirements of ANSI/ANS Standard 2.29-2008 *Probabilistic Seismic Hazard Analysis*. That Standard was developed to be consistent with ANSI/ASME NQA-1-2008 *Quality Assurance Requirements for Nuclear Facility Applications*, the NRC's NUREG/CR-6372, *Recommendations for Probabilistic Seismic Hazard Analysis: Guidance on Uncertainty and Use of Experts* (also known as the

SSHAC study [Budnitz et al. 1997]), as well as the detailed implementation guidance provided in NUREG-2117, *Practical Implementation Guidelines for SSHAC Level 3 and 4 Hazard Studies* (NRC 2012a). The final hazard calculations were conducted following procedures for qualifying computer codes developed in accordance with DOE Order 414.1D (DOE 2011).

A key element of the ANSI/ANS Standard 2.29-2008 PSHA process is “participatory peer review.” The PPRP conducted a review that included both the implementation of the PSHA process and the technical approach and the data used for the PSHA. The panel’s acceptance of the process followed and the result of the analysis is indicated in the Closure Letter included in Appendix B.

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