NEI 07-12 [REV 1]

FIRE PROBABILISTIC RISK ASSESSMENT (FPRA) PEER REVIEW PROCESS GUIDELINES

June 2010

NEI 07-12 [Rev 1]

Nuclear Energy Institute

Fire Probabilistic Risk Assessment (FPRA) Peer Review Process Guidelines

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ACKNOWLEDGEMENTS

This report is a summary of work made possible by the cooperative efforts of a diverse group of participants. The Fire Probabilistic Risk Assessment (FPRA) Peer Review Process was developed, based on the Internal Event Peer Review process in Nuclear Energy Institute (NEI) 05-04, developed by the Boiling Water Reactor Owners Group (BWROG), Pressurized Water Reactor Owners Group (PWROG) and industry participants. The revised/adapted FPRA Peer Review process in this document was developed by Dennis Henneke (GE Hitachi) and Stanley Levinson (AREVA NP), with support from the BWROG and PWROG. The authors appreciate the review efforts of NEI's FPRA Task Force (FPRATF) and the Nuclear Regulatory Commission (NRC). In particular, the authors acknowledge the support of David Finnicum (Westinghouse) and Victoria Anderson (NEI).

The draft FPRA Peer Review process was used during the pilot peer review at Diablo Canyon Nuclear Plant. The Peer Review Team was led by David Finnicum, and included Dennis Henneke, Stuart Lewis (Polestar, now at EPRI), Sum Leung (First Energy), Robert Ladd (Nuclear Management Company, now EPM), and James Masterlark (Nuclear Management Company, now at EPM). The process observer for the pilot review was Stanley Levinson. Additionally, the peer review was observed by the NRC and selected industry participants. The Diablo PRA team supporting the pilot peer review provided valuable support during the review, and was lead by Amir Afzali. The team for the pilot peer review provided valuable feedback that resulted in improvements to both the peer review guidance and the FPRA Standard requirements being reviewed.

NOTICE

EXECUTIVE SUMMARY

This document provides guidance material for use in conducting and documenting a Fire Probabilistic Risk Assessment (FPRA) Peer Review. The Peer Review process provides the method for reviewing a FPRA against Part 4 of the ASME/ANS PRA Standard, ASME/ANS RA-Sa-2009 [5].

The Peer Review Process and guidance material was developed using the guidance in NEI 00-02 [1], Industry PRA Peer Review process Guidelines, Revision A3, and NEI 05-04 [2], Rev. 2, Process for Performing Follow-on PRA Peer Reviews using the ASME PRA Standard.

The FPRA Peer Review is a written process that is necessary to satisfy the peer review requirements of the AMSE/ANS PRA Standard. With a process available and implementation by the FPRA owners, it is expected that the result will be to streamline regulatory review of risk-informed applications. Thus, an attempt has been made, in this program, to maintain consistency with the original Peer Review to the extent feasible, while incorporating FPRA specific issues.

After some exercising of this process by the industry, lessons learned were incorporated to produce Revision 1 of this guidance document.

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ACRONYMS

ANS	American Nuclear Society
AS	Accident Sequence Analysis (Part 2 Technical Element)
ASME	American Society of Mechanical Engineers
B&WOG	Babcock & Wilcox Owners Group
BWR	Boiling Water Reactor
BWROG	BWR Owners Group
CEOG	Combustion Engineering Owners Group
CF	Circuit Failure Analysis (Part 4 Technical Element)
CNRM	Committee on Nuclear Risk Management
CS	Cable Selection and Location (Part 4 Technical Element)
DA	Data Analysis (Part 2 Technical Element)
DE	Dependency Analysis
EPRI	Electric Power Research Institute
ES	Equipment Selection (Part 4 Technical Element)
FHA	Fire Hazards Analysis (or Assessment)
F&O	Fact & Observation (form)
FPRA	Fire Probabilistic Risk Assessment
FQ	Fire Risk Quantification (Part 4 Technical Element)
FSS	Fire Scenario Selection and Analysis (Part 4 Technical Element)
GL	Generic Letter
HLR	High Level Requirement
HR	Human Reliability (Part 2 Technical Element)
HRA	Human Reliability Analysis or Postfire HRA (Part 4 Technical Element)
IE	Initiating Event (Part 2 Technical Element)
IGN	Ignition Frequency (Part 4 Technical Element)
LE	LERF Analysis (Part 2 Technical Element)

LOCA	Loss of Coolant Accident
MU	Maintenance and Update
N/A	Not Applicable
NEI	Nuclear Energy Institute
NRC	Nuclear Regulatory Commission
PP	Plant Partitioning (Part 4 Technical Element)
PRA	Probabilistic Risk Assessment
PRM	Plant Response Model (Part 4 Technical Element)
PSA	Probabilistic Safety Analysis
PWR	Pressurized Water Reactor
PWROG	PWR Owners Group
QA	Quality Assurance
QLS	Qualitative Screening (Part 4 Technical Element)
QNS	Quantitative Screening (Part 4 Technical Element)
QU	Quantification and Results Interpretation (Part 2 Technical Element)
R&R	Risk & Reliability (Workstation)
RISC	Risk-Informed Standard Committee
SC	Success Criteria (Part 2 Technical Element)
SF	Seismic Fire Interactions (Part 4 Technical Element)
SR	Supporting Requirement
SY	Systems Analysis (Part 2 Technical Element)
SSC	System, Structure, and Component
T-H	Thermal-Hydraulic
UNC	Uncertainty Analysis (Part 4 Technical Element)
WOG	Westinghouse Owners Group

FIRE PRA PEER REVIEW PROCESS GUIDELINES

1 INTRODUCTION

1.1 OVERVIEW AND PURPOSE

The objectives of the Fire Probabilistic Risk Assessment (FPRA)[1] Peer Review process are to:

- Provide a consistent and uniform method for establishing the technical adequacy of a FPRA for a spectrum of potential risk-informed plant licensing applications for which the FPRA may be used.
- Provide a means for identifying, over time, areas of consistency or inconsistency in the treatment of issues important to understanding plant fire risk and implementing risk-informed applications.

The FPRA Peer Review employs a team of PRA, FPRA and Fire Protection engineers, each with considerable expertise in PRA and FPRA development, fire modeling, circuit analysis, and risk-informed applications (that may require an understanding of fire risk). The Peer Review Team is guided by the high level requirements (HLRs) and supporting requirements (SRs) in Part 4 of the ASME/ANS PRA Standard [5]. A Peer Review against the peer review process provides both an objective review of the FPRA technical elements (against the ASME/ANS PRA Standard), and an assessment, based on the Peer Review Team members' FPRA experience, of the technical adequacy of the FPRA elements to support risk-informed applications. The team uses a set of Capability Category Summary Sheets as a framework within which to evaluate the scope, comprehensiveness, completeness, and fidelity of the FPRA being reviewed.

One of the key aspects of the review is an assessment of the Maintenance and Update process used to ensure that the FPRA continues to reflect the configuration of the plant over time, so that the results and conclusions of FPRA applications also continue to be consistent with the as-built, as-operated plant. This is a necessary aspect of a FPRA so that it can be used to support risk-informed applications. Another key aspect of the FPRA Peer Review is the completion of a previous Internal Events PRA Peer Review and the review of the fact and observation sheets (F&Os) and the results of any self-assessment that has been performed for relevance to the FPRA. This ensures consistency with the Internal Events PRA Peer Review, and the ability to rely on the Internal Events PRA Peer Review for aspects of the FPRA that are similar to the Internal Events PRA model (i.e., system modeling, data, etc.).

[1] Note that, while the term PRA is used throughout this document, no distinction is made between PRA and PSA (probabilistic safety analysis). These terms are used interchangeably.

A desired outcome of using the FPRA Peer Review process is to show conformance with Part 4 of the ASME/ANS PRA Standard to the extent that certain risk-informed applications can be supported. A byproduct of using the ASME/ANS PRA Standard (and this FPRA Peer Review process) is that the regulatory review process for risk-informed applications may be expedited. Thus, an attempt has been made, in this process, to maintain consistency with the original Internal Events PRA Peer Review [Reference 1] and the Follow-on Peer Review [Reference 2] to the extent feasible[2]. Consistency with the Internal Events PRA Peer Review is to ensure that conclusions reached for that process can continue to be used for the FPRA. Consistent with this industry objective, substantial portions of the Internals Event PRA Peer Review and follow-on Peer Review and documentation have been incorporated directly into this FPRA Peer Review document. An additional desired outcome of the Peer Review is to provide a forum for the exchange of ideas and techniques for effective use of FPRAs among participating utilities. This is accomplished by the participation of knowledgeable utility personnel on the FPRA Peer Review Teams.

The FPRA Peer Review process discussed below also includes a follow-on Peer Review. In general, a Follow-on Peer Review implies that an initial FPRA Peer Review has already been conducted, and at least the F&Os classified as "Findings" from that review have been addressed. A Follow-on Peer Review would be needed as a result of a FPRA upgrade, performed either in response to a peer review or as a result of the normal evolution of the FPRA model. A change that constitutes a PRA upgrade is defined in Part 1 of the ASME/ANS PRA Standard. In some cases, a Follow-on Peer Review may be requested for the entire FPRA model because of changes made to the methodology throughout the PRA model. Thus, a Follow-on Peer Review's scope can be as narrow as a single FPRA technical element, or as expansive as a peer review of the entire FPRA.

The FPRA Peer Review requires the successful completion of an Internal Events PRA[3] peer review (using NEI 00-02 and/or NEI 05-04). The Internal Events PRA peer review encompasses both the models and methods used to develop the Internal Events PRA, on which heavy reliance is placed during the FPRA development. As such, these models and methods should not need to be reviewed again during the FPRA Peer Review. Exceptions to this conclusion include:

- F&Os that were not addressed prior to the FPRA Peer Review
- Recent updates affecting the FPRA
- Unique system models, event trees, and other PRA model inputs developed as a part of the FPRA

The review of Internal Events PRA model issues is addressed in the self-assessment discussion in Section 1.4 below. A Follow-on Peer Review of the Internal Events PRA is not required prior to performing a Follow-on Peer Review of the FPRA, unless the model upgrade or changes affect both

[2] The original peer reviews were either based on NEI 00-02 or directly against the ASME PRA Standard. When done against NEI 00-02, a self-assessment is necessary to bridge the "gap" between NEI 00-02 and the ASME PRA Standard.

[3] Internal Fire has historically been considered an external event, but is defined in RG 1.200 as an internal event. References to an Internal Events PRA are meant to refer to the PRA for internal events other than fire.

the Internal Events PRA and the FPRA. If the most recent Internal Events PRA Peer Review was performed against an older version of the ASME/ANS PRA Standard and RG 1.200 (prior to Addendum B or Revision 0 of the Standard), a gap assessment is needed to assess whether the Internal Events PRA meets the latest NRC-endorsed ASME/ANS PRA Standard, per the guidance in NEI 05-04.

1.2 SCOPE

The FPRA Peer Review is a one-time[4] evaluation that examines both the current FPRA, and the FPRA Maintenance and Update process. Using the FPRA Peer Review process, reviewers assign Capability Categories to the various technical elements of the FPRA. By including an examination of the Maintenance and Update process, the FPRA addresses the mechanism by which the FPRA will continue to adequately reflect the as-built, as-operated plant to support risk-informed applications. The Capability Categories denote the relative capability of the technical elements for use in FPRA applications.

Among the most important elements to ensure a usable and successful FPRA for applications are:

- FPRA/PRA organization.
- Management attention.
- Communication between the PRA group and other parts of the organization, such as the Fire Protection Staff.
- FPRA technical adequacy.
- Living FPRA process, including maintenance and updates.

The first three elements are plant-specific management issues that should be addressed by each utility to ensure successful use of the FPRA in applications. The last two items are FPRA-specific items, which are the focus of the Peer Review.

The general scope of this implementation of the FPRA Peer Review includes review of 12 main technical elements, using tables (to cover the HLRs and SRs) shown in Appendix B, and the Maintenance and Update process for FPRA.

An issue unique to FPRA Peer Reviews is the effect of specific applications that may result in a plant requesting a review of a plant that reflects the "as-built, as-operated in 20XX" (projected) plant as opposed to the "as-built, as-operated" (current) plant. Either configuration should be allowed for peer review, but the basis needs to be clearly stated in the peer review report and delineated for the Peer Review Team in advance of the review.

[4] Note that “one-time” in this context means once for the existing FPRA scope and approach. It is not expected that any additional full peer review would be required unless substantial changes are made to the model. Similarly, substantial modifications to the methodology used in the existing FPRA or PRA, such as changing from a large event tree (support system modeling) approach to a large fault tree (fault tree linking) approach might warrant additional peer review, even if the current PRA scope were unchanged.

1.3 BACKGROUND

In 1997, the Boiling Water Reactor Owners Group (BWROG) developed a process for performing a peer review of a plant's Level 1 at-power PRA models that would assess the capability of the PRA for various risk-informed applications and also assess whether a process was in place to provide a means for the long-term maintenance of that level of capability. The key features of the BWROG process were a highly structured schedule for a focused review of the PRA and a set of 11 tables to be used to document the review of ten technical elements of an Internal Events PRA, plus the program in place for maintenance of the PRA models, and a four-level grading scheme for the 11 technical areas.

The Combustion Engineering Owners Group (CEOG) adopted the BWROG peer review process with some slight modifications. In parallel, the Nuclear Energy Institute (NEI), working with the Westinghouse Owners Group (WOG), the Babcock & Wilcox Owners Group (B&WOG) and the CEOG, adopted the BWROG peer review process and revised the checklists to incorporate pressurized water reactor (PWR) specific items, as needed. NEI issued NEI 00-02 as the industry standard for performing PRA peer reviews. The industry peer review presented in NEI 00-02 was intended to cover a single peer review of a utility's PRA with on-going maintenance of the capability of the PRA covered by reviewing the utility's PRA Maintenance and Update process to ensure that it was sufficient to maintain the PRA at the appropriate capability level.

In April 2002, the American Society of Mechanical Engineers (ASME) issued ASME RA-S-2002, the ASME PRA Standard; this was updated with Addendum A in December 2003 (Reference 3) and Addendum B in December 2005 (Reference 4). Section 1-5.4 of the ASME PRA Standard requires a peer review for PRA upgrades. (Note: The ASME PRA Standard defines PRA upgrade as "the incorporation into a PRA model of a new methodology or significant changes in scope or capability. This could include items such as new human reliability analysis methodology, new data update methods, new approach to quantification or truncation, or new treatment of common cause failure.") NEI 05-04, "Process for Performing Follow-on Peer Reviews using the ASME PRA Standard" was developed because the overall scope and set of detailed requirements in the ASME PRA Standard are somewhat different than that of NEI 00-02. Thus, peer reviews conducted in accordance with NEI 00-02 did not cover the full scope of the ASME PRA Standard. In Appendix B of Regulatory Guide 1.200 (RG 1.200) (Reference 5), the Nuclear Regulatory Commission (NRC) recognized the validity of the peer reviews conducted in accordance with NEI 00-02 as partially covering the scope of the ASME PRA Standard and they endorsed the concept of performing a self-assessment to show compliance with ASME PRA Standard requirements, including those not covered by the NEI 00-02 peer reviews. Appendix B of RG 1.200 explicitly identifies which ASME PRA Standard requirements are either not covered by the NEI peer review checklists or are only partially covered and thus specifies the scope of an incremental self-assessment (i.e., gap analysis) to bring the NEI review to adequate equivalence with the ASME PRA Standard, given that an NEI peer review has been previously performed.

In November 2007, the American Nuclear Society (ANS) issued the FPRA Standard [10] that is the basis for the peer review scope and methods. This standard was incorporated into the ASME PRA Standard, and the ASME/ANS PRA Standard was issued as ASME/ANS RA-S-2008. Addendum A of the PRA Standard [5] was issued in March 2009, with the FPRA requirements included in Part 4. The ASME/ANS PRA Standard was endorsed, with comment, by RG 1.200, Revision 2 [6]. Part 4 of the Standard references the Internal Events portion (Part 2) in three ways. First, a review of the internal events against the ASME/ANS PRA Standard is required as a starting point for Part 4 of the ANS/ASME PRA Standard. The performance of a peer review of the Internal Events PRA and a review of open Internal Events PRA F&Os is therefore the starting point for the FPRA Peer Review (see Part 4 SR PRM-B2). Second, some of the SRs for developing system models and supporting analysis (data, HRA, etc.) refer to the HLRs and SRs in the Internal Events Part of the Standard. These two attributes need to be considered during the peer review for a FPRA as discussed in Section 3.3.1 and Appendix D below. Finally, the FPRA Part of the Standard adopts many of the Internal Events Part requirements, such as the section for upgrades, and others.

Although Part 4 of the ASME/ANS PRA Standard requires the completion of internal events review, many of the issues can have no effect on the FPRA or can have a smaller effect due to minor impact on the FPRA results. For example, thermal-hydraulic (T-H) analysis for medium or large loss of coolant accident (LOCA) may have no effect on the FPRA (no fire-induced medium or large LOCA is postulated). However, the T-H analysis for a small LOCA can be shown to have a major impact on the Internal Events PRA, but a minor impact on the FPRA, if the fire-induced small LOCA sequences are relatively unimportant for the FPRA.

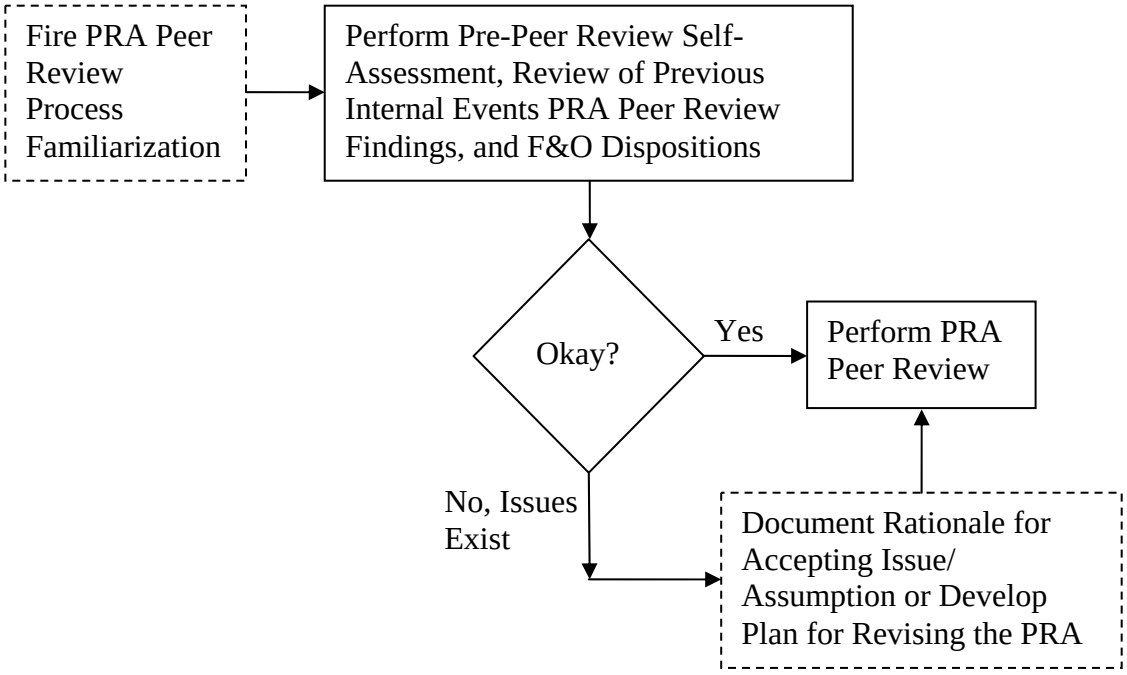
Revision 0 of this document was issued in December 2007; this revision incorporates lessons learned following the conduct of several FPRA Peer Reviews after issuance of Revision 0.

1.4 PROCESS OVERVIEW

The overall process includes two main steps, as illustrated in Figure 1-1. These are:

1. An FPRA self-assessment, review of previous Internal Events PRA Peer Review findings/observations, or other preparatory activity, conducted by the host utility prior to the peer review
2. The FPRA Peer Review itself

Figure 1-1
FPRA Peer Review Process



FPRA Peer Review Preparatory Review and Self-Assessment

Prior to the performance of the Peer Review Team preparatory review, the host utility should perform a self-assessment against the guidance in this document and the FPRA Part of the Standard (see Section A.3.2). This self-assessment will help identify any known issues with the existing FPRA, and allow the utility a chance to either correct any issues or to disposition any self-assessment F&Os. The self-assessment should also identify all FPRA documentation to support specific SRs.

The self-assessment is key to ensuring the overall peer review process is completed within the scheduled time and that all of the required review is completed. Due to the large number of SRs being reviewed, and the complexity of the FPRA, it can be challenging to complete the peer review with one week on-site by six to seven peer reviewers. If the peer review does not have a good road map of the FPRA documentation, or encounters considerable problems during the review, the peer review team will have difficulty completing the review.

An objective of the recommended preparatory self-assessment is for the host utility to identify areas where the baseline FPRA should be improved before being used for particular risk-informed applications. This self-assessment is largely based on the peer review guidance and, although not an independent review, provides a basis and opportunity for a critical re-evaluation of how well the FPRA has been constructed and maintained.

Additional objectives of the preparatory review and self-assessment are:

- To have an opportunity to identify and address, prior to the arrival of the Peer Review Team, using guidance similar to that used by the peer reviewers, areas where the FPRA may require:
    - Additional or alternative documentation.
    - Additional technical analysis.
    - Process improvements.
- To review documentation, and ensure that as complete a set of documentation as feasible is available for the reviewers, including a description (roadmap) of where the FPRA SRs for each technical element are documented, to streamline the peer review, and allow for a more effective review.
- To review the Internal Events PRA Peer Review results including open and closed/dispositioned PRA F&Os, and document the effect of these on the FPRA.

Additional guidance and recommendations on the performance of the self-assessment is provided in Appendix A.

As part of the self-assessment, utilities should complete a limited self-assessment of the referenced Internal Events SRs listed in Table D-1. For SRs where the methodology uses the same or similar process as used in the Internal Events PRA, the self-assessment should reference the previously completed Internal Events PRA Peer Review. Specific areas for which the Internal Events PRA cannot be relied upon (e.g., results review, uncertainty analysis) would need to be specifically evaluated in the self-assessment. The portion of the self-assessment involving Table D-1 should focus on changes made for FPRA development and any departures from the process used for Internal Events PRA development. For example, because initiating events are grouped, there may be an initiator that was included in the Internal Events PRA model (and thus peer reviewed) but not explicitly treated or modeled in detail. If this initiator then becomes a separate event tree as part of a FPRA, then a self-assessment should be warranted. While this may not qualify as a PRA upgrade because the method was not changed, the fact that this is now a separate event tree in the FPRA is likely a significant model change that should be reviewed. Another example occurs in the human reliability element where Level 1 internal events human failure events (HFE) may be used in the FPRA. Any new HFEs (pre-initiator or post-initiator) that were added to the FPRA model need to be included in the self-assessment. The degree of review is dependent on whether the HRA approach for the FPRA HFEs is the same as was used for the Internal Events PRA. If not, the HFEs should be subject to a high degree of scrutiny to ensure that the relevant HRA SRs are met.

Sufficient time should be allocated between the self-assessment/preparatory activity and the FPRA Peer Review to either address such areas, or to formulate plans for how they may be addressed, prior to the peer review.

FPRA Peer Review Process

The FPRA Peer Review includes the following steps, which are discussed in the sections below:

1. Collect plant and FPRA information for pre-visit review (see Sections 2.3 and A.3)
2. Identify and assemble the Peer Review Team (see Section 2.2)
3. Pre-visit review of selected material and host utility self-assessment
4. Pre-visit telecoms, as necessary
5. Identification of specific information required during on-site visit
6. Pre-visit visit (by Team Lead), as necessary
7. On-site visit, including:
    a) interaction with the host utility FPRA group to obtain an overview of the FPRA (see Section A.8)
    b) examination of each FPRA technical element using questions and review summary sheets (see Section 3.2)

c) verification of spatial dependencies by walkdown[5]
d) examination of results of a FPRA sensitivity run(s) performed during the peer review (see Section A.6)
e) examination of the FPRA Maintenance and Update process

8. Develop preliminary findings and results
9. Closeout meeting
10. Follow-up team telecoms
11. Follow-up host utility telecoms, as necessary
12. Development of draft report
13. Review of draft report by host utility
14. Provide the Final Report of the FPRA Peer Review

A flowchart of the FPRA Peer Review process is shown in Figure 1-2. This figure describes the general approach and process steps used in the application of the FPRA Peer Review process to an individual FPRA. The reviewers begin prior to their arrival on-site, by reviewing material provided in advance by the host utility. This review includes:

- Internal Events PRA peer review (including gap assessment) and F&Os (including the open and closed/dispositioned F&Os)
- Plant self-assessment performed prior to the peer review, including the review of both open and closed/corrected issues
- Documentation provided to the Peer Review Team in support of meeting the FPRA SRs

By beginning its initial review of the FPRA prior to arrival and devoting time equivalent to one work week on preparations, the members of the Peer Review Team can focus on walkdowns and details of the FPRA during the on-site visit. Note that during the site visit, most or all of the Peer Review Team will likely be involved in one or more walkdowns, and this should be accounted for in the schedule.

The on-site FPRA Peer Review is a one-week, tiered review in which the reviewers begin with relatively high-level element review summary sheets and criteria, and progress successively to additional levels of detail, as necessary to ensure the robustness of the model. This is an intensive week, following a relatively rigid schedule (see Attachment 3 of Exhibit A-1) so that all of the required elements are adequately covered. This schedule should consider the issues identified in the pre-review.

The FPRA technical elements, the Capability Categories (CCs) of the process, and insights from FPRA experts were used to establish HLRs and SRs. The HLRs and SRs, as listed in the FPRA

[5] Unlike the Internal Events PRA walkdown, the FPRA walkdowns may involve most of the Peer Review Team in order to review plant partitioning, ignition frequencies, scenario development, fire modeling and seismic fire requirements.

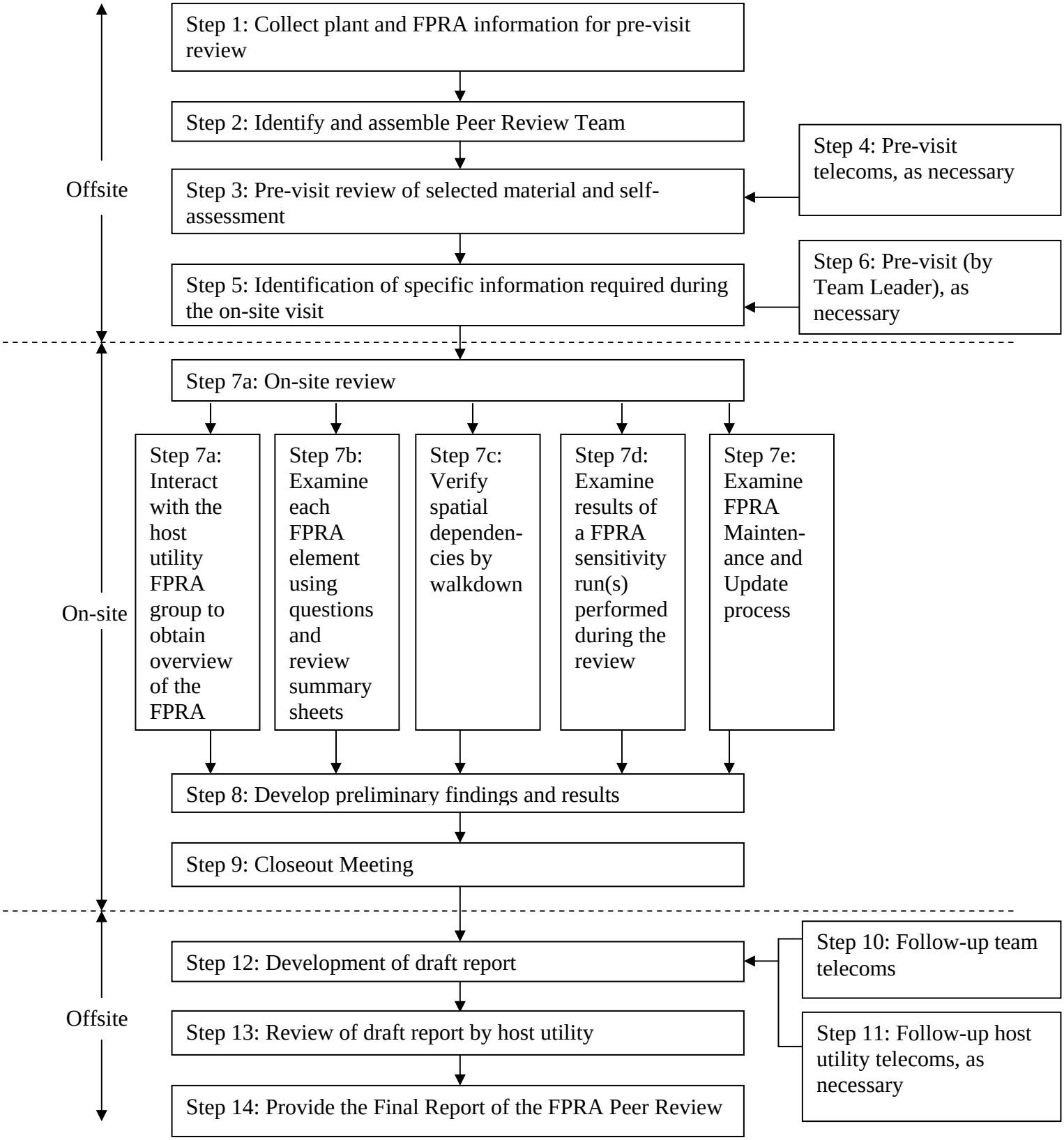
Section of the Standard, are the criteria used for the FPRA Peer Review. The FPRA Peer Review guidance provided in this document does not provide any new technical requirements.

The FPRA Peer Review is developed as a rational approach to assess FPRA technical adequacy and provide the necessary focused feedback for FPRA improvement. The process does not require a 10CFR50 Appendix B program for the review or for the FPRA. However, the review process includes the principal elements of an effective 10CFR50 Appendix B quality assurance review of documents via:

- Use of qualified reviewers.
- Use of reviewers who are independent of the original FPRA study.
- Development of a list of issues to be addressed.
- Documentation of the review conclusions.

More specific details of the FPRA Peer Review process are provided in Section 2.

Figure 1-2
FPRA Peer Review Process Flow Chart



1.5 MULTI-UNIT SITE PEER REVIEW

A peer review of a multi-unit site will need to consider unit differences that affect the FPRA. In general, due to spatial differences between one unit to the next, separate FPRA models are likely developed for each unit. Even small spatial differences can have a large impact in the overall risk, especially for spatial differences in significant[6] fire areas/compartments.

Planning for the peer review should account for these unit-specific differences, and allow for the additional resources needed to review the differences and unit specific results. This would include additional time for walkdowns and review of analysis and documentation for each SR where unit-specific analysis is performed.

1.6 FPRA PEER REVIEW CAPABILITY CATEGORIES

The FPRA Peer Review uses Capability Categories to assess the relative technical merits and capabilities of each technical element reviewed, in terms of the FPRA SRs in Part 4 of the ASME/ANS PRA Standard. The Capability Categories were developed considering attributes of a FPRA necessary to ensure technical adequacy, elements of a FPRA that are critical to its technical adequacy, and elements needed to support risk-informed applications. Three Capability Category levels are used to indicate the relative technical adequacy of each SR based on the criteria at hand. In some cases, the assessment may result in a "not met" assignment when none of the requirements for an SR capability requirement are met. The assessment process is further described in Section 3.

It is important to note that neither the HLRs, nor the entire FPRA, are assigned an overall Capability Category. Each SR is assessed. Then, based on the SR Capability Categories, a summary of the technical adequacy is provided for each of the HLRs and the 13 technical elements.

The major benefits of this review process are the assignments of Capability Categories to SRs that assess the technical adequacy of the base FPRA, as well as the recommendations for improvements and the acknowledgment of the strengths of the FPRA. Additional beneficial outcomes of the review process are the exchange of information regarding FPRA techniques, experiences, and applications among the host utility and industry reviewer personnel, and an anticipated evolving level of consistency from review to review.

The review process requires that the existing FPRA meet the SR criteria, or be assigned a "not met" for the SR. Furthermore, documentation methods and FPRA Maintenance and Update processes must be in place to ensure the long-term technical adequacy of the FPRA.

As insights are gleaned from the peer review process efforts, they will be fed back into the FPRA Peer Review guidance (this document) for revision.

[6] When used in this document, the word "significant" has the same definition as that used in the ANS/ASME PRA Standard.

1.7 DOCUMENT ORGANIZATION

The remainder of this document is organized as follows. Section 2 discusses the key elements of the peer review, and the functions and requirements of the Peer Review Team. Section 3 provides guidance on the peer review Capability Categories. Section 4 discusses the peer review reporting process and process forms. Appendix A provides guidance on preparing for the peer review, and review logistics. Appendix B contains the review summary sheets for the technical elements. Appendix C contains the review tables for the maintenance and update of the FPRA. Appendix D provides review tables for the Internal Events SRs that are referenced in one or more of the FPRA Section SRs. Appendices E, F and G provide some example review documentation forms.

2 PEER REVIEW PROCESS

This section focuses on the key elements of the FPRA Peer Review and describes the role and function of the Peer Review Team and the requirements governing the team.

2.1 FPRA PEER REVIEW PROCESS DESCRIPTION

The FPRA Peer Review is a requirement of the ASME/ANS PRA Standard to assess the technical adequacy of the FPRA, and is complementary to the Internal Events PRA Peer Review used by the industry in NEI 00-02 and with the Peer Review process in NEI 05-04.

A flowchart of the FPRA Peer Review process was shown in Figure 1-2. That figure describes the general approach and process steps used in the application of the peer review to an individual FPRA. The FPRA Peer Review is a tiered review that begins with SR Capability Category summary sheets and summarizes this into the HLR Summary Tables.

The applicability of specific HLRs/SRs may vary from plant to plant. This variance results from the differences in the FPRA techniques and models being evaluated, including the computer modeling methodology used at the plant, the use of qualitative or quantitative screening, the use of detailed fire modeling, etc. The Peer Review Team through their consensus discussions determines the applicability of specific HLRs/SRs to the plant FPRA being reviewed. For example, if the FPRA does not include quantitative screening (an optional step), then the Peer Review Team would determine that the HLRs and SRs for quantitative screening are not applicable.

To start the FPRA Peer Review, the host utility should request and schedule a peer review through the appropriate Owners Group representative. As the FPRA Peer Review process begins, the host utility should complete the prerequisites discussed in Appendix A and Section 1 above.

Selection of the Peer Review Team Leader would occur prior to gathering the initial information. This selection is based on discussion between the Owners Group representative (coordinator) and the host utility. The process described below assumes the Team Leader responsibilities are assigned to a single individual. However, the responsibilities could be split between two individuals, based on logistics and technical assignments. One person can be designated the Technical Lead and would have the overall technical responsiblity for the Peer Review, as well as the preparation of the Final Report. The second person can be designated the Facilitator; the facilitator would be responsible for ensuring the schedule is maintained, moderating discussions, acting as an interface to the host utility, etc.

Selection of a Peer Review Team can also occur prior to collecting all of the initial plant FPRA information, including the determination whether particular expertise (e.g., fire modeling or circuit analysis) is needed for the Peer Review. As discussed in Section 2.2 below, the Peer Review Team should possess sufficient expertise to cover all of the FPRA elements. The utility can request particular expertise beyond the general expertise identified in Section 3-2.1 of the ASME/ANS PRA Standard for the Peer Review Team, where more specialized skills are needed. The Team Leader should verify the team skills needed once the FPRA plant information is reviewed.

The major steps in the FPRA Peer Review process are described below, with particular emphasis on information pertinent to the Peer Review Team.

Step 1: Collect plant and FPRA information for pre-visit review

Before the on-site review meeting, the host utility FPRA project manager should distribute the pre-review material to the Peer Review Team Leader (and Team, when assigned). Guidance on the types of information required is provided in Section 2.3 and Appendix A.5. This material includes the results from the self-assessment of the FPRA by the host utility, as well as the results of the limited self-assessment of the internal events PRA as discussed in Section 1.4.

Step 2: Identify and assemble the Peer Review Team

Based on the plant information collected in Step 1, and the guidance in Section 2.2 below, the Peer Review Team should be identified. Information collected in Step 1 will be distributed to the Peer Review Team, and the schedule for the peer review, including completion of pre-site visit reviews, can be completed.

During the selection of the FPRA Peer Review Team, the Team Leader (or utility) should determine if specific review capabilities are needed. These capabilities are discussed in Section 2.2 below. For example, if the FPRA depended heavily on three-dimensional fire modeling, then expertise in this area may be needed. Similarly, if detailed circuit analysis is important to the FPRA results, then expertise is needed for review of this analysis. The determination of need for specific FPRA Peer Review Team member skills should be performed sufficiently early to allow the scheduling of these team members on the review team.

Step 3: Pre-visit review of selected material and self-assessment

The information collected in Step 1 is provided to the Peer Review Team. The review of this information prepares the Peer Review Team to investigate the details of the FPRA. This can be accomplished by thoroughly reviewing the FPRA documentation sent out for study prior to the on-site visit. Individual team members, however, should focus on those areas to which they have been assigned for review. (This assignment will have been made in the scheduling letter sent as the first item in the timetable of Figure 2-1; an example letter is shown in Exhibit A-1.) As needed, information can be sent to a reviewer prior to the on-site visit to supplement the initially prepared information for the Peer Review Team.

The pre-visit review also includes review of the plant's self-assessment and the review of the Internal Events PRA peer review, and open and closed/dispositioned F&Os.

The pre-visit review also includes a review of any ASME inquiries with responses on Part 4 of the ASME/ANS PRA Standard.

Step 4: Pre-visit telecoms, as necessary

It is expected that there will be several conference calls prior to the on-site visit performed. These calls should help determine both the makeup of the team, the schedule, and any additional review information needed by the team for the pre-visit review.

As noted in Section 3.3, Inquiries on the interpretation of specific SRs may have been forwarded to the ASME Committee on Nuclear Risk Management (CNRM). The set of Inquiries that have been resolved by CNRM should be obtained from the ASME CNRM Secretary and reviewed prior to conducting a Peer Review and discussed in a pre-visit telecom, as necessary.

Step 5: Identification of specific information required during on-site visit

Based on the pre-visit review and Peer Review Team discussion, the team should identify prior to the on-site visit, a list of specific information that will be needed during the one-week on-site review. This may include references, such as calculations or drawings that were the basis for each of the steps in the FPRA, or may include fire protection or other plant information not provided for the pre-review.

Step 6: Pre-visit (by Team Leader), as necessary

It may be useful for the Team Leader to perform an on-site visit several weeks prior to the Peer Review Team on-site visit. This visit can help finalize the logistics for the on-site visit, and help in the process of transmitting pre-visit review information needed for the on-site review.

Step 7: On-site review

The on-site review includes a number of steps, discussed below:

Step 7a: Interact with the host utility FPRA group to obtain overview of the FPRA

The host utility FPRA team is expected to prepare detailed presentations on the key elements of the FPRA, as discussed in Appendix A.9. For the review process to be completely effective, the host utility should be well prepared for presenting information to the Peer Review Team. The scope of the detailed presentations should be limited and may not require the entire team. Additionally, the Team Leader through discussions with the host utility should establish the scope and schedule for the presentations.

During this step, and also the subsequent steps, it is imperative that the members of the Peer Review Team and the host utility FPRA team communicate openly and candidly. A successful review requires efficient and candid communication among review team members, and between the review team and site PRA team members.

Step 7b: Examine each FPRA element using questions and review summary sheets

The peer review begins with higher-level investigations and progresses to examining detailed technical issues. This involves a combination of a breadth (wide) and depth (deep) examination of the FPRA elements. The review summary sheets (see Appendix B) provide a structure, which in combination with their individual FPRA experience provides the basis for examining the various FPRA technical elements. The checklist also includes a review of the open Internal Events PRA F&Os. Peer review of each applicable HLR and SR from Part 4 of the ASME/ANS PRA Standard listed on the review forms in Appendix B help to ensure completeness in the review. If a reviewer discovers a question or discrepancy, it is expected that a more through, detailed search will be conducted.

Thus, in reaching their conclusions regarding the technical adequacy of the various elements and the FPRA as a whole, reviewers are expected to investigate the FPRA at several different levels. The reviewers, working in small teams, will present their views to the entire Peer Review Team, at which time a (team) consensus process will be used to determine the final Capability Category for each FPRA SR.

Optional FPRA tasks such as Qualitative or Quantitative Screening that are not performed in the FPRA should be noted on the review. Capability Categories for these tasks are considered not applicable.

Information regarding the Capability Categories is provided in Section 3.

Step 7c: Verify spatial dependencies by walkdown

An important element of the FPRA review is the walkdown of the areas of the plant that are important to the FPRA results. This walkdown can be performed by a subset of the Peer Review Team after the specific issues have been identified during the first several days of the review, but may need to be followed up with more specific fire compartment walkdowns, as needed.

The walkdown for the FPRA may need to be performed in two parts. First, the walkdown for the base FPRA plant partitioning should be performed during the review of this element. Plant-specific features credited in the FPRA can be included in the walkdown at this time, such as the location of suppression, combustible controls, and other plant features. Second, a walkdown of specific fire scenarios may be necessary to confirm assumptions using in the supporting fire modeling, damage time, and other calculations. The two review areas performed during the walkdown may be combined into a single walkdown typically performed mid-week.

The host utility should make arrangements for the plant walkdown in advance of the on-site visit. These arrangements would include participants for each walkdown, and the scheduled dates. Information needed to arrange for site access should be requested from the Team Leader prior to the on-site visit. It may be necessary to perform a third walkdown towards the end of the on-site visit to confirm any information not initially verified in the initial two walkdowns.

Since most or all of the Peer Review Team may be involved in one or more of the walkdowns, the Team Leader should account for the time needed for walkdowns and preparations for walkdowns in the schedule. The difficulty of getting into critical areas should be accounted for in the schedule, and minimized by preplanning.

Step 7d: Examine results of a FPRA sensitivity run(s) performed during the review (see Section A.6)

It is likely that during the review, certain issues or questions may arise relative to the FPRA results. It may be useful for the host utility to perform, during the on-site review, one or more sensitivity cases with the FPRA computerized model to investigate these sensitivities and to demonstrate the host utility FPRA team's approach for solving and applying the FPRA.

Step 7e: Examine FPRA Maintenance and Update process

The process for maintaining the FPRA in a state of fidelity with the plant, plant procedures, and utility staff training is a necessary element for ensuring that the FPRA can be effectively used for applications. Appendix C provides a review worksheet that can be used in the evaluation of the FPRA Maintenance and Update process. The requirements for model maintenance are discussed in Section 1.5 of the ASME/ANS PRA Standard.

Step 8: Develop preliminary findings and results

This step involves the development of the preliminary findings and peer review results, and the compilation of a draft report. This preliminary report forms the basis for the closeout meeting with the FPRA group and with host utility management.

Consensus sessions of the Peer Review Team are required for every technical element to ensure that the summary sheets are completed. The two/three reviewers assigned for a particular technical element may hold mini-consensus sessions in preparation for the full Peer Review Team consensus session. The assignment of a Capability Category for each SR is developed based on a consensus of the entire Peer Review Team. Similarly, the assignment of F&Os classified as findings is also based on Peer Review Team consensus. However, a dissenting opinion can be issued, based on one or more Peer Review Team members review.

Step 9: Closeout Meeting

During the closeout meeting (or exit meeting), the FPRA Peer Review Team presents the results of the preliminary findings to the host utility FPRA group and management; this is held on the last day of the on-site review. In addition, feedback should be provided to the host utility FPRA group at some point of each day of the on-site review (daily debrief). Electronic copies of all F&Os, completed forms, and draft write-ups should be provided to the host utility prior to (or at) the closeout meeting, in order to expedite correction of any errors, comment feedback, etc. Additionally, if the team has any open questions that could potentially result in F&Os, the host utility should be made aware of this at the exit meeting. Any Peer Review Team work associated

with pursuing these questions should be done on a limited basis. No new review efforts, beyond those open items identified at the exit meeting, should take place following the conclusion of the review week. Prior to issuance of the final peer review report, the consensus process for any open issues should be completed via post-review week conference call(s) with the entire team. Discussions, as appropriate, should be held with the host utility.

Step 10: Follow-up team telecoms

Telecoms with team members after the on-site visit may be useful to finalize the peer review report, and close out any open issues from the on-site review. These telecoms may be performed in conjunction with telecoms with the host utility (see Step 11), as additional information is needed and open questions are answered. These telecoms can also be used for any new consensus required by the addition or re-interpretation of the FPRA information.

Step 11: Follow-up host utility telecoms, as necessary

Any open questions from the on-site visit can be addressed either by e-mail or by follow-up phone calls between the host utility and selected review team members. New information provided to the team that was not available during the on-site visit can be provided with the telecoms used to answer any questions resulting from review of this new information.

Step 12: Development of draft report

A draft review report should be completed shortly after the on-site visit is complete. Section 4.0 below provides the details and contents of this report. Several drafts may be developed, based on the timing of completion for the various documentation tasks for the report. If desired by the Peer Review Team Lead, review of the final draft report by the team can be performed in parallel with Step 13 below (review of the draft report by the host utility).

Step 13: Review of draft report by host utility

The host utility should review the draft report(s), and provide comments to the Peer Review Team prior to Final Report documentation. The comment process should be performed in a timely manner as to ensure completion of the Final Report in a reasonable timeframe.

Step 14: Provide the Final Report of the FPRA Peer Review:

The designated Peer Review Team member using the information prepared during the on-site review compiles the Final Report and any additional summary comments provided by the Peer Review Team, and signed off by each of the members of the FPRA Peer Review Team. The report will identify the Peer Review Team's Capability Category assignments for each SR, along with appropriate rationale, and may indicate where improvements are required in order for elements to be accepted at the next higher levels. In general, the Final Report is considered proprietary to the host utility; the appropriate Owners Group will maintain a copy for historical reasons, to develop summary information (statistics/metrics), and to develop lessons learned. Report documentation is discussed in additional detail in Section 4.0 below.

Figure 2-1
FPRA Peer Review Process Suggested Timeline

Review Week	Task
Week 0:	Team Lead and Reviewers Identified
Week 4:	Team Lead defines Reviewer Responsibilities and Transmits Information Request to Host Utility
Week 7:	Host Utility Transmits Pre-Review Material to Reviewers
Week 8:	Review Team Conference Call
Week 9:	Logistics Conference Call with Review Team and Utility
Week 10:	Onsite Review
Week 11:	Team Lead assembles Draft Report and transmits for Review Team review
Week 14:	Team Lead assembles Final Draft Report and transmits for Utility Review
Week 20:	Team Lead issues Final Report to Utility

2.2 FPRA PEER REVIEW TEAM

The single most important aspect of the FPRA Peer Review process is the selection of the Peer Review Team that carries out the review process. The Peer Review Team is composed of utility, vendor, and contractor personnel knowledgeable in FPRA issues and experienced in the performance and application of FPRAs. The Peer Review Team will include peers, knowledgeable in FPRAs for plants similar to the plant being reviewed. The Team Leader and the host utility determine the specific composition of the Peer Review Team. However, due to the variability of FPRA and the analysis tools used to support the FPRA, team member capability will vary, based on the plant-specific FPRA.

Section 1-6 of the ASME/ANS PRA Standard provides guidance for PRA peer reviews. Section 1-6.2 of the ASME/ANS PRA Standard provides specific peer review team requirements that must be met. Specifically, Section 1-6.2.3 allows a single expert to perform the peer review of a single technical PRA element, given that the expert has appropriate knowledge and experience. It is assumed with regard to the independence requirement of Section 1-6.2.1 that reasonable and practicable interpretation will be made allowing, as needed, use of non-involved utility personnel from other sites for multi-site utilities, use of current contractors (on-site or otherwise) involved in other work, etc. With the exception of individuals who have worked on the subject FPRA, there are no automatic exclusion criteria; however, the host utility may question the independence of any proposed Peer Review Team member. A requirement of absolute independence coupled with the need for adequate technical expertise can be difficult to achieve in some situations.

The desired attributes of the Peer Review Team, as a whole, are as follows:

- Independent of the FPRA being reviewed
- Expert in all phases of FPRA
- Experienced in performance of FPRAs

The Peer Review Team can include utility representatives from other Owners Groups. One of the useful by-products of the FPRA Peer Review is the technology transfer to the utility personnel involved as the reviewers.

Experience from the pilot FPRA Peer Reviews has indicated that a minimal team size is six members, with an optimal (recommended) team size of seven to eight members. The actual number of members on any specific team will be a function of the skill sets required, as per the analytical methods used in the FPRA. The team should be sized to ensure overlap in skills key to the FPRA process listed below. The intent of this is to ensure that there is more than one peer reviewer with experience in each key FPRA process, but not to require two experts in each skill set. Additional team members may need to be added for multi-unit site FPRAs, depending on the amount of plant-specific analysis performed for each unit. The following is a brief description of the attributes of the Peer Review Team:

- Expert in all phases of FPRA: A broad experience base *for the team* is essential to effectively implement the FPRA Peer Review process. However, it is somewhat difficult to translate this into requirements for individual members of the team. Nevertheless, the following guidance is provided to ensure that individual members are qualified, and that the team as a whole possesses *sufficient expertise to cover all of the FPRA elements*:

    - **Experience Expectations for Individual Peer Review Team Members:**
        - Bachelors Degree in Engineering/Science/Mathematics[7]
        - At least five years of nuclear plant PRA experience
            - Experience in performance of FPRAs: Each member of the team should have participated in the performance of or managed at least one FPRA[8]. This experience should span at least three years.
    - **Additional Experience Expectations for the Team as a Whole**
        - The team should be selected such that the team, as a whole, has experience in the following key areas of the process:
            - HRA with specific experience in HRA for FPRA
            - FPRA (modeling or quantification)
            - Fire Protection or Fire Safe Shutdown

[7] Significant experience may be substituted for an engineering degree, consistent with guidelines used by licensing bodies (varies by state). For example, a reviewer with engineering degree coursework and at least 20 years experience in the nuclear field would be considered to have met the requirements for degree/experience. Additionally, an advanced degree in Engineering/Science/Mathematics can be counted towards years of experience.
[8] Specialists in Circuits Analysis, Fire Modeling or Fire HRA may not have participated in a full FPRA. Training on FPRA methods may be used in lieu of FPRA experience for these specialists.

  - Fire modeling (see below)
  - Circuit analysis (see below)
- The Peer Review Team should have adequate outside utility participation. The team may be augmented by contractors to provide specific areas of expertise, and to provide continuity and consistency across reviews.

Specialized expertise in fire modeling or detailed circuit analysis should be strongly considered if the FPRA results are, in the opinion of the host utility, highly dependent on complex and specific analysis in these areas. Fire modeling or circuit analysis using generic methods or commonly used fire modeling tools would not require specialized expertise, although the team makeup should still include experience in generic circuit analysis and the commonly used fire modeling tools. However, use of a specific fire modeling tool (e.g., computational fluid dynamics (CFD) model) would indicate that the team should include at least one member with experience in this area. When a FPRA includes considerable detailed circuit analysis, a team member experienced in this area would be desirable.

The process requires the reviewers to follow a very tight schedule and is most likely to be successful if the team consists of fully qualified members. A training session should be held at the outset of each review to ensure that all of the reviewers share a common understanding of the process, review summary sheets, and Capability Category criteria. This training session should be held by phone during the meeting preparation in order to optimize on-site review time.

Peer Review observers who are participating as a part of a learning process are not considered a part of the Peer Review Team. Observer skills cannot be considered in determining the skills of the Peer Review Team.

2.3 HOST UTILITY PREPARATION AND PARTICIPATION REQUEST

The host utility should initiate the review process. A request for a FPRA Peer Review should be made to the appropriate Owners Group contact. The Owners Group will send a letter to the host utility management outlining the process, the goals, and the expectations for the host utility. An example letter is provided as Exhibit A-1 in Appendix A.

The resource needs by the host utility are summarized in Table A-1.

Additional guidance for the host utility regarding information requirements and interactions as they relate to the Peer Review is provided in Appendix A.

2.4 REVIEW WEEK AGENDA

The example agenda for the initial review meeting hosted by the utility is provided in Attachment 3 to Exhibit A-1 in Appendix A.

3 FPRA PEER REVIEW PROCESS ELEMENTS AND GUIDANCE

3.1 OVERVIEW

A FPRA for a nuclear power plant is an extensive and detailed engineering and statistical analysis of complex systems and uncertain physical processes. The intent of the review process is to ascertain the level of technical adequacy of the FPRA to support risk-informed applications by verifying its use of assumptions, degree of conservatism, realism of analysis, completeness, reasonableness of results, and documentation. This section provides guidance on peer review criteria and the establishment of levels, or Capability Categories, to be used during the peer review.

3.2 PEER REVIEW PROCESS CRITERIA

The Peer Review Team will focus on the host utility's self-assessment of the applicable elements against Part 4 of the ASME/ANS PRA Standard and the degree to which the FPRA meets the applicable SRs.

The Peer Review Team is divided into sub-teams to review the various aspects of the FPRA. The composition of the sub-teams will vary from day-to-day to meet the review needs for each day. As the peer review process is very intense and focused because of the amount of material to cover in a limited period of time, schedules and element assignments should be considered flexible, though the Team Leader needs to ensure that all the material is adequately reviewed.

Prior to the start of the review, the Peer Review Team members will perform a "refresher" review of the applicable portions of the ASME/ANS PRA Standard, with emphasis on Section 4.3, and establish a common perspective regarding the general assignment philosophy. The applicable HLRs in Section 4.2 will also be briefly reviewed to ensure the team is familiar with the high level scope of the review.

At the beginning of the review for each technical element, the reviewer(s) should review the HLRs for the element and review the individual SRs. In Table A-3 of RG 1.200, the NRC has provided a Regulatory Position relative to some specific SRs in Part 4 of the ASME/ANS PRA Standard. The peer reviewer(s) should consider these NRC clarifications and qualifications, where applicable, during the review, and note the extent to which the FPRA element(s) being reviewed address these positions. The reviewer(s) should provide an assessment relative to the NRC's clarifications and qualifications, particularly those in Table A-3 (Appendix A) of RG 1.200.

The starting point for the review of each SR is typically the host utility's self-assessment. This will provide the utility's assessment of the Capability Category that has been assigned to the FPRA SRs and the basis for this assessment. More importantly, the self-assessment should provide pointers to the associated PRA documentation. The reviewers look at the basis and review the associated documentation to a sufficient level of detail to make their own assessment. However, the reviewers are not limited to the referenced documents; they may request review of any pertinent

documentation they believe is needed to make their assessment. Assessment of the SRs can be recorded in tables such as provided in Appendix B of this document.

As the SRs are purposefully open to some interpretation, there may need to be some discussion to determine the appropriate assignment of a Capability Category, or even determine if a SR is considered to be "met." The reviewers must consider the "whole" of the PRA and not be overly focused on a specific discrepancy. To declare that an an SR is not "met," a preponderance of evidence must be observed. In cases where an SR description includes an example, the reviewers should be cautioned that conformance with the example is not necessary to meet that SR. Determination of the status of an SR should be guided by the following approach from RG 1.200 [6]:

> ... [If] there are a few examples in which a specific requirement has not been met, it is not necessarily indicative that this requirement has not been met. If, the requirement has been met for the majority of the systems or parameter estimates, and the few examples can be put down to mistakes or oversights, the requirement would be considered to be met. If, however, there is a systematic failure to address the requirement (e.g., component boundaries have not been defined anywhere), then the requirement has not been complied with.

A specific instance where application of this approach is important is when the analysis is incomplete for multiple physical analysis units. In these cases, if the analysis that is complete is performed in a manner that meets the appropriate SRs of the ASME/ANS PRA Standard, a single F&O referencing the applicable SRs should be issued stating that the incomplete analysis needs to be completed. Preponderance of the evidence, as discussed above, should be the criterion for assigning the Capability Category. For example, if the SR(s) for the completed analysis meets CC II and the majority of the analysis is complete, assessing CC II for that SR(s) may be appropriate.

During the review of each SR, any applicable ASME Inquiries should be considered during the evaluation. The ASME Inquiries represent the latest interpretation of the ASME/ANS PRA Standard SRs. The Peer Review Team should consider the ASME Inquiry information in determining the appropriate assignment of a Capability Category for the SR.

During the review of an SR, if the reviewers identify any issues/problems that impact the capability of the PRA, they will document these problems using an F&O form equivalent to that presented in Appendix E of this report. The F&Os specify the PRA element and SR of concern, and describe the PRA level of compliance with the criteria. The issue documented may be a weakness (finding), a strength (best practice), a simple observation (suggestion), or one regarding methods unfamiliar to the team (unreviewed analysis method). It should be noted that the review team may document an F&O finding regardless of the Capability Category assessment. Such findings are typically for non-systemic discrepancies that the PRA peer review team judges require correction. The F&O includes an assessment of the importance of the observation on the level of capability of the SR, and, for weaknesses, a proposed resolution for the weakness. The importance of each observation is classified as a:

Finding – an observation (an issue or discrepancy) that is necessary to address to ensure:

- The technical adequacy of the PRA (relative to a Capability Category).
- The capability/robustness of the PRA update process.
- The process for evaluating the necessary capability of the PRA technical elements (to support applications).

Suggestion – an observation considered desirable to maintain maximum flexibility for PRA applications and consistency with industry practices. Failing to resolve a suggestion should have no appreciable impact on the PRA results or the integrity of the PRA. Some examples of a suggestion include:

- Editorial and minor technical items
- Recommendations regarding incorporation of recently-developed methods
- Recommendations for consistency with industry practices (e.g., replacing a given consensus model with a more widely used model)
- Recommendations to enhance the PRA's technical capability as time and resource permit
- Observations regarding PRA technical adequacy that may affect one or more risk-informed applications

Best Practice – Observations of practices that utilities throughout the industry would want to emulate.

Unreviewed Analysis Method – an observation regarding the use of methods unfamiliar to the review team. Such an observation is appropriate when the review team does not possess the expertise necessary to evaluate the technical adequacy of methods used in the FPRA.[9]

Each technical element has a HLR and a number of associated SRs with respect to documentation. In general, the requirement for documentation of the HLRs is that they be sufficient to facilitate peer reviews by describing the processes used, providing the assumptions used and their bases, and providing the associated SRs specific details for each technical element. Assessing the Capability Category for the documentation SRs does not require a separate review for each SR. At the start of the review for a given technical element, the Peer Review Team should review the documentation HLR and SRs for that element to identify any unique documentation aspects for that technical element. At the completion of the review of the technical element, the reviewers for that element may assess the PRA compliance with the documentation SRs based on availability, scope and completeness of the documentation that they used to review the technical SRs for the technical element.

[9] The industry is forming an expert review panel that will evaluate Unreviewed Analysis Method F&Os to assist utilities in dispositioning these items.

At the end of the review for each technical element, the team members will conduct consensus discussions to assign Capability Categories to the SRs. The Lead Reviewer will lead the consensus session for a particular technical element.

In documenting the F&Os, it is important to note that the reviewers need not match F&Os to SRs one-to-one. F&Os on common SRs that cross several PRA Technical Elements should be combined into a single F&O (i.e., uncertainty, documentation for peer review and applications). It should also be noted that for different technical issues affecting a single SR, it may be appropriate to write separate F&Os.

As stated in Section 1.6 of the ASME/ANS PRA Standard, "The peer review need not assess all aspects of the PRA against all requirements in the Technical Requirements Section of each respective Section of this Standard; however, enough aspects of the PRA shall be reviewed for the reviewers to achieve consensus on the adequacy of methodologies and their implementation for each PRA Element". Part 4 of the ASME/ANS Standard adopts the Part 2 requirement for Section 1.6, thus requiring the peer review to achieve consensus. The set of key review areas identified in Section 4.3.3 of Part 4 of the ASME/ANS PRA Standard for the technical element(s) being peer reviewed must be addressed.

During the review of a given technical element, the Lead Reviewer may elect to skip selected SRs if the other reviewers determine that they can achieve consensus on the adequacy of the PRA with respect to the HLR without the identified (skipped) SRs. Before electing to skip any SRs, the Lead Reviewer should consult Section 4.3 of the ASME/ANS PRA Standard to ensure that the review will be consistent with the appropriate requirements in this section. The review sub-team must document their basis for not reviewing the given SR. Optional FPRA tasks, such as qualitative and quantitative screenings are good examples of this, but additional areas where the SR does not impact the overall risk can be excluded with justification.

The reviewers should specifically address sources of model uncertainty and related assumptions in the elements being reviewed. Such assumptions and uncertainties, and their potential impact on the baseline PRA results and PRA applications, should be reviewed. The host utility's characterization of uncertainty should be qualitative. Their opinions and suggestions regarding these key assumptions and uncertainty sources, as well as where the issue arises in the model, should be documented.

Section 1.5 of the ASME/ANS PRA Standard provides the requirements for a PRA configuration control program, and should be used by all PRA Peer Review Teams. The FPRA Peer Review Team should provide a summary assessment of how well the PRA maintenance program satisfies ASME/ANS PRA Standard Section 1.5 requirements relative to the technical element(s) being reviewed for the FPRA. The requirements defined by the Maintenance and Update (MU) checklist in NEI 00-02 may be used as guidance for this summary assessment for the specific technical element(s).

EPRI's DocAssist tool (Reference 7), for example, can be used to review the results of the original NEI 00-02 peer review, status of F&Os, and results of the host utility's self-assessment. EPRI's tool can also be used by the FPRA Peer Review Team, at the direction and discretion of the host

utility, to record their findings; e.g., new F&Os as a result of the peer review. The tables in Appendix B can also be used to record peer review results. Regardless of the tool used, all Capability Category assignments, comments, and F&Os should be made available in an electronic form to the Team Leader (to prepare the final report) and the host utility (for review). Methods for this need to be determined prior to the on-site visit and must be acceptable to the Peer Review Team and the host utility. It is further suggested that a sequential F&O log be maintained throughout the review, with the identification format of TE-SR-## being used throughout, where TE identifies the technical element, SR identifies the supporting requirement, and ## is the sequential number for the F&O for that SR. Appendix E contains a sample F&O log that can be used during reviews.

During the FPRA Peer Review process, assignment of Capability Categories for the individual SRs is established by a consensus process that requires that all reviewers agree with the final assignment. If a condition arises where there is not a consensus, then, at the request of any peer reviewer, differences or dissenting views among peer reviewers should be documented with any recommended alternatives for resolution of these differences. The dissenting opinion is provided for information to the host utility, and should not be characterized as an F&O finding. This process should only be used in the most exceptional situations, as, from the perspective of the host utility, this is a highly undesirable situation. Therefore, the Peer Review Team should strive to achieve a consensus position on all review elements.

It is recommended that (except for a one-day visit) there is a daily debrief with the host utility. The purpose of a debrief would be to (a) inform the host utility of any expected concerns with the PRA, (b) clearly delineate any "owed" information from the host utility, (c) identify any new requested information, (d) as appropriate, seek clarification or confirmation on prepared F&Os, and (e) exchange any other relevant information. The timing and duration of such meetings should be mutually agreed to by the Peer Review Team lead and the host utility.

In the course of performing the PRA peer review, insights will be developed related to the process (as described in this guidance document) or PRA practices (e.g., identification of a "best practice"). Such insights (i.e., lessons learned) should be documented and transmitted to NEI, with the host utility's approval, for subsequent updates. Appendix D provides an example Lessons Learned form that can (optionally) be used.

3.3 ASSIGNMENT OF CAPABILITY CATEGORIES

The Capability Categories assigned during the Peer Review are based on the ASME/ANS PRA Standard Capability Categories. The utility PRA will be assigned a Capability Category for each SR reviewed. A summary of the SR review is then provided for each HLR. It is important to note that neither the HLRs, nor the entire FPRA, are assigned an overall Capability Category.

The major benefit of the review process, however, is not the SR assignments, but rather the recommendations for improvements and the acknowledgments of the unique strengths of the PRA. Additional beneficial outcomes of the review process are the exchange of information regarding PRA techniques, experiences, and applications among the host utility and industry review personnel, and an anticipated evolving level of consistency from review to review.

3.3.1 Process for Peer Reviews Against Part 4 of the ASME/ANS PRA Standard

Section 4-2 of the ASME/ANS PRA Standard presents the risk assessment technical SRs for FPRA. These requirements are specified in terms of Capability Category requirements with increasing scope and level of detail, increasing plant-specificity, and increasing realism as SRs satisfy Capability Category I through Capability Category III. See Table 1-1.3-2 of the ASME/ANS PRA Standard.

For a peer review against the Fire Section of the ASME/ANS PRA Standard, the applicable portions of a host utility's FPRA will be reviewed against the applicable SRs in Sections 4-2 of the ASME/ANS PRA Standard, following the guidance of Section 4-3 of the PRA Standard. For each SR reviewed, the host utility's FPRA will be assigned a Capability Category for that SR.

For each Capability Category, the SRs define the minimum requirements necessary to meet that Capability Category. Some of the SR action statements apply to only one Capability Category, while others extend across two or three Capability Categories. When an action statement spans multiple categories, it applies equally to each Capability Category. When necessary, the differentiation between Capability Categories is made in other associated SRs. The interpretation of a SR whose action statement spans multiple categories is stated in Table 1. It is intended that, by meeting all the SRs under a given HLR, a PRA will comply with that HLR.

Table 1 -- Interpretation of Supporting Requirements

Action Statement Spans	Peer Review Finding	Interpretation of the Supporting Requirement
All Three Capability Categories (I/II/III)	Meets SR	Capable of supporting applications in all Capability Categories
	Does not meet SR	Does not meet minimum standard
Single Capability Category (I or II or III)	Meets Individual SR	Capable of supporting applications requiring that Capability Category or lower
	Does not meet any SR	Does not meet minimum standard
Lower Two Capability Categories (I/II)	Meets SR for CC I/II	Capable of supporting applications requiring Capability Category I or II
	Meets SR for CC III	Capable of supporting applications in all Capability Categories
	Does not meet SR	Does not meet minimum standard
Upper Two Capability Categories (II/III)	Meets SR for CC II/III	Capable of supporting applications in all Capability Categories
	Meets SR for CC I	Capable of supporting applications requiring Capability Category I
	Does not meet SR	Does not meet minimum standard

If there are instances where it appears that this approach leads the reviewer(s) to question the adequacy of the requirement for the higher capability categories, the reviewer(s) will document the interpretation of the SR that has been applied, and the host utility or any member of the Peer Review Team may submit an Inquiry to the ASME CNRM requesting a clarification.[10]

The host utility may request that the team review against CC I or CC II; this choice may be made on a per-Technical Element basis. If the utility chooses to be reviewed against CC I for a given SR, an F&O need not be written for those SRs if assessed as CC I. Further, it is important to note that the team may write an F&O regardless of the CC assessment for a given SR.

No Capability Category will be assigned to HLRs, but a qualitative assessment of the HLRs will be made based on the associated SR assignments.

The applicable portions of the PRA and associated documentation will also be reviewed for conformance to the expert judgment requirements of Section 1-4.3 of the ASME/ANS PRA Standard as part of the overall review.

It should be noted that several of the SRs of Part 4 of the ASME/ANS PRA Standard include statements that invoke HLRs or specific SRs in Part 2 of the ASME/ANS PRA Standard. The intent in Part 4 is that each of these SRs be assessed as written in Part 2, although if the previously completed Internal Events PRA peer review can be referenced, a full SR-by-SR review may not be necessary. An example is HRA-B4, which includes the statement "…in accordance with HLR-HR-F and its SRs in Section 2." The intent in Part 4 is that each of these SRs be assessed as written in Part 2, which may include subdivision into Capability Categories. The FPRA Peer Review team should use the Internal Events PRA self-assessment discussed in Section 1.4 as the starting point for their review of the referenced SRs. There should be limited review of referenced SRs in those cases where the utility confirms that previously peer reviewed processes were followed. However, there should be more in-depth review where there is departure from those processes, FPRA analysis does not rely on the internal events PRA, or where internal events PRA F&Os related to the referenced SRs have not been addressed. Referenced SRs that cannot rely on previous processes will need to be reviewed fully; this includes the HRA and FQ referenced SRs.

The referenced SRs are identified and evaluated as follows:

- For FPRA SRs in Table B-2 that refer to SRs in Part 2 of the ASME/ANS PRA Standard, the Basis column in Table B-2 provides a reference to the appropriate SRs in the Appendix D, Table D-1. The evaluation of the FPRA SR is assessed as either "met" or "not met," based on the referenced SRs, with a "met" being identified if, and only if, all referenced SRs are "met," or assessed at Capability Category I or better. If the referenced SRs are not used or required, the SR is assessed as "not applicable."
    - In one case, the FPRA SR (ES-A3) has two sets of requirements that include both an evaluation of the criteria in the FPRA SR, and an evaluation (possible) of the

[10] This assumes the Fire PRA Standard is published as part of the ASME/ANS PRA PRA Standard for which ASME maintains the interpretation responsibility.

referenced SR. In this case, the FPRA SR and the referenced SR need to be evaluated separately.
  - In some cases, the Part 2 SRs are mentioned in the FPRA SR (see ES-A4), but no specific or additional review of the Part 2 SR is required.
  - In some cases, the Part 2 SRs are mentioned in the Notes/Discussion of the Fire SR. Again, no additional review of the Part 2 SR is required.

- Table D-1 in Appendix D provides a listing of the Part 2 SRs referenced in the FPRA SRs.
- F&Os regarding the referenced SRs should be directly related to the FPRA, and should be written against the Part 4 SR. A specific SR from Part 2 can be referenced upon utility request. Multiple F&Os can be written against one SR.
- In most cases, these are evaluated only when the FPRA performs the technical steps that are covered by the referenced SRs. It is expected that a large number of the referenced SRs will be evaluated as "not applicable." In other cases, where the modeling, data analysis, etc. is performed per the original Internal Events PRA procedures and processes, the evaluation of the new modeling can rely heavily on the Internal Events PRA peer review of the procedures and processes. When the FPRA includes new steps not previously evaluated, such as the inclusion of fire-induced performance shaping factors in the HRA, the evaluation of the new steps may have to be more extensive. The evaluation of referenced SRs would be to the appropriate Capability Category as identified in the Section 2 SR.

3.4 ADDITIONAL GUIDANCE ON THE TECHNICAL ELEMENTS REVIEW

The following general information applies to the use and interpretation of the summary sheets in Appendix B. These are provided as additional input to understanding the nature of the criteria.

- The "independent review" identified for evaluation as part of the checklist for each element under "Documentation" is a review sponsored by the host utility to make an assessment of the specified FPRA element. The Peer Review Team will review the results of that independent review process.
- The review sheets are not prescriptive with respect to the assignment of specific probabilities or frequencies. A reviewer commenting on either the strength or the inadequacy of an element in the FPRA should make an effort to provide a generally accepted reference to support the comment, where appropriate.
- For each SR, assumptions and uncertainties associated with the SR are to be factored into the criteria of that element.
- Section 4-2 of the ASME/ANS PRA Standard includes some high level considerations to be assessed in the peer review for each HLR and SR.
- Maintenance and updates: FPRA maintenance encompasses the identification and evaluation of new information, and the incorporation of this information into the FPRA on an as-needed basis. FPRA maintenance typically refers to minor model modifications and effort. More extensive maintenance may be performed if a specific application requires

refinement of certain parts of the model. A FPRA update is a comprehensive revision to the FPRA models and associated documentation.

- A certain level of subjectivity is expected when determining if an SR has been met. For example, when there are many instances of compliance, and there are a few instances where compliance is lacking, this does not necessarily mean that the SR is considered not met. Any non-compliance should be documented with an F&O. However, there should be a preponderance of evidence to conclude that an SR is not met.

3.5 FOLLOW-ON FPRA PEER REVIEW

The Follow-on Peer Review will cover the set of HLRs and SRs for the applicable FPRA technical elements in Section 4-2 of the ASME/ANS PRA Standard. Further, the scope may be limited within a FPRA technical element to only the SRs that are germane to a specific FPRA upgrade (e.g., re-evaluation of circuit failure probabilities). The Follow-on Peer Review may be limited to a single FPRA technical element, or may include multiple (or all) technical elements.

FPRA updates are scheduled to be performed periodically. In addition, they may also be performed on an as-needed basis as determined by the FPRA group leader. FPRA maintenance should serve to keep the FPRA reasonably current between FPRA updates. Additionally, it should be noted that the performance of an update does not generally require the performance of a Follow-on Peer Review, as discussed in Section 1-5 of the ASME/ANS PRA Standard. Performance of a FPRA upgrade will, however, require performance of a Follow-on Peer Review. (Note: The PRA Standard defines PRA upgrade as "the incorporation into a PRA model of a new methodology or changes in scope or capability that impact the significant accident sequences or the significant accident progression sequences. This could include items such as new human error analysis methodology, new data update methods, new approaches to quantification or truncation, or new treatment of common cause failure.") In terms of FPRA, an upgrade may include the use of new methods for fire modeling, inclusion of additional fire-induced accident sequences, etc.

The host utility should initially determine the scope of the intended Follow-on Peer Review. This should be sent early enough to the Peer Review Team Leader to permit feedback to resolve any issues prior to performing the review. (Scope may have been discussed during the planning stages, but the actual reviewers should be very clear on the scope details.)

The performance of the Follow-on Peer Review would then be relatively similar to the initial peer review, with a modified scope, schedule, etc., based on the intended scope of the Follow-on Peer Review. Similarly, the Peer Review Team may be smaller, since some review skills may not be needed for the Follow-on Peer Review. For example, if fire modeling is not part of the Follow-on Peer Review, the required team skill for fire modeling is not needed.

3.6 FPRA LEVEL OF DETAIL

Section 4-2 and Table 4-1-1 of the ASME/ANS PRA Standard discusses the variable and iterative nature of a FPRA. Since the FPRA includes analysis of fire risk for many areas in the plant, with each area possibly resulting in several possible initiating events, the level of detail for each area and each initiating event (scenario) is variable. A significant contributor to the FPRA

results may need to be analyzed in great detail, while a lower risk scenario or area could be analyzed with less detail.

When reviewing individual SRs against this principle, it will be necessary to take into account this principle and the relative importance of the fire area, compartment, or scenario. For example, when applying fire modeling tools, a range of tools is expected. For areas that are not significant contributors (see the ASME/ANS PRA Standard for discussion on this), bounding assumptions on fire damage could be used (Capability Category I). For significant contributors, detailed fire modeling for a group of ignition sources can be used (Capability Category II), or for each ignition source (Capability Category III) would likely be used. If properly applied, the SR would receive an assessed Capability Category of II or III (depending on which was applied to significant contributors) even with a majority of fire areas using bounding analysis. However, if a significant contributor was analyzed using bounding assumptions of fire damage, then Capability Category I would likely be assigned even if all other significant contributors were analyzed with detailed fire modeling. Another possibility would be the assignment of fire damage using "non-conservative" (not bounding) assumptions, which could result in either an F&O or a "not met" assessment for the SR, depending on the potential impact.

Many of the SRs will have to be reviewed with a similar consideration. This peer review guidance does not try to develop guidance for all of the SRs and possible levels of detail supporting each. However, the general principle discussed in Section 4-2 of the ASME/ANS PRA Standard should be considered in the peer review assessment for a Capability Category. In general, the assigned Capability Category will be based on the assessed level for the significant contributors, while ensuring the non-significant contributors still meet Capability Category I.

4 PEER REVIEW PROCESS RUSULTS AND DOCUMENTATION

4.1 PEER REVIEW REPORT

The output of the peer review is a written report documenting both the details and the summary findings of the review. The checklists, F&Os, and other forms prepared during the on-site review constitute the largest portion of the report. The principal results, conclusions, and recommendations of the Peer Review Team are communicated to the host utility at the completion of the on-site review, and included in the report. Also included are the resumes of the Peer Review Team members.

The peer review report will clearly state the following:

- The Capability Category assigned for each FPRA SR and the basis of the assignment
- The conclusions of the Peer Review Team
- Any recommendations to achieve the next higher Capability Category (if applicable). For example, if a majority of the SRs for a FPRA are assessed as Capability Category II, then where recommendations can be made for SRs assessed as Capability Category I, these should be provided in the report. This may not be possible in all cases.

The host utility should only expect one round of comments (i.e., there will not be multiple draft reports provided for utility review), and should not expect that the Peer Review Team would hold teleconferences or other meetings with the utility in order to review comment resolutions. Additionally, as time does not allow for the FPRA Peer Review Team to provide the host utility with early results and then to meet to discuss interpretations, etc. during the on-site review, consensus/debate meetings with the host utility during the on-site review should be avoided outside the context of any daily debriefs.

The utility is welcome and encouraged to comment on the draft FPRA Peer Review report. Such comments can address factual technical issues, as well as interpretations of the Standard. The Team Lead is responsible for resolving these comments with the team and issuing a final report. Note, however, that interpretation of the ASME/ANS PRA Standard SRs needs to be addressed via the ASME inquiry process – this can be done by either the team lead or the host utility. It is recommended the inquiry be submitted by the host utility due to needed follow-up on the PRA when the inquiry is answered. The utility should not expect that the review team would rescind and F&O or revise an SR Capability Category assessment based on the host utility stating they will address the issue. The review is to determine the state of the FPRA at the time of the review; the team does not have the time either on-site or during the report development stage to reconsider issues based on revised work transmitted by the utility.

The peer review report should be made part of the host utility's FPRA documentation file for future internal and external reference. The sponsoring Owners Group will maintain a record copy of the peer review report, but it should not be accessible to others than the host utility. Team members

should retain documentation of their participation in the PRA peer review, but should not redistribute any notes or utility documentation.

4.2 PROCESS SUMMARY FORMS AND INFORMATION

There are a number of tables and forms that have been developed for use as part of the process in order to help make effective use of the limited time available, and to document the results of the FPRA Peer Review. These forms are included and further described in Appendix B.

It is not the intent of this process to assign an overall Capability Category to the FPRA. The strength of the process is in the derivation and assignment of Capability Category for each SR, which serves to focus future FPRA update activities or for use in strengthening specific applications with additional deterministic assessments.

This FPRA Peer Review is focused principally on formal documented models, results, and their inputs. Notes or partial update results can be considered as an indication of the intent of the process, however, the review must be tied to the formal documentation that is available to describe the model and its results, and any documented and interpreted sensitivities.

An overall evaluation of the FPRA by the Peer Review Team is included in the report, using the form shown in Appendix B. This overall evaluation indicates the per-technical element basis for the evaluation, to allow focusing resources on those items that can be modified to improve the FPRA. An additional perspective on the Capability Category assignments is provided in the summary provided using Table B-2 that shows a more in-depth breakdown of the Capability Categories assigned to the FPRA SRs.

4.3 PROCESS FEEDBACK

It is anticipated that, as reviews are performed using this process, the participants will identify additional insights and suggestions for improving the quality and the efficiency of the peer review process. Appendix D provides an example of a process feedback form that can be used to report such improvements to the Owners Group peer review program coordinator. This will allow the process to be maintained as a "living" process, such that if incremental improvements are identified in subsequent peer reviews, the guidelines can be updated to reflect these enhancements.

4.4 FOLLOW-ON PEER REVIEW

The Follow-on Peer Review, as discussed in Section 3.5 above, will be documented in a similar manner to the original Peer Review, but with changes to account for the focused scope of this review. The final report should include a discussion on the reason for the Follow-on Peer Review, and the impact of the changes on the FPRA. Because of the limited scope of the review, not all tables in Appendix B would need to be completed. However, an overall evaluation of the FPRA would be based on a combination of the Follow-on Peer Review and the previous Peer Review (for sections not reviewed during the Follow-on Peer Review).

5 REFERENCES

1. "Probabilistic Risk Assessment (PRA) Peer Review Process Guidance," NEI 00-02, Revision A3, Nuclear Energy Institute, October 2000.

2. "Process for Performing PRA Peer Reviews Using the ASME PRA Standard (Internal Events)," Rev. 2, NEI-05-04, November 2008.

3. "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications, Addendum A," ASME RA-Sa-2003, American Society of Mechanical Engineers, December 2003.

4. "Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications, Addendum B," ASME RA-Sb-2003, American Society of Mechanical Engineers, December 2005.

5. "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications, Addendum A," ASME/ANS RA-Sa-2009, American Society of Mechanical Engineers, March 2009.

6. Regulatory Guide 1.200, "An Approach For Determining the Technical Adequacy of Probabilistic Risk Assessment Results For Risk-Informed Activities," U.S. Nuclear Regulatory Commission, Office of Nuclear Regulatory Research, Revision 2, March 2009.

7. ePSA PRA Documentation Module (DocAssist), Beta Version 2, The Electric Power Research Institute, May 2003.

8. "Process for Performing PRA Peer Review Follow-on Reviews and for Performing PRA Peer Reviews Using the ASME PRA Standard," WCAP-16091, Westinghouse Electric Company, LLC, June 2003.

9. "Process for Performing Follow-on PRA Peer Reviews of Individual PRA Technical Elements Using the ASME PRA Standard," WCAP-16181-NP, Rev. 0 (Draft, Not Issued), Westinghouse Electric Company, LLC, November 2003.

10. "Fire PRA Methodology, an American National Standard," ANSI/ANS-58-23-2007, American Nuclear Society, November 20, 2007.

APPENDIX A
Preparation Material for the Peer Team Review

This Appendix provides the following information referenced in the Guidelines:

- An estimate of the anticipated host utility resources for the FPRA Peer Review process
- An example letter to be sent to the host utility for initiating the FPRA Peer Review process
- A list of the material to be sent by the host utility to the Peer Review Team
- A list of the material to be available during the on-site visit
- The agenda for the on-site visit

A.1 Estimated Host Utility Resources

The FPRA Peer Review includes a detailed review of the FPRA. This detailed review is not only of the FPRA results, but also of the basis for decisions made in the development of the FPRA. Of particular interest are assumptions regarding the development of fire initiating events, human error probabilities, plant model (including event trees, quantification, recovery and sequences/cutsets), success criteria, independent review, fire modeling, circuit selection and analysis, and uncertainty. Given the depth and breadth of the review, it is important that all documentation of the FPRA development process be available and in a reviewer-friendly format. As a result, the Peer Review Team will require access to any and all FPRA documentation and supporting plant information, and also access to members of the host utility FPRA group. This, in turn, requires a considerable amount of preparation effort and support from the host utility.

An estimate of host utility required resources appears in Table A-1.

A.2 Example Letter

An example letter from the Owners Group to the host utility is included as Exhibit A-1. This letter explains what is required of the host utility in preparing for the review, including the following:

- Review material to be sent to the Peer Review Team
- Material to be available during the on-site review period
- The proposed agenda for the week
- Information on the use of detailed circuit analysis and fire modeling in the FPRA (as needed)
- Self-Assessment report for the FPRA
- Assessment of the Internal Events PRA open and closed F&Os for impact on the FPRA

Additional explanation of what is required of the host utility is provided in the following sections.

A.3 Host Utility Preparation and Participation Guidance

A considerable amount of host utility involvement is critical to ensure that the process can be accomplished successfully. The host utility should plan to spend a minimum of two person-weeks preparing documentation for the FPRA Peer Review Team, in addition to time required for the duplication or transmittal of requested information or for the preparation of the backup or support documents. Documentation should be provided electronically, if possible. Additional effort is required if documentation is not readily retrievable. In the current process, this documentation preparation will likely occur as part of the self-assessment, but the general requirements and considerations are the same.

Host Utility Information Requirements

There are several types of information that the host utility is required to provide for a successful review:

- Information to be available during the on-site review (Section A.3.1)
- Information for reviewers prior to the on-site review (Section A.4)
- Interpretation of information and models during the review, and responses to reviewer questions (Section A.5)
- Preparation of sensitivity studies to demonstrate the robustness of the FPRA (Section A.6)
- Presentations to explain details of the model that would otherwise require extended study by the reviewers for full understanding (Section A.7)

A.3.1 Information Availability and Preparation via the Self-Assessment

A list of information that should typically be available or readily accessible during the on-site review is provided in Attachment 1 of Exhibit A-1. However, having the required documentation available requires more than simply having the information available in a file drawer. The host utility should, as part of the self-assessment or preparatory activities, review any and all pertinent backup information and documentation in its files to ensure that the information is current and pertinent. The self-assessment should also provide a description of what information supports each of the SRs from Part 4 of the ANS/ASME PRA Standard, and should also include a limited evaluation of the referenced SRs from Part 2 as discussed in Section 1.4. Extraneous information and documents, such as draft copies, editorial comments and outdated information or information no longer pertinent, should not be presented to the Peer Review Team. Such information should be removed and placed in an archive file. In this way, the FPRA Peer Review Team can concentrate on the pertinent documentation. It is important to note that, although the FPRA Peer Review following this process is not a certification of the documentation, inadequate documentation is a factor in FPRA quality, and inadequate or inscrutable documentation affects the ability of the reviewers to determine FPRA quality and can affect the assigned Capability Categories.

In instances where limited backup information is available, the host utility should document, in outline form, what they believe was assumed in the analysis. Using this approach allows the reviewers to comment on the technical rationale and provides a forum for discussion of what other utilities have done regarding the same or similar issues. In this way, the host utility receives the maximum benefit from the FPRA Peer Review.

In addition, as part of the preparatory review/self-assessment process, the host utility may be requested to fill out the checklists of the FPRA Peer Review process elements and sub-elements. When performing a self-assessment, the host utility should be asking the question *"What information or basis is available to support the assignment for the sub-element Capability Category?"* The host utility should prepare a list or a collection of documents that were used in the development of the element and, where appropriate, the sub-element. This activity greatly enhances the likelihood that adequate documentation will be made available to the Peer Review Team and puts the host utility in a better position to appropriately respond to preliminary findings of the reviewers.

A.3.2 Suggested Performance of the FPRA Self-Assessment

A thorough and objective self-assessment of the FPRA against the ASME/ANS PRA Standard can help ensure the FPRA Peer Review is completed with minimal F&Os (see Section 1.4). The requirements listed above focus on the development of supporting documentation or a road map for the FPRA, basically discussing where the documentation supporting an SR is provided. However, the Peer Review Team may not agree with the self-assessment conclusions, especially if the Peer Review Team quickly determines the self-assessment did an incomplete job of assessing the FPRA documentation against the ASME/ANS PRA Standard.

To fully benefit from a self-assessment, the host utility can perform the assessment in a manner that ensures the results provide useful results to the plant. Points to consider on the self-assessment include:

1) The self-assessment should be performed and initially completed with sufficient time to incorporate any findings into the FPRA prior to the peer review. Depending on the available FPRA personnel support, this may require the self-assessment to be generally completed up to two months prior to the completion of the peer review.
2) Completion of the self-assessment in parts may ensure the schedule of the FPRA is not greatly impacted by the results of the self-assessment. Tasks completed early in the FPRA, such as plant partitioning, component selection, cable selection, and ignition frequency calculations can be reviewed well in advance of the peer review. This will allow corrections to be made to the FPRA early in the process, resulting in less impact to the overall schedule. For example, if the self-assessment determines a particular scenario was missed in the component selection step, the time to add the new components, trace and analyze cables, and re-analyze all of the impacted fire scenarios can be considerable. Therefore, it may be beneficial to perform the self-assessment in two to three phases, as several of the FPRA tasks are completed.

3) If items identified during the self-assessment are corrected, this should be reflected in the self-assessment. This can either be done through disposition of any identified items (similar to F&Os), or by updating the self-assessment to reflect the latest documentation.
4) The self-assessment may be documented in a database or spreadsheet, which can be easily reviewed by the peer review team. The OG peer review database can be used for the self-assessment, which would allow the peer review team to directly correlate the self-assessment results with the peer review results.
    - When using the OG peer review database or similar, the documentation should include the "roadmap" documentation for each SR, i.e., basically pointing to the document and location supporting the SR. Typical peer review databases do not include a separate data entry for documents supporting each SR, while a self-assessment database would likely include this information.

Use of some of the above guidance can help minimize the number of F&Os identified during the peer review.

A.4 Information for Reviewers Prior to the Review

A specific list of information to be sent by the host utility to the review team in preparation for the on-site review is provided in Attachment 1 of Exhibit A-1. This information is primarily a subset of the information required to be available during the on-site review. The listed information should be provided to each reviewer at least two weeks before the review, to allow sufficient preparation time. There are some items that should be provided to each reviewer, while other items may only need to be provided to those specific reviewers who will be responsible for their review. Examples of the more limited distribution documents might include HRA example calculations, Ignition Frequency Analysis and methodology, fire modeling, and selected sensitivity cases. The distribution requirements should be discussed with the Owners Group review coordinator.

Specific pre-review of detailed circuit analysis and fire modeling may be required. An initial review by the Peer Review Team Lead would be performed to ensure that team members are selected that can adequately review the supporting FPRA information. For example, if a particular fire model is used in the FPRA and is key to the results, then a reviewer with familiarity with the fire model would be needed for the Peer Review. Selected team members with expertise in electric/circuit analysis and fire modeling would also need to review some of the detailed supporting analysis prior to coming on-site in order to focus the site review on key areas of the analysis.

It is assumed that a review of the open Internal Events PRA Peer Review F&Os has been performed prior to the FPRA Peer Review. This review should document the potential impact of the F&Os on the FPRA. The disposition of these F&Os is to be provided to the review team, prior to the review. Additionally, the results of the review of opened, closed and dispositioned F&Os from the Internal Events PRA Peer Review should be provided to the review team.

A.5 Information Transfer and Interpretation during the Review

The optimum benefits to the host utility are derived from the presence of the "owner(s)" of the FPRA (i.e., the staff member(s) most aware of the details of the development and current implementation of the FPRA) during the on-site visit. Otherwise, a set of other knowledgeable personnel needs to be present to provide support for the review team. These individuals and their areas of expertise need to be identified to the Peer Review Team members at the outset of the visit and available to respond promptly to questions during the review.

A.6 Preparation of Sensitivity Calculations

As part of the preparation process, it is requested that the results of several FPRA runs also be performed by the host utility and made available to the Peer Review Team prior to the on-site visit. The selected sensitivity cases are meant to demonstrate that:

- The fire cutsets or fire sequences that appear to not address dependencies have been properly accounted for in the model and quantification process.
- The fire cutsets or fire sequences that appear as a result of the sensitivity can be explained relative to their low frequency in the baseline fire model.
- Sequences or cut sets are not omitted as a result of assumed fire damage or time to damage.
- A method is provided to exercise the model and provide interpretation of results.

Note that the actual CDF numerical results of the sensitivity cases may be of limited relevance for the peer review.

The sensitivity studies may be chosen from the following list and should include a printout of the sufficient number of cutsets or sequences (at least 100) to illustrate that the conclusions relative to the stated aims are robust, plus importance reports for:

- Sensitivity of results to fire size and damage zone.
- Sensitivity of results to non-suppression probabilities.
- Sensitivity of results to the assumed equipment damaged by the fire.
- Sensitivity of the results to the circuit failure likelihood or circuit coordination.
- Sensitivity of the results to changes in operator failure rates, including control room abandonment and performance of local manual actions.

Additional or alternative sensitivities that may be more appropriate to the specific FPRA can be identified by the host utility.

A.7 Presentations

Several presentations by the host utility to the Peer Review Team are required during the on-site review. These informal presentations are considered crucial to success of the peer review and to generate valuable feedback to the host utility, and include: an initial presentation to the Peer Review Team to provide an overview of the important plant design features; and subsequent presentations on specific aspects of the FPRA.

Initial Presentation

The initial presentation is intended to provide the reviewers with an overview of the important plant features that influence the FPRA results, and also to help focus the Peer Review Team resources by highlighting specific areas of the FPRA for which the host utility desires review emphasis. This presentation may be made prior to the on-site visit via conference call. Similarly, it is valuable for the Peer Review Team to be made aware of any technical review elements and criteria that may not be applicable to a given plant (and the reason why), at the outset of the review so that the reviewers have a basis for not considering these items.

The overview presentation by the host utility should include the following detailed information:

- A brief summary of the scope, methods, and key results (including dominant sequences and fire areas/zones) of the FPRA
- A brief summary of any unique design features of the plant
- A brief summary of the FPRA Maintenance and Update process, including examples of current uses of the FPRA
- A brief overview of where the PRA group fits into the utility organization, and an indication of utility/plant management views on use and maintenance of the FPRA
- A summary of the types of risk-informed applications for which the FPRA has been used or is planning to be used
- The location of the FPRA documents, and of information in the documents, covered briefly in a manner that allows the Peer Review Team to be able to find the necessary information quickly throughout the week
- A description of any elements of the FPRA that would benefit from other FPRA practitioners' insights

Subsequent Presentations

The host utility is also expected to provide focused presentations on technical topics pertinent to the FPRA. These may vary from review to review, but will typically include one-hour discussions of the fire modeling, cable routing and circuit analysis, quantification method, and Fire Safe Shutdown procedures.

A.8 Administrative Details

Prior to the inception of the review at the plant site, there is a need for extensive planning and scheduling off-site to ensure that the review can be performed efficiently and effectively. The most important administrative details include the meeting location and report reproduction support.

Choosing a good meeting location is necessary to efficiently perform the review. Distractions must be minimized. Since long hours will likely be required, comfortable meeting rooms should be provided. At least two separate meeting rooms (one large enough for meetings with all of the team members plus several members of the host utility staff), and individual work areas (if possible) should be available for use by the Peer Review Team during the entire week. It is also useful to have quiet areas where team members can collect thoughts, and prepare or summarize findings. The Peer Review Team may request arrangements for box lunches to save time, or if there is no convenient cafeteria service. The host utility should supply to the reviewers a map and hotel list for the team to make logistical arrangements. Additionally, information on the accessibility of computers, printers, Internet, etc., should be provided. It is recommended that the review be conducted at the location that provides the best access to relevant documentation, as delays due to document retrieval difficulties are not acceptable during on-site reviews.

A.9 Host Utility Preparation Summary

In summary, the host utility should not request an FPRA Peer Review until the following tasks are accomplished[11]:

- Perform a self-assessment or other preparatory activities sufficiently in advance of the peer review so that there is time to address missing or inaccurate information
- Provide information to the Peer Review lead on the importance and use of detailed fire modeling and circuit analysis in the FPRA in time to support the Peer Review Team selection
- Ensure that all necessary information for the review is available on-site in reviewer-friendly format
- Provide initial information to be reviewed prior to the Peer Review Team visit, including sensitivity studies (at least 1 week in advance of the visit)
- Prepare for and host the Peer Review Team during the 1 week visit:
    - provide facilities for the use of the review team while on-site
    - provide an overview presentation and presentations on selected topics, and responses to reviewer questions
    - provide a proof test run of the model and sensitivity runs as needed
    - provide access to the management chain to discuss the FPRA process
    - provide selected focused walkdown(s) of the plant to augment the spatial interaction assessments
    - provide necessary capability for the Team's computers

[11] The decision on whether the host utility has completed these tasks will be made by a representative of the respective Owners Group, such as the PRA peer review coordinator or the proposed PRA team leader.

Table A-1
Host Utility Involvement and Resource Estimates

Item	Resource Estimate
Support a pre-review visit by a member of the Peer Review Team to identify the level of documentation that should be made available to the reviewers, and to help in coordinating the on-site review logistics	0.2 person-week
Supply initial information, which includes: • FPRA summary document • Other material at the discretion of the host utility • Sensitivity cases, if any have been requested by the Peer Review Team Lead prior to the review • Internal Events PRA Peer Review F&Os (open and closed/dispositioned), and their effect on the FPRA (may need to add time in the schedule for this)	1 person-week
Conduct FPRA Self-Assessment/FPRA Preparatory Activities*	3-4 person-weeks
Host the Peer Review Team during the one-week visit (Including focused plant walkdowns)	1-2 person-weeks
Prepare initial presentation information • Initial expectations regarding peer review assessment of Capability Categories, and basis for the expectations • Summary of plant and principal design features • Summary of the FPRA Maintenance and Update process • Application examples • PRA Group Management Role in Use of FPRA	0.5 person-week
Assemble all supporting documentation for the on-site visit	1 person-week
Provide responses to questions during the on-site visit	1 person-week
Provide presentations on selected topics	0.4 person-week
Provide a proof test run of the model during on-site visit	0.1 person-week
Provide access to the management chain to discuss the FPRA process	0.1 person-week
Resolution of F&Os/comments	This effort can vary appreciably no estimate is given here.
Closeout Meeting	~ 0.3 person-week
Total host utility Resource Requirement for Peer Review	~ 11 to 15 person-weeks[12]

* Time estimate does not include possible model improvements following the self-assessment prior to the peer review.

[12] This estimate is associated with a FPRA with good documentation and technical bases. With excellent documentation and Technical Bases, this estimate could be reduced, and with reduced levels of documentation, the estimate could be higher.

Exhibit A-1

Example Peer Review Planning Letter From
Owners Group to Host Utility

Peer Review Planning Letter

Manager PRA
Host Utility

SUBJECT: FPRA Peer Review

Dear Manager:

Thank you for your participation in the Fire Probabilistic Risk Assessment (FPRA) Peer Review program. In addition to the direct benefits of this peer review to your organization's applications of the FPRA, this program will provide benefits to the _____ (Fill in) Owners Group and its individual member utilities. The FPRA Peer Review should provide valuable insights for your use in gauging the overall technical adequacy of your FPRA for future use in risk-informed applications and in planning for FPRA update and maintenance activities.

This letter outlines the following:

- Expectations for the review process
- Proposed agenda for the peer review
- Information about the reviewers
- Key dates
- Commitment to support peer reviews of other sites

A considerable amount of FPRA information is being requested for the review team. Attachment 1 provides a list of information that is needed before the on-site review and information that would be desirable to have during the visit.

The members of the FPRA Peer Review Team for *Plant X* are:

	Reviewer	Affiliation
1.	_____	_____
2.	_____	_____
3.	_____	_____
4.	_____	_____
5.	_____	_____
6.	_____	_____

{For this review, we would also like to include participation by several observers who will not be official reviewers or have official peer review responsibilities, but who either represents one of other Owners Groups or an organization with which we are cooperating in conducting this program.}

The addresses and other information for these people are enclosed as Attachment 2. Attachment 3 provides the proposed agenda for the Peer Review meeting the week of _____. If you need to make any modifications to this agenda, please notify me as soon as possible. Please arrange to have at least two separate meeting rooms (one large enough for meetings with all of the Peer Review Team members plus several members of your staff), and individual work areas (if possible) available for use by the team members during the entire week. Also, the Peer Review Team will need computer and printer access, as well as assistance for lunch. Finally, please note that the Peer Review Team will require extended hours on-site during the review.

The pre-visit information for the review should be sent so that the reviewers receive it two weeks prior to the on-site review, i.e., by _____. This is important so that the Peer Review Team has adequate preparation time. Also note that the Peer Review team would like to discuss with you the anticipated types of planned risk-informed applications and any expectations for the FPRA.

The Peer Review Team includes members from other utilities, as coordinated through the X Owner's Group process. In order to ensure success of this program, the host utility should identify review team members that will be available for reciprocal support of other peer reviews, and the general time frame each team member will be available.

In summary, the key dates for the review are as follows:

- _____: Receipt of Information from host utility by the Reviewers
- _____: Initial day of the Peer Review meeting at host utility offices
- _____: Final Report on the FPRA Peer Review

Your input on all phases of the process, both before-hand and as a post-review critique, are encouraged. Evaluation of the process provides a valuable feedback mechanism for improving the quality of the review and the process.

If you have any questions, please call at any time.

Sincerely,

Coordinator, Owners Group FPRA Peer Review Program

cc: _____ (Review Team Member)
_____ (Review Team Member)
_____ (Review Team Member)
_____ (Review Team Member)
_____ (Review Team Member)

Attachment 1 to Peer Review Planning Letter

Information to be Available for Review by the Peer Review Team

Information to be sent for review in preparation for the on-site visit includes the following:

- FPRA summary document
- The Self-assessment of the FPRA.
- Example detailed FPRA documentation, such as:
  - Example analysis guidance documents
  - HRA methodology and example calculations
  - Data analysis methodology and common cause methodology
  - FPRA quantification notebook (or methodology), with summary of dominant core damage frequency (CDF) and large early release frequency (LERF) contributors, and the dominant fire areas or compartments
  - Containment performance notebook and LERF methodology
  - Sensitivity and uncertainty methodology and results
  - Results of previous peer reviews including open Internal Events F&Os, and the utility disposition of F&OS and their effect on the FPRA
- Other material at the discretion of the host utility
- Sensitivity cases, if any have been requested by the Peer Review Team leader prior to the review

In general, the material supplied to the peer review team is the host utility's decision. However, the more information that can be provided in advance, the more the on-site visit will be facilitated. Providing documentation and/or the FPRA computer model prior to the visit may permit the reviewer(s) to become more familiar with the FPRA model and conduct a more effective on-site review.

Information to be available on-site in (or in close proximity to) the Meeting Room(s) for the Peer Review Team (All Tier 1, 2, and 3 documents related to the following):

<u>GENERAL PLANT INFORMATION</u>

- System Descriptions
- Pre-fire plans
- Abnormal Operating Procedures for Fire
- Emergency Operating Procedures
- Fire Safe Shutdown Analysis and supporting analysis such as circuit analysis
- Technical Specifications
- Updated Final Safety Analysis Report
- P&IDs and General Arrangement Drawings
- Electrical Schematics

GENERAL PRA INFORMATION

- FPRA
- Internal Events PRA
- Guidance Documents
- Staff Evaluation Report for the IPEEEE, if applicable
- Responses to the IPEEE Request for Additional Information (If applicable)
- Previous Internal Events PRA Peer Review results and status of F&Os.
- Documentation of Independent Review
- Documentation of Plant Walkdowns for the FPRA (signoff/check off sheets or comment forms)

PLANT PARTITIONING

- Plant Partitioning Guidance
- Plant Layout Drawings
- Fire Protection Boundary Drawings

EQUIPMENT SELECTION

- Equipment Selection Development Guidance
- Expert Panel Report for Spurious Operation, if performed
- Appendix R SSD Equipment List
- PRA Basic Event Mapping to Plant Components
- Analysis performed in support of Equipment Selection

CABLE SELECTION AND LOCATION

- Cable Selection Guidance
- Cable Routing Database (electronic), with supporting software, it needed.
- Safe Shutdown Analysis Cable Routing results, if different from above.

QUALITATIVE SCREENING

- Qualitative Screening Guidance (if applicable)
- Results of Qualitative Screening (if applicable)
- Cable Routing for support system Initiating Events (if applicable)

FPRA PLANT RESPONSE MODEL

- System Notebooks for new systems modeled (if applicable)
- Fault Trees
- Basic Event Descriptions and Values
- System Success Criteria Basis for new FPRA event Trees (if applicable)
- System Descriptions
- P&IDs and Layout Drawings
- Electrical Schematics
- FPRA models and supporting database, such as FRANC models or similar

FIRE SCENARIO SELECTION AND ANALYSIS

- Fire Scenario Selection Guidance
- Fire Modeling Guidance

- Scoping Fire Modeling Results and Analysis
- Detailed Fire Modeling Results and Analysis
- Control Room Smoke Modeling Analysis
- Fire Suppression Calculations
- Multi-Compartment Analysis
- Scenario Selection Calculations
- Cable Damage Criteria
- Fire Wrap Location Information
- FPRA Walkdowns

IGNITION FREQUENCY

- Ignition Frequency Guidance
- Plant Fire History
- Ignition Source Data Sheets
- Assessment of Maintenance, Occupancy and Storage of Combustibles
- Ignition Frequency Walkdowns

QUANTITATIVE SCREENING

- Quantitative Screening Guidance (If Applicable)
- Analysis of Contribution for Screen Fire Areas/Compartments (If Applicable)

CIRCUIT FAILURES

- Circuit Failure Development Guidance
- Electrical Drawings for key components
- Circuit Likelihood Analysis

HUMAN RELIABILITY ANALYSIS

- HRA Guidance Documents
- Description of HRA Methodology and Human Actions Evaluated
- Evaluation of fire conditions on local actions
- Final HRA Values Used

SEISMIC FIRE

- Seismic Fire Guidance Documents
- Walkdowns

MAINTENANCE AND UPDATE PROCESS

- FPRA Update Guideline or Procedure
- Other Procedures or Guidelines which reference FPRA
- Other Documentation of Involvement in Plant Processes

Attachment 2 to Peer Review Planning Letter

Reviewer Addresses and Contact Information

NAME:		*Reviewer #1*
COMPANY:		
ADDRESS:		
Telephone:	Email:	
Fax:	SSN (if needed for site access):	

NAME:		Reviewer #2
COMPANY:		
ADDRESS:		
Telephone:	Email:	
Fax:	SSN (if needed for site access):	

NAME:		Reviewer #3
COMPANY:		
ADDRESS:		
Telephone:	Email:	
Fax:	SSN (if needed for site access):	

NAME:		Reviewer #4
COMPANY:		
ADDRESS:		
Telephone:	Email:	
Fax:	SSN (if needed for site access):	

NAME:		Reviewer #5
COMPANY:		
ADDRESS:		
Telephone:	Email:	
Fax:	SSN (if needed for site access):	

NAME:		Reviewer #6
COMPANY:		
ADDRESS:		
Telephone:	Email:	
Fax:	SSN (if needed for site access):	

Attachment 3 to Peer Review Planning Letter

Review Schedule and Agenda
(not sure we can have an accurate (rough) schedule until after the pilot applications. However, the general steps of the FPRA can be listed, with slightly more time given to the latter steps (other than uncertainty).

AGENDA ITEM	REVIEWER	TIME
SUNDAY		
Recommended Pre-Review Meeting of Peer Reviewers to Review the Process/Schedule, and for Calibration	(All)	(Evening)
MONDAY		
Overview Meeting of Team • Initial Observations and Changes in Focus	(All)	8 - 9 a.m.
Overview Presentation by host utility • Unique Plant Capabilities • Location of Reference Material (use Information Request as checklist) • Overview of Dominant Fire Scenarios • Model Treatment – Solution Method – Ignition Frequency Data – Quantification – Spurious Operations	(All)	9 - 10 a.m.
General Review of Documents	(All)	10 a.m. - 12 p.m.
Demonstration of Model: • General Approach • Philosophy/Assumptions • Nomenclature, etc.	Reviewers 1, 2, 4, 5 & 6	10 a.m. - 12 p.m.
LUNCH		

Attachment 3 to Peer Review Planning Letter

Review Schedule and Agenda
(not sure we can have an accurate (rough) schedule until after the pilot applications. However, the general steps of the FPRA can be listed, with slightly more time given to the latter steps (other than uncertainty).

AGENDA ITEM	REVIEWER	TIME
Walkdowns: • Plant Partitioning • Fire Ignition Frequencies • Initial Review of Critical Areas	Reviewers 1, 4, 5, & 6	1 p.m. – 4 p.m.
Monday-Friday: Detailed review of All Technical Elements	All	See high level Schedule in Attachment 4

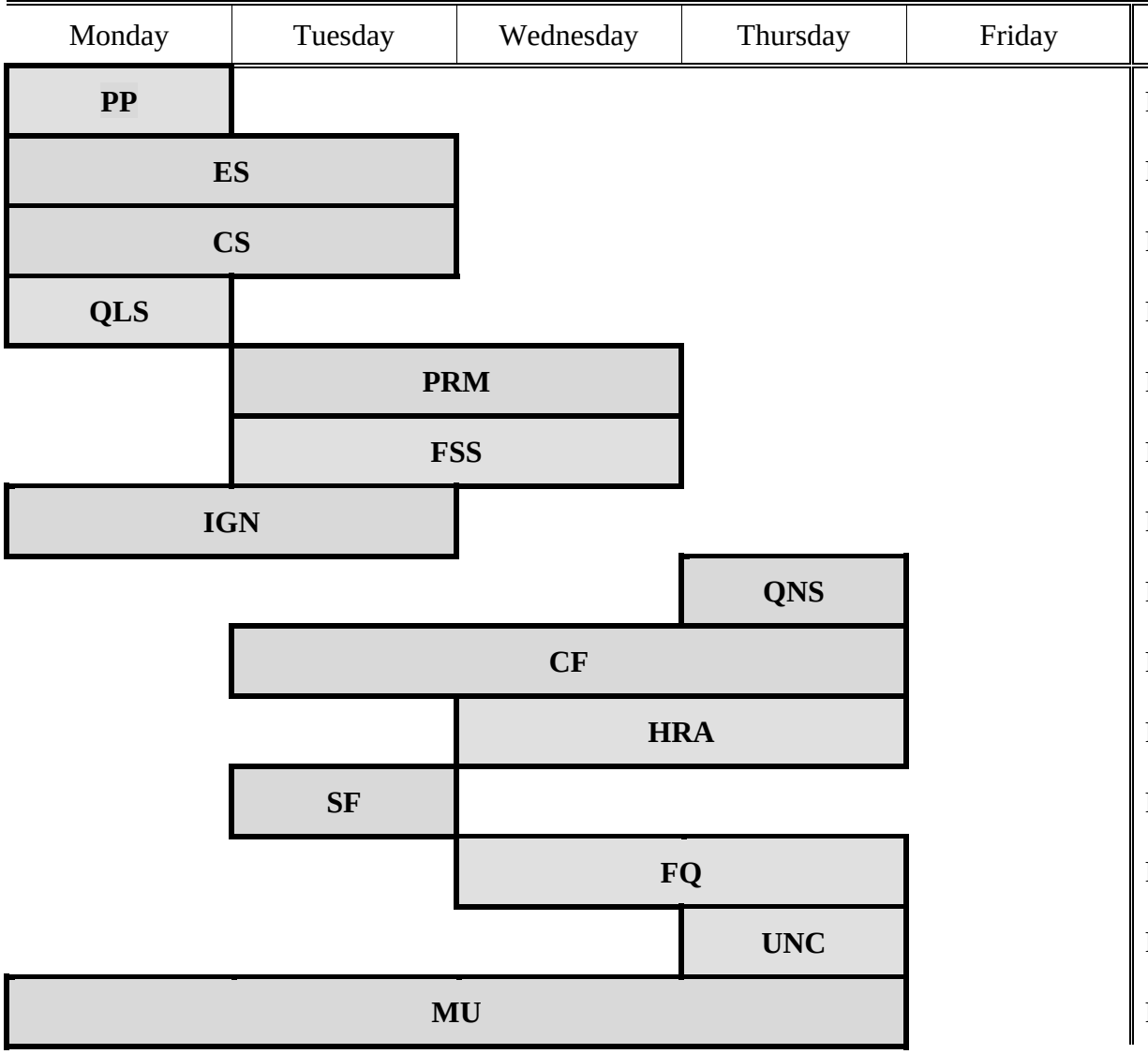
Attachment 3 to Peer Review Planning Letter

Review Schedule And Agenda

AGENDA ITEM	REVIEWER	TIME
FRIDAY		
Focused Study of Open Items	(All)	8 - 11 a.m.
Considerations of Utility on Feedback Findings	(All)	11 a.m. - Noon
LUNCH		
Exit Meeting	(All)	1 - 4 p.m.

Attachment 4

GRAPHICAL OVERVIEW OF REVIEW SCHEDULE[(1)]



Notes: (1) Bars indicate days that include scheduled review hours for the Technical Element in question.

APPENDIX B
Peer Review Sample Summary Sheets

Note: Users should confirm that the structure of the tables below conforms to the version of the PRA standard being applied, and make any changes as necessary.

Table B-1A Sample Summary Table for Plant Partitioning (PP)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-PP-A	Define the global boundaries of the FPRA.	
HLR-PP-B	Perform a Plant Partitioning analysis to identify and define the physical analysis units.	
HLR-PP-C	Documentation	

Table B-1B Sample Summary Table for Equipment Selection and Location (ES)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-ES-A	Identify equipment whose fire-induced failure or spurious operation will cause an initiating event.	
HLR-ES-B	Identify equipment whose failure or spurious operation would adversely affect credited functions.	
HLR-ES-C	Identify instrumentation whose failure or spurious operation would adversely affect operator actions.	
HLR-ES-D	Documentation	

Table B-1C Sample Summary Table for Cable Selection and Location (CS)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-CS-A	Identify and locate cables equipment whose fire-induced failure could adversely affect credited equipment or functions.	
HLR-CS-B	Perform a review for additional circuits that are either required to support a credited circuit or could adversely affect a credited circuit *and* identify any additional equipment and cables related to these additional circuits.	
HLR-CS-C	Documentation	

Table B-1D Sample Summary Table for Qualitative Screening (QLS)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-QLS-A	Identify those physical analysis units that screen out without quantitative analysis	
HLR-QLS-B	Documentation	

Table B-1E Sample Summary Table for FPRA Plant Response Model (PRM)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-PRM-A	Develop a FPRA Plant Response Model capable of supporting quantification.	
HLR-PRM-B	Include fire-induced initiating events, both fire-induced and random failures of equipment, as well as non-fire-related human failures associated with safe shutdown, accident progression events, and the supporting probability data.	
HLR-PRM-C	Documentation	

Table B-1E Sample Summary Table for Fire Scenario Selection and Analysis (FSS)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-FSS-A	Select one or more combinations of an ignition source and damage target sets to represent the fire scenarios for each unscreened physical analysis unit.	
HLR-FSS-B	Include an analysis of potential fire scenarios leading to the MCR abandonment.	
HLR-FSS-C	Characterize the factors that	

Table B-1E Sample Summary Table for Fire Scenario Selection and Analysis (FSS)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
	will influence the timing and extent of fire damage for each scenario.	
HLR-FSS-D	Quantify the likelihood of risk-relevant consequences for each scenario.	
HLR-FSS-E	Base the parameter estimates used in fire modeling on relevant generic industry and plant-specific information.	
HLR-FSS-F	Analyze scenarios with the potential for causing fire-induced failure of exposed structural steel.	
HLR-FSS-G	Evaluate the risk contribution of multicompartment fire scenarios.	
HLR-FSS-H	Documentation	

Table B-1F Sample Summary Table for Ignition Frequency (IGN)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-IGN-A	Develop fire ignition frequencies for every physical analysis unit	
HLR-IGN-B	Documentation	

Table B-1G Sample Summary Table for Quantitative Screening (QNS)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-QNS-A	Establish quantitative screening criteria.	
HLR-QNS-B	Identify those physical analysis units that screen out as individual risk contributors	
HLR-QNS-C	Verify that the cumulative impact of screened physical analysis units on CDF and LERF is small.	
HLR-QNS-D	Documentation	

Table B-1H Sample Summary Table for Circuit Failures (CF)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-CF-A	Determine the applicable conditional probability of the cable and circuit failure mode(s).	
HLR-CF-B	Documentation	

Table B-1I Sample Summary Table for Quantitative Screening (QNS)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-HRA-A	Identify human actions relevant to the Fire PRA.	
HLR-HRA-B	Include human actions in the FPRA Model.	
HLR-HRA-C	Quantify HEPs accounting for the plant-specific and scenario-specific influences on human performance, particularly including the effects of fires.	
HLR-HRA-D	Include recovery actions accounting for the effects of fires.	
HLR-HRA-E	Documentation	

Table B-1J Sample Summary Table for Seismic Fire (SF)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-SF-A	Include a qualitative assessment of potential seismic/fire interaction issues.	
HLR-SF-B	Documentation	

Table B-1K Sample Summary Table for Fire Scenario Selection and Analysis (FSS)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-FQ-A	Quantify the fire-induced CDF	
HLR-FQ-B	Use appropriate models and codes.	
HLR-FQ-C	Determine that all identified dependencies are addressed appropriately	
HLR-FQ-D	Quantify the fire-induced LERF	
HLR-FQ-E	Review the quantification results and identify significant contributors to CDF and LERF.	
HLR-FQ-F	Documentation	

Table B-1L Sample Summary Table for Uncertainty and Sensitivity Analysis (UNC)		
High Level Requirement Number	**Summary of High Level Requirement**	**Summary of Assessment Capability for FPRA**
HLR-UNC-A	Identify sources of CDF and LERF uncertainties and related assumptions.	

Table B-2
FPRA Review Sheets

SR	FPRA Capability Categories			Assign-ment of CC	Basis	Associated Facts and Observations
	I	II	III			
PP-A1	Meets/Not Meets					
PP-B1	Meets/Not Meets					
PP-B2	I	II/III				
PP-B3	I	II/III				
PP-B4	Meets/Not Meets					
PP-B5	I	II/III				
PP-B6	Meets/Not Meets					
PP-B7	Meets/Not Meets					
PP-C1	Meets/Not Meets					
PP-C2	Meets/Not Meets					
PP-C3	Meets/Not Meets					
PP-C4	Meets/Not Meets					
ES-A1	Meets/Not Meets					
ES-A2	Meets/Not Meets					
ES-A3	Meets/Not Meets			N/A	See Table D-1.	
ES-A4	I/II		III	N/A	See Table D-1.	
ES-A5	I	II	III			
ES-A6	I	II	III			
ES-B1	I	II	III			
ES-B2	I	II	III			
ES-B3	Meets/Not Meets					
ES-B4	Meets/Not Meets					
ES-B5	Meets/Not Meets					
ES-C1	Meets/Not Meets					
ES-C2	I	II	III			

Table B-2
FPRA Review Sheets

SR	FPRA Capability Categories			Assign-ment of CC	Basis	Associated Facts and Observations
	I	II	III			
ES-D1	Meets/Not Meets					
CS-A1	Meets/Not Meets					
CS-A2	I	II	III			
CS-A3	Meets/Not Meets					
CS-A4	Meets/Not Meets					
CS-A5	Meets/Not Meets					
CS-A6	Meets/Not Meets					
CS-A7	Meets/Not Meets					
CS-A8	Meets/Not Meets					
CS-A9	Meets/Not Meets					
CS-A10	I	II	III			
CS-A11	Meets/Not Meets					
CS-B1	I	II/III				
CS-C1	Meets/Not Meets					
CS-C2	Meets/Not Meets					
CS-C3	Meets/Not Meets					
CS-C4	Meets/Not Meets					
QLS-A1	Meets/Not Meets					
QLS-A2	Meets/Not Meets					
QLS-A3	Meets/Not Meets					
QLS-A4	Meets/Not Meets					
QLS-B1	Meets/Not Meets					
QLS-B2	Meets/Not Meets					
QLS-B3	Meets/Not Meets					
PRM-A1	Meets/Not Meets					

Table B-2
FPRA Review Sheets

SR	FPRA Capability Categories			Assign-ment of CC	Basis	Associated Facts and Observations
	I	II	III			
PRM-A2	Meets/Not Meets					
PRM-A3	Meets/Not Meets					
PRM-A4	Meets/Not Meets					
PRM-B1	Meets/Not Meets					
PRM-B2	Meets/Not Meets					
PRM-B3	Meets/Not Meets					
PRM-B4	Meets/Not Meets			N/A	See Table D-1.	
PRM-B5	Meets/Not Meets			N/A	See Table D-1.	
PRM-B6	Meets/Not Meets			N/A	See Table D-1.	
PRM-B7	Meets/Not Meets			N/A	See Table D-1.	
PRM-B8	Meets/Not Meets			N/A	See Table D-1.	
PRM-B9	Meets/Not Meets			N/A	See Table D-1.	
PRM-B10	Meets/Not Meets					
PRM-B11	Meets/Not Meets					
PRM-B12	Meets/Not Meets					
PRM-B13	Meets/Not Meets			N/A	See Table D-1.	
PRM-B14	Meets/Not Meets					
PRM-B15	Meets/Not Meets			N/A	See Table D-1.	
PRM-C1	Meets/Not Meets			N/A	See Table D-1.	
FSS-A1	Meets/Not Meets					
FSS-A2	Meets/Not Meets					
FSS-A3	Meets/Not Meets					
FSS-A4	Meets/Not Meets					
FSS-A5	I/II		III			
FSS-A6	I/II		III			

Table B-2
FPRA Review Sheets

SR	FPRA Capability Categories			Assign-ment of CC	Basis	Associated Facts and Observations
	I	II	III			
FSS-A7	Meets/Not Meets					
FSS-A8	I/II		III			
FSS-B1	Meets/Not Meets					
FSS-B2	I	II	III			
FSS-C1	I	II	III			
FSS-C2	I	II/III				
FSS-C3	I	II/III				
FSS-C4	I	II	III			
FSS-C4	Meets/Not Meets					
FSS-C5	I/II		III			
FSS-C6	I/II		III			
FSS-C7	Meets/Not Meets					
FSS-C8	Meets/Not Meets					
FSS-D1	Meets/Not Meets					
FSS-D2	Meets/Not Meets					
FSS-D3	I	II	III			
FSS-D4	Meets/Not Meets					
FSS-D5	I/II		III			
FSS-D6	Meets/Not Meets					
FSS-D7	I	II	III			
FSS-D8	Meets/Not Meets					
FSS-D9	I	II/III				
FSS-D10	I	II/III				
FSS-D11	Meets/Not Meets					
FSS-E1	Meets/Not Meets					
FSS-E2	Meets/Not Meets					

Table B-2
FPRA Review Sheets

SR	FPRA Capability Categories			Assign-ment of CC	Basis	Associated Facts and Observations
	I	**II**	**III**			
FSS-E3	I	II	III			
FSS-E4	Meets/Not Meets					
FSS-F1	I/II		III			
FSS-F2	I	II/III				
FSS-F3	I	II/III				
FSS-G1	Meets/Not Meets					
FSS-G2	Meets/Not Meets					
FSS-G3	Meets/Not Meets					
FSS-G4	I	II	III			
FSS-G5	I	II/III				
FSS-G6	I	II/III				
FSS-H1	Meets/Not Meets					
FSS-H2	I	II/III				
FSS-H3	Meets/Not Meets					
FSS-H4	Meets/Not Meets					
FSS-H5	I	II	III			
FSS-H6	Meets/Not Meets					
FSS-H7	Meets/Not Meets					
FSS-H8	Meets/Not Meets					
FSS-H9	Meets/Not Meets					
FSS-H10	Meets/Not Meets					
IF-A1	Meets/Not Meets					
IF-A2	Meets/Not Meets					
IF-A3	Meets/Not Meets					
IF-A4	I	II	III			
IF-A5	Meets/Not Meets					

Table B-2
FPRA Review Sheets

SR	FPRA Capability Categories			Assign-ment of CC	Basis	Associated Facts and Observations
	I	II	III			
IF-A6	Meets/Not Meets					
IF-A7	Meets/Not Meets					
IF-A8	I	II/III				
IF-A9	Meets/Not Meets					
IF-A10	I	II	III			
IF-B1	Meets/Not Meets					
IF-B2	Meets/Not Meets					
IF-B3	Meets/Not Meets					
IF-B4	Meets/Not Meets					
IF-B5	Meets/Not Meets					
QNS-A1	Meets/Not Meets					
QNS-B1	Meets/Not Meets					
QNS-B2	Meets/Not Meets					
QNS-C1	I	II	III			
QNS-D1	Meets/Not Meets					
QNS-D2	Meets/Not Meets					
CF-A1	I	II/III				
CF-A2	Meets/Not Meets					
CF-B1	Meets/Not Meets					
HRA-A1	Meets/Not Meets			N/A	See Table D-1.	
HRA-A2	Meets/Not Meets			N/A	See Table D-1.	
HRA-A3	I	II	III			
HRA-A4	I	II/III				
HRA-B1	I/II		III			
HRA-B2	Meets/Not Meets			N/A	See Table D-1.	

Table B-2
FPRA Review Sheets

SR	FPRA Capability Categories			Assign-ment of CC	Basis	Associated Facts and Observations
	I	II	III			
HRA-B3	I	II	III			
HRA-B4	I	II	III	N/A	See Table D-1.	
HRA-C1	I	II	III	N/A	See Table D-1.	
HRA-D1	I	II	III			
HRA-D2	Meets/Not Meets			N/A	See Table D-1.	
HRA-E1	Meets/Not Meets			N/A	See Table D-1.	
SF-A1	Meets/Not Meets					
SF-A2	Meets/Not Meets					
SF-A3	Meets/Not Meets					
SF-A4	Meets/Not Meets					
SF-A5	Meets/Not Meets					
SF-B1	Meets/Not Meets					
FQ-A1	Meets/Not Meets					
FQ-A2	Meets/Not Meets					
FQ-A3	Meets/Not Meets					
FQ-A4	Meets/Not Meets			N/A	See Table D-1.	
FQ-B1	Meets/Not Meets			N/A	See Table D-1.	
FQ-C1	Meets/Not Meets			N/A	See Table D-1.	
FQ-D1	Meets/Not Meets			N/A	See Table D-1.	
FQ-E1	Meets/Not Meets			N/A	See Table D-1.	
FQ-F1	Meets/Not Meets			N/A	See Table D-1.	
FQ-F2	Meets/Not Meets					
UNC-A1	Meets/Not Meets			N/A	See Table D-1.	
UNC-A2	Meets/Not Meets					

APPENDIX C
Maintenance and Update Process Review Checklist

Note: The Checklist Criteria presented in this appendix were extracted from Table MU in Appendix B of NEI 00-02. Thus, the terms “PRA maintenance” and “PRA update” as used in the table and its footnotes have slightly different meanings than those given and implied in Section 2 of the ASME PRA Standard.

Table MU PRA Configuration Control Process[1]		
DESIGNATOR	**CRITERIA**	**COMPLIANCE**
GUIDANCE		
MU-1	• Describes the process used	
MU-2	• Consistent with industry practices	
MU-3	• Sufficient detail provided to update the evaluation	
INPUT – MONITORING AND COLLECTING NEW INFORMATION[2]		
MU-4	• Each of the following information sources is part of the PSA update process for monitoring new information associated with the following:	
	– Operational Experience	
	– Plant Design	
	– New Maintenance Policies	
	– Operator Training Program	
	– Technical Specification	
	– Revised Engineering Calculations	
	– Emergency and Abnormal Operating Procedures	
	– Operating Procedures	
	– Emergency Plan	
	– Accident Management Programs	
	– Industry Studies	
MU-5	• Plant-specific data is included for quantitative reevaluation.	
MODEL CONTROL		
MU-6	• The computer models of the PRA are stored in a controlled manner. This also applies to sensitivity cases that may be performed to support a specific application.	
SOFTWARE CONTROL		
MU-7	• Computer code controls are formalized to ensure that the effect on the PRA of changes to these codes are understood and addressed if appropriate	
UPDATE/MAINTENANCE		
MU-8	• A process is in place to maintain the PRA. The PRA update model process consists of the elements identified and the steps in the process. The model update process consists of the following:	
	– Identification of Affected Model Elements	

Table MU PRA Configuration Control Process[1]		
DESIGNATOR	**CRITERIA**	**COMPLIANCE**
	– Modification of PRA Models	
	– Requantification of PRA Models	
	– Evaluation of Results	
	– Re-Evaluation of Past PRA Applications	
MU-9	• The plant has defined a fixed update schedule and criteria upon which to base the need for an update.	
MU-10	• The PRA results are evaluated by knowledgeable personnel before the results are used. [3]	
RE-EVALUATION OF PAST PSA APPLICATIONS		
MU-11	• Past PRA Applications are evaluated qualitatively to assure that the conclusions remain valid. [4]	
MU-12	• Past PRA Applications that may be affected by the latest information and update are re-performed.	
DOCUMENTATION		
MU-13	• Documentation reflects the process used	
MU-14	• Includes an independent review for the documented results	
MU-15	• Provides the basis of the update process and the results are traceable to specific changes in design, procedures, training, or operating experience.	

Notes to Table MU

1) PRA maintenance encompasses the identification and evaluation of new information, and the incorporation of this information into the PRA on an as-needed basis. PRA maintenance typically refers to minor model modifications and effort. More extensive maintenance may be performed if a specific application requires refinement of certain parts of the model. The on-going maintenance of the PRA can be performed on a resource-available basis when not driven by specific application needs. PRA maintenance should serve to keep the PRA reasonably current between PRA updates.

   A PRA update is a comprehensive revision to the PRA models and associated documentation. PRA updates are scheduled to be performed periodically. In addition, they may also be performed on an as needed basis as determined by the PRA Group leader. It is recommended that the update frequency should be no greater than once per year and no less than once per every three years (or every other fuel cycle).

The need for an update prior to a specific application is dependent upon the needs of the specific application (e.g., greater detail in specified areas) and the effect of new information on the assessment of the fidelity of the model to the current plant and procedures.

2) The purpose of the monitoring and data collection process is to identify information that could impact the PRA models. Monitoring implies a vigilant attitude towards industry and plant experiences, information, and data with the purpose of identifying inputs pertinent to the PRA. Collection refers to the process of logging the information and collecting explanatory information to evaluate its importance to the PRA.

3) An evaluation of the results of the PRA update need to be performed to ensure that the plant design and procedural changes have been accurately reflected and that biases have not been introduced into the accident sequence quantification.

4) The update of the PRA may result in a dramatically changed risk profile. Changes to the risk profile can in turn affect the results of past PRA applications. Possible examples are the safety significance determination in the Maintenance Rule, the in-service test interval for IST evaluations, or the on-line safety matrix to support on-line maintenance safety evaluations. PRA Application re-evaluations can be performed in a rigid fashion that involves a complete re-analysis. However, in general, a qualitative review of the applications would appear to be sufficient for many applications. A complete reanalysis may be needed only on a selected basis.

APPENDIX D
Peer Review Sample Summary Sheets Referenced SRs

Note: The tables in this appendix do not necessarily reflect the latest SRs in the PRA Standard. Users should confirm that the structure of the tables below conforms to the version of the standard being applied, and make any changes as necessary.

Table D-1
Referenced Internal Events Standard Section SRs.

HLR	SR	Referenced from?	Capability Category			Not Reviewed	Associated F&Os	Summary of Assessment
			I	II	III			
HLR-IE-C	IE-C4	ES-A3, ES-A4, ES-D1						
HLR-IE-A	IE-A1	PRM-B4: SRs IE-C4, IE-C6, IE-C7, IE-C8, IE-C9, and IE-C12 in Section 2 are to be addressed in the context of a fire inducing the initiating events excluding initiating events that cannot be induced by a fire						
	IE-A2							
	IE-A3							
	IE-A4							
	IE-A5							
	IE-A6							
	IE-A7							
	IE-A8		N/A					
	IE-A9		N/A					
	IE-A10							
HLR-IE-B	IE-B1							
	IE-B2							
	IE-B3							
	IE-B4							
	IE-B5							
HLR-IE-C	IE-C1							
	IE-C2							
	IE-C3							
	IE-C4							
	IE-C5							
	IE-C6							
	IE-C7		N/A	N/A				
	IE-C8							

Table D-1
Referenced Internal Events Standard Section SRs.

HLR	SR	Referenced from?	Capability Category			Not Reviewed	Associated F&Os	Summary of Assessment
			I	II	III			
	IE-C9							
	IE-C10							
	IE-C11							
	IE-C12							
	IE-C13							
	IE-C14							
	IE-C15							
HLR-AS-A	AS-A1	PRM-B5, PRM-B6						
	AS-A2							
	AS-A3							
	AS-A4							
	AS-A5							
	AS-A6							
	AS-A7							
	AS-A8							
	AS-A9							
	AS-A10							
	AS-A11							
HLR-AS-B	AS-B1							
	AS-B2							
	AS-B3							
	AS-B4							
	AS-B5							
	AS-B6							
HLR-SC-A	SC-A1	PRM-B7, PRM-B8						
	SC-A2							
	SC-A3							
	SC-A4							
	SC-A5							
	SC-A6							
HLR-	SC-B1							

Table D-1
Referenced Internal Events Standard Section SRs.

HLR	SR	Referenced from?	Capability Category			Not Reviewed	Associated F&Os	Summary of Assessment
			I	II	III			
SC-B	SC-B2		N/A					
	SC-B3							
	SC-B4							
	SC-B5							
HLR-SY-A	SY-A1	PRM-B9						
	SY-A2							
	SY-A3							
	SY-A4							
	SY-A5							
	SY-A6							
	SY-A7							
	SY-A8							
	SY-A9							
	SY-A10							
	SY-A11							
	SY-A12							
	SY-A13							
	SY-A14							
	SY-A15							
	SY-A16							
	SY-A17							
	SY-A18							
	SY-A19							
	SY-A20							
	SY-A21							
	SY-A22							

Table D-1
Referenced Internal Events Standard Section SRs.

HLR	SR	Referenced from?	Capability Category			Not Reviewed	Associated F&Os	Summary of Assessment
			I	II	III			
	SY-A23							
	SY-A24							
HLR-SY-B	SY-B1							
	SY-B2		N/A	N/A				
	SY-B3							
	SY-B4							
	SY-B5							
	SY-B6							
	SY-B7							
	SY-B8							
	SY-B9							
	SY-B10							
	SY-B11							
	SY-B12							
	SY-B13							
	SY-B14							
	SY-B15							
HLR-DA-A	DA-A1	PRM-B13						
	DA-A2							
	DA-A3							
	DA-A4							
HLR-DA-B	DA-B1							
	DA-B2							
HLR-DA-C	DA-C1							

Table D-1
Referenced Internal Events Standard Section SRs.

HLR	SR	Referenced from?	Capability Category			Not Reviewed	Associated F&Os	Summary of Assessment
			I	II	III			
	DA-C2							
	DA-C3							
	DA-C4							
	DA-C5							
	DA-C6							
	DA-C7							
	DA-C8							
	DA-C9							
	DA-C10							
	DA-C11							
	DA-C12							
	DA-C13							
	DA-C14							
	DA-C15							
	DA-C16							
HLR-DA-D	DA-D1							
	DA-D2							
	DA-D3							
	DA-D4		N/A					
	DA-D5							

Table D-1
Referenced Internal Events Standard Section SRs.

HLR	SR	Referenced from?	Capability Category			Not Reviewed	Associated F&Os	Summary of Assessment
			I	II	III			
	DA-D6							
	DA-D7							
	DA-D8							
HLR-LE-A	LE-A1	PRM-B15						
	LE-A2							
	LE-A3							
	LE-A4							
	LE-A5							
HLR-LE-B	LE-B1							
	LE-B2							
	LE-B3							
HLR-LE-C	LE-C1							
	LE-C2							
	LE-C3		N/A					
	LE-C4							
	LE-C5							
	LE-C6							
	LE-C7							
	LE-C8							
	LE-C9							
	LE-C10							
	LE-C11							
	LE-C12							
	LE-C13							
HLR-LE-D	LE-D1a							
	LE-D1b							
	LE-D2							
	LE-D3							
	LE-D4							
	LE-D5							
	LE-D6							

Table D-1
Referenced Internal Events Standard Section SRs.

HLR	SR	Referenced from?	Capability Category			Not Reviewed	Associated F&Os	Summary of Assessment
			I	II	III			
HLR-IE-D	IE-D1	PRM-C1						
	IE-D2							
	IE-D3							
HLR-AS-C	AS-C1							
	AS-C2							
	AS-C3							
HLR-SC-C	SC-C1							
	SC-C2							
	SC-C3							
HLR-SY-C	SY-C1							
	SY-C2							
	SY-C3							
HLR-DA-E	DA-E1							
	DA-E2							
	DA-E3							
HLR-HR-E	HR-E1	HRA-A1, HRA-A2						
	HR-E2							
	HR-E3							
	HR-E4		N/A					
HLR-HR-F	**HR-F1**	HRA-B2, HRA-B4						
	HR-F2							
HLR-HR-G	HR-G1	HRA-C1						
	HR-G2							
	HR-G3							
	HR-G4							
	HR-G5							
	HR-G6							

Table D-1
Referenced Internal Events Standard Section SRs.

HLR	SR	Referenced from?	Capability Category			Not Reviewed	Associated F&Os	Summary of Assessment
			I	II	III			
	HR-G7							
	HR-G8							
HLR-HR-H	HR-H2	HRA-D2						
	HR-H3							
HLR-HR-I	HR-I1	HRA-E1						
	HR-I2							
	HR-I3							
HLR-QU-A	QU-A1	FQ-A4						
	QU-A2							
	QU-A3							
	QU-A4							
	QU-A5							
HLR-QU-B	QU-B1	FQ-B1						
	QU-B2							
	QU-B3							
	QU-B4							
	QU-B5							
	QU-B6							
	QU-B7							
	QU-8b							
	QU-B9							
	QU-B10							

Table D-1
Referenced Internal Events Standard Section SRs.

HLR	SR	Referenced from?	Capability Category			Not Reviewed	Associated F&Os	Summary of Assessment
			I	II	III			
HLR-QU-C	QU-C1	FQ-C1						
	QU-C2							
	QU-C3							
HLR-LE-E	LE-E1	FQ-D1						
	LE-E2							
	LE-E3							
	LE-E4							
HLR-QU-D	QU-D1	FQ-E1						
	QU-D2							
	QU-D3		N/A per FQ-E1					
	QU-D4							
	QU-D5							
	QU-D6							
	QU-D7							
HLR-LE-F	LE-F1							
	LE-F2							
	LE-F3							
HLR-QU-F	QU-F1	FQ-F1						
	QU-F2							
	QU-F3							
	QU-F4							
	QU-F5							
	QU-F6							
HLR-LE-G	LE-G1							
	LE-G2							
	LE-G3							
	LE-G4							
	LE-G5							
	LE-G6							

Table D-1
Referenced Internal Events Standard Section SRs.

HLR	SR	Referenced from?	Capability Category			Not Reviewed	Associated F&Os	Summary of Assessment
			I	II	III			
HLR-QU-E	QU-E1	UNC-A1						
	QU-E2							
	QU-E3							
	QU-E4							
HLR-LE-F	LE-F2							
	LE-F3							

APPENDIX E
Example PRA Peer Review Lessons Learned Form

PRA Peer Review Team **LESSONS LEARNED INPUT FORM**
Process Lessons Learned:
PRA Lessons Learned:
Review Team Member (optional): _____

APPENDIX F
Sample Fact and Observation Form

FACT/OBSERVATION REGARDING PRA TECHNICAL ELEMENTS
OBSERVATION (ID:) [13] / Technical Element ___ / Supporting Requirement ___
LEVEL OF SIGNIFICANCE:
BASIS FOR SIGNIFICANCE
POSSIBLE RESOLUTION

LEVELS OF SIGNIFICANCE FOR FACTS AND OBSERVATIONS

Finding	An observation (an issue or discrepancy) that is necessary to address to ensure the technical adequacy of the PRA, the capability of the PRA, or the robustness of the PRA update process.
Suggestion	An observation considered desirable to maintain maximum flexibility in PRA applications and consistency with Industry practices, or simply to enhance the PRA's technical capability as time and resources permit, at the discretion of the host utility. Also includes editorial or minor technical item left to the discretion of the host utility.
BP	Represents "best industry practice," to the extent that other PRA owners would want to emulate.

[13] A suggested format for F&O ID number is *ee-sr-##*, where *ee* is the 2 letter code for the Technical Element (e.g., HR for Human Reliability Analysis), *sr* is the identifier for the specific supporting requirement (e.g., A3), and *##* is a sequential number for F&Os for the given SR. For example, *HR-A3-02* would be the second F&O referring to supporting requirement HR-A3.

APPENDIX G
Example F&O Sequential Number Selection Log

F&O Sequential Number Selection Log	
F&O Number	**Reviewer**