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February 14, 2014
L-14-064

ATTN: Document Control Desk
U. S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT:
Beaver Valley Power Station, Units No. 1 and 2
BVPS-1 Docket No. 50-334, License No. DPR-66
BVPS-2 Docket No. 50-412, License No. NPF-73
<u>Supplemental Information Regarding Application for License Amendment to Adopt NFPA 805, "Performance Based Standard for Fire Protection for Light Water Reactor Electric Generating Plants (2001 Edition)" (TAC Nos. MF3301, MF3302)</u>

By letter dated December 23, 2013 (Agencywide Documents Access and Management System Accession Number ML14002A086), FirstEnergy Nuclear Operating Company submitted an application for license amendment to adopt NFPA 805 as the licensing basis for fire protection programs at the Beaver Valley Power Station (BVPS). In support of the application for license amendment, an analysis of the adequacy of the internal events probabilistic risk assessment (PRA) for BVPS is enclosed.

There are no regulatory commitments established in this letter or its enclosure. If there are any questions or if additional information is required, please contact Mr. Thomas A. Lentz, Manager - Fleet Licensing, at 330-315-6810.

I declare under penalty of perjury that the foregoing is true and correct. Executed on February 14, 2014.

Sincerely,

Eric A. Larson

Enclosure: Beaver Valley Power Station Units 1 and 2 - Internal Events PRA Quality

cc: Director - NRC Office of Enforcement (w/o Enclosure)
NRC Regional Administrator - Region I (w/o Enclosure)
NRC Resident Inspector (w/o Enclosure)
NRC Project Manager (w/o Enclosure)
Director - State of Pennsylvania BRP/DEP (w/o Enclosure)
Site Representative - State of Pennsylvania BRP/DEP (w/o Enclosure)

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Enclosure
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Beaver Valley Power Station Units 1 and 2 Internal Events PRA Quality

(301 pages follow)

Beaver Valley Power Station Units 1 and 2
Internal Events PRA Quality

The Level 1 and Level 2 Probabilistic Risk Assessment (PRA) analyses for Beaver Valley Power Station (BVPS) Units 1 and 2 were originally developed in response to Generic Letter 88-20, Individual Plant Examination for Severe Accident Vulnerabilities – 10 CFR 50.54(f).

The BVPS-1 Individual Plant Examination (IPE) and the Individual Plant Examination of External Events (IPEEE) were submitted to the Nuclear Regulatory Commission (NRC) in October 1992 and June 1995, respectively. Since the inception of these studies, the BVPS-1 PRA model has evolved and has been updated many times. The following table provides a summary of the BVPS-1 PRA model revision history.

Date	Revision	BVPS-1 PRA Model Change
10/1992	0	Individual Plant Examination (IPE) NRC submittal
06/1995	1	Individual Plant Examination – External Events (IPEEE) NRC submittal
06/1998	2	Integrated Level 1 and Level 2 models
09/2003	3	WOG NEI 00-02 Peer Review with Category A/B F&Os addressed
06/2006	4	HRA [Human Reliability Analysis] Calculator, replacement steam generators, atmospheric containment conversion, and extended power uprate model
12/2010	5	RG 1.200, R1 (excluding Floods) CCII Compliant Model
01/2013	5a	Interim model update to include Internal Flooding, RG 1.200, R1 (including Floods) CCII Compliant Model

The BVPS-2 Individual Plant Examination (IPE) and the Individual Plant Examination of External Events (IPEEE) were submitted to the NRC under separate letters in March 1992 and September 1997, respectively. Since the inception of these studies, the BVPS-2 PRA model has evolved and has been updated many times. The following table provides a summary of the BVPS-2 PRA model revision history.

Date	Revision	BVPS-2 PRA Model Change
03/1992	0	Individual Plant Examination (IPE) NRC submittal
09/1997	1	Individual Plant Examination – External Events (IPEEE) NRC submittal
10/1997	2	Integrated Level 1 and Level 2 models
01/2002	3A	WOG NEI 00-02 Peer Reviewed
05/2003	3B	WOG NEI 00-02 Peer Review with Category A/B F&Os addressed
04/2007	4	HRA [Human Reliability Analysis] Calculator, atmospheric containment conversion, and extended power uprate model
12/2010	5	RG 1.200, R1 (excluding Floods) CCII Compliant Model

08/2012	5a	Interim model update to include Internal Flooding, RG 1.200, R1 (including Floods) CCII Compliant Model

The BVPS-1 and BVPS-2 PRA models, PRA-BV1-AL-R05 (BV1REV5) and PRA-BV2-AL-R05a (BV2REV5A), were the starting points for the Fire PRA. The BVPS PRA models have been subjected to assessments establishing the technical adequacy of the PRA. These assessments are identified and discussed in the paragraphs below.

- 2002 – An independent PRA peer review of the BVPS PRA models (BV1REV3 and BV2REV3A) was conducted under the auspices of the Westinghouse Owners Group (WOG) in July 2002, following the guidance provided by the Nuclear Energy Institute in NEI 00-02, "Probabilistic Risk Assessment Peer Review Process Guidance," Revision A3, March 2000 (NEI 00-02).

- 2007 – Following the BVPS-1 PRA model revision in 2006 (BV1REV4) and the BVPS-2 PRA model revision in 2007 (BV2REV4) which incorporated necessary updates and changes to address F&Os from the 2002 peer review, a self-assessment of the BVPS PRA models was performed against the American Society of Mechanical Engineers Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications, (ASME-RA-S-2002, and addenda, hereafter referred to as the ASME PRA Standard) using NRC Regulatory Guide (RG) 1.200, Revision 1, January 2007, An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk Informed Activities.

- 2007 – As part of the resolution to several F&Os from the 2002 PRA peer review, a change in the Human Reliability Analysis (HRA) methodology was incorporated into the 2006 BVPS-1 and the 2007 BVPS-2 PRA model revisions, so a focused scope peer review of the HRA Technical Elements against the ASME PRA Standard was performed using RG 1.200, Revision 1.

- 2011 – Due to an upgrade of the internal flooding model following the revision of both BVPS PRA models in 2010 (BV1REV5 and BV2REV5), a focused scope peer review of the Internal Flood PRA Technical Elements was performed against the applicable requirements of Part 3 of the ASME PRA standard as endorsed in RG 1.200, Revision 2.

Facts and Observations (F&Os) from the various reviews are assigned significance levels of A, B, C, D, or S for the 2002 peer review and 2007 self-assessment; or Finding, Suggestion, or Best Practice for the 2007 HRA peer review and the 2011 Internal Flooding peer review. The F&O significance levels are defined as follows.

<u>2002 Peer Review</u>

- A – Extremely important and necessary to address to assure the technical adequacy of the PRA or the quality of the PRA or the quality of the PRA update process

- B – Important and necessary to address, but may be deferred until the next PRA update

- C – Recommended, and considered desirable to maintain maximum flexibility in PRA Applications and consistency in the Industry, but not likely to significantly affect results or conclusions

- D – Editorial or Minor Technical Item, left to the discretion of the host utility

- S – Superior treatment, exceeding requirements for anticipated applications and exceeding what would be found in most PRAs

2007 Self-Assessment

- A and B level F&Os represent issues that have the potential to affect the risk results and/or risk insights. B level F&Os also represent documentation issues that are required to meet Capability Category II. All A and B level F&Os need to be resolved to achieve Capability Category II or higher.

- C and D level F&Os are comments or suggestions to improve documentation or traceability of analyses, but do no impact the supporting requirement grades. A C level F&O may also provide a suggestion on an alternative approach to achieve an objective, but does not imply that the approach used is not sufficient to meet the supporting requirements at the stated grade.

- S level F&Os are considered to be superior and do not reflect any shortfall to a requirement.

2007 HRA Focused Peer Review and 2011 Internal Flooding Focused Peer Review

- Finding – Equivalent to the old A and B levels of significance

- Suggestion – In general, equivalent to the old C and D levels of significance

- Best Practice – Equivalent to the old Strength (S) level of significance

The WOG conducted the Beaver Valley PRA model peer review following the NEI 00-02 process in July 2002. This peer review focused on the Unit 2 PRA model but also provided a cursory review of the Unit 1 PRA model and methodology. The Peer Review Team noted that Unit 1 uses the same PRA modeling techniques as Unit 2, so when the Unit 1 PRA revision is performed in the future using the same modeling assumptions as Unit 2 (including addressing applicable peer review comments) the Unit 1 PRA model and results should have the same level of confidence and applicability as those of Unit 2.

The significant findings (Category A and B F&Os) from the BVPS PRA peer review were incorporated into the 2003 BVPS-1 Revision 3 (BV1REV3) and the 2003 BVPS-2 Revision 3B (BV2REV3B) PRA models respectively. A long term solution to one of the PRA peer review findings was to revise the human reliability analysis methodology from the success likelihood index methodology (SLIM) to the EPRI HRA Calculator. The BVPS HRA were revised using the EPRI HRA Calculator and the results were incorporated into the 2006 BVPS-1 Revision 4 (BV1REV4) and 2007 BVPS-2 Revision 4 (BV2REV4) PRA models respectively. The Revision 4 PRA models included the replacement steam generators for BVPS-1, and the atmospheric containment conversion and extended power uprate to 2900 MWt for both units.

Following the BVPS-1 PRA Model Revision 4 in 2006 and the BVPS-2 PRA Model Revision 4 in 2007, a self-assessment of the BVPS PRA models was conducted in 2007 with the assistance of Westinghouse. Once again this review focused on the BVPS-2 PRA model, but to the extent that the PRA modeling methodologies are equivalent this self-assessment was also applicable to the Unit 1 PRA. This self-assessment was performed to determine if there were any gaps present between the BVPS PRA models and meeting the Capability Category II Supporting Requirements (SR) in the 2005 version of the ASME PRA Standard Addendum B, as endorsed by RG 1.200, Revision 1.

The status of the A and B level F&Os from the 2002 BVPS peer review were also checked, and were found to be resolved when considering the change in methodology to the EPRI HRA Calculator and associated reports that document the HRA inputs and considerations.

In January 2008, Westinghouse provided the final summary report of the BVPS PRA models self-assessment to demonstrate compliance with the ASME PRA Standard and RG 1.200, Revision 1. A total of 73 F&Os were identified in this review, and this assessment provided a starting point for determining where enhancements to the model, sensitivity analyses, or evaluations outside the PRA may be needed for a given application of the PRA to adequately support the integrated decision-making process.

A focused scope peer review was conducted by Westinghouse in October 2007 on the upgraded BVPS HRA methodology (EPRI HRA Calculator) to determine compliance with Addendum B of the ASME PRA Standard and RG 1.200, Revision 1. Because the methodology is the same between Units and the basic analyses differ only in minor details, the review focused on the Unit 2 HRA Report but is also applicable to Unit 1. Seven new F&Os were prepared to document the specific issues that were identified, all of which were classified as Findings.

In 2010 the BVPS-1 and BVPS-2 Revision 5 PRA models (BV1REV5 and BV2REV5, respectively) resolved the identified PRA self-assessment F&Os and focused HRA peer review F&Os, with the exception of the 27 F&Os associated with internal flood which required an upgrade of the internal flooding model to comply with the ASME PRA Standard internal flooding methodology.

The BVPS-1 Revision 5 and the BVPS-2 Revision 5 internal flooding PRA models were upgraded to comply with the Capability Category II Supporting Requirements of the combined ASME/ANS PRA standard (RA-Sa-2009), as endorsed by RG 1.200, Revision 2. In June 2011, these upgraded BVPS PRA models underwent a focused PRA peer review on the Internal Flooding portion of the model, which superseded the previous 27 internal flooding F&Os from the 2007 self-assessment and resulted in 17 new F&Os.

The 17 internal flooding PRA F&Os were appropriately resolved in the interim 2013 BVPS-1 Revision 5a (BV1REV5A) PRA model and the interim 2012 BVPS-2 Revision

5a (BV2REV5A) PRA model. These Revision 5a PRA models (documented as PRA-BV1-AL-R05a and PRA-BV2-AL-R05a, respectively) are the current effective reference models at BVPS.

The BVPS-1 Revision 5a PRA model (PRA-BV1-AL-R05a) and BVPS-2 Revision 5a PRA model (PRA-BV2-AL-R05a) have resolved all of the applicable F&Os identified in the 2002 BVPS PRA Peer Review, 2007 BVPS PRA Self-Assessment, 2007 BVPS HRA Focused Peer Review, and the 2011 BVPS Internal Flood PRA Focused Peer Review. These PRA models are considered to be fundamentally compliant with RG 1.200, Revision 1 for the scope of this application, meet Capability Category II or above in the ASME PRA Standard (RA-Sb-2005), and are capable of supporting all risk-informed applications requiring Capability Category I or II.

The Fire PRA model for BVPS-1 was based on the BVPS-1 Revision 5 PRA model, in which all previous F&Os except those related to internal flooding were resolved. Interim Issued Revision 5a PRA has already addressed all internal flooding F&Os. Final Fire PRA will be integrated into the updated working PRA model prior to the implementation of NFPA-805. The Fire PRA model for BVPS-2 was based on the BVPS-2 Revision 5a PRA model in which all F&Os, including those related to internal flooding, are resolved. Furthermore, BVPS is currently working on a regular update of 5a internal events PRA models, and the final Fire PRA model will be integrated into the latest revision of the PRA models as they are rolled out.

A brief summary of the BVPS final resolutions to the A, B, C, and D level F&Os from the 2002 WOG NEI 00-02 BVPS PRA Peer Review is provided in Table 1-1 Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions, and Table 2-1 Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions.

The resolutions to the 2007 BVPS PRA Self-Assessment F&Os are provided in Table 1-2 Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions, and Table 2-2 Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions.

The resolution to the seven F&Os from the 2007 BVPS HRA Focused Peer Review are provided in Table 1-3 Summary of BVPS-1 HRA Focused Peer Review – Facts and Observations Resolutions, and Table 2-3 Summary of BVPS-2 HRA Focused Peer Review – Facts and Observations Resolutions.

The 2011 BVPS Internal Flood PRA Focused Peer Review F&O resolutions are provided in Table 1-4 Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions, and Table 2-4 Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
AS-10	AS-12	A	Y	The BV PRA uses the WOG 2000 seal LOCA in a way that may be unacceptable to the NRC for risk based applications. MAAP runs are performed to find the core uncovery times for various sizes of seal LOCA. If the best estimate MAAP runs show the core is covered at 24 hours, the sequence is considered success. The result is that all SLOCA sizes except the 480 gpm leak have no impact on CDF, because the core is shown to remain covered at 24 hours. This strict interpretation of the 24 hour mission time results in a .01 probability of core uncovery, even in sequences where SW or AC power is not restored. This result is significantly more optimistic than most other Westinghouse PRAs. The uncertainty in the calculation [due to the possible variation in RCS pressure or seal LOCA size from the predicted] is not pursued. The MAAP analysis shows time to core uncovery of greater than 24	Additional MAAP uncertainty cases for BVPS-1 were performed using pessimistically biased values along with setting input parameters to their high or low limits. These cases were run out to 48-hours or until core damage occurred. The success state for the BV1REV3 PRA model was redefined as any case (including uncertainties) that did not go to core damage before 48-hours. For cases that went to core damage before 48-hours but after 24-hours, additional electric power recovery values were used, based on NUREG/CR-5496. For cases that lead to core uncovery before 24-hours, a plant specific electric power recovery model was used. If electric power recovery was successful for these cases, the sequence was also binned to the success end state.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

[1] The Supporting Requirement is in reference to NEI 00-02 Element – Subelement.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**[1]	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				hours, but the plant is not yet in a stable configuration. Declaration of success at this point, based only on MAAP results without thorough investigation of MAAP uncertainties (e.g., sensitivities) is a liberal application of the intent of the 24 hour success criteria and may be non-conservative.		

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
HR-07	HR-10	A	Y	The BV PRA uses the SLIM methodology. The HEP's are grouped in to 10 categories and then each category is "calibrated" in terms of 1 to 5 other PRA's. The PRA's that were used were Oconee (1984), Seabrook (1983), Diablo Canyon (1987), TMI (1985), Fermi (not referenced), South Texas (1988). The categories reflect each type of error (rule, skill, knowledge, diagnosis, response). The HRA's on which these are based are representative of nuclear plant procedures, training and operator cognizance typical for mid-1980. The error rate curves should be updated to reflect current operator performance in the nuclear power industry. The use of 15 year old reliability data will limit the ability of the PRA to support risk based applications.	As a resolution to this PRA Peer Review observation all operator actions having a Risk Achievement Worth (RAW) greater than 2 (generally accepted as the risk significant threshold) were compared to similar actions for all Westinghouse plants by using the WOG/B&WOG PSA Comparison Database (Revisions 2 and 3). Additionally, a smaller subset of these plants was also looked at that consisted of 3-loop plants (since these were assumed to have similar operation action completion times based on plant power to heatup volume ratios), plants that also used the SLIM process, and Indian Point 2, which received a superior finding in their Human Reliability Analysis. The results of this comparison show that for the operator actions that were compared, the human error rates used in the BV1REV3 PRA model are all within the range of both comparison groups defined above. It is therefore believed that the basic error curves used in the calibration of	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
					the BV1REV3 HRA are not grossly out of date, and that the current human error rates used in the PRA model are acceptable as is. Moreover, as a final resolution to this observation, future BVPS PRA models will use the EPRI HRA Calculator, which uses a more current and robust methodology. This F&O was written against an obsolete HRA PRA model (BV1REV3) and is considered to be resolved by the updated HRA PRA model incorporated in BV1REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	
HR-11	HR-27	A	Y	The BV HRA does not have a process to perform a systematic search for dependent human actions credited on individual sequences. One case of dependent HEPs was identified and treated (OF1 and OB2). However, it is	To identify dependent human actions, sequences with two or more failed split fractions that have a contribution from human actions were reviewed. Of the sequences reviewed the human	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				not known how this was found. Other potential cases of dependent human actions in SGTR. LOCAs or feed and bleed sequences were not addressed. PRAs typically have one or more of the dependent HEPs. SGTR-OD*CD*WM, or RR*WM SGTR-SL*OD*CD*WM SLOCA -CD*MU Trans- OB*MU Trans- OF*OB*MU Init - Start standby CCP * Trip RCP There could potentially be other combinations that were not identified. Current HRA practices generally require a systematic process to identify, assess and adjust dependencies between multiple human errors in the same sequence, including those in the initiating events. Moreover, there was no process in the HRA to adjust HEP on the final sequences and determine combinations of operator errors credited on individual sequences. A sensitivity study was done, but did not adjust the HEPs. The cutoff was 4E-9, so that many other combinations were already below the truncation. It is not	actions were determined to be independent between split fractions. Human actions that are modeled in a single top event have appropriate dependencies modeled in the event tree logic and rules. Moreover, as a final resolution to this observation, future BVPS PRA models will use the EPRI HRA Calculator, which uses a more current and robust methodology to identify human action dependencies. This F&O was written against an obsolete HRA PRA model (BV1REV3) and is considered to be resolved by the updated HRA PRA model incorporated in BV1REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				clear how HEPs in the initiating events were treated in the study. To be consistent with current HRA methods, there must be a systematic process to identify, assess and adjust dependencies between multiple human errors in the same sequence, including those in the initiating events.		
AS-07	AS-19	B	Y	For the SGTR event tree one of the operator actions is to initiate Bleed and Feed (top event OB). The success criteria for OB indicates that the basis for the success criteria assumes that the operator must have stopped the RCPs prior to OB in order to extend the time available to initiate bleed and feed (referenced EOP FR-H.1). If the tripping of the RCPs is a prerequisite for the degree of success of OB where in the model is this dependency accounted for.	Based on the EOP Background document for FR-H.1, steam generator dryout is expected to occur at 33.1 minutes if all RCP remain running during a loss of all secondary cooling. If the RCP are tripped 5 minutes after the reactor trip, steam generator dryout is expected to occur at 40.9 minutes. This difference of less than 8 minutes is not expected to significantly impact the human error rates calculated for Top Event OB, since the actions to trip the RCPs, initiate SI and open a PORV are fairly simple actions that can be accomplished within minutes. Therefore, these actions are all assumed to be accounted for in the human action failure rate.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
DA-06	DA-8	B	Y	The generic MGL data used in the BV Unit 2 PRA is referenced, almost exclusively to the PLG generic	A summary of all of the MGL parameters used in the top event common cause groupings is now	No impact to Fire PRA, because this issue was

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				database. Although the data analysis was updated recently, there is no discussion in the Data Analysis Notebook regarding the availability of newer data sources, e.g., NUREG/CR-5497. There should, at a minimum be a discussion of the currently available data sources. It is noted that at least one Beta factor from NUREG/CR-5497 is used, but it is not referenced in the data notebook.	provided in Appendix C, Table C-7 of the Data Analysis PRA Notebook. No further Corrective Actions are required. Updated common cause failure data from WCAP-16672, based on NUREG/CR-6819, were ultimately used in the BV2REV5 PRA model and appropriately documented. The methodology for the update was taken from NUREG/CR-5485.	addressed in the base PRA model prior to building the Fire PRA.
DA-09	DA-10	B	Y	There is very little guidance for or documentation of the process of selecting CCF groups. The System Analysis Overview and Guidance Notebook provides some of the high level methodology, but there is no discussion in the Data Analysis or System Notebooks as to the development of the groups that were ultimately modeled. In general, the system notebooks document the CCF groups by referring to the Riskman output files. This is not very informative. For example, the AC Electric Power System Notebook provides no discussion of the CCF model for the diesel generators. A discussion of decoupling the Unit 2 diesels from the Unit 1 should be included.	Resolutions to this F&O included adding a better reference to the methodology used in retaining the common cause groupings, along with a listing of all of the common cause groupings used in the quantification of the system top event models. These are provided in Section 6 "Common Cause Modeling" and Appendix A, Table A-1 of the BVPS-1 Systems Analysis Overview and Guidance PRA Notebook, respectively. Additionally, a summary of all of the MGL parameters used in the top event common cause groupings is now provided in Appendix C, Table C-6 of the Data Analysis PRA Notebook.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
					Furthermore, it is the opinion of the BVPS PRA staff that the details of the common cause groups that were retained in the PRA system models and presented in Appendix C of the BVPS Unit 1 PRA System Notebooks, under the common cause sections of the RISKMAN System Notebook files are adequately documented and can be found by knowledgeable personnel. Therefore, the practice of referencing this part of the notebook is deemed acceptable.	
DA-10	DA-7	B	Y	The test and maintenance unavailabilities for DG were reviewed. The following were observed. 1. The DG are used in a cross-tie situation for either unit. Thus, it is possible that the unaffected unit could be in shutdown and the DG could be in overhaul. The outage time for the DG (when used as a cross-tie) must include the OOS time during shutdown. 2. Appendix B of the data document indicates maintenance outage was collected Nov 98 through May 2000.	Unit 2 emergency diesel generator unavailability data during refueling outages was collected for 3/99 through 2/02 by the system engineer. This data was used in addition to the 2.5% assumed on-line unavailability, for a total Unit 2 emergency diesel generator unavailability of 4.4% used in the BV1REV3 PRA model update for the AC power crosstie.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				This is not long enough to capture the DG overhaul experience. 3. For unit 2, the unit 1 DG are used for the cross-tie. The T&M data must come from unit 1 experience. This information was not found.		
DE-04	DE (Draft IF-09)	B	Y	There is no discussion of some flow characteristics (e.g., spray effects, pipe whip) in the consideration of impacts from flood initiators.	In response to this observation, the work that was completed for the Beaver Valley Unit 1 Risk-Informed In-Service Inspection (RI-ISI) Indirect (Spatial) Consequence Evaluation was reviewed (8700-DMC-1333, Rev. 0). As a part of this evaluation process, an assessment of the postulated indirect (spatial) consequences associated with piping failures was made in order to further distinguish the piping segments. The indirect effects assessment was accomplished through an investigation of existing plant documentation on	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
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					pipe breaks, flooding, and plant layout along with a focused plant walkthrough. The indirect effects that were specifically looked at included; pipe whip, jet impingement, sprays, and *flooding resulting from pipe* breaks or leaks. The results of this indirect effects evaluation did not identify any viable SSC impacts due to flood induced failure mechanisms that were not already addressed in the PRA flooding analysis documentation. No further flooding impacts were incorporated into the BV1REV3 PRA. This F&O was written against an obsolete Internal Flooding PRA model (BV1REV3) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are	F&O will be resolved when NFPA 805 is implemented.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					presented in Table 1-4.	
DE-05	DE (Draft IF-25, IF-26)	B	Y	A number of flood-specific HEPs are included in the analysis (e.g., ZHEFL1-4). These four HEPs are evaluated in the HRA Notebook in the calculation tables, but no discussion of these actions is included in the HRA documentation, and only ZHEFL1 and ZHEFL2 appear in the flood documentation in the Appendix C of the IE Notebook.	To resolve this PRA Peer Review observation at Unit 1, operator actions ZHEFL1, ZHEFL2, ZHEFL3, and ZHEFL4 were added to Table 3-1 "Beaver Valley Human Actions " and discussions of the scenarios now appear in Appendix A "Dynamic Action Identifier Sheets This F&O was written against an obsolete Internal Flooding PRA model (BV1REV3) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
HR-01	HR-4	B	Y	Miscalibration errors are not considered for either independent or common cause pre-initiator human errors. The PRA assumes that both would be captured in the equipment failure data. However, the generic common cause failure database is not verified as having included miscalibration errors as well. Therefore, there is a potential misapplication of the generic common cause data use since the generic data source may not include the common cause miscalibration.	This observation is not totally correct, since the SSPS model did include instrument string miscalibration errors in the fault tree model. Additionally, common cause miscalibration errors between trains are considered to be rare events since the On-line Maintenance Program is developed to alternate work between trains on different weeks. Furthermore, a search in the Corrective Action database and EPIX did not reveal any such miscalibration errors between trains at BVPS. Therefore, this observation was assumed to be resolved by the instrument string miscalibration errors already accounted for in the SSPS model. No further miscalibration errors were incorporated into the BV1REV3 PRA. This F&O was written against an obsolete HRA PRA model (BV1REV3) and is considered to be resolved by the updated HRA PRA model incorporated in BV1REV4, which underwent a focused Peer Review in accordance with the guidance in	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	
HR-03	HR-2	B	Y	The BV PRA uses the SLIM methodology to quantify the post initiator human actions. The HRA quantification currently in use was completed for the IPE and has not been updated. The SLIM method can only combine the PSFs linearly to develop the overall FLI for each action. Current industry practice contends that PSFs can have significant non-linearities. For example if a particular action is rated poorly for a given PSF and moderately in all the others, middle of the road HEPs tend to result even though poor performance in only one PSF may be indicative of poor human reliability irrespective of what is going on with the other PSFs. Mosleh of University of Maryland has addressed this issue in a refinement of the FLIM method (which allows assignment of importance to PSFs) in an update of	While it is true that the FLI is a linear combination of the PSF rankings and weightings product, the actual HER is logarithmic as discussed in Section 2.1 of the HRA notebook. Additionally, as shown in Table B-4 "Beaver Valley Unit 1 – Group 2 Human Actions Evaluation" between ZHEMU1 and ZHEMU2, where the only major difference is in the timing rankings, there is a significant difference in the HER values. This PRA Peer Review observation was dispositioned by, the resolution of F&O HR-07 above, where it was shown that the current human error rates used in the PRA model are acceptable as is, and by acknowledging the PRA Peer	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				the Calvert Cliffs PRA. The BV PRA uses linear compilation of PSFs. The ability to use non-linear compilations, if desired would be an enhancement.	Review Team comment on its significance on CDF. Moreover, as a final resolution to this observation, future BVPS PRA models will use the EPRI HRA Calculator, which uses a more current and robust methodology to identify human action dependencies. This F&O was written against an obsolete HRA PRA model (BV1REV3) and is considered to be resolved by the updated HRA PRA model incorporated in BV1REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
HR-09	HR-03	B	Y	There is not enough detail in the HRA to reproduce the results. The following information was not available and does not appear to have been retained: a) the time lines b) discussion of the events chosen for "calibration" from the other PRA's and the reason why they are applicable. c) the basis for choosing 10 categories of HEP and the basis for assigning each BV HEP to a category	This CA is being (was) rolled into CA 02-09046-29 to track its resolution. This F&O was written against an obsolete HRA PRA model (BV1REV3) and is considered to be resolved by the updated HRA PRA model incorporated in BV1REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
HR-13	HR-19	B	Y	Some discrepancies in the timing were observed in the PRA. All the timing calculations were based on hand calculations. Although the times seemed reasonable compared to other PRAs, there were some observations. 1) There was a calculation done for steam generator dryout, which assumed all the water would be exhausted from the SG by 1.1 hours. Using 1.1 hours overestimates the time available to do F&B or restore AFW. Effectiveness of decay heat removal will decrease way before all the water is gone in the SG. 2) ZHECC1 - start standby CCP provides a time of 30 minutes, based on seal failure after loss of seal cooling. But, after loss of CCW, the RCP must be tripped with in 5-10 minutes to avoid catastrophic seal failure. The 30 minutes for seal failure after loss of cooling does not apply. This scenario is for bearing failure after loss of CCW. The timing should be consistent. 3) ZHEIC1 and ZHEIC2 show 70 and 30 minutes based on seal failure after loss of seal cooling. The time should	CAs 02-09045-18, -19, -20, 02-05632-01, and 03-07552-06 are all associated with re-evaluating operator actions for Revision 4 of the BVPS-1 PRA model using the EPRI HRA Calculator. This F&O was written against an obsolete HRA PRA model (BV1REV3) and is considered to be resolved by the updated HRA PRA model incorporated in BV1REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				be consistent and should consider if the Loss of CCW to the RCP bearing must be considered. 4) ZHEMU1 - timing for MU indicates the operator has 1.6 hours to act, based on the time it takes to drain the RWST from minimum level "empty". The number should be coordinated with the boron dilution calculation, which assumes boron dilution times from a RWST level of 140,000 or 360,000 gallons. time allowed for operator diagnosis on the front end must be subtracted from time allowed 5) ZHEOB1 provides 78 minutes for feed and bleed, based on the time for a PORV to lift after loss of AFW. There is no analysis for this. In most PWR, F&B must be started prior to the time the PORV lifts. Start time for F&B should be based on MAAP analysis. 6) ZHEOC1 - states there are 30 minutes to trip RCP after loss of seal cooling. The other parts of the PRA state 5 or 10 minutes. 30 min is a seal failure number, not a bearing failure number. ZHEOC1 be based on 5 minutes. 7) ZHEOS6 - timing states 1.3 hour		

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				available to start AFW. 1.3 hours is the time from reactor trip to core uncovery. AFW must be started before 1.3 hours. Also, if there is 1.3 hours allotted to start AFW, then there is no time for MFW restoration and F&B. The time from reactor trip to core damage must be apportioned to the 3 actions in this sequence. 8) ZHEWA5- 30 minutes to align diesel driven SW pump after LOSP. This time is based on seal failure due to loss of SW. The DG will fail in 8 minutes if there is no SW. The time to align Diesel driven pump is based on failure of the DG, which is 8 minutes.		
IE-04	IE-16	B	Y	Subtier criteria requires that "The initiating event frequency should not use data from the initial year of commercial operation." Contrary to this data from 1987 (Beaver Valley initial year of operation) is included in the data update. Use of this data, though conservative, could shift the importance of components.	For Unit 1, full power operation began on May 1977. The Unit 1 PRA model initiating event data collection started on Jan. 1, 1980. Therefore, no revision of data is needed based on this observation.	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IE-05	IE-13	B	Y	In appendix D of the initiating event notebook, the interfacing systems LOCA frequency is calculated referring to two references from 1985. The 2 landmark ISLOCA reports (NUREG/CR-5102 and NSAC-152) were written in 1992. Although the frequency calculated in the Beaver Valley PRA does not seem out of the recognized range of values for this frequency, due to the importance of this event for LERF, the compatibility of the method and data used in the PRA should be checked against the later references. Other inconsistencies in the analysis are: OST 2.11.16 is performed prior to startup, if it has not been performed in the previous 9 months. The PRA assumes there are 3 shutdowns per year (which is not supported by the historical performance of BV), so assigns a test frequency of 3 months. The maximum possible test interval for OST 2.11.16 is 26 months [plant ascends to power 8 months from last test for an 18 month run]. The minimum is 9 months. The true average test interval is likely in the 13-20 month range. Substituting this test	The interfacing system's LOCA (ISLOCA) initiating event frequency was recalculated based on NUREG/CR-3862, NUREG/CR-5102, NUREG/CR-5603, and NSAC-152. The new value used in the BV1REV3 PRA model, with a Monte Carlo quantification is 1.07E-05 events/yr.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				interval into the equation would have a significant affect on frequency. The probability of MOV 8889 being inadvertently open is not considered. The LHSI lines are interconnected such that if CV 552 and 109 fail, both 132 and 133 will be challenged. This is true for the other injection lines also. So the valve combination is 3 times higher than shown. The probability of pipe over pressure is assumed to be the same as pipe rupture. This is not consistent with the two 1992 references listed above.		

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
IE-08	IE-13	B	Y	Bayesian updating is used extensively in data analysis and also in initiating event frequency calculations. Although mathematically correct, the use of Bayesian updating without some limitations has been criticized, with justification, in the past. Under certain conditions, bayesian updating with zero or 1 failures may reduce a prior mean (with a high error factor) considerably. Since PRA results and applications depend on, and are measured mainly by point estimate (mean) results, but not by uncertainty bounds, any evidence that shifts the mean considerably must be rigorously justified. The BV PRA uses bayesian analysis for virtually all transient initiating events. In most cases, the plant specific data is 0 trips in 11 years. In general the posterior is lower than the prior. If the plant specific data was used by itself, the is enough data to justify a point estimate of about .05/yr. The prior for LOSP is .027. The prior for SGTR is .0074. The posterior for LOSP is .025 and for SGTR .0048. In both these cases, the posterior is lower than the prior and lower than the plant specific data can justify. This is due to the use of Bayesian analysis	Regarding Bayesian Update with 0 failures, there are indeed situations that updating with 0 failures could cause the posterior mean to be significantly lower than the prior mean. A known situation is the case of using moment matching. This refers to the practice of changing a prior that is presumably a lognormal distribution, to a gamma distribution by matching the mean and the standard deviation. After the Gamma distribution is updated with plant data analytically, the resulting gamma distribution is convert back to the lognormal distribution again using the moment matching method. It is known that in this practice, if there should be 0 failures, the resulting posterior gamma distribution has a mean value significantly lower than the prior mean. The BVPS analysis did not use the moment matching. Instead, the Bayesian update functionality provided by RISKMAN was used. There are two classes of priors used in the BVPS analysis. The first class are the lognormal	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

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F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				when too little plant specific data exists. Rules for when to use Bayesian analysis and when to use generic data should be developed to ensure that failure rates and initiating event frequencies are not reduced below both the generic values and the plant specific estimates.	distribution based on parameters from the NUREG study (for LOCA initiators, for example). Updating a lognormal distribution with 0 events in about 10 years does not change the mean in most cases (or there is a slight change in the third significant number). A more general type of priors is the industry data. The prior consists of three parts. The first and most important part is the failure and success data for a set of PWR power plants. The second part is the so-called grid, which consists of a set of values for the median (of the assumed prior curve), and a set of values for the range factor (of the assumed prior curve). The selection of median and range factor should be such that the resulting distribution should not skewed toward either end of the median or range factor in the grid (grid is the matrix of median and range factor values). The third part of a prior is the so-called lambdas, which is a set of values for the possible bin values that the distribution can locate. The	

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F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
					lambdas do not affect the posterior mean distribution as long as has sufficient range and sufficient number of values (typically 20 bins are sufficient for a distribution). It should be pointed out that for the industrial data type of prior, updating it with zero failures typically results in a smaller mean value for the posterior then the prior. However, the decrease is much smaller in magnitude than the moment matching approach, and it should be treated as a normal behavior of the Bayesian analysis (i.e., zero failures always provide information leading to a lower estimate). In response to this observation, each posterior distribution that was Bayesian updated with zero failures was reexamined to assure that there was no skewing of results on the grid, and that there were no abnormally large values (excessive probabilities) in a single lambda bin. In some cases a few more lambdas were added to actually bring the probability per each lambda lower than 0.1. However, in	

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					these cases the posterior distribution changed little compared to the original set of lambdas (note, the grid was not changed in this response because these were checked in the original analysis and quality was assured). The results of the review did not identify any concerns, so confidence in the Bayesian update results using zero failures based on the discrete probabilistic distribution approach, which is a robust process, was maintained. Based on the above discussion, no revision of the Unit 1 data are necessary in response to this observation.	
L2-03	L2-18	B	Y	All early SGTR core damage sequences with wet SGs are classified as SERF (small early release frequency) vs. LERF without regard to break location or other sequence specific conditions such as SG isolation, primary to secondary pressure equalization, etc. The basis for the use of small release was scrubbing; however, there is no documentation supporting this classification. For example, failure to cooldown and depressurize the RCS	The BV1REV3 PRA model assumes that all steam generator tube ruptures that are faulted and have a depleted RWST or have a loss of all secondary cooling are considered to be LERF contributors, even if the tubes are wetted (i.e., no credit for scrubbing going to SERF instead of LERF). It is assumed that leakage from the RCS will continue indefinitely through the faulted steam generator and the	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				may result in lifting the ruptured SG ASDVs or safety valves. Radionuclides, both volatile and non-volatile, entrained in the escaping steam result in a release to the environment. Without evaluation, the magnitude of the release to the environment is unknown, and may be sufficient to meet LERF classification.	core will uncover after the RWST depletes. This LERF definition is in agreement with WCAP-15955, "Steam Generator Tube Rupture PSA Notebook". Subsequently after closing this F&O, the ASME Standard recognizes scrubbing during SGTRs as a way to reduce LERF. Ultimately resolved by GAP F&O LE-C10-01 (see Table 1-2).	
MU-02	MU-06	B	Y	The computer models of the PRA (electronic files for the input and output of the PRA model and its sensitivity analyses) should be stored in a controlled manner. The subtier criteria states that " a secure offsite storage facility for computer codes, inputs, outputs, and models should be used". Discussions with the BV PRA staff indicate that the PRA model files are kept on CDs and also on a network drive (not a protected drive). To meet the intent of the subtier criteria, the model files should be also stored with the same philosophy as the paper copies of calculation notes; namely stored by a dedicated	IT has placed restrictions to the "S:/All/PRA Engineering" directory. The permissions for this directory are limited to specific design Engineering personnel. This will prevent unauthorized personnel from accessing PRA reports and models. In addition, the network is backed up daily, making retrieval of lost files very easy.	No impact to Fire PRA, because this issue was addressed for the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				organization (preferably outside of the PRA group), in a protected manner and be available for long term retrieval.		

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
QU-02	QU-08	B	Y	The original top ten sequences were for total CDF and not just internal. Of these three were control building fire, one seismic, and four external. The number 1 was ELOCA and number 2 was ISLOCA, both which were the initiating event which leads to guaranteed failure. The remaining four were internal sequences which meant something. The number five sequence was loss of AC bus "Purple" with other failures that lead to core damage. Sequences 7 and 8 were LOIA with loss of heat removal (high and dry). The number 10 sequence was ATWT (on a turbine trip) with the failure of the operator to manually trip the reactor, with all subsequent operator actions guaranteed failure. Since this had limited internal sequences, a larger report was reviewed with the objective to see what SBO looked like. The SBO was not on this and in fact the first LOSP was very low on the list. Then a sequence report was reviewed looking at LOSP only. Sequence #57 was the first SBO sequence and #58 was the second SBO sequence. The only difference between these was in the containment tree. With this is was realized that the containment tree was splitting up ("fractionalizing") the	The BV1REV3 PRA model now includes Top Event CG (LEVEL 1 OR LEVEL 2 SEQUENCE GROUP), in the Containment Event Trees (CET & CETLOCA). This Top Event bypasses the Level 2 Top Events when it is set to a guaranteed failure, and will query the Level 2 Top Events when it is set to a guaranteed success. To quantify only the Level 1 CDF, the Split Fraction logic rule for CG1 (1.0) uses the NOT NOMELT (-NOMELT) macro. Therefore, all core melt sequences bypass the Level 2 Top Events, and the resultant sequences have the Level 2 Spilt Fractions suppressed. When the Level 2 Top Events need to be quantified for LERF, the Split Fraction logic rule for CG1 (1.0) is changed to SS=F*SS=S, which can never be true, so the guaranteed success Split Fraction CG2 (0.0) is used and the Level 2 Top Events get queried and retained in the sequences.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				LOSP sequences, as opposed to some other sequences (such as ELOCA) which had one path through the containment tree. It was now realized that in order to analyze the sequences in the same context as previously, there needed to be a run of the event trees where the extra details of the containment tree suppressed. The utility staff ran this and the results and insights were noticeably different than before. The results of the top ten were significantly different. The ELOCA and VSLOCA stayed the same value but now are sequences 2 and 4 respectively. The number 1 sequence is now loss of instrument air. ATWT on PLMFWA is number three (while the previous ATWT went to 12). Two sequences are control building flooding.		

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
QU-03	QU-08	B	Y	In ATWT, if the operators fail to trip the reactor as an immediate action (top event OT) then subsequent operator actions RI and OA are failed. I suspect that this sequence has always been this way in the past, but with the recent enhancements in the model, the sequence has risen into the top ten. This leads to an overly conservative results in CDF. This appears to be the number 6 in internal (#10 sequence in total CDF). Of the top 50 sequences, 20% are ATWS. The total CDF for ATWS is a noticeable part of the CDF, and would not support any future RI ATWS applications.	In response to this observation, the BV1REV3 PRA model was revised to incorporate giving credit for the longer term operator action to emergency borate, even though the earlier actions to manually trip the reactor or to insert the control rods may have failed. The BV1REV3 PRA model was revised by removing the emergency boration (Top Event OA) human action dependency on prior ATWS human actions, which must be performed immediately; i.e., manual reactor trip (Top Event OT) and manual rod insertion (Top Event RI). This involved editing the ATWS event tree split fraction logic rules for OAF by removing OT=F + RI=F, as shown in Table 3.5-3 "ATWS Event Tree Logic Rules" of the Event Tree Analysis Notebook. The basis for this change was derived from WCAP –15831-P Section 5.1.1.12, where it is assumed that the operator action to emergency borate is independent of the previous	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					operator actions since it does not need to be completed in the same short time period as the operator actions to trip the reactor, or manually drive in the control rods.	
QU-04	AS-12	B	Y	An asymmetry discussion is provided in the PRA Quantification Notebook, section A.3. The write-up includes general discussion regarding the use of alignments to simulate the various modeling asymmetries in the systems modeling and the effect on event trees by partitioning some of the initiating event categories with some examples being provided. Some of these asymmetries are due to modeling assumptions and some are due to actual plant differences. No specific discussion is provided to explain what system asymmetries are due to simple	Asymmetries in a PRA model can occur in the system fault trees, maintenance alignments, or in the event tree modeling. All specific system asymmetries due to plant differences are addressed in the system fault trees. A system example is the River Water system, where only the A header can supply an emergency source of water to the Auxiliary Feedwater system. Specific system asymmetries due to plant NSA differences are addressed in the maintenance	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				modeling assumptions and which ones are due to plant differences.	alignment module of RISKMAN. An example of this is the auxiliary feedwater system, in which the turbine driven AFW pump is normally aligned to the A header. Actual plant data from the Maintenance Rule for train unavailabilities have been utilized when possible to account for maintenance alignment asymmetries. Whenever no specific plant data was available it was assumed that the train alignments were symmetrical. An example of this is with the Reactor Plant Component Cooling Water system, where each pump is equally assumed to be the running pump. The only exception to this was in the River Water system maintenance alignments, where due to the limitation on RISKMAN it was assumed that the A pump was always the running pump. These differences between the trains are addressed in the BV1REV3 PRA model top events and by the split fraction rules in the event trees. In the event trees, potential issues with asymmetries	

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					associated with initiating events have been removed by partitioning some of the initiating event categories. Examples of initiating events partitioned are Large LOCAs, which now models a break in each specific loop (initiating events LLOCAA, LLOCAB, and LLOCAC) using the same probability.	
QU-07	QU-15	B	Y	A review of the non-dominant sequences was made. The non-dominant sequences are those that are not normally saved when the entire model is run. It was necessary to quantify one initiator at a time to get the cutsets below 4E-10. A review of these cutsets had the following observations: 1) SGTR 1.507E-12: IAF * OD16B - how is OD possible when IA is failed? 2) TTrip 7.26E-11: AF1*OF1*OB4*CDF*RRI - if AF, OF, OB and CD are failed, how can RR be asked in a probabilistic manner. RR should be RRF. 3) TTrip 3.233E-11: SA1*OS6*AF3A*OFF*OBF*CDF*RR1 - How can RR be asked in a probabilistic fashion after failure of all	The specific sequences listed in the issue description only apply to the Unit 2 BV2REV3A PRA model. To ensure that the Unit 1 sequences are valid, the BV1REV3 PRA model was quantified using only the Level 1 Top Events so that a review of the CDF sequences could be performed to verify that the split fraction logic rules made sense. This included looking at non-dominate sequences 5 orders of magnitude lower than the total CDF value.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				that? 4) TTrip 8.34E-12 AF1*MFF*OB1*CDF*RR1 - same question about RR? 5) TTrip 1.1649E-12: PR7*HH2A*OR3A*MU2: If HH2A is failed, how can MU2 succeed? Does not MU2 use the HHSI pumps? 6) TLMFW 1.2559E-12: AF1*OF1*OB1*HH1: Why is OF1 in the tree for Loss MFW? Why is OB1 in the same sequence as HH1. If OB1 fails, there is no initiation of HHSI, so why is HH1 included?		
QU-09	QU-31	B	Y	This element asks whether the sequence results by sequence, sequence types, and total was reviewed and compared to similar plants to assure reasonableness and identify any exceptions. A review of the PRA documentation did not reveal a comparison of the current PRA revision results to results of similar plants.	As a resolution to this PRA Peer Review observation a ballpark comparison was made utilizing the WOG PSA Model and Results Comparison Database, Revision 3. Items compared included; initiating event frequencies and their conditional CDF, component failure rates, human error rates, and success criteria. While, this review was not detailed no outliers were identified, and the conditional CDF from LOSP initiators was comparable with North Anna, a nearly identical plant. During the	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					next PRA model update a more thorough comparison will be made utilizing the most recent WOG PSA Model and Results Comparison Database, and the findings documented. Ultimately resolved by GAP F&O F&O IE-C10-01 (see Table 1-2).	
QU-10	QU-30	B	Y	The initiating event frequency for interfacing system LOCA (i.e., initiator VSX) was quantified using point estimates (result of 2.2E-7) and using Riskman's Monte Carlo algorithm (result 3.0E-7). The difference is explainable based on data dependence between valve failures. But the event tree quantification used the lower, point estimate result. The 3.0E-7 Monte Carlo result should be used in the quantification.	This PRA Peer Review Fact & Observation was written against the Unit 2 BV2REV3A PRA model. For Unit 1, the BV1REV3 PRA model recalculated the interfacing system's LOCA (ISLOCA) initiating event frequency based on NUREG/CR-3862, NUREG/CR-5102, NUREG/CR-5603, and NSAC-152. The new initiating event frequency value used in the BV1REV3 PRA model is 1.07E-05 events/yr, which was performed using a Monte Carlo quantification.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
ST-02	ST-10	B	Y	The internal flooding analysis was done for the IPE and has not been updated since then. All flood barriers were treated deterministically and assumed to succeed. The sub-criteria for this element suggests that flood propagation pathways should include failure of doors, floor drains, and other flood barriers.	In response to this observation, the work that was completed for the Beaver Valley Unit 1 Risk-Informed In-Service Inspection (RI-ISI) Indirect (Spatial) Consequence Evaluation (8700-DMC-1333, Rev. 0), as well as, several updated flooding analyses performed after the IPE submittal were reviewed. The results of this review determined that the flooding analyses did consider the potential of flood barrier failures due to the flood water static head on the door latching mechanisms and likelihood that floor drains were inadequate. It was concluded that the IPE flooding analysis assumptions regarding the propagation of floodwaters did consider flood barrier failures, and therefore, they remain valid. No further flooding impacts were incorporated into the BV1REV3 PRA.. This F&O was written against an obsolete Internal Flooding PRA model (BV1REV3) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	
SY-01	SY-12	B	Y	Loss CCP/CCR results in a loss of seal water heat exchanger cooling (discharges directly to the charging pump suction) as well as loss of non-Regenerative heat exchanger cooling (discharges to the VCT). The result is a potential common mode failure of all charging pumps due to an increasing charging pump inlet temperature, coupled with the loss of CCP/CCR, this results in an RCP seal LOCA. Riskman macro RWSTSO (VCT swap-over to RWST) contains logic to include the failure of the components required to perform this action, but the operator action is not included. Given the uncertainty of the time to charging pump failure, the operator action may dominate the mechanical component failures.	With multiple high temperature alarms coming in at more than 100 °F prior to reaching this temperature, there would be plenty of time available to operators to perform mitigating actions. Moreover, a loss of NPSH would only impact the running charging pump, since the standby pump does not automatically start, unless a Safety Injection Signal is present, in which case the suction would automatically swap over to the RWST. The third pump would only be manually aligned and started following the failure of the first two normally aligned pumps. Therefore, this observation was not considered to be a valid common cause failure mechanism of the charging/HHSI pumps, so the operator action	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
					was not included in the BV1REV3 PRA model.	
SY-02	SY-3	B	Y	The degree of documentation in the systems analysis should provide enough detail that the systems analysis can be duplicated with minimal effort. A review of the Auxiliary Feedwater System Notebook (Book 2, Tab 2) and the Main Feedwater System (Book 3, Tab 6) revealed that the Split Fraction definition / truth tables are not documented and the Common Cause assumptions are not documented. There is no discussion as to where these assumptions came from or the definition of the split fractions utilized	Split fraction definitions were developed by using the dependency matrices located in Appendix B of the Level 1 Event Tree Analysis PRA Notebook. Split fractions and truth tables for Top Events AG, AL, AM, HC, HH, HL, HM, HR, LA, LB, LC, LL, LM, LO, LP, LQ, OP, OR, VA, VB, VC, VL and XL are found in the Split Fraction sections of the RISKMAN System Notebook files in Appendix C. Common cause failure inputs, assessment methodology and data update	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				in the Systems Analysis. The absence of this information could result in the inability to reproduce the Systems Analysis for verification of results or future applications.	summaries are located in Appendix C of the Data Analysis Notebook. Top Events AG, AL, AM, HC, HH, HL, HM, HR, LC, LL, LM, LO, LP, LQ, OR, VA, VB, VC, VL and XL Common Cause failures are found in the common cause sections of the RISKMAN System Notebook files in Appendix C.	
SY-03	SY-15	B	Y	Some initiator dependent component failure modes do not appear to be modeled. For example, the SI8890 MOVs are included in the model for fail to open to prevent LHSI pump overheating during low flow conditions. For this specific example, large LOCAs should only consider transfer open as a flow diversion; failure to open is not applicable. For small LOCAs, the failure to open is correctly modeled, but transfer closed should also be included. For medium LOCAs, the need to open or close the SI8890's may require additional thermal hydraulic analyses. Other system designs susceptible to initiator specific failure modes include systems with pumps which have mini-flow which return to the pump's suction. Systems like this may require operator action to stop these pumps if downstream pressure prevents	The LHSI mini-flow valves MOV-1SI-885A/B/C/D are NSA open at Unit 1, so a failure to open is not applicable to the PRA model. The MOV transfer closed failures are included in the LA/LB Top Events. This is a slightly conservative assumption for the large LOCA, when the RCS pressure is low and mini-flow is not required, but is not a significant contributor to the failure probability. Also, a failure to close is not considered to be a valid flow diversion path for large LOCAs since the 3" mini-flow lines are less than 1/3 of the diameter of the 10" injection lines. These valves are required to close on SI recirculation, which is included in Top Events VA/VB. It is concluded that the LHSI mini-flow valves are properly	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**[1]	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				adequate flow to prevent pump overheating.	modeled in the BV1REV3 PRA model. The AFW mini-flow recirculation valves are controlled in auto and do not require any operator actions to open or close; therefore, this is not an issue for the Unit 1 AFW system.	
SY-06	SY-6	B	Y	Assumptions concerning non-modeled failure modes, or support systems due to low frequency sequences need to be reconsidered with respect to specific applications. For example, condenser hotwell level is assumed to always be adequate due to redundancy of sources (i.e., via steam dumps, or makeup); however, some of these sources may not be available during online T/M. Also many of these done when the CDF was in the 2E-4 range. Now that CDF is in 8E-6 range many of these items may no longer be insignificant in the current model.	The failures of non-modeled support systems are accounted for in the initiating event frequencies. Also, as was originally assumed in the previous PRA models, these supporting systems for Support Systems are considered available for mitigating system functions (e.g., condenser is available to support the MFW system) following the initiating event. Additionally, even though the CDF has reduced through the years, the individual system function probabilities have not generally changed much. Guidance was also added to the System Analysis and Overview Notebook to include assumptions concerning non-modeled failure modes, or support systems.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
SY-16	SY-13	B	Y	The sequence modeling credits RWST refill for LOCA's and SGTR. The RAW worths of the split fractions indicate that without RWST, CDF would be 3.8E-5. RWST refill is modeled in split fractions WM and MU. The minimum make up rate is 150 gpm. The actual makeup rate [if this procedure was used] may be up to 400 gpm. The initial water source for RWST refill is the boric acid blenders. This system has a 7,000 gallon tank at 7,000 ppm boron. This system does not have sufficient volume nor flow rate to match the times and volumes needed for safe shutdown in the sequences modeled. The ultimate source of water is unborated river water. To provide enough input to the RWST, the flow path is into the Fuel Pool and then from the fuel pool to the RWST. The Miscellaneous Notebook documentation states "The current BV2REV3A PRA model assumes that 400 gpm is required for makeup to the RWST during the entire mission time." Boron dilution of the fuel pool is calculated, but not boron dilution of the core. The observation is that if	Using the BVPS-1 Cycle 16 BOL boron requirement of 1195 ppm for shutdown (k=0.99) with all rods in and hot zero power from WCAP-15995, Rev.1 as the minimum required boron concentration, the expected RWST boron concentration after 24 hours of dilution would be 1208 ppm. This value assumes that 400 gpm of river water is delivered to the spent fuel pool during the first 5 hours following RWST depletion, with 120 gpm makeup for the remaining hours, as identified in the MAAP success criteria calculation (FAI/03-18) for required RWST makeup rates using the spent fuel pool during LOCAs. Therefore, makeup to the RWST via the spent fuel pool, with river water makeup to the spent fuel pool is considered to be successful, since minimum shutdown boron requirements will take longer than 24 hours to achieve. A precaution was also added to BVPS-1 OM Procedure 1OM-7.4.Q "Makeup To The Refueling Water Storage Tank," that if a	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				unborated water was used to make-up for the times required, boron dilution could occur in the core, thus negating the RWST make up function. Due to the fact that RWST cause significant core damage reduction, the ability to use RWST make-up should have a more substantial analytical basis. This observation is worse for unit 2 than unit 1, because of the smaller RWST volume. The minimum core boron concentration for hot zero power at BOL is 771 ppm. For most of the sequences where RWST make-up is used, the reactor is assumed to be depressurized and cooled down [LOCA's and SGTR]. For the purpose of this F&O, it is assumed necessary to maintain a 1500 ppm boron concentration. The RWST switchover is 140,000 gallons for unit 1 and 360,000 gallons for unit 2. Times to boron dilution (in the RWST) is shown below: Unit 1 dilution to 771 ppm at 150 gpm = 15h Unit 1 dilution to 771 ppm at 400 gpm = 5h Unit 1 dilution to 1500 ppm at 150 gpm = 4.5h Unit 1 dilution to 1500 ppm at 400	significant volume of river water is added to the Spent Fuel Pool, boric acid addition to the Spent Fuel Pool may be required to maintain adequate shutdown margin.	

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				gpm = 1.7h Unit 2 dilution to 771 ppm at 150 gpm = 38 h Unit 2 dilution to 771 ppm at 400 gpm = 14h Unit 2 dilution to 1500 ppm at 150 gpm = 11.5h Unit 2 dilution to 1500 ppm at 400 gpm = 4.3h Only one of these conditions can meet a 24 hour mission time. Considering that RWST make-up is used to lower CDF and LERF to the extent it does, the technical basis should be stronger. The calculation must match the conditions of the sequences for which it is used, must use a representative flow rate, and must consider the uncertainties in the inputs and the outcome.		
SY-17	SY-21	B	Y	Service Water success criteria appears to have no supporting analysis as to 1 service water cooling pump could provide sufficient flow. Additionally, there appears to be some HEP for some manual operator action to start standby pumps under some circumstances. No success criteria for the time available for these actions was found.	This concern is not applicable to the Unit 1 River Water System. BVPS-1 UFSAR Section 9.9.2 specially described that each river water pump is able to deliver approximately 9,000 gpm and is designed to supply the quantity of water needed for the essential safety-related cooling requirements for all unit operating conditions.	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
TH-02	TH-8	B	Y	The Beaver Valley Unit 2 Ventilation and Room Cooling Analysis Notebook Table 7 lists that for item 10, Control Building, Operators add portable fans; not included in risk model. It appears from Figure A-9 "Temperature as a Function of Time in Control Room with No Ventilation-Fan Added in 10 Minutes," that without the addition of the fans the temperature in the Main Control Room would impact instrument qualification. Though this appears to be an important operator action that justified not adding MCR HVAC to the model, there is no operator action to add fans for MCR cooling within 10 minutes. Additional investigation into the MCR heatup calculation 12241-US(B)-211 revealed that two different values were used for the MCR heat load. Page C-4 uses a MCR heatup value of 156,861 BTU/hr (~46000W) and page IPE-4 uses 74665W. The trend shown on Figure C-3 is the more expected MCR room heatup, rather than the temperature spike seen on IPE-9.	Calculation 8700-DMC-3467, Rev. 1, was developed to show the heatup of the common control room following a loss of BV1 HVAC due to a fire. The results of this calculation are also applicable for the PRA evaluation of a loss of all control room cooling, and are provided below. It takes longer than 24 hours to reach a room ambient temperature of 115*F, using an initial room temperature of 75*F, calculated heat loads, and taking credit for the Unit 2's HVAC. This conclusion is based on the assumption that a homogenous mixture of air exists between the control room volumes. In order to keep this assumption valid, the operators must immediately (within 10 minutes) open all of the common doorways between the control rooms, following the loss of Unit 1's HVAC. The accomplishment of this action is not considered to be unrealistic, since human nature would drive the operators to keep cool, as they begin to feel uncomfortable. It is also recommended that at least one portable fan be set up	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					at an open common doorway, so that it is blowing the cooler air into Unit 1's control room. This would assist the natural buoyancy driven air flow between the units and provide a constant air recirculation path, which would further ensure that a homogeneous mixture exists. The time to accomplish this action to set up a portable fan is not calculated, but it is expected that 2 hours would suffice. Therefore, based on these results, a loss of Unit 1 control room HVAC does not need to be modeled in the Unit 1 PRA.	
AS-01	AS-12	C	Y	Beaver Valley is using a modified version of the WOG 2000 seal LOCA model, which is derived from the BNL "best estimate" model, with Beaver Valley specific MAAP runs for time to core uncovery. The time of the start of excessive leakage is 30 minutes in this model. The NRC has not accepted this from licensing submittals. Since Beaver Valley is planning some extensive AOT submittals in the future, this will have to be addressed.	As a resolution to this PRA Peer Review observation, sensitivity analyses were performed on the BVPS Unit 1 MAAP RCP seal LOCA cases to investigate the impact of varying the timing of the increased RCP seal leakage from 30 to 13 minutes on the resultant time to core damage. The conclusion from these sensitivities was that the change in onset of the increased RCP seal LOCA leakage from 30 minutes to the minimum time of 13 minutes would not lead to	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					significantly earlier times to core damage. Ultimately resolved based on WCAP-15603, Rev. 1-A, NRC Approved, May 2003, Seal LOCA start time is 13 min.	
AS-04	AS-07	C	Y	AMSAC is a mitigation system that only appears in the ATWS tree. Actually AMSAC is a redundant start of AFW and turbine trip that is useful in mitigation even when SSPS has failed but the reactor trip has been successful. Additionally AMSAC is only model as a system point estimate of 1E-2 (see F&O SY-20). This could affect/reduce the system/equipment importance of SSPS, AFW and Turbine Trip	In response to this PRA Peer Review observation, the GENTRANS Event Tree (see Figure D-4a) was modified to include Top Event PL (Power Level <40 %) and Top Event AS (ATWS Mitigating System Actuation Circuitry) before asking Auxiliary Feedwater in Top Event AF. The split fraction logic rules and macros were also modified to credit the use of AMSAC for providing a diverse method of starting the AFW pumps (see Tables 3.4-3 & 3.4-4). Section 3.4 "General Transient/Small LOCA Event Trees" and Tables 3.4-1 and 3.4-2 were also revised to account for these new top events in the GENTRANS Event Tree. With respect to the AMSAC top event being quantified using a point estimate value instead of a	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					fault tree analysis, it was not deemed necessary to pursue a detailed fault tree analysis at this time. The point estimate value of 1.0E-02/demand used in the BVPS PRA models is taken from WCAP –11993 (Reference 1) and is conservative with respect to unavailabilities of a one signal train and the design criteria applied to AMSAC by the Westinghouse Owner's Group. Additionally, the more recent WCAP-15831-P (Reference 14) also uses this point estimate value, as has other studies, as an appropriate value to use. A detailed fault tree would probably result in a lower AMSAC unavailability value, but this is not expected to have a significant impact on the core damage frequency, due to the already low significance of SSPS failures in non-ATWS sequences.	

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
AS-09	AS-18	C	Y	The SGTR event tree assumes that the actuation of PORVs (should be PORV due to definition of B&F success criteria) will result in the CIB (8 psig) actuation. A review of the MAAP runs (Success Criteria, Attachment A, Appendix F, Table 3) indicates that CIB occurs for cases in which OB (B&F) is successful for cases in which AFW is failed and it occurs in approximately 2 hours. The QSS is assumed to be actuated given the CIB signal. The water injected to the containment sump is necessary for NPSH success. It isn't clear what will happen in the case that CIB does not occur until 2 hours into the scenario and what effect this may have on the NPSH concerns.	The concerns of this PRA Peer Review observation are unfounded, since the timing of the CIB initiation following bleed-and-feed scenarios during a SGTR will not impact the NPSH of the HHSI pumps. This CA was dispositioned by examining the MAAP SGTR accident sequence summary files as summarized below: For the SGTR cases with a loss of secondary cooling, the HHSI pumps will initially be taking suction from the RWST, either due to an SI signal being generated or to the bleed-and-feed initiation. After about 6 minutes following the initiating of bleed-and-feed, the containment sump would begin to fill when the PRT rupture disc blows. During this time there will be RCS mass and energy released inside of the containment from the open PORVs, which will slowly start to increase the containment pressure and also be providing inventory directly into the containment sump. After approximately 2 hours a	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
					CIB occurs, and QS will start and also begin to add RWST inventory into the sump, so that when the RS pumps start about 210 seconds later there should be sufficient inventory in the sump to provide adequate NPSH to the RS pumps. However, if a sufficient amount of water is not collected in the containment sump after this time, the recirculating spray pumps must be manually turned off and then turned back on when NPSH is sufficient. Operator actions to first turn off and then to turn on the RS pumps are modeled in Top Events SM and OR. Success of these actions ensures that the RS pumps will be available when the RWST reaches the low-level setpoint and SI Recirculation is initiated. At this time the HHSI pumps could be piggybacked onto the RS pumps if the LHSI pump trains were unavailable, and adequate NPSH would be provided. Prior to this CIB signal being generated, the QS and RS will not start. However, the HHSI	

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					pumps will continue to take suction from the RWST until the low level SI Recirculation setpoint is reached. At this time even without a CIB initiation, approximately 296,000 gallons of RWST water would have been directed into the containment sump though the opened PORVs, so that if the HHSI pumps are piggybacked onto the LHSI/RS pumps, adequate NPSH would also be provided.	
DA-03	DA-03	C	Y	The documentation of the CCF MGL parameters is presented in Appendix C of the Data Analysis Notebook. The final compilation of the MGL parameters is presented in Table C-6. The results are presented as "Plant-Specific" distributions, but this table is in fact a mix of parameters developed based on plant specific event screening, in some cases Bayesian updating, and in other cases generic data. With some difficulty, the reviewer could trace back through the documentation to determine the actual	The resolution to this F&O was to put shading and bold text in Table C-5 for the MGL distributions that were developed based on a plant specific analysis, so that they are more easily identified. This table was also renamed to Table C-5 Beaver Valley Unit 1 – Common Cause MGL Distributions.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				source of the MGL parameter, but a naming convention that identifies the parameter as plant specific, or generic would be helpful. As a minimum, generic data could be presented in a separate table from the parameters generated based on plant specific analysis.		
DA-04	DA-5	C	Y	The data notebook describes several sources for the generic component failure distributions for the BV Unit 2 model. Column 6 provides the disposition of the 6 sources of information. Item f-1994 STP data was used to derive the failure rate distribution for the automatic recirculation check valve failure to open and was cloned from ZTVCOS using PLG generic check valve database distributions. Then the data from STP of 0 in 704 demands was used. It is not clear what this database variable was used for and if it is currently being used. The discussion does not indicate why was no information used from the BV plant history in this update process.	The BV1REV3 PRA model does not use any automatic recirculation check valves in the model. Therefore, this is not an issue at Unit 1.	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
DA-05	DA-03	C	Y	Table C-6 lists the Beta factor for battery failure fails to operate (ZBBCHR) as a point estimate of 1.26E-2. The source of this value is not documented in the Data Analysis Notebook. A review of the EP System Notebook found a reference to this value in an assumption, stating that the value was taken from NUREG/CR-5497. Appendix C of the Data Analysis Notebook should be self contained with respect to the source of the generic MGL. Appendix C does not reference NUREG/CR-5497. Are all other generic parameters actually from the PLG database or are other sources used? Is this the only value taken from 5497? What was the basis for using one selected value from 5497?	The disposition of this PRA Peer Review observation was to include a discussion on the availability of newer data sources and justification as to why they were not used, to Section 3.6 of this notebook. Although, Appendix C does not specifically list the source document references, they are specifically identified in Section 3.6 "Calculation of Common Cause Factors," and are included in Section 5 "References" in the Data Analysis PRA Notebook. Section 3.6 also provides the basis for using common cause data sources other than the PLG common cause database.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
DA-11	DA-05	C	Y	A statement needs to be made in the assumptions to describe the method of assembling the data. The write-up implies that only unit 2 data is included in the tables but there appears that some unit 1 pumps may have been included. If this is the case, then the text needs to explain that Unit 2 equipment is included and only the Unit 1 equipment that may be needed to shutdown Unit 2 is included.	This PRA Peer Review observation was dispositioned by adding a discussion in Section 3.3 "Presentation of Plant-Specific Data" of the Data Analysis PRA Notebook to identify what Unit 2 equipment is included in the development of the Unit 1 database distributions or test and maintenance unavailability.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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DE-03	DE-11	C	Y	The flooding analysis and the IPE state (briefly) that a plant walkdown was performed. But there is no documentation of the walkdown, or the insights gained from the walkdown, available for review. The walkdown "notebook" would be a valuable resource for analyst in future updates of the PRA.	Since the documentation for the flooding walkdown that was performed as part of the IPE could not be located, the walkdown that was completed for the Beaver Valley Unit 1 Risk-Informed In-Service Inspection (RI-ISI) Indirect (Spatial) Consequence Evaluation was credited, as discussed in the response to F&O DE-04 above. Since this RI-ISI walkdown is documented in a BVPS calculation and is retrievable, it is not deemed necessary to reproduce it for the PRA notebooks. This F&O was written against an obsolete Internal Flooding PRA model (BV1REV3) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					presented in Table 1-4.	
DE-06	SY	C	Y	Some of the flood frequencies are based on a document (PLG-0624) that is dated 1988. The next update should include consideration of more recent flood data sources.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV3) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
DE-07	SY	C	Y	The PRA documentation should include a discussion of the potential impact of floods on systems that are shared between the two units. Although this impact is expected to be minimal, one example is the potential impact on the electric power crosstie to Unit 1 availability due to floods in the service water intake structure. Is the Unit 1 diesel dependence on service water correctly accounted for when the flood impacts the availability of the Unit 1 service water system?	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV3) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
HR-02	HR-06	C	Y	A generic error of omission term from the PLG database (ZHEO1A) was used for all misalignment HEPs without regard for procedural or operational failure barriers such as independent verification, peer checks, walkdowns, etc. However, plant specific data was used for test and maintenance frequencies. Therefore, the overall misalignment errors were a hybrid of generic and plant specific data. This was used for systems	This F&O was written against an obsolete HRA PRA model (BV1REV3) and is considered to be resolved by the updated HRA PRA model incorporated in BV1REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				which are important to CDF (e.g., AF, SI).	result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	
HR-10	HR-18	C	Y	The number of operators interviewed for the performance shaping factors was stated to be 3 operators, 3 training staff and 3 PRA staff. This is a low number of operators for the FLIM method to succeed. Having the PRA staff fill out the PSF forms dilutes the operator input to the process.	This PRA Peer Review observation was dispositioned by acknowledging that, while technically only 3 operators were interviewed, the training staff personnel were former operators that still held a senior reactor operator's license at the time of the interview. Therefore, a total of six licensed personnel were used in developing the PSFs. Additionally, as a final resolution to this observation, future BVPS PRA models will use the EPRI HRA Calculator, which uses a more current and robust methodology to identify human action dependencies. This F&O was written against an obsolete HRA PRA model (BV1REV3) and is considered to be resolved by the updated HRA PRA model incorporated in	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					BV1REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	
IE-01	IE-04	C	Y	In section 3.3 of the Initiating Events Notebook, there is a discussion about the justification for the exclusion of Random RCP Seal LOCAs as a separate IE that is based on the RCP floating ring seals and the assumption of limited leak flow. The justification provided to account for assuming this is a discussion by FENOC with Westinghouse. No documentation of this discussion is provided and no further technical justification is given as to why random seal failure should have the frequency and be included in Category G1/QG9 under RTRIP.	In response to this observation, Section 3.3 of the Initiating Events Analysis PRA Notebook was revised to add further clarification based on the floating ring seals (per Reference 15) as to why random RCP seal LOCAs were eliminated from the Beaver Valley PRA model. Additionally, this Section was revised to provide justification as to why a random RCP seal failure at Beaver Valley that resulted in a reactor trip would be captured under the RTRIP initiating event frequency.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
IE-02	IE-13	C	Y	In the discussion of the process used for Initiating Event frequency update, BWR data and other NSSS vendor PWRs are excluded from the update without sufficient documentation.	In response to this observation, Section 2.3 of the Initiating Events Analysis PRA Notebook was revised to provide a brief explanation for why BWR and	No impact to Fire PRA, because this issue was addressed in the base PRA model

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					other PWR NSSS vendor data were excluded from the BVPS initiating event frequency update.	prior to building the Fire PRA.
IE-03	IE-10	C	Y	The Support System Faults that are used as Initiating Events are assigned a Code Designator. The System Codes and Top Events for these designators are not explained. The System Notebook does not clearly explain how the System is considered to cause an Initiating Event in the Model.	In response to this observation Tables A1 and A10 in the Initiating Events Analysis PRA Notebook was revised to include a cross-reference from the initiating event "Code Designator" to the applicable PRA System Notebook. In addition, Table A2 of this notebook provides a *failure modes and effects* analysis of the key BVPS Unit 1 support systems and why they were considered for initiating events, so it was not judged to be necessary to duplicate this information in the System Notebooks. It was not the intent of the PRA System Notebooks to be stand-alone documents, but rather to be supplemented by the PRA analysis notebooks.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-1. Summary of BVPS-1 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IE-06	IE-16	C	Y	Plant trip trends in the recent years are showing a general decrease in trips/year. A simple trend analysis (like a histogram) showing number of trips versus years for each unit should be considered as a subsection in the initiating events section. This would possibly allow better estimation of plant specific transient event frequency. Currently, there appears to be no analysis to show whether there is a positive or negative trend (or a lack of it). Also, a trend analysis fits well with the concept of plant-specific nature of analysis in question. For example, consider a plant with 10 years of trip data; the first 5 years each have 5 trips/year; the last 5 years have 1 trip per year. This would result in an average of 3 events per year over a ten-year period. Now consider another plant where the two numbers are interchanged; it has 1 event per year for the first five years and 5 events per year for the next five years. The overall average is still 3 events per year. In both cases, there are definite trends; the first plant should actually use a frequency of 1 trip per year; the second plant should use 5 trips per year. In any case, neither plant should use 3 trips per year.	In response to this observation, Figure 3-1 was generated to present a plan trip trend histogram and Section 3.2 of the Initiating Events PRA Notebook was revised to include a discussion of the plant trip trend analysis performed for BVPS Unit 1.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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IE-07	IE-03	C	Y	There was not enough information in the initiating event report to reproduce the results. 1. The prior distributions were not available. 2. the screening of the WCAP IE report was not available 3. The derivation of prior means was not available.	In response to this observation, Table A12 was generated in Appendix A of the Initiating Events Analysis PRA Notebook to show the set of input data used in the creation of each first stage (prior) distribution identified in Table A4, as well as, the resultant RISKMAN distribution parameters for the mean, median, 5th and the 95th percentiles. This data was input into the RISKMAN Data Module, using the 'First Stage of Two Stage' distribution option to create the resultant prior distributions. The derivation of how RISKMAN generates these prior distributions using this option is contained in the RISKMAN Software Users Manual, and does not need to be reproduced in this notebook. Additionally, there was no screening of the Westinghouse WCAP-15210 initiating event data since each individual utility performed a thorough review of their plant's trip events to ensure that the data was valid.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
L2-02	L2-08	C	Y	Most containment phenomena are either excluded via generic, or plant specific analyses, or are modeled as a point estimate. Other issues such as whether the containment is inerted are more directly quantified. For example, the L1/L2 interface directly quantifies those end states when the sprays are operating; operation of the sprays is considered to de-inert containment.	Ultimately resolved by GAP F&O LE-F2-01 (see Table 1-2)	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
L2-04	L2-21	C	Y	Top Event 10 - Containment Failure Prior to Vessel Breach (C1) states that because the Beaver Valley Unit 2 containment normally operates at subatmospheric conditions, the existence of large pre-existing leaks is believed to be negligible. Current L2 analysis would not support containment conversion application.	Ultimately resolved by GAP F&O LE-D6-01 (see Table 1-2)	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
MU-01	MU-04	C	Y	Plant changes that may impact the PRA model are documented, and resolved via Risk Evaluation Review (RER) forms. Continuing training is used to educate engineering (includes procedure writers) on when an RER is required vs. direct procedural guidance. The update process could be improved by adding a similar review process into other plant change procedures	Ultimately resolved by procedure NOBP-CC-6001 and Design Interface Evaluation (DIE) process that evaluates changes for PRA impact.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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MU-03	MU-11	C	Y	When the PRA model is updated for plant modifications or for decreases in CDF all areas of applications should be evaluated. Certain applications can be adversely impacted by decreases in CDF. For example, credit taken for examining segments in a RI-ISI program could decrease with a decrease in CDF (or even an unrelated CDF increase, depending on changes to the risk profile.) Additionally more than just the change in CDF needs to be evaluated. The risk profile may change drastically without a corresponding change in the CDF. For example CDF due to one IE may go up by 30% in conjunction with another change in CDF due to a different IE decreasing by 25%. This would cause only a 5% change in CDF but significant changes to the risk profile.	Ultimately resolved by procedure NOBP-CC-6001, Section 7 lists RI-applications that need updated following a new ERM (Effective Reference Model).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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QU-01	QU-07	C	Y	PRA Peer Review Subtier Criteria for this sub-element describes the need for documentation of the limitations of simplified models. This documentation could not be found for Beaver Valley Unit 2.	As resolution to this PRA Peer Review observation it should be noted that the RISKMAN model is used for purposes for risk sensitivities (e.g., SDP findings) and risk-informed applications, as such, there are no simplified model used for these purposes and hence nothing to document. Additionally, the intent of the PRA Notebooks was to document the development process and results of the RISKMAN PRA model, not to document the Safety Monitor model or its process that currently uses pre-solved sequence, or to document other risk-informed sensitivities and programs. Moreover, future versions of the Safety Monitor for RISKMAN users are to incorporate a full requantification of the sequences in place of pre-solved sequences.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
QU-05	QU-23	C	Y	RISKMAN allows the user to apply a cutoff at the system (i.e., top event) level. This cutoff is applied prior to the event tree quantification. In general, no truncation (i.e., a value of 0) is used in the systems cutset generation. But non-zero values are used for a handful of top events. Of these most	In general, the BV1REV3 PRA model update did not use any truncation limits (i.e., a value of 0) for cutset generation. However, when the cutsets exceeded the quantification limits, very low non-zero values were used. This was only	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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				use very low cutoffs (<1E-12). The one exception to this (as best this reviewer could determine) is the quantification of Top Event WC where a cutoff of 5E-7 was used. Top Event WC is an intermediate top used to quantify Top Event WA and WB. Split Fraction WC1 has an unavailability of about 3E-9. The SW system notebook discusses the system level cutoff and when it is used. However, the potential quantitative impacts associated with the truncated results are not discussed.	present in a handful of top events. The one exception to this is the quantification of Top Event WC where a cutoff of 7E-7 was used. Top Event WC is an intermediate top used to quantify Top Events WA and WB. The 7E-7 cutoff was used for the cutset generation with elevated common cause failure rates for pump and fan starts and run basic events. The failure rates are reset to best estimate values prior to the quantification of split fractions. This is done so that the cutoff is high enough to stay below the Riskman cutset limitation, but allows the cutsets to contain the higher order cutsets that will allow analysis of degraded boundary conditions (i.e., split fractions). Split Fraction WC2B (DC Purple fails) has an unavailability of about 9.6914E-6, and only accounts for the probabilistic failure of the A header since DP=F causes a guaranteed failure of the B header. When this value is compared to the	

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					Split Fraction WA1 (all support available) value of 1.0493E-5 (generated using a 1E-12 truncation limit), it can be shown that only about 8% of the expected unavailability is lost due to the higher truncation limits used in Top Event WC. Furthermore, truncation limits will not be required in RISKMAN version 6, which uses binary decision diagrams to generate Split Fractions values directly without cutsets. Ultimately resolved by quantifying the split fractions using the BDD methodology, starting with the revision 4 PRA model.	
SY-04	SY-27	C	Y	It would be desirable to reference the success criteria source in the system notebook. Success criteria are specified in the "Success Criteria" notebook, and the reviewers found it difficult to flip from one source to another, especially when using the electronic documentation CD.	Ultimately resolved in Revision 5 PRA model System Notebooks, Section 3 "SYSTEM SUCCESS CRITERIA"	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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SY-05	SY-12	C	Y	The system notebooks do not specifically discuss the dependencies that may be present regarding HVAC / room cooling. However, review of the HVAC notebook identified the various spatial locations that may require HVAC and indicated the various analyses that have been completed to either require HVAC dependencies or not.	Ultimately resolved in Revision 5 PRA model System Notebooks, Section 4 "SUPPORT SYSTEMS"	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-07	SY-26	C	Y	The Beaver Valley Unit 2 system notebooks have no indication of system engineering reviews. These reviews help ensure that systems are model in accordance with day-to-day plant operations and additionally expand the PRA knowledge of the system engineers.	Ultimately resolved by GAP F&O F&O SY-C1-02 (see Table 1-2).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-08	SY-01	C	Y	The guidance did not provide for more complete description of the actual boundary conditions used in the system analysis. It did talk about support, but the actual details are not required (i.e. what AC bus is needed for which pump for that boundary condition for the split fraction). As a result most of the notebooks do not give a good description of what each split fraction means and its usage. The only place this appears to be actually documented is the description on the split fraction in the RISKMAN split fraction.	The split fraction definitions were developed using the dependency matrices located in Appendix B of the Level 1 Event Tree Analysis PRA Notebook. Split fractions for Top Events are found in the Split Fraction sections of the RISKMAN System Notebook files in Appendix C. Common cause failure inputs, assessment methodology and data update summaries are located in Appendix C of the Data Analysis Notebook.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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SY-09	(*sic* SY-14)	C	Y	System Diagrams contained in System Notebooks do not have explanation of color highlighting. Figures are difficult to read and many component IDs are not legible. There also does not appear to be a discussion of 'Operating experience for the system' required in the guidance document.	Hard copy of 11x17 with markups of plant drawings are provided in the System Notebook. Components modeled in the PRA are highlighted in PINK, while the flow paths are highlighted in YELLOW. Operating experience for the system is subsumed in the system engineer's review.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-10	(*sic* SY-14)	C	Y	The Fault Trees for IA, IC have Transfer Gates and page numbering that is confusing. IA page 6 transfers to page 7 but page 7 top gate transfers to page 1. In IC, page 1 is a transfer from page 5 which is the Top Event IC. This is confusing and is easily fixed.	Resolved in Revision 5 PRA models that have Fault Trees redrawn so Top Gate is on page 1. NOTE: The Fire PRA FTs are not organized due to addition of NFPA 805 basic events.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA. Also, this is a documentation-only issue.
SY-12	SY-17	C	Y	The Service cooling water system notebook assumption #7 has 10 minutes to trip the RCP's on loss of cooling. However, in the Miscellaneous system notebook, top event OC has 5 minutes to trip the RCP's. Note, this time might be important in quantifying an HEP.	Ultimately resolved by GAP F&O F&O SY-B7-01 (see Table 1-2).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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SY-13	SY-13	C	Y	Several systems appeared to be modeled as point estimate only, AMSAC and the Switchyard. This is acceptable, per the peer review guidance, but consideration could be given to adding some detail to these models.	The AFW pump macros were revised in the BV1REV3 PRA model to include credit for AMSAC to start the AFW pumps (in addition to the SSPS signal), given that the signal is generated during non-ATWS events. The Switchyard (Top Event OG) was modeled as a single basic event. However, it used a lognormal distribution to quantify Monte Carlo values in addition to the point estimate value. Furthermore, the PRA model already addressed transient induced LOSP events due to failures of the USST/SSST and Switchyard breakers in the normal bus top events. The current methods to address the AMSAC and Switchyard failure probabilities are deemed acceptable as is.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-15	SY-10	C	Y	HVAC support analysis appears to only consider 8 hours versus 24 hours. The analysis was extended to 24 hours based upon the fact that the curves were essentially flat after 8 hours. Some of the curves are straight and increasing and not flat and constant.	As a resolution to this PRA Peer Review observation Table 3 in the Ventilation and Room Cooling Analysis Notebook was revised to show the expected area temperature at 24 hours following the loss of ventilation.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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AS-05	AS-17	D	Y	The success criteria for top event TT is missing from Table 3.3-2 of the Event Tree Notebook although it is described on page 58 of the notebook.	Ultimately resolved in Revision 5 PRA model Level 1 Accident Sequence Analysis Notebooks, Table 3.3-2 & Table 3.4-2.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
AS-06	AS-17	D	Y	The success criteria for top event NM is missing from Table 3.3-6 of the Event Tree Notebook although it is described on page 67 of the notebook.	Top Event NM is a switch to query if early core damage has occurred during the SI injection phase, and does not have any success criteria per se, so is not included in the Success Criteria Tables.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
DE-01	DE-01	D	Y	The guidance for including spatial information in the system notebooks could not be found in the system notebook guidance document. However, it appears that most, if not all, the system notebooks did have a section on spatial considerations for flooding, fire and seismic.	Ultimately resolved in Revision 5 PRA model Systems Analysis Overview and Guidance Notebooks, Section 5 "SPATIAL CONSIDERATIONS"	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-11	SY-15	D	Y	The AC power system calculation notebook, has top event OG which has a split fraction for generic loss of power after a plant trip. The basic event report for this was missing from the system notebook, but the system notebook listed a database variable "OG1X" used. This variable could not be found in the data notebook. It was in the RISKMAN model with no references from where it came from. It	Ultimately resolved in Revision 5 PRA model Data Analysis Notebooks, Tables A-1 and A-2.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				was determined that it came from the PLG-0500 revision 1, 1989.		

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IE-A6-01	IE-A6	B	Y	There is no documentation of interviews of plant personnel (e.g., operations, maintenance, engineering, safety analysis) to determine if potential initiating events have been overlooked. This is required to meet capability category II	Documentation of interviews with system engineering plant personnel to determine if potential system descriptions have been overlooked is located in the Unit-1 PRA Notebook Systems Analysis Overview and Guidance, Appendix B. Review of the initiating events section in the system notebooks was also included as review of the system description by system engineers. System engineers were asked to identify from a list of the current initiating events if there are any top events whose failure could result in a potential initiating event (plant/reactor trip), which may have been overlooked. No additional potential initiating events were brought up. Also, review of AOPs (e.g., 1OM-53C.4.1.28.1) can be credited	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IE-C8-01	IE-C8	C	Y	All the relevant combinations of events involving the annual frequency of one component failure combined with the unavailability (or failure during the repair time of the first component) of other components are not available in the support system notebooks. The support system notebooks list which initiators are developed from the fault trees and provide a diagram of the fault tree, however there is no narrative explanation of how these fault trees are modified and what assumptions are used to develop the support system initiator frequencies. RISKMAN reports, provided as System Notebook appendices, list the details of the system IE models (i.e. cutsets, modified basic event equations, etc.), however there is no discussion of which component failures were considered, what mission time assumptions are used, or description of the development of the system IE models. Therefore it is difficult to determine if all relevant combinations of events have been considered.	The Initiating Events section of the system notebooks now contain a description of the development of the support system initiating events. Except as noted, the mission time for normally running equipment is changed from 24 hours to 8760 hours times the plant availability factor. Portions of the system fault tree logic which is not used to quantify support system initiating event frequency is also noted.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
IE-C9-01	IE-C9	B	Y	Plant-specific information used in the assessment and quantification of recovery actions included in the support system initiating event analysis is not included in the support system notebooks. Analysis of the recovery actions should be consistent with the applicable requirements in the Human Reliability Analysis	The Recovery Considerations section of the System Notebooks now documents the operator actions that were modified in the quantification of the system initiating event frequency. No new recovery actions are credited in the analysis of initiating event frequency.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
IE-C10-01	IE-C10	B	Y	There is no comparison of the initiating event analysis with generic data sources or explanation of differences to provide a reasonableness check of the results.	In the Initiating Events Analysis Notebook, Table A6 demonstrates a comparison of initiating event frequencies for the Westinghouse 3-loop PWR. The industrial events are from WOG Rev 7 PSA comparison database. Comparably Beaver Valley 1 to other Westinghouse 3-loop PWR plants has most initiating events frequencies close to order of magnitude. Some differences in plant frequency include Loss of Emergency Switchgear HVAC (BVX) with a much lower frequency then the other plants and MLOCA. The reason for difference in HVAC is due to the high detail of the ventilation and room cooling analysis, as well as several ventilation sources available in the area (i.e., normal fans, emergency	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					fans, and portable fans). MLOCA initiating event frequency has been updated for PRA-BV1-AL-R05 to a new methodology based on NUREG-1829 (April 2008) and lowering the effective break size therefore lowering the frequency. The WOG Rev 7 of other Westinghouse 3-loop PWRs was developed before the methodology of NUREG-1829 was used. Blank gaps in Table A6 do not have data for that plant from the WOG database.	
DA-C4-01	DA-C4	B	Y	A clear basis for the identification of events as failures is not included in the Data Analysis Notebook. This basis could be used to distinguish between those degraded states for which a failure, as modeled in the PRA, would have occurred during the mission and those for which a failure would not have occurred (e.g., slow pick-up to rated speed). It could not be determined from the Data Analysis Notebook if any failures were screened out or if the maintenance rule MPFFs are used as the data source.	Documentation of this is now included in Section 3.3 of the Unit 1 Data Analysis Notebook.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
DA-C5-01	DA-C5	B	Y	There is no listing or description in the Data Analysis Notebook of repeated component failures that were counted as a single failure.	For Beaver Valley Unit 1, repeated plant specific component failures occurring within a short time interval were counted as a single failure	No impact to Fire PRA, because this issue was

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				Repeated component failures occurring within a short time interval should be counted as a single failure if there is a single, repetitive problem that causes the failures. In addition only one demand should be counted.	during implementation of the Maintenance Rule. PRA data is taken from Maintenance Rule sources and therefore meets the requirements of the ASME PRA standard."	addressed in the base PRA model prior to building the Fire PRA.
DA-C8-01	DA-C8	B	Y	Plant records should be used and documented to determine the time that components are configured in their standby status. This is required to change SR DA-C8 from Capability Category I to III	Maintenance Rule plant specific unavailability data is incorporated into the PRA model. Documentation of this can be found in the Presentation of Plant-Specific Data section of the Data Analysis notebook under sub-section Component Maintenance Data and is evidenced by the Prior Maintenance Data of Appendix B."	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
DA-C10-01	DA-C10	B	Y	Decompose failure modes into sub-elements and count demands/failures individually in the sub-elements.	Component failure modes have been handled appropriately to meet this Supporting Requirement at the CC-II level. Failures of sub-elements of a component that are modeled explicitly in the PRA are associated with the sub-element and not the component itself. Documentation of this can be found in the Presentation of Plant-Specific Data section of the Data Analysis Notebook under sub-section Component Failure Event Allocation and is evidenced by the data in Table A-1.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
HR-B1-01	HR-B1, HR-D2	B	Y	This F&O is a carry-over from the peer review (F&O HR-2). A generic error of omission term from the PLG database (ZHEO1A) was used for all misalignment HEPs without regard for procedural or operational failure barriers such as independent verification, peer checks, walkdowns, etc. However, plant specific data was used for test and maintenance frequencies. Therefore, the overall misalignment errors were a hybrid of generic and plant specific data. This was used for systems which are important to CDF (e.g., Auxiliary Feedwater, Safety Injection).	As outlined in HRA Notebook Section 2.2, testing and maintenance procedures were evaluated to identify potential misalignments. These potential misalignments were evaluated using the EPRI HRA Calculator 4.1.1 to develop specific HEPs for each potential misalignment as documented in HRA Notebook Table 3.5.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-D3-01	HR-D3	B	Y	While the discussion in the system notebooks (AFW and QS/RS notebooks were reviewed) references the procedures, no documentation of quality of those procedures or administrative controls was found.	Procedure quality has been incorporated into human error probability assessments. Documentation of this can be found throughout the HRA Notebook, particularly the Dynamic Actions section and tables of Section 3."	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-I2-01	HR-I2	B	Y	The BV HRA does document a process to perform a systematic search for dependent human actions credited on individual sequences. It is clear from the human action identifier sheets documented in the BVPS-2 HRA	Section 2.3 of the Unit 1 HRA notebook has been created to document the process employing the EPRI HRA calculator that is used to complete the dependency analysis evaluation. The results of the human	No impact to Fire PRA, because this issue was addressed in the base PRA

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				notebook that such an evaluation has been performed, but there is no evidence of the process documented in the HRA notebook. To be consistent with current HRA methods, there must be a systematic process to identify, assess and adjust dependencies between multiple human errors in the same sequence, including those in the initiating events.	action dependency analysis presented in Appendix F show that the dependency contributions to the split fraction values are insignificant. The largest change identified is for split fraction CDC which has a value of 1.40E-2 and a dependency contribution of 6.41E-4 or a 4.6% increase due to dependencies. This increase in the split fraction CDC value due to operator action dependencies would lead to a 0.34% increase in the core damage frequency. This level of change is considered insignificant to the overall results, and did not reveal any new dependencies that were not already analyzed and accounted for. Furthermore, these results confirm the success of using the Event Sequence Diagrams during development of the IPE to identify dependencies between operator actions, and account for these dependencies in the development of the HEPs	model prior to building the Fire PRA.
HR-I3-01	HR-I1, HR-I3, AS-C3, IE-D3, IF-F3, LE-F3, LE-G4,	B	Y	The HRA notebook sporadically discusses assumptions and uncertainties. Per the Clarification to regulatory Guide 1.200 Revision 1, there is an increased importance in the industry to identify assumptions and uncertainties in the PRA model. In reviewing the HRA notebook, it is	A new Assumptions section has been added to the Unit 1 HRA notebook. All major assumptions and sources of uncertainty are listed in this location.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
	SC-C1, SC-C3, QU-F4			difficult to locate the assumptions and uncertainties.		Fire PRA.
HR-I1-01	HR-I1, HR-I2	C	Y	The Beaver Valley Unit 2 system and data notebooks have been updated and exist in draft form, but there is no record of formal review and approval. Furthermore, only a subset of the total PRA notebooks have been updated for this revision of the PRA.	The BVPS Units 1 & 2 PRA and System notebooks were formally reviewed and signed off as part of the update process.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-I2-02	HR-I2	C	Y	There is no evidence in the HRA or Success Criteria notebooks that an operator review of the HRA has been performed.	During the Extended Power Uprate evaluation, plant operations did review the operator actions and timings. These reviews are documented in FENOC Letters L-06-003 and L-06-018. Furthermore, several operator action scenarios were evaluated using the plant simulator.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
IF-A1a-01	IF-A1a	B	Y	It is not clear from the documentation that a comprehensive assessment has been conducted to finalize the combined rooms including propagation, barriers, etc. The IF assessment is based on large flood areas but there is no description of the process used to define those areas with respect to flood propagation and barriers.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
					from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-A3-01	IF-A3	B	Y	There is no evidence in the IF Notebook that it represents the current as-built-as operated plant (circa 2007). Rev4 documentation in another document may include the information to show that the IF assessment is current, but it is not in this Notebook, IF-A3-01 was written as a B level F&O to provide documentation that the IF assessment still represents the as-built as operated plant in 2007, This probably also applies to other PRA elements from the ASME PRA Standard (e.g., SY, SC, HR, etc.) and should be addressed generically for the BVPS PRA. This would facilitate future reviews and development of PRA applications.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
						working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-B1-01	IF-B1	B	Y	The ASME PRA Standard states "for each flood area, identify the potential sources of flooding." Section C3.1 identifies flood sources in each area but clear documentation of each source in an area is lacking. The Standard expects a more systematic approach for identifying potential flood sources and then later screening them. The IF assessment here includes initial screening without written justification. It is suggested that a complete discussion of potential sources be documented and the basis for screening potential sources.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
						Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-B1-02	IF-B1	B	Y	Section C3.1 states that major flood sources were reviewed to identify potential flood locations. The ASME standard suggests that first you identify flooding areas then identified all flooding sources in that area. This method used for BVPS may have lead to overlooking other sources of flooding within each area.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
						resolved when NFPA 805 is implemented.
IF-B2-01	IF-B2, IF-B3	B	Y	The SR B-2 of the PRA Standard requires "For each source of flooding, identify the flooding mechanisms that would result in a fluid release including failure models, human-induced mechanisms, and other events resulting in a release into the flood area." In addition, SR B-3 requires "For each source and its identified failure mechanism, identify the characteristic of release and the capacity of the source." Section C3.1 of the IF Notebook does not provide enough detail to judge whether these requirement is met. One example is that although a few human error induced floods (e.g., testing or maintenance errors) were considered, there is no evidence of a systematic assessment of potential test and maintenance errors.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
						its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-C2b-01	IF-C2b	B	Y	Section C3.1 does not have enough detail to show that the capacity of the drains and the amount of water retained by the sumps, berms, dikes, and curbs was estimated. The reviewer notes that it is likely that this was performed but there is no record of the assessment. The capacity of drains and the amount of water retained by sumps, etc. should be documented in the IF Notebook.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
						uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IF-C3-01	IF-C3	B	Y	The PRA Standard states "for each SSCs identified in IF-C2c identify the susceptibility of each SSC in the flood area to flood-induced failure mechanism". Also, the SR-C3a states, "to determine susceptibility of SSC to flood-induced failure mechanism, take credit for the operability of SSC identified in IF-C2c with respect to internal flood impact only if supported by an appropriate combination of: 1) test or operational data, 2) engineering analysis, and 3) expert judgment." It is likely that flood-induced failure mechanisms were considered in the IF assessment but are not identified in the IF Notebook. Section C3.1 does not provide enough detail on the impact of the flood on SSCs.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
IF-C3b-01	IF-C3a, IF-C3b	B	Y	The IF-C3b SR requires that all potential mechanisms that can create interconnections between flooding areas be considered for CCII and that barrier unavailability also be considered for CCIII. There is no evidence in the Appendix C of the Initiating Events Notebook that any mechanism other than open obvious pathways (e.g., vents in doors, tunnels, etc.) were considered. This may be just a documentation issue for CCII. Also, the RI-ISI program did a comprehensive assessment of flooding potential for various break locations. A comparison should be performed between the RI-ISI flooding assessment and the PRA IF assessment to ensure consistency. Note that upgrading to CCIII requires the additional consideration of barrier unavailability, for example due to maintenance activities or maintenance unavailability.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-C3c-01	IF-C3c	B	Y	Develop engineering calculations for ALL flooding scenarios, not just the "worst case" scenarios. This is likely just a documentation issue, but since it is missing from the IF Notebook, SR IF-C3c is not met.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
					focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-C4-01	IF-C4, IF-C6, IF-C8	B	Y	The operator actions credited in the IF flooding assessment are based on detailed HRA assessments for two	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be	No impact on the submitted BVPS-1 Fire

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				operator actions. Cues, procedures, etc. are detailed in the HRA assessment. It is not clear if these actions are also applied to scenarios other than those used to quantify the HEP in the HRA Notebook. In addition, there are a number of other instances in which the operators are assumed to be highly reliable. There is also no indication that these are validated by operator interviews. Cleaner documentation of the operator actions that are credited (as well as those not credited), and their basis, should be completed to assist in future reviews and for risk applications in which the performance of operators is important. Also a clear linkage between the IF and HRA Notebooks should be documented for the basis of the important HRA input and some of the operator actions to screen scenarios is based on highly reliable operator actions.	resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-C4-02	IF-C4	B	Y	SR-IF-C4 requires the development of flood scenarios by examining the equipment and relevant plant features in the flood area and area in potential propagation paths, taking credit for appropriate flood mitigation systems or operator actions, and identifying susceptible SSCs. No flood scenarios are developed in the IF Notebook.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-C5-01	IF-C5, IF-C5a, IF-C7, IF-D7	B	Y	The screening methodology documented in Section C3.1 does not follow the systematic methodology described in the Standard. For the IF assessment, the screening is performed at the source and location level and, in some cases, without adequate basis as discussed in a previous F&O (IF-B1-01). The method used in the IF flooding assessment may be technically adequate, if the basis is better documented, even though it does not meet the Standard SRs for C-5, C5a and C7.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
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						Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-D1-01	IF-D1	B	Y	The FENOC response to DE-06 from the OG Peer Review is incomplete. The F&O is concerned about the vintage of the data used to estimate pipe break frequencies and the FENOC response talks about walkdowns.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when

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						NFPA 805 is implemented.
IF-D5-01	IF-D5, IF-D5a	B	Y	The IF pipe and tank break frequencies used in the IF assessment are based on 1988 and 1990 data. The prior pipe break frequencies should be updated to reflect more recent experience and should include plant specific experience. In estimating pipe break frequencies, it is recommended that experience with safety related vs. BOP piping be considered along with active pipe degradation mechanisms. Credit for condition monitoring programs should also be applied where applicable.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

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IF-E1-01	IF-E1	B	Y	The Standard states "for each flood scenario, review the accident sequences for the associated plant-initiating event group to confirm applicability of other accident sequences model." A spot check was made to provide reasonable confidence that the overall results are correct. However, there is no record that EACH scenario was reviewed.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

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IF-F1-01	IF-F1, SY-A4	B	Y	The Internal Flooding documentation does not include the results of the walkdowns performed during the original assessment. FENOC response to OG Peer Review F&O DE-4 indicates that the RI-ISI walkdowns are documented and cover the issues required for an Internal Flooding walkdown. To facilitate future maintenance and reviews of the internal flooding assessments, the use of the RI-ISI walkdowns for internal flooding should be documented in the Internal Flooding Notebook and a direct reference to a retrievable copy the RI-ISI walkdowns should also be included.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

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F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IF-F2-01	IF-F2	B	Y	The documentation of the processes to identify flood areas, sources, pathways, scenarios, etc. are not clearly documented. For example, the rules used to screen out sources and areas are not defined and the bases for eliminating or justifying propagation pathways is either not clearly defined or not provided at all.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
IF-F2-02	IF-F2	B	Y	The IF Notebook states that the annual frequency of a flood scenario in location X is Rx = Fi*fx,i*fs,x*fp,x and the quantify scenarios in which recover actions can be included is Sx=Rx (Dx + Ix). However, the frequency is never quantified using these equations. This is confusing for a reviewer -- what is the purpose of these statements if they are not used? or if they are used, an explanation is needed.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

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IF-A1-01	IF-A1b, IF-B1a, IF-C4a, IF-D4	C	Y	Although it is apparent that dual unit impacts for internal flooding were considered, the details are buried in the individual assessments. To assist future reviews and the development of risk informed applications, it is recommended that a separate section of the Internal Flooding documentation be created to summarize the search for and results of an assessment of dual unit internal flooding impacts.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-A4-01	IF-A4,	B	Y	The OG Peer Review F&O DE-3 documented the lack of documentation of a walkdown for internal flooding and other PRA purposes. The F&O response by FENOC is incorrect and does not address the F&O. As a result, the walkdown documentation is still not	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis.

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F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
	IF-C9, IF-D4			identified. The walkdown needs to be documented and reviewed from the perspective of internal floods in order to assign a CC to several of the SRs for Internal Flooding. It is noted that in response to OG F&O DE-04, FENOC used the RI-ISI documentation in place of the original walkdown documentation. Based on the scope of the RI-ISI walkdowns, this is considered to be an acceptable substitute for the Internal Flooding assessment since the same considerations are being investigated (e.g., drain locations, equipment elevations, etc.). However, a retrievable walkdown document needs to be identified in the IF Notebook.	with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-D1-	IF-D1, IF-D3,	C	Y	The IF assessment does not rely on grouping of IEs, sources, locations, etc.	This F&O was written against an obsolete Internal Flooding PRA model	No impact on the submitted

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F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
02	IFD3a			The screening methodology discussed in the IF Notebook and assessed under the IF-C-xx SRs methodology resulted in only a handful of flooding events to be considered. These were individually assessed in the overall PRA quantification using RISKMAN. The methodology used may be technically adequate in spite of not meeting the ASME Standard SRs for grouping if it can be justified that only a handful of events are important.	(BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-D4-01	IF-D4	C	Y	The PRA documentation should include a discussion of the potential impact of floods on systems that are shared between the two units. This impact is expected to be minimal. One example is the potential impact on the electric power crosstie to Unit 1 availability due to floods in the service water intake structure. Is the Unit 1 diesel	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and

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F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				dependence on service water correctly accounted for when the flood impacts the availability of the Unit 1 service water system?	during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-D5-02	IF-D5	C	Y	The IEF for pipe breaks is based on a generic 80% capacity factor. There are two issues with this method: a) current capacity factors are typically greater than 80% so that the IEFs are slightly lower, and b) the method is inconsistent with the method used to calculate other IEFs. It is recommended that the calculation for IF IEF be revised to be consistent with the method used for other IEFs.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore,

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F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
						the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-D6-01	IF-D6	C	Y	The IF flooding assessment uses screening criteria to limit the operator induced floods during maintenance (e.g., due to operator errors such as inadvertently opening isolation valves which maintenance is occurring). One of the screening criteria is whether the maintenance activity is performed during power operation or at shutdown. The application of these criteria to potential floods should be re-assessed in light of recent practices to perform more maintenance at power to shorten the shutdown periods. It is expected that this will have a small to negligible impact on the IF assessment and is therefore assigned a Level C.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be

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						resolved when NFPA 805 is implemented.
IF-E5-01	IF-E5	C	Y	There are a number of operator actions credited in the IF assessment that are used to screen potential flooding events based on the operator's ability to diagnose the pipe break and isolate the leak thereby preventing the flood. However, these operator actions are based on judgment. For others, one of the two HEPs that are analyzed is used based on judgment. Examples include: 1) In Section C4.3.6 it is stated that operator will receive sump alarms and be alert to the loss of RWST tank level ... the possibility that the operators do not locally isolate the tank ... is estimated as 6.7E-03 from ZHEFL2.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model

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				2) In Section C3.2.1 it is stated that a flood from the fan room should be detected quickly since this room is next to the control room. The control building sump high-level alarm would alert operators. Failure of the air conditioning would also alert operators. It is recommended that a better basis for these operator actions be developed to ensure consistency with the remainder of the PRA.\		uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-E5a-01	IF-E5a	C	Y	Several operator actions in the IF assessment use the HEPs documented by detailed analysis for ZHEFL1 and 2. These assume that the cues, procedures steps, action, timing, etc. are similar enough to that for ZHEFL1 or 2 but this is not documented in the IF Notebook or the HR Notebook. To be consistent with the operator action assessments for the remainder of the PRA, it is recommended that better documentation be developed to support the use of ZHEFL1 or 2 for these operator actions, or new HEPs be developed as appropriate.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as

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						its basis, so this F&O will be resolved when NFPA 805 is implemented.
IF-F1-02	IF-F1	C	Y	If the current IF methodology is retained, a comparison of the current methodology to the ASME Standard is recommended to facilitate future reviews.	This F&O was written against an obsolete Internal Flooding PRA model (BV1REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV1REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-4.	No impact on the submitted BVPS-1 Fire PRA, which used the BV1REV5 as its basis. Internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so

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						this F&O will be resolved when NFPA 805 is implemented.
LE-C2a-01	LE-C2a, LE-C2b, LE-C3, LE-C6	B	Y	SR LE-C2a is assigned a capability category I because BVPS 2 does not use operator actions post core damage. This is considered conservative treatment of operator actions following the onset of core damage. To meet capability category III for this SR, BVPS 2 level 2 analysis must contain realistic operator actions, based on SAMGs, EOPs, etc. such as WCAP-16657-P.	The Level 2 LERF Analysis Notebook Section 2.5 "General Discussion of Level 2 Operator Actions" discusses operator actions considered for this model. WCAP-16657-P suggests seven potential operator actions (OA) for inclusion in a Level 2 PRA model. Each of these actions along with two others were reviewed specifically for Beaver Valley Unit 1. The Level 2 OA to restore feedwater to a dry steam generator was added to the PRA model.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-C2b-01	LE-C2b	B	Y	Only recovery of AC power after UTAF is discussed in the Level 2 notebook. It is concluded that not enough time exists to assign a high success probability. No other recoveries are discussed.	Section 2.5 of the Level 2 LERF Analysis Notebook discusses the use of Level 2 Operator Actions for recovery; specifically recovery of feedwater to a dry steam generator is included in the CET Top Event OL. AC electric power recovery is included in the Level 1 Top Event RE	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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LE-C9a-01	LE-C9a, LE-C9b	B	Y	Level 2 and LERF analysis stopped at containment failure and continued operation of equipment and operator actions were not modeled. Operation of mitigating systems after containment failure is not modeled either. Justify the lack of credit of equipment survivability.	A discussion has been added to Section "General Modeling Assumptions and Criteria for Level 2 Analysis" in the Level 2 LERF Analysis Notebook to justify the significance of the containment spray system operability on LERF mitigation following containment failure. Details of equipment survivability can also be found in Appendix A, Sections A.1.7 and A.1.10.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-C10-01	LE-C10	B	Y	SGTR and containment bypass did not take credit for scrubbing. WCAP-16657 suggests that scrubbing for tube rupture events can be credited by an operator action restart auxiliary feedwater to the ruptured steam generator.	A discussion has been added to the Level 2 LERF Analysis Notebook Section 3.3 "Containment Event Tree," Top Event OL to credit SGTR scrubbing and the basis for the decontamination factor.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-D5-01	LE-D5	B	Y	Beaver Valley Thermal Induced SGTR is based on a 1995 Fauske and Associates report and Westinghouse Calculation CN-RRA-02-38. Recent investigations suggest that these results may be too optimistic. A more reasonable approach may be implementing WCAP 16341, "Simplified LERF Model," and characterizing the uncertainties based on that latest EPRI, PWROG, and NRC interactions.	The PI-SGTR and TI-SGTR methods are included in Appendix F of the Level 2 LERF Analysis Notebook.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-D6-	LE-D5	B	Y	The CI analysis for BV2REV3b is based on a sub-atmospheric containment.	Following the Beaver Valley Unit 1 Atmospheric Containment Conversion	No impact to Fire PRA,

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01				BV2 has been converted to atmospheric so this analysis must be revisited. BV1REV4 does account for the atmospheric containment conversion in the Containment Isolation notebook. The results of a similar assessment for BV-2 need to be incorporated in the LERF notebook.	modification, the containment still normally operates at slightly sub-atmospheric conditions. A discussion has been added in Section "Condensed Plant Damage State Matrix for Beaver Valley Unit 1" to outline the Beaver Valley Unit 1 containment change from sub-atmospheric to atmospheric and the impact on the Level 2 analysis.	because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-E4-01	LE-E4	B	Y	The BV2 LERF model is quantified using RISKMAN. Only point-estimates for each top event are used and there are no uncertainty estimates or uncertainty propagation.	The Level 2 phenomena split fraction distributions are included in Table 3-26 of the Level 2 LERF Analysis Notebook. This table contains Beaver Valley Unit 1 plant specific Level 2 phenomena distributions along with the mean, median, 5th%ile, and the 95th%ile. A discussion on how these distributions were developed is provided in Section 3.4 of this notebook.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-F2-01	LE-F2	B	Y	The PRA Peer Review Team suggested in F&O L2-02 using uncertainty analysis for the LERF top events to ensure that future applications are not affected by use of point estimates.	The LERF uncertainty analysis was performed as part of the quantification process using Monte Carlo sampling of the Level 2 split fraction distributions. The result of this analysis is provided in the BVPS-1	No impact to Fire PRA, because this issue was addressed in the base PRA

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				This F&O was entered into the BVPS Corrective Action Program as CA 02-09043-26 (Reference 16) to track and resolve the issues. The suggested PRA Peer Review Team resolution to this observation was not addressed in the BV2REV3B PRA model update, but will be evaluated sometime later in a future PRA model update. This update has not yet been completed. At the time, it was a "C" level F&O but the PRA standard raises the requirements for PRA quality and this F&O is now a "B" level.	Quantification Notebook, Revision 5, Section 1.5.6 "Results of Containment Performance Analysis."	model prior to building the Fire PRA.
LE-G5-01	LE-G5	B	Y	Limitations of the LERF analysis are identified throughout the BV2 Level 2 notebook. However, they need to be gathered into a single location to facilitate future usage.	Section "Limitations of the Level 2 Model" has been added to the Level 2 LERF Analysis Notebook to include limitations of the Level 2 analysis.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-B3-01	LE-B3	C	Y	In Section 2.1 of the LERF Notebook, it is stated that MAAP, STCP, and MELCOR are used to characterize the timing of important events. There is no evidence that STCP and MELCOR are ever used.	Level 2 LERF Analysis Notebook Section 2.1 "Guidelines on Grouping Core Damage Sequences into Plant Damage States Based on Their Accident Progression Attributes" has been updated to include a discussion of the codes used and their applicable analyses.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
LE-D3-02	LE-D3	C	Y	The LERF assessment for ISLOCA is self contained in the Appendix D of the Initiating Event Analysis notebook. There is no reference to the ISLOCA assessment in the LERF notebook. It is not readily apparent from reading the LERF notebook that an ISLOCA assessment was done.	The ISLOCA analysis is reported in the Initiating Event Notebook. The Level 2 LERF Analysis notebook contains a pointer to the ISLOCA analysis in Section 1.2 "Interrelationship with Other Parts of PRA."	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
QU-F4-01	QU-F4, QU-E4, IE-D3	A	Y	The Revision 3B Quantification notebook Section 5 states that the PRA notebooks..."include an estimation of the uncertainty introduced by the data used to quantify the PRA model...This uncertainty estimation does not, however, reflect possible effects on the results from other sources of uncertainty. Such sources may include such things as: optimism or pessimism in definitions of sequence, component, or human action success criteria; limitations in sequence models due to simplifications (for example, not modeling available systems or equipment) made to facilitate quantification; uncertainty in defining human response within the emergency procedures...; degree of completeness in selection of initiating events; assumptions regarding phenomenology or structures, systems, and components (SSC) behavior under accident conditions... While it is difficult to	Documentation of a more rigorous uncertainty analysis for the Beaver Valley Unit 1 PRA model is presented in Section 5 of the Quantification Notebook Westinghouse has provided support for the BVPS-1 Revision 5 uncertainty analysis that is documented in "Transmittal of the Beaver Valley Power Station Unit 1 PRA Notebook Uncertainty Analysis," LTR-RAM-II-10-052, December 21, 2010.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				quantify the effects of such sources of uncertainty, it is important to recognize and evaluate them because there may be specific PRA applications where their effects may have a significant influence on the results. QU-F4 requires that these sources of uncertainty be characterized regardless of the difficulty of the evaluation. By Beaver Valley's own admission (above), it is important to recognize and evaluate them because there may be specific PRA applications where their effects may have a significant influence on the results. Furthermore, the documentation provided in Chapter 5 of the Quantification notebook makes a start at identifying the sources of model uncertainty. PWROG guidance suggests the number of identified sources of uncertainty typically is on the order of 50 items. it is also suggested the BVPS perform a more rigorous search to complete a fairly complete list of sources of uncertainty.		

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
QU-B9-01	QU-B9	B	Y	Component boundary conditions are not well defined. The Data Analysis Notebook, as well as several system notebooks (AFW & SWS) were reviewed and there is no discussion of component boundary (a pump fail to start, for example...does the component boundary include the local circuitry?). There are assumptions made regarding system boundaries, but no discussion of component boundaries. As a result, module definitions can not be determined.	A table of component boundaries was added to section A.4 of the Unit 1 PRA Data Analysis Notebook. .	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
QU-F4-02	QU-F4, QU-F5	B	Y	A detailed description of the RISKMAN quantification process is provided. However, the Revision 3B Quantification notebook does not discuss limitations in the methodology.	Documentation of the RISKMAN software quantification limitations are presented in Appendix A, Section A.1.1 "RISKMAN Software Limitations" of the Quantification Notebook	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
QU-D5a-01	QU-D5a	B	Y	Significant contributors to CDF have been identified, but there is no identification of SSCs and operator actions that contribute to initiating event frequencies and event mitigation	Documentation of the significant contributors to CDF, including initiating events, accident sequences, basic events (containing common cause failures), components, systems, and operator actions are included in Section 3 "Results" of the Quantification notebook. The System Notebooks also provide information on SSC and operator action (i.e.,	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
					basic event) contribution to initiating event frequencies and event mitigation, in the cutset listing reports.	
QU-F6-01	QU-F6	B	Y	Beaver Valley does list important operator action basic events; however, there is no documented definition of "significant". The Revision 3B Quantification notebook lists top accident sequences but provides no definition of whether they are "significant" or not. The only discussion is that there is "no single sequence makes up a large fraction of the CDF". The Revision 3B Quantification notebook states the following definition for important systems: "The system rankings for determining High Importance is based on having an F-V Importance greater than 5.0E-02 or a RAW greater than 10, while the Low Importance is based on having an F V Importance less than 5.0E-03 and a RAW less than 2. Medium Importance systems are comprised of everything else in between these importance measures." This definition agrees with the Regulatory Guide 1.200 definition for "significant contributors." However,	The definition of significant accident sequences is provided in Section 3.1 of the Quantification Notebook. Section 3.1.4 provides the definition of significant systems. The top 10 basic events, components, and operator actions ranked by Birnbaum importance are also considered significant.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				there is no documented justification (no reference to a standard definition, such as R.G. 1.200 or the EPRI PRA Applications Guide).		
QU-D5-02	QU-D5b	C	Y	The BVPS-2 system importance rankings are based on component importances; however there is no specific discussion of component or basic event importances (excluding operator actions).	Documentation of the basic event and component importances are provided in Section 3.1.3 "Basic Event and Component Importance Rankings," of the Quantification Notebook. A complete listing of CDF importance measures for all basic events and components is provided in the linked files "CDF Basic Event Importance.xls" and "BV1REV5 CDF Component Importance.xls."	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SC-A5-01	SC-A5	B	Y	This SR requires that for sequences in which stable plant conditions would not be achieved by 24 hr using the modeled plant equipment and human actions, PERFORM additional evaluation or modeling by using an appropriate technique.	A discussion has been added in the medium LOCA Top Event MU to address containment flooding and supply of make water. Containment flooding is a severe accident mitigating strategy used to flood up to the lower head of the RPV to significantly delay, and possibly prevent vessel failure. The	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
					consequences of containment flooding have been addressed in BVPS-1 SAMG CA-5, "Containment Water Level and Volume," to determine when water levels are jeopardizing vital equipment and monitoring capabilities. A review of Figures 1 & 2 and Table 6 of this document reveals that no significant core damage mitigating equipment or instrumentation would be impacted, even if 3 RWST volumes are injected. There is an unlimited supply of makeup water via the Ohio River.	
				The MU top event for medium LOCA and Small LOCA/General Transient uses RWST makeup as part of the success path when recirculation has failed. While a mission time of 24 hours is assumed, the plant is not at a safe stable state because another action is required for long term success. The RWST refill results in additional water to the containment which eventually will result in the design basis flooding level being exceeded and the potential for subsequent loss of instrumentation and control. The impact of continued RWST makeup and injection into containment needs to be discussed in relation to the achievement of a safe stable state where no additional operator actions	Furthermore, if a significant volume of river water is added to the Spent Fuel Pool, makeup procedure 1OM-7.4.Q recommends the addition of boric acid to the Spent Fuel Pool to maintain adequate shutdown margin. Therefore, at BVPS actions to add makeup to the RWST and use the HHSI pumps in SI injection mode for continued RCS makeup are determined to result in a safe stable plant condition. This would be true for all accidents identified in the F&O (i.e., medium LOCA, small LOCA, General Transient, SGTR, and ISLOCA).	

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				are required. A similar situation exists for SGTR and ISLOCA where RWST refill is being used to maintain core cooling, but the justification for mission time of only 24 hours is not apparent given that the plant is not in a safe stable state by traditional definitions.		
SC-C2-01	SC-C2	B	Y	No discussion of the limitations of the MAAP code for Success Criteria are provided in the Success Criteria Notebook. Two known limitations are the use of MAAP for early phase large LOCAs and the use of MAAP for SG dryout assessments without benchmarking to design basis codes (e.g., bleed and feed initiation). It was observed in the Success Criteria Notebook that MAAP runs were made to justify only 1 accumulator (but that 2 of 2 intact accumulators appear to have been actually used as stated to be used in Section 3.1 of the Notebook). It is recommended that a discussion of MAAP limitations (similar to that provided in the EPRI assessment for MAAP 3) be documented or referenced in the Success Criteria Notebook.	Section "MAAP-DBA Limitations" has been added to the Success Criteria Analysis Notebook to identify the limitations of the MAAP-DBA code.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
SC-A5-02	SC-A5	C	Y	The success criteria for top event WM for the SGTR states that 400 gpm makeup to the RWST is sufficient to maintain HHSI for RCS inventory control at full RCS pressure despite leakage through a ruptured SG tube. The maximum RCS inventory loss through a single SGTR is on the order of 600 gpm if the primary side is at normal operating pressure and the secondary side of the SG is not depressurized. This is in excess of the 400 gpm makeup and therefore appears to invalidate the success criteria as stated. Also, if continued HHSI at full system pressure is required, SG overfill is likely to occur and the SG will be depressurized and the leakage through the ruptured tube will even be higher.	A discussion has been added to the Success Criteria Analysis Notebook in Section 3.5 "Steam Generator Tube Rupture" Top Event WM to address RWST makeup.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SC-B1-01	SC-B1	C	Y	Reviewer Note R7 for TH states that MAAP limitations were observed and MAAP was not used for Large LOCA early success criteria such as accumulators. It was observed in the Success Criteria Notebook that MAAP runs were made to justify only 1 accumulator but that 2 of 2 intact accumulators was stated to be used in Section 3.1 of the Notebook. This may be confusing for future use because no discussion of MAAP limitations is	Section "MAAP-DBA Limitations" has been added to the Success Criteria Analysis Notebook to identify the limitations of the MAAP-DBA code.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				presented in the Appendix containing the MAAP analyses (e.g., at page C-8 of the U2 Success Criteria Notebook).		
SC-B5-01	SC-B5	C	Y	The ASME PRA requirement for SC-B5 includes the possibility of comparison to check the reasonableness of the success criteria. It is recommended that such as effort be undertaken, possibly as a PWROG or EPRI effort.	Attachment D has been added to the Success Criteria Analysis Notebook to compare the Beaver Valley Unit 1 results with North Anna Unit 1. Furthermore, the Beaver Valley PRA model success criteria developed using MAAP were compared with the NUREG-1953 Surry success criteria (a similar plant), which used the MELCOR computer code and were found to be in good agreement.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SC-C1-02	SC-C1, SY-C1	C	Y	The ASME PRA Standard for SC-C1 requires that Success Criteria be documented in a manner that facilitates applications, upgrades, and peer reviews. The current state of the BVPS PRA Success Criteria is that the accident sequence success criteria are	Section "System Success Criteria" has been added to the Success Criteria Analysis Notebook to show where the system specific success criteria are contained in each system notebook.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				gathered in the Success Criteria Notebook, but other success criteria are scattered about though the PRA. Examples include the SW success criteria and ISLOCA success criteria for U1. It is recommended that FENOC consider gathering all success criteria in the Success Criteria Notebook to facilitate future usage.	This was believed to be the best place to locate support system success criteria.	building the Fire PRA.
SC-B1-02	SC-B1	S	Y	CCIII of the standard requires that plant specific analyses be used to determine success criteria with plant specific analyses. The large number of MAAP analyses for success criteria meet this requirement and the BVPS U1 and U2 PRAs are considered to be exemplary in this respect.	No response required for F&O SC-B1-02.	No impact to Fire PRA, because this was identified as a strength of the model.
SY-A14-01	SY-A14, SY-A12, SY-C1	B	Y	The DRAFT Revision 4 System notebooks (AFW, SWS, CCS, CCP, MFW were reviewed) discuss failure modes and contributors to system unavailability and unreliability that are excluded from the systems analysis. However, the SY-A14 criteria does not appear to have been applied consistently throughout the analysis. The only exceptions found where the SY-A14 criteria are explicitly met is in the CCS notebook, Section 14, c, Assumption #2, and the AFW notebook Section 14, c, Assumption #3. In some instances, such as the CCP notebook Section 14, c, Assumption #1, there	Instances of excluded failure modes and contributors to unavailability for the applicable systems were reviewed and compiled into a single location in their respective System Notebooks. When warranted, justification for the excluded failure mode or unavailability contributor was made more thorough. This information is located in the Excluded Failure Modes and Unavailability Contributors section of the notebooks.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				was no explanation given for why the contributor was not modeled.		
SY-C1-01	SY-C1	B	Y	In providing the response to peer review F&O DA-09, which deals with providing documentation of the CCF groupings, Beaver Valley noted that the Systems Analysis Overview and Guidance notebook provides the process used to identify CCF groupings. The response further suggests details of the common cause groups that were retained in the PRA system models and presented in Appendix C of the BVPS Unit 2 PRA System Notebooks, under the common cause sections of the RISKMAN System Notebook files are adequately documented and can be found by knowledgeable personnel.	The Common Cause section of the System Notebooks now reference the Common Cause Modeling section, Table A-1, and Table 1 of the Systems Analysis Overview and Guidance Notebook to thoroughly document the methodology and grouping of the common cause modeled in the PRA.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				The reviewer agrees that one can review Appendix C of the Systems notebooks and see what the CCF groupings are and how the CCF probabilities were generated. The reviewer also agrees that high level guidance is provided in the Systems Analysis Overview and Guidance notebook. However, it appears a link between the two documents is missing. For example, the guidance states "When identical, nondiverse, and active components are used to provide redundancy, they should be considered for assignment to common cause groups, one group for each identical redundant component". When the Systems notebook Appendix C is reviewed, the components contained in the CCF group is clearly identified, but there is no documentation that states that those components are "identical, and/or non-diverse" or used to provide redundancy. Further examination of other sections System notebooks (such as Section 3 "System Success Criteria", or Section 6 "Operating Features" would lead a reviewer to find this type of information. But this documentation is not always		

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F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				intuitively obvious and makes peer review difficult at times.		
SY-A11-01	SY-A11	C	Y	The system notebooks do not specifically discuss the dependencies that may be present regarding HVAC / room cooling. However, review of the HVAC notebook identified the various spatial locations that may require HVAC and indicated the various analyses that have been completed to either require HVAC dependencies or not.	An additional response has been added to the evaluations of the areas that are represented by the actual top event equipment whether the HVAC dependency is required or not and is located in Support Systems section in the system notebooks.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-B1-01	SY-B1	C	Y	At the time of the BVPS Unit 2 common cause MGL data update during Revision 3, the NRC update to NUREG/CR-5497 was still not available. As such, a decision was made during the update process to keep the existing generic MGL data, which is almost exclusively based on the PLG generic database dated circa 1989. There is no documentation to illustrate that the Beaver Valley considered NUREG/CR-5497 during the Revision 4 PRA update.	Up-to-date generic MGL CCF data has been updated in PRA-BV1-AL-R05 using WCAP-16672-P (Section 3.6 and Table C-5 in the Data Analysis Notebook). In June 2008, Westinghouse issued WCAP-16672-P which covers 1980 – 2003 in order to provide guidance to address the concerns that were raised regarding the consistency and correctness of the CCF events included in the NRC CCF database. The WCAP data source contains CCF parameter estimates for the majority of risk-significant components whose performance are potentially applicable to PWROG utilities only in the U.S. designed by either Westinghouse or	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					Combustion Engineering. The parameter estimates for failure modes of significant components that are generally included in the PRA are provided for the Alpha factors that are converted to the Multiple Greek Letter approach (MGL) by the method in NUREG/CR-5485 and to allow for quantifying CCF probabilities.	
SY-B7-01	SY-B7	C	Y	The Service cooling water system notebook assumption #7 lists 10 minutes to trip the RCPs on loss of cooling. However, in the Miscellaneous system notebook, top event OC has 5 minutes to trip the RCPs. Note, this time might be important in quantifying HEP for RCP trip.	The Miscellaneous Top Events Notebook, Top Event OC models the operator actions to trip the RCPs during situations that exist for greater than 5 minutes, in which either CCR is lost to the RCPs and seal injection is maintained, or both RCP seal injection and thermal barrier cooling are lost. Both of these conditions would be covered in the abnormal operating procedure 1OM-53C.4.1.6.8 "Abnormal RCP Operation", and RCP parameters would be monitored to identify situations that warrant an immediate RCP shutdown.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					If either of these conditions exist for greater than 5 minutes, the human reliability analysis for operator actions OPROC1 (loss of CCR) and OPROC2 (Loss of RCP seal Cooling) assume that the operators would trip the RCPs at 5 minutes, and that the RCPs seals would be damaged in 13 minutes if they were not tripped, leading to a 480 gpm per RCP seal LOCA. These timing assumptions and consequences are based on BVPS AOPs and WCAP-16141.	
SY-C1-02	SY-C1	C	Y	The Beaver Valley Unit 2 system notebooks have no indication of system engineering reviews. These reviews help ensure that systems are model in accordance with day-to-day plant operations and additionally expand the PSA knowledge of the system engineers.	System Engineers reviewed the system notebooks for PRA-BV1-AL-R05, in which they had to present comments and provide input for the top event system review. System Engineering comments have been incorporated into BVPS-1 PRA corresponding system notebooks. A table that contains the comments is located in Appendix B in the System Analysis Overview for BVPS-1.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-B5-01	SY-B5, SY-B6, SY-B10, SY-B11	D	Y	The system notebooks do not specifically discuss the dependencies that may be present regarding HVAC / room cooling. However, review of the HVAC notebook identified the various spatial locations that may require HVAC and indicated the various analyses that have been completed to either require	An additional response has been added to the evaluations of the areas that are represented by the actual top event equipment whether the HVAC dependency is required or not and is located in Support Systems section in the system notebooks.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the

Table 1-2. Summary of BVPS-1 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				HVAC dependencies or not.	Since this F&O is essentially the same as F&O SY-A11-01, it was also resolved by it	Fire PRA.

Table 1-3. Summary of BVPS-1 HRA Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
HR-PR-001	HR-D5, HR-G7, HR-H3, HR-I1, HR-I2(d)3	Finding	Y	BVPS does not have a written process for evaluating dependencies between multiple HEPs occurring in a single accident and does not provide a summary of HEPs that were explicitly evaluated for dependencies and the associated levels of dependencies and joint HEPS. The BVPS HRA notebooks do not have a single summary table of the preinitiator human actions and the documentation of the evaluation of pre-initiator human actions in the system notebooks, which make it difficult to identify which actions were actually evaluated.	Section 2.2 of the HRA Notebook documents the methodology and evaluation of the pre-initiator HEPs. A summary of the EPRI HRA Calculator results can be found in Table 3.5 which supplements the detailed calculations documented in Appendix E. Section 2.3 documents the methodology developed to evaluate the dependency between multiple HEPs. Section 2.3 of the HRA notebook has been created to document the process employing the EPRI HRA calculator that is used to complete the dependency analysis evaluation (See F&O HR-I2-01 in Section 6).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-PR-002	HR-G6, HR-I2	Finding	Y	BVPS does not appear to have evaluated their HEPs for internal consistency consistent with the requirements of HR-G6 and does not have a documented process to do so.	An internal consistency check for pre-initiator HEPs is documented in Section 3.4 of the Unit 1 HRA notebook. The original post-initiator HRA was developed using the SLIM/FLIM process, and as such were grouped with respect to similar performance shaping factors and weights (e.g., actions where time and preceding actions are most important were	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-3. Summary of BVPS-1 HRA Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					grouped together) to have internal consistency during the HEP development. As a final check of overall consistency, the HEPs from each group were then compared with those of other groups to determine if the differences in the HEPs were warranted by the differences in the scenarios and PSF ratings. The BV1REV4 PRA model revised the HRA methodology from the SLIM/FLIM process to the EPRI HRA Calculator. The HRA Calculator is a software program that is designed to implement consistency within the field of human action analysis by creating a standard methodology for quantification and documentation of HEPs in the context of the PRA. After this conversion was complete, the resulting HEP values were then compared to the previous BV1REV3 SLIM/FLIM HRA model (see Table 3-4 of the HRA Notebook, Revision 1 drafted for BV1REV4), to verify consistency in overall trends between events. Since these BV1REV3 PRA Model SLIM/FLIM HEPs were compared to the BV1REV4 PRA Model HRA Calculator HEPs to check their	

Table 1-3. Summary of BVPS-1 HRA Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
					reasonableness, there is a de facto consistency check in the HEPs.	
HR-PR-003	HR-D2, HR-D3, HR-D4, HR-I1, HR-I2	Finding	Y	The method for quantifying pre-initiator misalignment errors as described on page 8 of the "Beaver Valley Power Station Unit 2 PRA Notebook – Human Reliability Analysis," Revision 2, dated 10/01/07, relies on the use of a generic Error of Omission rate that does not reflect any detailed assessment of the HEPs. The process also does not consider the quality of plant-specific written procedures, administrative controls or the man-machine interface and does not include an explicit assessment of the potential for recovery that specifically delineates which procedures and processes influence the potential for identification and recovery. Furthermore, the method for quantifying post-maintenance miscalibrations relies on a single generic error of omission rate. A complication in reviewing the pre-initiator Human Failure Events (HFEs)	Pre-initiators are now quantified using the THERP methodology as presented in the EPRI HRA Calculator. This is documented in Sections 2.2 & 3.4 and Table 3-5 of the HRA Notebook. The pre-initiator human error probabilities were determined using BVPS operator input and BVPS specific procedures and processes. The process now considers the plant specific written procedures, administration controls, and man-machine interface. A list of the pre-initiator HFEs and their probabilities was added to Section 3 in Table 3 5.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-3. Summary of BVPS-1 HRA Focused Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				was that the HRA notebook does not include a list of the pre-initiator HFEs or their probabilities. The system notebooks provide evidence of the search for and identification of misalignments but they do not present a list of such events or their probabilities.		

Table 1-3. Summary of BVPS-1 HRA Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
HR-PR-004	HR-C2	Finding	Y	Post-maintenance misalignments were excluded for normally operating system based on the assumption that misalignments on normally operating systems would be quickly detected and corrected. Post-maintenance unavailabilities were included for standby systems as appropriate. However, nowhere in the HRA notebook or the system notebooks that were reviewed was there any indication that BVPS had performed a review of their operating/maintenance data to look for post-maintenance misalignments.	Section 2.2 and Appendix C of the HRA Notebook document the review of BVPS procedures (OSTs, BVTs, and MSPs) to identify potential misalignments. Section 2.2 and Appendix D of the HRA Notebook documents the review of historical event data for misalignment identification. A search of the BVPS 1&2 Corrective Action Program (CAP) was performed to identify pre-initiators that have occurred at BVPS. A review was also performed with the BVPS operator.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-PR-005	HR-I3	Finding	Y	The BVPS HRA is documented in the "Beaver Valley Power Station Unit 2 PRA Notebook – Human Reliability Analysis", Revision 2, dated 10/01/07. This notebook does not have an explicit assumptions section to identify and characterize assumptions. A review of this notebook revealed assumptions scattered throughout the text.	Section 7 of the Unit 1 HRA notebook was added to document HRA assumptions.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-PR-006	HR-F2	Finding	Y	In reviewing the set of post-initiator HFEs in Table 3-1, It was noted that for the HFE ZHEMA2, the specified time window, 13.26 hours, was not consistent with the information provided in the "Success Criteria/ Basis of Timing" for that HFE. A review of the referenced MAAP case	The present BV1REV5 value for HFE ZHEMA2 is 258 minutes = 4.3 hours (based on MAAP Run U1_SBO2) which is consistently stated in both Table 3-1 and Appendix B of this notebook.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-3. Summary of BVPS-1 HRA Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				indicates that the 13.26 hours is the appropriate timing. Furthermore, continued review of table 3-1 indicated that this seemed to be an isolated event.		
HR-PR-007	HR-B1	Finding	Y	In general, BVPS excludes virtually all miscalibration events based on the assumption that events related to instrument miscalibrations are captured in the equipment failure rate data and the On-line Maintenance program precludes common-cause miscalibration by scheduling work on opposite trains in different weeks. Post-maintenance misalignments were excluded for normally operating system based on the assumption that misalignments on normally operating systems would be quickly detected and corrected. While these rules seem reasonable, they are applied to classes of maintenance and test activities to screen them from further consideration. This is sufficient for Capability Category I but not for Capability Category II.	ASME/CNRM Inquiry 09-56 states that miscalibrations are included in the Common Cause Failure (CCF) events for the NRC CCF Database. Since BVPS includes miscalibrations in the CCF events, it would be double counting to also include them as pre-initiators. As a result, it is believed that BVPS's current treatment of miscalibrations as part of the CCF events and not pre-initiators meets Capability Category II (instead of Capability Category I). An exception to this is the SSPS model, which did include instrument string miscalibration errors in the fault tree model. A search of the Corrective Action database in April 2010 did not reveal any such miscalibration errors between trains at Beaver Valley Unit 1 to date.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IFPP-B1-01	IFPP-B1, IFSO-B1, IFSN-B1, IFEV-B1, IFQU-B1	Finding	Y	The documentation generally does not facilitate peer review. The technical aspects of the analysis are documented in a manner that cannot be readily understood by individuals outside the staff. The ordering of the documentation is significantly different from the standard; a detailed graphical roadmap of the analysis process would enable peer reviewers to relate the order of the documentation to the standard.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 17, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 2 of the documentation was revised in order to facilitate the Peer Review process. Figure 2-1 provides an overview of the ASME/ANS PRA Standard requirements and their relationships to the analysis and information contained in the various sections/appendices/tables of the report. This documentation mapping is consistent with that presented in the EPRI Final Report 1019194, Guidelines for Performance of Internal Flooding Probabilistic Risk Assessment	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IFPP-B2-01	IFPP-B2	Finding	Y	The process described the identification of site buildings and flood areas, but the documentation does not clearly establish the basis for the set of buildings considered in the analysis. The references to source material are not sufficiently specific to allow replication of the process. The documentation will be	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 6, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, the intent of Table 3-1 was clarified prior to Section 3.1 (Identify Flood Areas) to plainly indicate the table represents a complete list of plant buildings/structures based on referenced materials and that it includes the preliminary building screening.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other.

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				easier to follow if the basis for the selection of buildings considered in the analysis is enhanced. There is reference to review of plant documentation including the fire analysis, but no statement that the list of buildings in Table 3-1 is the complete list of buildings.		Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IFPP-B3-01	IFPP-B3	Finding	Y	The process used to determine the plant partitioning requires some level of assumptions concerning how the plant partitions are established. The current plant partitioning has no discussion of the uncertainties and assumptions associated with the plant design features used to create flood areas.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 7, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, plant partitioning assumptions were documented in Section 3.5.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
IFSO-A4-01	IFSO-A4	Finding	Y	The potential flooding effects is not listed within any of the tables documenting the potential flooding sources. The ASME/ANS standard requires the inclusion of the potential flooding mechanisms when describing the flood sources used in the model.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 3, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 4.2 (Flood Source Failure Mechanisms and Failure Modes Summary) was added to specifically address: a) a discussion of failure modes and mechanisms associated with each flood source with direct reference to latter documentation sections for further discussion, and b) the EPRI methodology which embeds failures of all piping system components as part of the piping segment failures averaged on a per linear foot basis. Furthermore, Section 4.3 was added to address any flood source identification assumptions with direct reference to latter documentation sections for further discussion.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IFSO-A5-01	IFSO-A5	Finding	Y	This supporting requirement identifies information used to characterize the flooding sources. Most of the information is provided in Sections 4 and 7 of the internal flooding PRA reports. The information identified by this SR was not provided in its entirety. For example, system temperatures are not captured in the documentation and some systems (primarily oil) pump HP and RPM are captured but not the flow rates.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 5, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, all normal operating flooding sources documented in the analysis (Table 4-1. Water Sources) have updated system flow information (including normal operating temperatures) based on available information provided in the references noted in the table.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IFSO-B3-01	IFSO-B3	Finding	Y	No clear documentation was provided of related assumptions for the identification of flood sources. The sources of model uncertainty are documented in Section 12 of the internal flooding PRA reports, 2294706-R-001, Rev. 0 and 2294706-R-002, Rev. 0, but it could not be determined how these	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 4, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 12.4.5 contains a review of the impact of all assumptions mapped to uncertainty along with sensitivity analysis that was evaluated. Table 12-7 contains a cross reference of all the assumptions in the development of the BVPS-1 internal flooding notebook related to the	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other.

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				sources of model uncertainty were connected to the various assumptions.	frequency uncertainties in Table 12-2.	Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IFSN-A1-01	IFSN-A1	Finding	Y	The description of the propagation paths is not complete. Table E-1 identifies the "source" location and the next locations to which it water can propagate. To determine the complete propagation path, these source/next pairs can be combined until the water reaches the accumulation point (no "next" location). However, the scenario descriptions in Table E-2 do not consistently account for the propagation paths identified in Table E-1. For example, scenario PA3C FWLP-3 propagates to several locations per Table	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 14, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 7.3 was augmented to clearly explain with an example, the differences in Table E-1 and E-2 due to subsuming of flood propagation paths, and a separate column was added to Table E-2 to indicate all of the flood propagation pathways that were subsumed for each documented flooding scenario so that it will be clear that all pathways have been accounted.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				E-2 (PA-3C, PA-3, PA-3I, PA-3H) but Table E-1 indicates that PA-3 can propagate to PA-S2, PA-S6, PA-3G, PA-3A, PA-3B, PA-3C, PA-3H, PA-3I; several of these are not accounted for in the propagate path in Table E-2. If the missing locations are not possible due to plant features, that should be stated to complete the accounting. Other examples of this deficiency were observed (PA4-FWLP-1, PT1-FWLP-1 from Unit 2, and PA1A-FWLP-1, FA1A-FWMP-1 from Unit 1). The propagation paths must account for the various possible flow paths. Combinations presented in the documentation that are not considered bring into question the completeness of the analysis.		
IFSN-B2-01	IFSN-B2, IFSN-A5,	Finding	Y	The process to identify scenarios lacks several of	This F&O was entered into the BVPS Notification System as BV1 Notification	This issue remains open in the BVPS-1

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
	IFSN-A6			the suggested areas that should be included (recognizing that the SR list is NOT a required set). The propagation pathways description is not complete in that it does not include all potential propagation paths identified in Table E-1 of the PRA reports. The impacted (failed) SSCs for each scenario are not clearly referenced (identified as needing to be "addressed" in a REMARKS column in Table E-2). Assumptions used in the scenario discussions are incomplete. Scenario screening is not clearly documented. The documentation has many weaknesses in capturing the suggested types of information to adequately document this topic.	#600689090, Task 15, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, a graphical depiction of the overall flood scenario development was provided as Figure 7-1 in Section 7.	Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IFSN-B3-01	IFSN-B3, IFSN-A4	Finding	Y	The use of the Excel VBA code to predict flow rates and failures of equipment has provided a great deal of realistic insight to plant flood response. Section 9.0 of the internal flooding PRA reports does not explicitly discuss all assumptions regarding the use of equations to predict flood heights, and the scenarios modeled in Appendix H of the PRA reports have some assumptions applied to each analysis.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 8, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 9.5 (Summary of Assumptions) was expanded to include Microsoft EXCEL VBA program specific assumptions and documentation pointers to flooding scenario specific assumptions.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IFEV-A7-01	IFEV-A7	Suggestion	Y	Maintenance and human-induced errors causing a flooding event can be important to the overall plant risk. A more detailed analysis of those activities within the plant that could lead to a system breach potential should be analyzed. Maintenance activities which could potentially breach pressurized systems could lead to internal flooding events. By not evaluating all potential online maintenance activities for the potential breaches, the flood-induced risk associated with these activities could be underestimated.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 9, to track and resolve the issues. As a resolution to this IFPRA Peer Review suggestion, an Operating Manual (OM) procedure review of at-power open maintenance was produced as Table 7-4 that evaluates systems 15, 26, 28, 29, 30, 31, and 33 for potential actions on equipment that could cause human-induced flooding scenarios. Some of the systems are indirectly reviewed based on other systems. The OM procedures for the condenser waterbox, CCR heat exchangers, and CCT heat exchangers are based on a frequency that is based on SAP work order record queries. The screening categories for the open maintenance and human-induced review are shown in Table 7-5.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IFEV-B2-01	IFEV-B2	Suggestion	Y	Documentation of the process that identifies applicable flood-induced initiating events is required to satisfy this SR. The flood scenario frequencies are provided in Tables 8-10, F-1, and J-1 of the internal flooding analysis reports (2294706-R-001, Rev. 0 and 2294706-R-002, Rev. 0). The associated HEPs for isolating the flood and adjustment factors used to refine the flood frequencies are also provided in Table F-1. A qualitative screening value of 1.0E-12 was used. The process does not clearly identify the relationship of the information provided in the various tables.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 18, to track and resolve the issues. As a resolution to this IFPRA Peer Review suggestion and as part of an expanded analysis to address probabilistic pipe failure during the 24 Hours after an initiator and system-based initiators, Section 8.1.3 and Tables 8-11 and 8-12 illustrate the scope of flooding elements (pipe, expansion joints) contained within the existing internal events model.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IFEV-B3-01	IFEV-B3	Finding	Y	The different values that go into the calculation of the internal flooding initiating event frequency are subject to uncertainties. These uncertainties need to be well documented to address all of the model impacts.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 10, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 12.4.5 contains a summary of the review of the impact of all assumptions mapped to uncertainty along with sensitivity analysis that was evaluated. Table 12-7	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-1 Final Resolution	Impact to Fire PRA
				The current flooding frequency calculations use factors to determine the actual initiating event frequency used within the model. The pipe lengths, location factors, directional factors, and operator action failures all have some levels of assumptions and uncertainties associated with them. These need to be addressed in order to meet the SR.	contains a cross reference of all the assumptions in the development of the BVPS-1 internal flooding notebook related to the frequency uncertainties in Table 12-2.	initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IFQU-A5-01	IFQU-A5	Finding	Y	It appears that no inter-HEP dependency analysis (between flood and non-flood HEPs) was performed. Dependency between HEPs can significantly increase the probabilities of combinations of HEPs. However, Section 10.4 of the internal flooding PRA reports states "Dependencies between the flood mitigation human actions and the non-flood human actions modeled in the remaining part of the PRA model were judged to be minimal due to the significant difference in the nature of the actions (e.g., flood mitigation actions require field investigation by the auxiliary operators, etc.) and separation in time, etc., and as such no additional dependency treatment was considered needed." An evaluation of the HEP combinations should be documented to demonstrate this conclusion.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 16, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 10.4.6 (Dependencies between Human Interactions) was expanded to reiterate Section 10.4.3 (Screening and Detailed Analysis) discussion on the multiplier factor applied to HEPs included in the Internal Events PRA based on such factors as the location of the action, the timing of the action, and stress, etc. and to include a discussion of the Riskman modeling analysis approach in which human actions included are evaluated conditionally based on the success or failure status of the preceding human action(s). As such, dependencies among the human failure events in the Internal Events model (i.e., non-flood human actions) were fully accounted.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IFQU-A7-01	IFQU-A7	Finding	Y	Performance of the internal flood events quantification should be consistent with the quantification of the internal events PRA. The quantification of the internal flooding requires that applicable requirements from the Internal Events Quantification section be met. The current section on Internal Flooding does not include a discussion of the topics addressed in Section 2-2.7 of the ASME/ANS Combined PRA Standard.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 12, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, analysis and discussion has been provided for performance of quantification with the applicable requirements. QU-B3 requirements have been documented in Section 12.4.4, Truncation Evaluation. The QU-B7 requirements have been documented in Section 12.5.3, Mutually Exclusive Events. QU-C1 & QU-C2 requirements have been documented in Section 12.5.4, HFE Dependency. QU-D1 & QU-D2 requirements have been documented in Section 12.5.5 Significant CDF Sequences and Accident Category (for CDF) and Section 12.5.8 Significant LERF Sequences and Accident Category (for LERF). QU-D4 requirements have been documented in Section 12.5.2 Internal Flooding Comparison Between Plants and Table 12-5. QU-D6 requirements have been documented in Sections 12.5.5 - 12.5.7, and 12.3 for significant contributions to CDF. QU-D7 requirements have been documented in Section 12.5.6 for system importance that is based on importance for components and basic events.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

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F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
IFQU-A9-01	IFQU-A9	Finding	Y	The loss of the CCR heat exchangers in the PRA models have made an optimistic assumption regarding the survivability of cooling to the heat exchangers following a system breach (see scenario VP1-FWLL-1). Use of this assumption allowed a potentially more severe scenario to be represented by a less severe scenario. The assumption was that the vacuum at the inlet to the CCR heat exchangers would prevent sufficient loss of cooling water from a break in the piping downstream of the river water (RW) check valve in the valve pit from failing both trains of RW. This assumption appears to be non-conservative.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 19, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, a BVPS Nuclear Engineering Analysis calculation was performed on this specific Valve Pit assumption. The calculation verified and demonstrated that once the Valve Pit floods (in less than 30 seconds), there is adequate flow to all the necessary heat exchanger loads, so only the ruptured header should be considered failed. Since the "A" RW pump is modeled and is the strongest pump in the current Proto Flow model, the "A" RW break is conservative and was hence used in this calculation. Results of the calculation are documented in Section 8.4 assumption 2.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IFQU-A10-01	IFQU-A10	Suggestion	Y	Internal flooding contribution to LERF should be documented in some way so that the apparent impacts on LERF from the flooding events could be reviewed. The discussion concerning the impacts on	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 11, to track and resolve the issues. As a resolution to this IFPRA Peer Review suggestion, Section 12.5.8 contains a review of internal flooding LERF sequences and accident categories which describes	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire

Table 1-4. Summary of BVPS-1 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-1 Final Resolution**	**Impact to Fire PRA**
				LERF for internal flooding events could be improved to discuss flooding impact on the different features used to mitigate releases.	impacts that are evaluated in internal flooding LERF analysis.	initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.
IFQU-B2-01	IFQU-B2, IFQU-B1	Finding	Y	The process used for quantification documents the calculation, screening, scenarios deleted and walkdowns. However, there is not enough documentation of the quantification process specifically concerning the PRA Standard requirements listed in HLR-QU-D. The SR requires that documentation must be consistent with the requirements described in HLR-QU-D. These requirements are not discussed at any point in the internal flooding PRA reports.	This F&O was entered into the BVPS Notification System as BV1 Notification #600689090, Task 13, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, the supporting requirements listed in HLR-QU-D have been completed in the internal flooding notebook Section 12.5 Results and Insights.	This issue remains open in the BVPS-1 Fire PRA model which uses the BV1REV5 model as its basis; however there is no impact to the Fire PRA because internal fire initiators and flood initiators are mutually exclusive and have no effect on each other. Furthermore, the BVPS-1 Fire PRA working model uses BV1REV5A as its basis, so this F&O will be resolved when NFPA 805 is implemented.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
AS-10	AS-12	A	Y	The BV PRA uses the WOG 2000 seal LOCA in a way that may be unacceptable to the NRC for risk based applications. MAAP runs are performed to find the core uncovery times for various sizes of seal LOCA. If the best estimate MAAP runs show the core is covered at 24 hours, the sequence is considered success. The result is that all SLOCA sizes except the 480 gpm leak have no impact on CDF, because the core is shown to remain covered at 24 hours. This strict interpretation of the 24 hour mission time results in a .01 probability of core uncovery, even in sequences where SW or AC power is not restored. This result is significantly more optimistic than most other Westinghouse PRAs. The uncertainty in the calculation [due to the possible variation in RCS pressure or seal LOCA size from the predicted] is not pursued. The MAAP analysis shows time to core uncovery of greater than 24 hours, but the plant is not yet in a stable configuration. Declaration of success at this point, based only on MAAP results without thorough investigation of MAAP uncertainties (e.g., sensitivities) is a liberal application of the intent of the 24 hour success criteria and may be non-conservative.	Additional MAAP uncertainty cases for BVPS-2 were performed using pessimistically biased values along with setting input parameters to their high or low limits. These cases were run out to 48-hours or until core damage occurred. The success state for the BV2REV3B PRA model was redefined as any case (including uncertainties) that did not go to core damage before 48-hours. For cases that went to core damage before 48-hours but after 20-hours, additional electric power recovery values were used, based on NUREG/CR-5496. For cases that lead to core uncovery before 20-hours, a plant specific electric power recovery model was used. If electric power recovery was successful for these cases, the sequence was	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

[1] The Supporting Requirement is in reference to NEI 00-02 Element – Subelement.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					also binned to the success end state.	
DA-07	DA-04	A	Y	The random independent failure probabilities are based on bayesian update of plant specific data. The plant specific data is based on the time interval 1987 to 2001, for unit 2 only. The processed data is presented in a tabular form. Several questions are raised when this data is reviewed: 1. The data collection effort gets data before the institution of the maintenance rule. The reporting rules and accuracy of the pre-1994 data should be justified to be the same as the post 1994 data collection effort. 2. The number of demands for several components is very high. For example, there were 2331 DG demands. This means that each DG was started 89 times per year, which is almost 2 per week. 3. The run time for the first hour for the DG's is 2331hr, which means each DG ran for one hour each time it was started. That leaves no time for the 931 hours of extended run time. The demands and run time do not match. 4. The RHR pumps have 371 demand to start. This means each pump is started 14 times per year. Since they are not operated during power operation, this number seems very high. 5. The MD AFW pump has 707 demands, which is 27 demands per year. 6. ZTPMOR and ZTPMSR are events for generic motor driven pump. There are no recorded failures in 1.4E+6 hr. This	As a resolution to this PRA Peer Review observation, the success data (demands and hours of operation) for all Unit 2 components that used Bayesian updating of their failure rates were checked against the Maintenance Rule estimated success data, and were revised as needed if discrepancies were found. Additionally, all RISKMAN failure data distributions that were Bayesian updated in the BV2REV3A PRA model were revised in the BV2REV3B PRA model using the results of review for estimated demands and hours of operation. All Top Events were requantified in the BV2REV3B PRA model using these revised component failure rates, which were then used to requantify the CDF and LERF. The specific observations identified in the PRA Peer	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				performance is far better than industry average. Without proper back-up information, it is suspect. 7. The TD AFW pump has 224 starts, which is 17 starts per year.	Review Fact & Observation DA-07 are addressed below: 1. The data collection effort gets data before the institution of the maintenance rule. The reporting rules and accuracy of the pre-1994 data should be justified to be the same as the post 1994 data collection effort. Response: Both the pre and post Maintenance Rule failure data were reviewed to the extent possible with the information available at the time to see if they met the requirements to be considered a PRA failure. This PRA failure definition has remained unchanged throughout the PRA model updating process, and is not based solely on the Maintenance Rule definition, so it was unaffected by the implementation of the Maintenance Rule. 2. The number of	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					demands for several components is very high. For example, there were 2331 DG demands. This means that each DG was started 89 times per year, which is almost 2 per week. Response: The DG start demands (ZTDGSS) was revised to 440 in the BV2REV3B PRA model. This value is based on the Maintenance Rule estimated OST starts (50) per DG (2) per 3 year period, during 13.2 year of operation, or about 16 starts per year for each DG. Using a two-stage Bayesian process with 0 failures in 440 demands resulted in a mean failure rate of 2.78E-03 per start, as opposed to the 8.42E-04 value used in the BV2REV3A PRA model. 3. The run time for the first hour for the DG's is 2331hr, which means each DG ran for one hour each time it was started. That leaves no time for	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					the 931 hours of extended run time. The demands and run time do not match. Response: According to the System Engineer, each Unit 2 emergency DG is run for about a total of 2 hours each time that the OST is performed. Therefore, using the revised start demand value of 440 in the 13.2 year update period, the operating hours for failures during the first hour (ZTDGS1) and operating hours for failures after the first hour (ZTDGS2) both used 440 hours during the Bayesian update process for the BV2REV3B PRA model. 4. The RHR pumps have 371 demand to start. This means each pump is started 14 times per year. Since they are not operated during power operation, this number seems very high. Response: The RHR	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					pump start demands (ZTPMAS) was revised to 168 in the BV2REV3B PRA model. This value is based on 13.2 year of operation comprised of historical IPE data (11/87 through 12/88), the BV2REV2 PRA model update data (1/89 through 12/96), and the Maintenance Rule estimates for the 1/97 through 12/00 period, or about 6 starts per year for each RHR pump. Using a two-stage Bayesian process with 0 failures in 168 demands resulted in a mean failure rate of 1.89E-03 per start, as opposed to the 1.38E-03 value used in the BV2REV3A PRA model. 5. The MD AFW pump has 707 demands, which is 27 demands per year. Response: The motor driven AFW pump start demands (ZTPMDS) was revised to 460 in the BV2REV3B PRA model. This value is based on	

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F&O ID	**Supporting. Requirement[1]**	***Significance* Level**	**Status Closed Y/N**	***Fact & Observation***	***BVPS-2 Final Resolution***	***Impact to Fire* PRA**
					13.2 year of operation comprised of historical IPE data (11/87 through 12/88), the BV2REV2 PRA model update data (1/89 through 12/96), and the Maintenance Rule estimates for the 1/97 through 12/00 period, or about 17 starts per year for each motor driven AFW pump. Using a two-stage Bayesian process with 0 failures in 460 demands resulted in a mean failure rate of 1.26E-03 per start, as opposed to the 1.02E-03 value used in the BV2REV3A PRA model. 6. ZTPMOR and ZTPMSR are events for generic motor driven pump. There are no recorded failures in 1.4E+6 hr. This performance is far better than industry average. Without proper back-up information, it is suspect. Response: Database variable ZTPMOR is only used for the main feedwater pumps. A	

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					thorough search of the available failure data from MWRs, NPRDS, and EPIX were reviewed for these pumps. Although these data sources did list failures for these pumps, they consisted of mechanical pump seal leaks, oil leaks, and packing leaks. It was further noted that these leaks only degraded the pumps and did not result in any failures. Therefore, theses leaks were not counted as failures in the PRA model. However, the pumps were taken off line to repair them after discovery, which was accounted for in the PRA model pump unavailability due to maintenance activities. Database variable ZTPMSR is used for the small standby pumps. A thorough search of the available failure data from MWRs, NPRDS, and EPIX were reviewed for these pumps. Although these data sources did list	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					failures for these pumps, they consisted of mechanical pump seal leaks, oil leaks, flange leaks, excessive oil consumption, and high pump vibrations. It was further noted that these only degraded the pumps and did not result in any failures. Therefore, theses were not counted as failures in the PRA model. However, the pumps were taken off line to repair them after discovery, which was accounted for in the PRA model pump unavailability due to maintenance activities if tracked by the Maintenance Rule or by using generic standby pump unavailability if they were not. 7. The TD AFW pump has 224 starts, which is 17 starts per year. Response: The turbine driven AFW pump start demands (ZTPTSS) was revised to 156 in the BV2REV3B PRA model.	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					This value is based on 13.2 year of operation comprised of historical IPE data (11/87 through 12/88), the BV2REV2 PRA model update data (1/89 through 12/96), and the Maintenance Rule estimates for the 1/97 through 12/00 period, or about 12 starts per year for each turbine driven AFW pump. Using a two-stage Bayesian process with 1 failure in 156 demands resulted in a mean failure rate of 1.50E-02 per start, as opposed to the 1.14E-02 value used in the BV2REV3A PRA model.	
HR-07	HR-10	A	Y	The BV PRA uses the SLIM methodology. The HEP's are grouped in to 10 categories and then each category is "calibrated" in terms of 1 to 5 other PRA's. The PRA's that were used were Oconee (1984), Seabrook (1983), Diablo Canyon (1987), TMI (1985), Fermi (not referenced), South Texas (1988). The categories reflect each type of error (rule, skill, knowledge, diagnosis, response). The HRA's on which these are based are representative of nuclear plant procedures, training and operator cognizance typical for mid-1980.	As a resolution to this PRA Peer Review observation all operator actions having a Risk Achievement Worth (RAW) greater than 2 (generally accepted as the risk significant threshold) were compared to similar actions for all Westinghouse plants by using the WOG/B&WOG PSA Comparison Database (Revisions 2	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				The error rate curves should be updated to reflect current operator performance in the nuclear power industry. The use of 15 year old reliability data will limit the ability of the PRA to support risk based applications.	and 3). Additionally, a smaller subset of these plants was also looked at. These consisted of; Westinghouse 3-loop plants (since these were assumed to have similar operation action completion times based on plant power to heatup volume ratios), plants that also used the SLIM process, and Indian Point 2, which received a superior finding in their Human Reliability Analysis peer review. The results of this comparison show that the human error rates used in the BV2REV3A PRA model are all within the range of both comparison groups defined above, except for human action OPRCD3 (operator fails to cooldown and depressurize during a SGTR). However, the BV2REV3A value is of the same order of magnitude as most of the other plants reviewed and is not considered to be an outliner. It is therefore believed that the basic	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
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					error curves used in the calibration of the BV2REV3A HRA are not grossly out of date, and that the current human error rates used in the PRA model are acceptable as is. Moreover, as a final resolution to this *observation, future* updates of the BVPS PRA models will use the EPRI HRA Calculator, which uses a more current and robust methodology. The BV2REV3B PRA model was not changed as a result of this observation. This F&O was written against an obsolete HRA PRA model (BV2REV3B) and is considered to be resolved by the updated HRA PRA model incorporated in BV2REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	
HR-11	HR-27	A	Y	The BV HRA does not have a process to perform a systematic search for dependent human actions credited on individual sequences. One case of dependent HEPs was identified and treated (OF1 and OB2). However, it is not known how this was found. Other potential cases of dependent human actions in SGTR. LOCAs or feed and bleed sequences were not addressed. PRAs typically have one or more of the dependent HEPs. SGTR-OD*CD*WM, or RR*WM SGTR-SL*OD*CD*WM SLOCA -CD*MU Trans- OB*MU Trans- OF*OB*MU Init - Start standby CCP * Trip RCP There could potentially be other combinations that were not identified. Current HRA practices generally require a systematic process to identify, assess and adjust dependencies between multiple human errors in the same sequence, including those in the initiating events. Moreover, there was no process in the HRA to adjust HEP on the final sequences and	In the initial development of the IPE HRA, an effort was made to eliminate the dependency between human actions by adjusting the split fraction value of the second dependent action, given that the first action failed. For example, if the operators failed to manually reestablish Main Feedwater following the failure of Auxiliary Feedwater, the human error rate for implementing Bleed and Feed cooling later in the accident progression was adjusted upwards. If the dependent actions were required to take place in the same period of time during the accident progression, the second dependent action was assigned to be a guaranteed failure. For example, if the operators failed to cooldown and	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				determine combinations of operator errors credited on individual sequences. A sensitivity study was done, but did not adjust the HEPs. The cutoff was 4E-9, so that many other combinations were already below the truncation. It is not clear how HEPs in the initiating events were treated in the study. To be consistent with current HRA methods, there must be a systematic process to identify, assess and adjust dependencies between multiple human errors in the same sequence, including those in the initiating events.	depressurize the RCS by using the secondary coolant system, no credit was given to the operators to depressurize the RCS using the Pressurizer PORVs. However, as a resolution to this PRA Peer Review observation a method was established to verify that all dependent operator actions were captured by reviewing sequences with two or more failed split fractions that have a contribution from human actions. Of the sequences reviewed, the human actions were either previously adjusted during the IPE HRA, or were determined to be independent between split fractions. This independence was based on the actions not being conducted by the same set of operators (e.g., control room Reactor Operator action vs. local Auxiliary Plant Operator action), or different procedures being used separated by sufficient time in the accident	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					progression (e.g., actions to makeup to the RWST given SI recirculation failures, following operator actions to align a spare Service Water pump earlier in the accident sequence progression). Human actions that are modeled in a single top event have appropriate dependencies modeled in the fault trees. Moreover, as a final resolution to this observation, future updates of the BVPS PRA models will use the EPRI HRA Calculator, which uses a more current and robust methodology. The BV2REV3B PRA model was not changed as a result of this observation. This F&O was written against an obsolete HRA PRA model (BV2REV3B) and is considered to be resolved by the updated HRA PRA model incorporated in BV2REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of	

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	
TH-01	TH-08	A	Y	The Beaver Valley Unit 2 Ventilation and Room Cooling Analysis Notebook describes the HVAC requirements for the South Safeguards Equipment Room. This analysis is described as the basis for not requiring room cooling in the PRA model. The heat load for this area is only listed as a number (24898W or 85034BTU/hr) with no description of equipment assumed operating or other conditions considered. The heat load for this analysis is referenced to Calculation Number 12241-US(B)-210, "Loss of Ventilation Study for Several Buildings/Areas Outside Containment." Again this calculation determines the heat source in the South Safeguards Room as 85034 BTU/hr by reference to another calculation and lacks any description of assumed equipment running etc. The referenced calculation was 12241-B-215-0, "Heat Gains, Heat Sinks and Beginning Temperature for Emergency Switchgear, CV&RCA, Diesel Gen. Bldg., Safeguards Bldg and Auxiliary Bldg for Loss of Ventilation	A new room heatup analysis was performed for the Safeguards Building using realistic time-dependent DBA heat loads, based on MAAP generated success criteria. The results of this analysis were reviewed and compared to the EQ temperature limits to see if the necessary components to mitigate core damage or containment failures would be functional at the time that they were required to function (up to 24 hours). It was concluded that all PRA modeled equipment located within the Safeguards Building would be available to perform its PRA function	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				Analysis." The objective of this calculation was to "...calculate the rate of increase of ambient temperature during a loss of ventilation [caused by a fire in the Cable Tunnel] in the areas listed..." In the Heat Gains to Areas section of this calculation the South Safeguards Area states "since the plant is not experiencing accident conditions, the load used for normal plant operation. However, since this analysis occurs assuming a fire, the auxiliary feedwater pump is in operation." The heat load in this area is calculated as MDAFWP(68700)+Electrical(16334)=85034 BTU/hr. An additional reference for this heat load is to calculation 12241-B-62B, Rev. 0, dated 8-13-85. This final calculation, "Safeguards Area Ventilation - Loads and Air Rates," describes the accident heat load for the South Safeguards Area as 210,136 BTU/hr and the heat load from one MDAFWP and electrical as 68,700 and 15,398 BTU/hr respectively. It appears from this research that the heat load values for this area are only for a single operating MDAFWP while the room additionally contains the TDAFWP, the Train A QSS Pump, and the Train A SIS Pump. It appears the values in previous calculations were misapplied and that the correct heat load during an accident situation has not been correctly analyzed for this area. As stated in 12241-B-62B, "Single failure	during a loss of all ventilation for up to 24 hours. Therefore, it was determined that the Safeguards Building ventilation system is not required for support of the PRA modeled equipment located within the area, and the BV2REV3A PRA modeling assumptions regarding this remain valid. The BV2REV3B PRA model was not changed as a result of this observation.	

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				cannot be applied in determining which components are operating since the worst case environment must be calculated. Therefore, all equipment must be assumed to be operating if the equipment function is required."		
AS-07	AS-19	B	Y	For the SGTR event tree one of the operator actions is to initiate Bleed and Feed (top event OB). The success criteria for OB indicates that the basis for the success criteria assumes that the operator must have stopped the RCPs prior to OB in order to extend the time available to initiate bleed and feed (referenced EOP FR-H.1). If the tripping of the RCPs is a prerequisite for the degree of success of OB where in the model is this dependency accounted for.	As resolution to this observation, existing documents were reviewed. Based on the EOP Background document for FR-H.1, steam generator dryout is expected to occur at 33.1 minutes if all RCPs remain running during a loss of all secondary cooling. If the RCPs are tripped 5 minutes after the reactor trip, steam generator dryout is expected to occur at 40.9 minutes. This difference of less than 8 minutes is not expected to significantly impact the human error rates calculated for Top Event OB, since the actions to trip the RCPs, initiate SI and open a PORV are fairly simple actions that can be accomplished within minutes. Therefore, these actions	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					are all assumed to be accounted for in the current human action failure rate, so the HER was not revised in the BV2REV3B PRA model.	
DA-02	DA-03	B	Y	Table A-1 indicates that the period of time for the data collection was approximately 13 years. The table indicates that this data is for Unit 2. However, when the estimated average demands per year were computed it was not clear how this information was derived based on the expected demands per year. In some cases the number of extrapolated demands per time period do not match what would be the expected number of demands.	As a resolution to this PRA Peer Review observation, the success data (demands and hours of operation) that was used in the Bayesian updating of the component failure rates for Unit 2 was revisited and checked against the Maintenance Rule estimated success data, provided by the System Engineers. The Maintenance Rule data was based on a 3-year frequency, so the demands and hours of operation were adjusted for the 13.2 years used for the Bayesian update. When there was a large discrepancy between the demands or hours of operation that were used in the BV2REV3A PRA model data update and those based on the Maintenance Rule data,	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
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					the demands or hours of operation used for Bayesian updating were revised to use those solely estimated from the Maintenance Rule data. When there was only a minor discrepancy between the two, the total success data used for Bayesian updating was based on the values from the IPE (11/87 through 12/88), the BV2REV2 PRA model data update (1/89 through 12/96), and the Maintenance Rule estimates for the 1/97 through 12/00 period. This helped to preserve any historical success data that may have been different from the test frequencies used by the System Engineers in estimating the Maintenance Rule demands and hours of operation. However, either way, all failure data distributions that were Bayesian updated in the BV2REV3A PRA model were revised in the BV2REV3B PRA model	

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F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					using these new estimated demands and hours of operation. This process and the results are documented in Appendix A (PLG Report: Summary of Plant Data December 2002 Update) and Appendix E (BV2 Component Failure and Success Data: From 11/17/87 - 12/31/00) of BVPS-2 Data Analysis PRA Notebook, Revision 1.	
DA-06	DA-08	B	Y	The generic MGL data used in the BV Unit 2 PRA is referenced, almost exclusively to the PLG generic database. Although the data analysis was updated recently, there is no discussion in the Data Analysis Notebook regarding the availability of newer data sources, e.g., NUREG/CR-5497. There should, at a minimum be a discussion of the currently available data sources. It is noted that at least one Beta factor from NUREG/CR-5497 is used, but it is not referenced in the data notebook.	The following wording was added to Revision 1 of the Data Analysis PRA Notebook to document the justification for using existing dated data in developing the common cause failure parameters for the BV2REV3B PRA model update. Additionally, NUREG/CR-5497 is now included in the notebook as Reference 15. In April 2001, Westinghouse issued WCAP-15674 in order to provide guidance to the owner's group utilities for	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					improving common cause analyses used in their PRA models. Section 5.5 of the WCAP recommended several generic common cause failure data sources, one of which was NUREG/CR-5497 that was issued in October 1998, along with a CD-ROM disc for utilities to use in developing better common cause MGL parameter estimates. This NUREG was also to be used in another Westinghouse project to develop a database consisting of a common set of realistic common cause failure events for use among the owner's group member utilities. During this project development it was noted that there were some major discrepancies in the classification of common cause failures between the published NUREG and the CD-ROM. As such, the NRC was to update the coding of their common cause failure	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					events and database, and Westinghouse was to provide input and feedback so that there would be consistency between plant-specific PRA models when using the data. However, at the time of the BVPS Unit 2 common cause MGL data update during Revision 3, the NRC update was still not available. As such, a decision was made during the update process to keep the existing generic MGL data, which is almost exclusively based on the PLG generic database (Reference 1), dated circa 1989. Two exceptions to this were for the development of the battery (ZBBATR) and battery charger (ZBBCHR) failure to operate beta factors. These beta factor parameter estimates were developed using the NUREG/CR-5497 corresponding maximum likelihood estimate (MLE) values.	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
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					Updated common cause failure data from WCAP-16672, based on NUREG/CR-6819, were ultimately used in the BV2REV5 PRA model and appropriately documented. The methodology for the update was taken from NUREG/CR-5485.	
DA-08	DA-04	B	Y	A comparison of the failure probabilities for diesel generators and DG output breakers was counter-intuitive. DG FTStart = 8.4E-4 CB fail to close =1.75E-3 CB fail to open = 8.1E-4 CB-beta = .12 DG-beta = 7.6E-3. From these probabilities, we can calculate the following CCF failure probabilities: CCF 2 DG fail to start = 6.08E-6 CCF 2 CB fail to close = 2.1E-4 CCF 2 CB fail to open = 9.7E-5 In the process of calculating station blackout frequency, these CCF's should appear in the model. 1. Failure of 2 DG will cause SBO at a single unit.	As part of the resolution to Corrective Action 02-09037-03, the diesel generator and circuit breaker failure probabilities were revised and incorporated into the BV2REV3B PRA model.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				2. Failure of the 2 DG output breakers will cause SBO at a single unit 3. Failure of the 2 bus feed breakers to open will cause SBO at a single unit that is not recoverable by cross-tie. 4. This data implies that the DG's are far more reliable than the circuit breakers and feed breakers which are a much larger contributor to SBO frequency.		
DA-09	DA-10	B	Y	There is very little guidance for or documentation of the process of selecting CCF groups. The System Analysis Overview and Guidance Notebook provides some of the high level methodology, but there is no discussion in the Data Analysis or System Notebooks as to the development of the groups that were ultimately modeled. In general, the system notebooks document the CCF groups by referring to the Riskman output files. This is not very informative. For example, the AC Electric Power System Notebook provides no discussion of the CCF model for the diesel generators. A discussion of decoupling the Unit 2 diesels from the Unit 1 should be included.	Resolutions to this F&O included adding a better reference to the methodology used in retaining the common cause groupings, along with a listing of all of the common cause groupings used in the quantification of the system top event models. These are provided in Section 7 "Common Cause Modeling" and Appendix A, Table A-1 of the BVPS-2 Systems Analysis Overview and Guidance PRA Notebook, respectively. Additionally, a summary of all of the MGL parameters used in the top event common cause groupings is now provided in Appendix C,	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					Table C-7 of the Data Analysis PRA Notebook. Furthermore, it is the opinion of the BVPS PRA staff that the details of the common cause groups that were retained in the PRA system models and presented in Appendix C of the BVPS Unit 2 PRA System Notebooks, under the common cause sections of the RISKMAN System Notebook files are adequately documented and can be found by knowledgeable personnel. Therefore, the practice of referencing this part of the notebook is deemed acceptable.	
DA-10	DA-07	B	Y	The test and maintenance unavailabilities for DG were reviewed. The following were observed. 1. The DG are used in a cross-tie situation for either unit. Thus, it is possible that the unaffected unit could be in shutdown and the DG could be in overhaul. The outage time for the DG (when used as a cross-tie) must include the OOS time during shutdown. 2. Appendix B of the data document indicates maintenance outage was collected Nov 98	As resolution to this observation, the Diesel Generator System Engineer was contacted to obtain the historical diesel generator unavailability during plant shutdown conditions. For the Unit 1 emergency diesel generators, the shutdown unavailability was based on data obtained from October	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				through May 2000. This is not long enough to capture the DG overhaul experience. 3. For unit 2, the unit 1 DG are used for the cross-tie. The T&M data must come from unit 1 experience. This information was not found.	1997 through September 2001. These values were then combined with the assumed on-line maintenance unavailability values to determine the total Unit 1 emergency diesel generator unavailability, which was used in the BV2REV3B electric power cross-tie model.	
DE-04	DE (Draft IF-09)	B	Y	There is no discussion of some flow characteristics (e.g., spray effects, pipe whip) in the consideration of impacts from flood initiators.	In response to this observation, the work that was completed for the Beaver Valley Unit 2 Risk-Informed In-Service Inspection (RI-ISI) Indirect (Spatial) Consequence Evaluation was reviewed. As a part of this evaluation process, an assessment of the postulated indirect (spatial) consequences associated with piping failures was made in order to further distinguish the piping segments. The indirect effects assessment was accomplished through an investigation of existing plant documentation on pipe breaks, flooding, and	No impact to Fire PRA. This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					plant layout along with a focussed plant walkthrough. The indirect effects that were specifically looked at included; pipe whip, jet impingement, sprays, and flooding resulting from pipe breaks or leaks. The results of this indirect effects evaluation did not identify any viable SSC impacts due to flood induced failure mechanisms that were not already addressed in the PRA flooding analysis documentation. No further flooding impacts were incorporated into the BV2REV3B PRA. This F&O was written against an obsolete Internal Flooding PRA model (BV2REV3A) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	
DE-05	DE (Draft IF-25, IF-26)	B	Y	A number of flood-specific HEPs are included in the analysis (e.g., ZHEFL1-4). These four HEPs are evaluated in the HRA Notebook in the calculation tables, but no discussion of these actions is included in the HRA documentation, and only ZHEFL1 and ZHEFL2 appear in the flood documentation in the Appendix C of the IE Notebook.	To resolve this PRA Peer Review observation, operator actions ZHEFL1 and ZHEFL2 were added to Table 3-1 "Beaver Valley Human Actions " and discussions of the scenarios now appear in Appendix A "Dynamic Action Identifier Sheets". Additionally, operator actions ZHEFL3 and ZHEFL4 are Unit 1 operator actions, and were removed from Table 3.5 "Human Error Rate Distributions" to avoid any confusion. This F&O was written against an obsolete Internal Flooding PRA model (BV2REV3A) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in	No impact to Fire PRA. This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	
HR-01	HR-04	B	Y	Miscalibration errors are not considered for either independent or common cause pre-initiator human errors. The PRA assumes that both would be captured in the equipment failure data. However, the generic common cause failure database is not verified as having included miscalibration errors as well. Therefore, there is a potential misapplication of the generic common cause data use since the generic data source may not include the common cause miscalibration.	This observation is not totally correct, since the SSPS model did include instrument string miscalibration errors in the fault tree model. Additionally, common cause miscalibration errors between trains are considered to be rare events since the On-line Maintenance Program is developed to alternate work between trains on different weeks. Furthermore, a search in the Corrective Action database and EPIX did not reveal any such miscalibration errors between trains at BVPS. Therefore, this	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					observation was assumed to be resolved by the *instrument string* miscalibration errors already accounted for in the SSPS model. No further miscalibration errors were incorporated into the BV2REV3B PRA. This F&O was written against an obsolete HRA PRA model (BV2REV3B) and is considered to be resolved by the updated HRA PRA model incorporated in BV2REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	
HR-03	HR-02	B	Y	The BV PRA uses the SLIM methodology to quantify the post initiator human actions. The HRA quantification currently in use was	While it is true that the FLI is a linear combination of the PSF rankings and	No impact to Fire PRA, because this issue was

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				completed for the IPE and has not been updated. The SLIM method can only combine the PSFs linearly to develop the overall FLI for each action. Current industry practice contends that PSFs can have significant non-linearities. For example if a particular action is rated poorly for a given PSF and moderately in all the others, middle of the road HEPs tend to result even though poor performance in only one PSF may be indicative of poor human reliability irrespective of what is going on with the other PSFs. Mosleh of University of Maryland has addressed this issue in a refinement of the FLIM method (which allows assignment of importance to PSFs) in an update of the Calvert Cliffs PRA. The BV PRA uses linear compilation of PSFs. The ability to use non-linear compilations, if desired would be an enhancement.	weightings product, the actual HER is logarithmic as discussed in Section 2.1 of the HRA Notebook. Additionally, as shown in Table B-4 "Beaver Valley Unit 2" Group 4 Human Actions Evaluation, between ZHEMU1 and ZHEMU4, where the only difference is in the timing rankings, there is a significant difference in the HER values. This PRA Peer Review observation was dispositioned by the resolution of F&O HR-07 above, where it was shown that the current human error rates used in the PRA model are acceptable as is, and by acknowledging the PRA Peer Review Team comment on its significance on CDF. Moreover, as a final resolution to this observation, future BVPS PRA models will use the EPRI HRA Calculator, which uses a more current and robust methodology	addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					to identify human action dependencies. This F&O was written against an obsolete HRA PRA model (BV2REV3B) and is considered to be resolved by the updated HRA PRA model incorporated in BV2REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	
HR-09	HR-03	B	Y	There is not enough detail in the HRA to reproduce the results. The following information was not available and does not appear to have been retained: a) the time lines b) discussion of the events chosen for "calibration" from the other PRA's and the reason why they are applicable.	This CA is being (was) rolled into CA 02-09043-30 to track its resolution. This F&O was written against an obsolete HRA PRA model (BV2REV3B) and is considered to be resolved by the updated HRA PRA model incorporated in BV2REV4,	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				c) the basis for choosing 10 categories of HEP and the basis for assigning each BV HEP to a category	which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	
HR-13	HR-19	B	Y	Some discrepancies in the timing were observed in the PRA. All the timing calculations were based on hand calculations. Although the times seemed reasonable compared to other PRAs, there were some observations. 1) There was a calculation done for steam generator dryout, which assumed all the water would be exhausted from the SG by 1.1 hours. Using 1.1 hours overestimates the time available to do F&B or restore AFW. Effectiveness of decay heat removal will decrease way before all the water is gone in the SG. 2) ZHECC1 - start standby CCP provides a time of 30 minutes, based on seal failure after loss of seal cooling. But, after loss of CCW, the RCP must be tripped with in 5-10 minutes to avoid catastrophic seal failure. The 30 minutes for seal failure after loss of cooling	These operator actions were reassessed during the BVPS-2 PRA model update, when the HRA was revised using the EPRI HRA Calculator. This F&O was written against an obsolete HRA PRA model (BV2REV3B) and is considered to be resolved by the updated HRA PRA model incorporated in BV2REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007,	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				does not apply. This scenario is for bearing failure after loss of CCW. The timing should be consistent. 3) ZHEIC1 and ZHEIC2 show 70 and 30 minutes based on seal failure after loss of seal cooling. The time should be consistent and should consider if the Loss of CCW to the RCP bearing must be considered. 4) ZHEMU1 - timing for MU indicates the operator has 1.6 hours to act, based on the time it takes to drain the RWST from minimum level "empty". The number should be coordinated with the boron dilution calculation, which assumes boron dilution times from a RWST level of 140,000 or 360,000 gallons. time allowed for operator diagnosis on the front end must be subtracted from time allowed 5) ZHEOB1 provides 78 minutes for feed and bleed, based on the time for a PORV to lift after loss of AFW. There is no analysis for this. In most PWR, F&B must be started prior to the time the PORV lifts. Start time for F&B should be based on MAAP analysis. 6) ZHEOC1 - states there are 30 minutes to trip RCP after loss of seal cooling. The other parts of the PRA state 5 or 10 minutes. 30 min is a seal failure number, not a bearing failure number. ZHEOC1 be based on 5 minutes.	by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	

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F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				7) ZHEOS6 - timing states 1.3 hour available to start AFW. 1.3 hours is the time from reactor trip to core uncovery. AFW must be started before 1.3 hours. Also, if there is 1.3 hours allotted to start AFW, then there is no time for MFW restoration and F&B. The time from reactor trip to core damage must be apportioned to the 3 actions in this sequence. 8) ZHEWA5- 30 minutes to align diesel driven SW pump after LOSP. This time is based on seal failure due to loss of SW. The DG will fail in 8 minutes if there is no SW. The time to align Diesel driven pump is based on failure of the DG, which is 8 minutes.		
IE-04	IE-16	B	Y	Subtier criteria requires that "The initiating event frequency should not use data from the initial year of commercial operation." Contrary to this data from 1987 (Beaver Valley initial year of operation) is included in the data update. Use of this data, though conservative, could shift the importance of components.	The initiating event frequencies were reanalyzed using data from January 1, 1989 through May 31, 2001. In addition, LOCA initiating event frequencies were reanalyzed to address aging-related failure mechanisms based on the interim LOCA frequencies from Table 4.1 of the "Technical Work to Support Possible Rulemaking for a Risk-Informed Alternative to 10CFR 50.46 / GDC 35, Revision 1", dated July 2002. The results of this reanalysis were	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					incorporated into the BV2REV3B by updating the initiating event frequencies.	
IE-05	IE-13	B	Y	In appendix D of the initiating event notebook, the interfacing systems LOCA frequency is calculated referring to two references from 1985. The 2 landmark ISLOCA reports (NUREG/CR-5102 and NSAC-152) were written in 1992. Although the frequency calculated in the Beaver Valley PRA does not seem out of the recognized range of values for this frequency, due to the importance of this event for LERF, the compatibility of the method and data used in the PRA should be checked against the later references. Other inconsistencies in the analysis are: OST 2.11.16 is performed prior to startup, if it has not been performed in the previous 9 months. The PRA assumes there are 3 shutdowns per year (which is not supported by the historical performance of BV), so assigns a test frequency of 3 months. The maximum possible test interval for OST 2.11.16 is 26 months [plant ascends to power 8 months from last test for an 18 month run]. The minimum is 9 months. The true average test interval is likely in the 13-20 month range. Substituting this test interval into the equation would have a significant affect on frequency. The probability of MOV 8889 being	The interfacing systems LOCA initiating event frequency was reanalyzed using the following documents: 1. G. Bozoki, P. Kohut, and R. Fitzpatrick, "Interfacing Systems LOCA Pressurized Water Reactors," prepared for U.S. NRC, NUREG/CR-5102, BNL-NUREG-52135, February 1989. 2. E. T. Burns, K. Mohammadi, T.P., Mairs, V. M. Anderson, and B. Hannaman, "ISLOCA Evaluation Guidelines," prepared for Electric Power Research Institute, NSAC-154, September 1991. 3. D. A. Wesley, T. R. Kipp, D. K. Nakaki, H. Hadid-Tamjed, "Pressure-Dependent Fragilities for Piping Components – Pilot Study on Davis-Besse Nuclear Power	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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				inadvertently open is not considered. The LHSI lines are interconnected such that if CV 552 and 109 fail, both 132 and 133 will be challenged. This is true for the other injection lines also. So the valve combinations is 3 times higher than shown. The probability of pipe over pressure is assumed to be the same as pipe rupture. This is not consistent with the two 1992 references listed above.	Station," prepared for U.S. NRC, NUREG/CR-5603, TI91 002465, October 1990. The results of this revised analysis were incorporated into the BV2REV3B by updating the interfacing systems LOCA initiating event frequency.	
IE-08	IE-13	B	Y	Bayesian updating is used extensively in data analysis and also in initiating event frequency calculations. Although mathematically correct, the use of Bayesian updating without some limitations has been criticized, with justification, in the past. Under certain conditions, bayesian updating with zero or 1 failures may reduce a prior mean (with a high error factor) considerably. Since PRA results and applications depend on, and are measured mainly by point estimate (mean) results, but not by uncertainty bounds, any evidence that shifts the mean considerably must be rigorously justified. The BV PRA uses bayesian analysis for virtually all transient initiating events. In most cases, the plant specific data is 0 trips in 11 years. In general the posterior is lower than the prior. If the plant specific data was used by itself, the is enough data to justify a point estimate of about .05/yr. The prior for LOSP is .027. The prior for SGTR is .0074. The	While there are indeed situations that Bayesian updating with zero failures could cause the posterior mean to be significantly lower than the prior mean, these are due to the use of using moment matching. This refers to the practice of changing a prior that is presumably a lognormal distribution, to a gamma distribution by matching the mean and the standard deviation. After the Gamma distribution is updated with plant data analytically, the resulting gamma distribution is convert back to the lognormal distribution again using the moment	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				posterior for LOSP is .025 and for SGTR .0048. In both these cases, the posterior is lower than the prior and lower than the plant specific data can justify. This is due to the use of Bayesian analysis when too little plant specific data exists. Rules for when to use Bayesian analysis and when to use generic data should be developed to ensure that failure rates and initiating event frequencies are not reduced below both the generic values and the plant specific estimates.	matching method. It is known that in this practice, if there should be zero failures, the resulting posterior gamma distribution has a mean value significantly lower than the prior mean. The BVPS analysis did not use the moment matching methodology. Instead, the Bayesian update functionality provided by RISKMAN was used. There are two classes of priors used in the BVPS analysis. The first class are the lognormal distributions based on parameters from industry studies (e.g., LOCA initiators). Updating a lognormal distribution with zero events in about 10 years does not change the mean in most cases (or there is a slight change in the third significant number). The second class, which is a more general type of priors, is the industry data. These priors consists of	

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F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					three parts. The first and most important part is the failure and success data for a set of PWR power plants. The second part is the so-called grid, which consists of a set of values for the median (of the assumed prior curve), and a set of values for the range factor (of the assumed prior curve). The selection of median and range factor should be such that the resulting distribution should not be skewed toward either end of the median or range factor in the grid (grid is the matrix of median and range factor values). The third part of a prior is the so-called lambdas, which is a set of values for the possible bin values that the distribution can locate. The lambdas do not affect the posterior mean distribution as long as it has sufficient range and sufficient number of values (typically 20 bins are sufficient for a distribution). It should be pointed out that for the	

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					industrial data type of prior, updating it with zero failures typically results in a smaller mean value for the posterior then the prior. However, the decrease is much smaller in magnitude than the moment matching approach, and it should be treated as a normal behavior of the Bayesian analysis (i.e., zero failures always provide information leading to a lower estimate). In response to this observation, each posterior distribution that was Bayesian updated with zero failures was reexamined to assure that there was no skewing of results on the grid, and that there were no abnormally large values (excessive probabilities) in a single lambda bin. In some cases a few more lambdas were added to actually bring the probability per each lambda lower than 0.1. However, in these cases	

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					the posterior distribution changed little compared to the BV2REV3A original set of lambdas (note, the grid was not changed in this response because these were checked in the original analysis and quality was assured). The results of the review did not identify any concerns, so confidence in the Bayesian update results using zero failures based on the discrete probabilistic distribution approach, which is a robust process, was maintained. For the BV2REV3B PRA model, since the success time changed from 11 critical years to 9.93 critical years in response to Corrective Action 02-09042-01 (to remove the first year of commercial operation), the posterior mean shifted slightly higher than the original BV2REV3A PRA model analysis.	
L2-03	L2-18	B	Y	All early SGTR core damage sequences with wet SGs are classified as SERF (small early	In response to this observation, the	No impact to Fire PRA, because this

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F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				release frequency) vs. LERF without regard to break location or other sequence specific conditions such as SG isolation, primary to secondary pressure equalization, etc. The basis for the use of small release was scrubbing; however, there is no documentation supporting this classification. For example, failure to cooldown and depressurize the RCS may result in lifting the ruptured SG ASDVs or safety valves. Radionuclides, both volatile and non-volatile, entrained in the escaping steam result in a release to the environment. Without evaluation, the magnitude of the release to the environment is unknown, and may be sufficient to meet LERF classification.	BV2REV3B PRA model was revised to incorporate WCAP-15955 "Steam Generator Tube Rupture PSA Notebook" classification of SGTRs into LERF. In the BV2REV3B PRA model update, all steam generator tube ruptures that are faulted and have a depleted RWST, or have a loss of all secondary cooling and consequential challenge to the steam relief valves are considered to be LERF contributors. For these cases it is assumed that leakage from the RCS will continue indefinitely through a faulted steam generator and the core will uncover after the RWST depletes. Subsequently after closing this F&O, the ASME Standard recognizes scrubbing during SGTRs as a way to reduce LERF. Ultimately resolved by GAP F&O LE-C10-01 (see Table 2-2).	issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
MU-02	MU-06	B	Y	The computer models of the PRA (electronic files for the input and output of the PRA model and its sensitivity analyses) should be stored in a controlled manner. The subtier criteria states that " a secure offsite storage facility for computer codes, inputs, outputs, and models should be used". Discussions with the BV PRA staff indicate that the PRA model files are kept on CDs and also on a network drive (not a protected drive). To meet the intent of the subtier criteria, the model files should be also stored with the same philosophy as the paper copies of calculation notes; namely stored by a dedicated organization (preferably outside of the PRA group), in a protected manner and be available for long term retrieval.	IT has placed restrictions to the "S:/All/PRA Engineering" directory. The permissions for this directory are limited to specific design Engineering personnel. This will prevent unauthorized personnel from accessing PRA reports and models. In addition, the network is backed up daily, making retrieval of lost files very easy.	No impact to Fire PRA, because this issue was addressed for the base PRA model prior to building the Fire PRA.
QU-02	QU-08	B	Y	The original top ten sequences were for total CDF and not just internal. Of these three were control building fire, one seismic, and four external. The number 1 was ELOCA and number 2 was ISLOCA, both which were the initiating event which leads to guaranteed failure. The remaining four were internal sequences which meant something. The number five sequence was loss of AC bus "Purple" with other failures that lead to core damage. Sequences 7 and 8 were LOIA with loss of heat removal (high and dry). The number 10 sequence was ATWT (on a turbine trip) with the failure of the operator to manually trip the reactor, with all subsequent	In response to this observation, a new top event was included in the BV2REV3B PRA model, which contained a switch to bypass the containment event tree top events. This allowed for the Level 1 (CDF only) sequences to be quantified and reviewed, while also maintaining the ability to provide Level 2 sequence results, when needed.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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				operator actions guaranteed failure. Since this had limited internal sequences, a larger report was reviewed with the objective to see what SBO looked like. The SBO was not on this and in fact the first LOSP was very low on the list. Then a sequence report was reviewed looking at LOSP only. Sequence #57 was the first SBO sequence and #58 was the second SBO sequence. The only difference between these was in the containment tree. With this is was realized that the containment tree was splitting up ("fractionalizing") the LOSP sequences, as opposed to some other sequences (such as ELOCA) which had one path through the containment tree. It was now realized that in order to analyze the sequences in the same context as previously, there needed to be a run of the event trees where the extra details of the containment tree suppressed. The utility staff ran this and the results and insights were noticeably different than before. The results of the top ten were significantly different. The ELOCA and VSLOCA stayed the same value but now are sequences 2 and 4 respectively. The number 1 sequence is now loss of instrument air. ATWT on PLMFWA is number three (while the previous ATWT went to 12). Two sequences are control building flooding.		
QU-03	QU-08	B	Y	In ATWT, if the operators fail to trip the reactor as an immediate action (top event OT) then subsequent operator actions RI and OA are failed. I suspect that this sequence	In response to this observation, the BV2REV3B PRA model was revised to incorporate	No impact to Fire PRA, because this issue was addressed in the

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				has always been this way in the past, but with the recent enhancements in the model, the sequence has risen into the top ten. This leads to an overly conservative results in CDF. This appears to be the number 6 in internal (#10 sequence in total CDF). Of the top 50 sequences, 20% are ATWT. The total CDF for ATWT is a noticeable part of the CDF, and would not support any future RI ATWT applications.	giving credit for the longer term operator action to emergency borate, even though the earlier actions to manually trip the reactor or to insert the control rods may have failed. The BV2REV3B PRA model was revised by removing the emergency boration (Top Event OA) human action dependency on prior ATWS human actions, which must be performed immediately; i.e., manual reactor trip (Top Event OT) and manual rod insertion (Top Event RI). This involved editing the ATWS event tree split fraction logic rules for OAF by removing OT=F + RI=F, as shown in Table 3.5-3 "ATWS Event Tree Logic Rules" of the Event Tree Analysis Notebook. The basis for this change was derived from WCAP – 15831-P Section 5.1.1.12, where it is assumed that the operator action to	base PRA model prior to building the Fire PRA.

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					emergency borate is independent of the previous operator actions since it does not need to be completed in the same short time period as the operator actions to trip the reactor, or manually drive in the control rods.	
QU-04	AS-12	B	Y	An asymmetry discussion is provided in the PRA Quantification Notebook, section A.3. The write-up includes general discussion regarding the use of alignments to simulate the various modeling asymmetries in the systems modeling and the effect on event trees by partitioning some of the initiating event categories with some examples being provided. Some of these asymmetries are due to modeling assumptions and some are due to actual plant differences. No specific discussion is provided to explain what system asymmetries are due to simple modeling assumptions and which ones are due to plant differences.	As a resolution to this PRA Peer Review observation the PRA Quantification Notebook, Section A.3 was revised to address which asymmetries are due to modeling and which are due to real plant differences. Asymmetries are also discussed in the System Notebooks to explain where and why changes were made to reduce or eliminate them from the model and to identify the important ones that remain. Multiple examples can be given of where asymmetries were eliminated by applying initiating events to multiple trains (SW A & B) or multiple similar events such as floods and LOCAs. This helps to	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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					avoid asymmetries in importance on which train is running, or which piping loop is broken. Furthermore, risk importance measures are grouped by BVPS system so asymmetries are negated when rating system importance. Additionally, Risk importance measures of sister components (similar functions) on opposite trains are also conservatively set at the highest importance value to negate asymmetries. By grouping these risk importance measures it ensures that Risk-Informed applications are not influenced by any PRA asymmetries.	
QU-07	QU-15	B	Y	A review of the non-dominant sequences was made. The non-dominant sequences are those that are not normally saved when the entire model is run. It was necessary to quantify one initiator at a time to get the cutsets below 4E-10. A review of these cutsets had the following observations: 1) SGTR 1.507E-12: IAF * OD16B - how is OD possible when IA is failed?	In response to this observation, the split fraction logic rules were re-examined and compared to the dependency matrices. The specific concerns identified by the peer review were reviewed and corrected in the	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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				2) TTrip 7.26E-11: AF1*OF1*OB4*CDF*RRI - if AF, OF, OB and CD are failed, how can RR be asked in a probabilistic manner. RR should be RRF. 3) TTrip 3.233E-11: SA1*OS6*AF3A*OFF*OBF*CDF*RR1 - How can RR be asked in a probabilistic fashion after failure of all that? 4) TTrip 8.34E-12 AF1*MFF*OB1*CDF*RR1 - same question about RR? 5) TTrip 1.1649E-12: PR7*HH2A*OR3A*MU2: If HH2A is failed, how can MU2 succeed? Does not MU2 use the HHSI pumps? 6) TLMFW 1.2559E-12: AF1*OF1*OB1*HH1: Why is OF1 in the tree for Loss MFW? Why is OB1 in the same sequence as HH1. If OB1 fails, there is no initiation of HHSI, so why is HH1 included?	BV2REV3B PRA model when in error. The BV2REV3B PRA model was then quantified using only the Level 1 Top Events so that a review of the CDF sequences could be performed to verify that the revised split fraction logic rules made sense. This included looking at non-dominant sequences 5 orders of magnitude lower than the total CDF value. Other concerns identified that were not in error, were determined to have sufficient justification provided in the System Notebooks and Dependency Matrices.	
QU-09	QU-31	B	Y	This element asks whether the sequence results by sequence, sequence types, and total was reviewed and compared to similar plants to assure reasonableness and identify any exceptions. A review of the PRA documentation did not reveal a comparison of the current PRA revision results to results of similar plants.	As an interim resolution to this PRA Peer Review observation a ballpark comparison was made utilizing the WOG PSA Model and Results Comparison Database, Revision 3. Items compared included; initiating event frequencies and their	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					conditional CDF, component failure rates, human error rates, and success criteria. While, this review was not detailed no outliers were identified, and the conditional CDF from LOSP initiators was comparable with North Anna, a nearly identical plant. This CA is being (was) rolled into CA 02--09043-30 to track its complete resolution. Ultimately resolved by GAP F&O F&O IE-C10-01 (see Table 2-2).	
QU-10	QU-30	B	Y	The initiating event frequency for interfacing system LOCA (i.e., initiator VSX) was quantified using point estimates (result of 2.2E-7) and using Riskman's Monte Carlo algorithm (result 3.0E-7). The difference is explainable based on data dependence between valve failures. But the event tree quantification used the lower, point estimate result. The 3.0E-7 Monte Carlo result should be used in the quantification.	In response to this observation, the Monte Carlo value generated for the updated interfacing systems LOCA initiating event frequency in response to CA 02-09042-02 previously identified, was used in the quantification of the BV2REV3B PRA model.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
ST-02	ST-10	B	Y	The internal flooding analysis was done for the IPE and has not been updated since then.	In response to this observation, the work that	No impact to Fire PRA. This F&O

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				All flood barriers were treated deterministically and assumed to succeed. The sub-criteria for this element suggests that flood propagation pathways should include failure of doors, floor drains, and other flood barriers.	was completed for the Beaver Valley Unit 2 Risk-Informed In-Service Inspection (RI-ISI) Indirect (Spatial) Consequence Evaluation, as well as, several updated flooding analyses performed after the IPE submittal were reviewed. The results of this review determined that the flooding analyses did consider the potential of flood barrier failures due to the flood water static head on the door latching mechanisms. It was concluded that the IPE flooding analysis assumptions regarding the propagation of flood waters did consider flood barrier failures, and remains valid. No further flooding impacts were incorporated into the BV2REV3B PRA. This F&O was written against an obsolete Internal Flooding PRA model (BV2REV3A) and is considered to be resolved by the updated Internal Flooding PRA	was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

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					model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	
SY-01	SY-12	B	Y	Loss CCP/CCR results in a loss of seal water heat exchanger cooling (discharges directly to the charging pump suction) as well as loss of non-Regenerative heat exchanger cooling (discharges to the VCT). The result is a potential common mode failure of all charging pumps due to an increasing charging pump inlet temperature, coupled with the loss of CCP/CCR, this results in an RCP seal LOCA. Riskman macro RWSTSO (VCT swap-over to RWST) contains logic to include the failure of the components required to perform this action, but the operator action is not included. Given the uncertainty of the time to charging pump failure, the operator action may dominate the mechanical component failures.	An evaluation was performed to see at what temperature the available NPSH would be lower than the required NPSH at the charging/HHSI pump design flowrate. The results of this evaluation revealed that the VCT temperature would have to increase by more than 123 °F for this condition to be true and result in a loss of NPSH. With multiple high temperature alarms coming in at more than 100 °F prior to reaching this temperature, there would be plenty of time available to operators to perform mitigating actions.	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

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F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					Moreover, a loss of NPSH would only impact the running charging pump, since the standby pump does not automatically start, unless a Safety Injection Signal is present, in which case the suction would automatically swap over to the RWST. The third pump would only be manually aligned and started following the failure of the first two normally aligned pumps. Therefore, this observation was not considered to be a valid common cause failure mechanism of the charging/HHSI pumps, so the operator action was not included in the BV2REV3B PRA model.	
SY-02	SY-03	B	Y	The degree of documentation in the systems analysis should provide enough detail that the systems analysis can be duplicated with minimal effort. A review of the Auxiliary Feedwater System Notebook (Book 2, Tab 2) and the Main Feedwater System (Book 3, Tab 6) revealed that the Split Fraction definition / truth tables are not documented and the Common Cause assumptions are not documented. There is no discussion as to where these assumptions came from or the	The Riskman Split Fraction and Common Cause Tables are attached as an Appendix to each of the System Notebooks. These tables contain the necessary split fraction and Common Cause information. This action closes this issue.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				definition of the split fractions utilized in the Systems Analysis. The absence of this information could result in the inability to reproduce the Systems Analysis for verification of results or future applications.		
SY-03	SY-15	B	Y	Some initiator dependent component failure modes do not appear to be modeled. For example, the SI8890 MOVs are included in the model for fail to open to prevent LHSI pump overheating during low flow conditions. For this specific example, large LOCAs should only consider transfer open as a flow diversion; failure to open is not applicable. For small LOCAs, the failure to open is correctly modeled, but transfer closed should also be included. For medium LOCAs, the need to open or close the SI8890's may require additional thermal hydraulic analyses. Other system designs susceptible to initiator specific failure modes include systems with pumps which have mini-flow which return to the pump's suction. Systems like this may require operator action to stop these pumps if downstream pressure prevents adequate flow to prevent pump overheating.	The LHSI initiator success criteria was reviewed to address the specific PRA peer review concerns. Once such concern was that the LHSI fault tree modeled the failure to open of the mini-flow MOVs during a small break LOCA, but did not model the transfer closed failure. Typically the PRA only modeled passive failures (e.g., transfer closed) if there were no active failure modes (e.g., failure to open) modeled, since the active failures dominate the components failure probability (usually by three orders of magnitude). Therefore, this concern was not incorporated into the BV2REV3B PRA model update. Another concern was that the LHSI fault tree always queried the opening of the pump mini-flow valves even though	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

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					they would not be required to open during a large break LOCA, and that doing so may provide a flow diversion. To address this concern the BVPS-2 LHSI fluid flow model was reviewed for large LOCAs with and without the mini-flow value opened. It was concluded that the difference in flow delivered to the reactor vessel was less than 75 gpm if the mini-flow valve remained open. Therefore, this was not determined to be a valid flow diversion path and was not incorporated into the BV2REV3B PRA model. Additionally, while including the mini-flow valve failure to open for large break LOCAs is not required, the Large break LOCA contribution to total CDF is less that 0.1 percent, so it was not considered to be vital to remove it from the BV2REV3A PRA model. The other Top Event fault trees for systems with mini-flow protected pumps	

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					were reviewed to ensure that there were no obvious potential for initiator specific success criteria missing form the model. It was found that the Recirculation Spray System Trains C and D also have the same type of mini-flow valve failure modes modeled as the LHSI pumps, so the above justification also applies. All other systems with mini-flow valves were not considered to be dependent on the initiating event.	
SY-06	SY-06	B	Y	Assumptions concerning non-modeled failure modes, or support systems due to low frequency sequences need to be reconsidered with respect to specific applications. For example, condenser hotwell level is assumed to always be adequate due to redundancy of sources (i.e., via steam dumps, or makeup); however, some of these sources may not be available during online T/M. Also many of these done when the CDF was in the 2E-4 range. Now that CDF is in 8E-6 range many of these items may no longer be insignificant in the current model.	As a resolution to this PRA Peer Review observation, guidance was added to the System Analysis and Overview Notebook to include assumptions concerning non-modeled failure modes, or support systems.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-16	SY-13	B	Y	The sequence modeling credits RWST refill for LOCA's and SGTR. The RAW worths of	An evaluation was performed using the	No impact to Fire PRA, because this

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				the split fractions indicate that without RWST, CDF would be 3.8E-5. RWST refill is modeled in split fractions WM and MU. The minimum make up rate is 150 gpm. The actual makeup rate [if this procedure was used] may be up to 400 gpm. The initial water source for RWST refill is the boric acid blenders. This system has a 7,000 gallon tank at 7,000 ppm boron. This system does not have sufficient volume nor flow rate to match the times and volumes needed for safe shutdown in the sequences modeled. The ultimate source of water is unborated river water. To provide enough input to the RWST, the flow path is into the Fuel Pool and then from the fuel pool to the RWST. The Miscellaneous Notebook documentation states "The current BV2REV3A PRA model assumes that 400 gpm is required for makeup to the RWST during the entire mission time." Boron dilution of the fuel pool is calculated, but not boron dilution of the core. The observation is that if unborated water was used to make-up for the times required, boron dilution could occur in the core, thus negating the RWST make up function. Due to the fact that RWST cause significant core damage reduction, the ability to use RWST make-up should have a more substantial analytical basis. This observation is worse for unit 2 than unit 1, because of the smaller RWST volume. The	BVPS Unit 2 Cycle 10 core design analysis (WCAP-15779, Rev. 0) boron requirements for shutdown (k=0.99) at beginning of life and hot zero power as the minimum required boron concentration to prevent recriticality. The results of this evaluation determined that the boron concentration delivered to the RCS would be above the minimum required to maintain subcriticality for the entire 24-hour mission time, when using unborated water for makeup to the RWST at the flowrates determined in the MAAP LOCA success criteria analyses. Additional operator actions to add boron to the RWST via the spent fuel pool, to increase the shutdown margin, could be implemented, but were not credited in the PRA model. The BV2REV3B PRA model was not changed as a result of this observation.	issue was determined to have no effect on the BVPS PRA model.

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				minimum core boron concentration for hot zero power at BOL is 771 ppm. For most of the sequences where RWST make-up is used, the reactor is assumed to be depressurized and cooled down [LOCA's and SGTR]. For the purpose of this F&O, it is assumed necessary to maintain a 1500 ppm boron concentration. The RWST switchover is 140,000 gallons for unit 1 and 360,000 gallons for unit 2. Times to boron dilution (in the RWST) is shown below: Unit 1 dilution to 771 ppm at 150 gpm = 15h Unit 1 dilution to 771 ppm at 400 gpm = 5h Unit 1 dilution to 1500 ppm at 150 gpm = 4.5h Unit 1 dilution to 1500 ppm at 400 gpm = 1.7h Unit 2 dilution to 771 ppm at 150 gpm = 38 h Unit 2 dilution to 771 ppm at 400 gpm = 14h Unit 2 dilution to 1500 ppm at 150 gpm = 11.5h Unit 2 dilution to 1500 ppm at 400 gpm = 4.3h Only one of these conditions can meet a 24 hour mission time. Considering that RWST make-up is used to lower CDF and LERF to the extent it does, the technical basis should be stronger. The calculation must match the conditions of the sequences for which it is used, must use a representative flow rate, and must consider the uncertainties in the inputs and the outcome.	A precaution was also added to BVPS-2 OM Procedure 2OM-7.4.O "Makeup To The Refueling Water Storage Tank," that if a significant volume of river water is added to the Spent Fuel Pool, boric acid addition to the Spent Fuel Pool may be required to maintain adequate shutdown margin.	
SY-17	SY-21	B	Y	Service Water success criteria appears to have no supporting analysis as to 1 service	The Service Water System Design Basis	No impact to Fire PRA, because this

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				water cooling pump could provide sufficient flow. Additionally, there appears to be some HEP for some manual operator action to start standby pumps under some circumstances. No success criteria for the time available for these actions was found.	Document provides the basis for one pump operation to meet the single failure criterion and still provide adequate station cooling under accident conditions. Table 3-1 of the Human Reliability Analysis PRA Notebook gives a summary description of the Service Water human actions analyzed in this study. Also provided in this table are the time windows that are available to the operators in the performance of the task described along with the basis for the timing.	issue was addressed in the base PRA model prior to building the Fire PRA.
TH-02	TH-08	B	Y	The Beaver Valley Unit 2 Ventilation and Room Cooling Analysis Notebook Table 7 lists that for item 10, Control Building, Operators add portable fans; not included in risk model. It appears from Figure A-9 "Temperature as a Function of Time in Control Room with No Ventilation-Fan Added in 10 Minutes," that without the addition of the fans the temperature in the Main Control Room would impact instrument qualification. Though this appears to be an important operator action that justified not adding MCR HVAC to the model, there is no operator action to add fans for MCR cooling within 10	The Unit 2 Ventilation and Room Cooling Analysis Notebook only looked at a loss of ventilation in the Unit 2 side of the Control Building. In reality, the Unit 1 and Unit 2 Control Rooms are located within the same building separated by a partial wall (there is no wall above the "egg crate" ceiling), so a loss of ventilation at one unit will not result in the	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

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				minutes. Additional investigation into the MCR heatup calculation 12241-US(B)-211 revealed that two different values were used for the MCR heat load. Page C-4 uses a MCR heatup value of 156,861 BTU/hr (~46000W) and page IPE-4 uses 74665W. The trend shown on Figure C-3 is the more expected MCR room heatup, rather than the temperature spike seen on IPE-9.	total loss of ventilation to the common Control Building. As resolution to this observation, a separate calculation (8700-DMC-3467, Rev. 1) was reviewed, which was previously performed in response to an Appendix R Unit 1 Control Room Ventilation fire. This calculation combined the Control Room volumes and heat loads, and took credit for the Unit 2 HVAC to cool both Control Room areas. While it was noted that this calculation was performed assuming a loss of Unit 1 HVAC it was determined to be applicable to a loss of Unit 2 HVAC as well, since the HVAC flow rate were similar at each unit. The results of this analysis concluded that during a loss of ventilation at one Unit, the Control Building temperature would remain below the Equipment Qualification limits during a 24-hour mission time, even without setting up portable ventilation fans.	

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					This analysis assumed a homogenous mixture of air existed between the Control Rooms, so it was assumed that the operators would open the common doors between the Control Rooms to aid in cooling. This action was assumed to be a guaranteed success in the PRA model, since both Control Rooms are continuously manned and human nature would drive the operators to do so after they begin to feel uncomfortable. It was determined that this observation did not impact the PRA model, so the recommend changes were not incorporated into the BV2REV3B PRA model.	
AS-01	AS-12	C	Y	Beaver Valley is using a modified version of the WOG 2000 seal LOCA model, which is derived from the BNL "best estimate" model, with Beaver Valley specific MAAP runs for time to core uncovery. The time of the start of excessive leakage is 30 minutes in this model. The NRC has not accepted this from licensing submittals. Since Beaver Valley is planning some extensive AOT submittals in the future, this will have to be addressed.	As a resolution to this PRA Peer Review observation, sensitivity analyses were performed on the BVPS Unit 1 MAAP RCP seal LOCA cases to investigate the impact of varying the timing of the increased RCP seal leakage from 30 to 13	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

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					minutes on the resultant time to core damage. The conclusion from these sensitivities was that the change in onset of the increased RCP seal LOCA leakage from 30 minutes to the minimum time of 13 minutes would not lead to significantly earlier times to core damage. Since the BVPS RCP Seal LOCA models are comparable between Unit 1 and Unit 2, it was concluded that there would be similar insignificant core damage timing impacts at Unit 2. Therefore, it was concluded that the time to core damage provided in Attachment A, Appendix E, of this notebook for the RCP seal LOCA sequences is sufficient for use in the electric power recovery models. The e-mail from Fauske & Associates to FENOC transmitting the results of these BVPS-1 MAAP SBO sensitivity runs is provided in Appendix E of	

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F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					the BVPS-2 Electric Power Recovery Analysis PRA Notebook. Ultimately resolved based on WCAP-15603, Rev. 1-A, NRC Approved, May 2003, Seal LOCA start time is 13 min.	
AS-04	AS-07	C	Y	AMSAC is a mitigation system that only appears in the ATWS tree. Actually AMSAC is a redundant start of AFW and turbine trip that is useful in mitigation even when SSPS has failed but the reactor trip has been successful. Additionally AMSAC is only model as a system point estimate of 1E-2 (see F&O SY-20). This could affect/reduce the system/equipment importance of SSPS, AFW and Turbine Trip	In response to this PRA Peer Review observation, the GENTRANS Event Tree (see Figure D-4a) was modified to include Top Event PL (Power Level <40 %) and Top Event AS (ATWS Mitigating System Actuation Circuitry) before asking Auxiliary Feedwater in Top Event AF. The split fraction logic rules and macros were also modified to credit the use of AMSAC for providing a diverse method of starting the AFW pumps (see Tables 3.4-3 & 3.4-4). Section 3.4 "General Transient/Small LOCA Event Trees" and Tables 3.4-1 and 3.4-2 were also revised to account for these new top events in	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					the GENTRANS Event Tree. With respect to the AMSAC top event being quantified using a point estimate value instead of a fault tree analysis, it was not deemed necessary to pursue a detailed fault tree analysis at this time. The point estimate value of 1.0E-02/demand used in the BVPS PRA models is taken from WCAP – 11993 (Reference 1) and is conservative with respect to unavailabilities of a one signal train and the design criteria applied to AMSAC by the Westinghouse Owner's Group. Additionally, the more recent WCAP-15831-P (Reference 14) also uses this point estimate value, as has other studies, as an appropriate value to use. A detailed fault tree would probably result in a lower AMSAC unavailability value, but this is not expected to have a significant impact on the	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					core damage frequency, due to the already low significance of SSPS failures in non-ATWS sequences.	
AS-09	AS-18	C	Y	The SGTR event tree assumes that the actuation of PORVs (should be PORV due to definition of B&F success criteria) will result in the CIB (8 psig) actuation. A review of the MAAP runs (Success Criteria, Attachment A, Appendix F, Table 3) indicates that CIB occurs for cases in which OB (B&F) is successful for cases in which AFW is failed and it occurs in approximately 2 hours. The QSS is assumed to be actuated given the CIB signal. The water injected to the containment sump is necessary for NPSH success. It isn't clear what will happen in the case that CIB does not occur until 2 hours into the scenario and what effect this may have on the NPSH concerns.	The concerns of this PRA Peer Review observation are unfounded, since the timing of the CIB initiation following bleed-and-feed scenarios during a SGTR will not impact the NPSH of the HHSI pumps. This CA was dispositioned by examining the MAAP SGTR accident sequence summary files as summarized below: For the SGTR cases with a loss of secondary cooling, the HHSI pumps will initially be taking suction from the RWST, either due to an SI signal being generated or to the bleed-and-feed initiation. After about 6 minutes following the initiating of bleed-and-feed, the containment sump would begin to fill when the PRT rupture disc blows. During this time there will be RCS mass and energy	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					released inside of the containment from the open PORVs, which will slowly start to increase the containment pressure and also be providing inventory directly into the containment sump. After approximately 2 hours a CIB occurs, and QSS will start and also begin to add RWST inventory into the sump, so that when the RSS pumps start about 10 minutes later there should be sufficient inventory in the sump to provide adequate NPSH to the RSS pumps. However, if a sufficient amount of water is not collected in the containment sump after this time, the recirculating spray pumps must be manually turned off and then turned back on when NPSH is sufficient. Operator actions to first turn off and then to turn on the RSS pumps are modeled in Top Events SM and OR. Success of these actions	

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					ensures that the RSS pumps will be available when the RWST reaches the low-level setpoint and SI Recirculation is initiated. At this time the HHSI pumps would be piggybacked onto the RSS pumps, and adequate NPSH would be provided. Prior to this CIB signal being generated, the QSS and RSS will not start. However, the HHSI pumps will continue to take suction from the RWST until the low level SI Recirculation setpoint is reached. At this time even without a CIB initiation, approximately 350,000 gallons of RWST water would have been directed into the containment sump though the opened PORVs, so that when the HHSI pumps are piggybacked onto the RSS pumps, adequate NPSH would also be provided.	
DA-03	DA-03	C	Y	The documentation of the CCF MGL parameters is presented in Appendix C of the	The resolution to this F&O was to put highlighted	No impact to Fire PRA, because this

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				Data Analysis Notebook. The final compilation of the MGL parameters is presented in Table C-6. The results are presented as "Plant-Specific" distributions, but this table is in fact a mix of parameters developed based on plant specific event screening, in some cases Bayesian updating, and in other cases generic data. With some difficulty, the reviewer could trace back through the documentation to determine the actual source of the MGL parameter, but a naming convention that identifies the parameter as plant specific, or generic would be helpful. As a minimum, generic data could be presented in a separate table from the parameters generated based on plant specific analysis.	shading and bold text in Table C-6 of the BVPS Unit 2 Data Analysis PRA Notebook for the MGL distributions that were developed based on a plant specific analysis, so that they are more easily identified. This table was also renamed to Table C-6 Beaver Valley Unit 2 - Common Cause MGL Distributions, so that it does not imply that all the MGL distributions are plant-specific.	issue was addressed in the base PRA model prior to building the Fire PRA.
DA-04	DA-05	C	Y	The data notebook describes several sources for the generic component failure distributions for the BV Unit 2 model. Column 6 provides the disposition of the 6 sources of information. Item f-1994 STP data was used to derive the failure rate distribution for the automatic recirculation check valve failure to open and was cloned from ZTVCOS using PLG generic check valve database distributions. Then the data from STP of 0 in 704 demands was used. It is not clear what this database variable was used for and if it is currently being used. The discussion does not indicate why was no information used from the BV plant history in this update process.	F&O DA-04 was originally assigned as a "B" Level of Significance in the draft WOG PRA Peer Review Report, but was downgraded to a "C" in the final report. This observation was resolved by adding discussions to Section 3.5.F "1994 STP Data" of the BVPS-2 Data Analysis PRA Notebook as to why and how the database variable for the automatic recirculation check valve failure to open (ZTVARD) was developed, as well as an	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					explanation as to why there wasn't any plant specific data included in the update.	
DA-05	DA-03	C	Y	Table C-6 lists the Beta factor for battery failure fails to operate (ZBBCHR) as a point estimate of 1.26E-2. The source of this value is not documented in the Data Analysis Notebook. A review of the EP System Notebook found a reference to this value in an assumption, stating that the value was taken from NUREG/CR-5497. Appendix C of the Data Analysis Notebook should be self contained with respect to the source of the generic MGL. Appendix C does not reference NUREG/CR-5497. Are all other generic parameters actually from the PLG database or are other sources used? Is this the only value taken from 5497? What was the basis for using one selected value from 5497?	This PRA Peer Review observation was dispositioned during the resolution of F&O DA-06 (CA 02-09042-12). Although, Appendix C does not specifically list the source document references, they are specifically identified in Section 3.6 "Calculation of Common Cause Factors," and are included in Section 5 "References" in the Data Analysis PRA Notebook. Section 3.6 also provides the basis for using common cause data sources other than the PLG common cause database.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
DA-11	DA-05	C	Y	A statement needs to be made in the assumptions to describe the method of assembling the data. The write-up implies that only unit 2 data is included in the tables but there appears that some unit 1 pumps may have been included. If this is the case, then the text needs to explain that Unit 2 equipment is included and only the Unit 1 equipment that may be needed to shutdown Unit 2 is included.	This PRA Peer Review observation was dispositioned by adding a discussion in Section 3.3 "Presentation of Plant-Specific Data" of the Data Analysis PRA Notebook to identify what Unit 1 equipment is included in the development of the	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					Unit 2 database distributions or test and maintenance unavailabilities.	
DE-02	DE-04	C	Y	In a limited review of the dependency matrices in Appendix B of the Event Tree Analysis Notebook, it appears that some items maybe missing. - There appeared to be no dependencies listed for instrument AC inverters 2-3 and 2-4, but it was later noticed that that was covered by a footnote in the AC section (2-1 & 2-2 had the footnote in both places). - Note 33 does not state the DC power for RTB shunt coil "B". - No DC power for containment isolation valves was listed. - No AC dependencies for AC power for instrument AC were identified. - There are no dependencies shown for AMSAC, but that maybe appropriate for the level of detail of AMSAC modeling.	Most of the concerns of this PRA Peer Review observation are unfounded, and are attributed to a lack of understanding of how to read the matrices. For example, sheet 2 of Table B-2 "Support-to-Frontline System Dependency Table" does list Note 30 for the DC dependencies. Likewise, sheet 1 of Table B-1 "Support-to-Support System Dependency Table" identifies vital bus III and vital bus IV as failing AMSAC. Additionally, sheet 2 of Table B-1 lists Note 43 for the AMSAC DC dependencies. However, as the Team observed, Note 33 of Table B-1 "Support-to-Support System Dependency Table" did not state the DC power for RTB "B" shunt coil, so this note was revised to	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					address this oversight. Also, Notes 4 and 5 were added to Table B-1 vital bus III and vital bus IV matrices to clarify their DC dependencies, while these same notes already identified the AC dependencies.	
DE-03	DE-11	C	Y	The flooding analysis and the IPE state (briefly) that a plant walkdown was performed. But there is no documentation of the walkdown, or the insights gained from the walkdown, available for review. The walkdown "notebook" would be a valuable resource for analyst in future updates of the PRA.	Since the documentation for the flooding walkdown that was performed as part of the IPE could not be located, the walkdown that was completed for the Beaver Valley Unit 2 Risk-Informed In-Service Inspection (RI-ISI) Indirect (Spatial) Consequence Evaluation was credited, as discussed in the response to F&O DE-04 above. Since this RI-ISI walkdown is documented in a BVPS calculation and is retrievable, it is not deemed necessary to reproduce it for the PRA notebooks. This F&O was written against an obsolete Internal Flooding PRA model (BV2REV3A) and is considered to be	No impact to Fire PRA. This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	
DE-06	SY	C	Y	Some of the flood frequencies are based on a document (PLG-0624) that is dated 1988. The next update should include consideration of more recent flood data sources.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV3A) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions	No impact to Fire PRA. This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					are presented in Table 2-4.	
DE-07	SY	C	Y	The PRA documentation should include a discussion of the potential impact of floods on systems that are shared between the two units. Although this impact is expected to be minimal, one example is the potential impact on the electric power crosstie to Unit 1 availability due to floods in the service water intake structure. Is the Unit 1 diesel dependence on service water correctly accounted for when the flood impacts the availability of the Unit 1 service water system?	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV3A) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev. 1, conducted during June 6-9 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	No impact to Fire PRA. This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
HR-02	HR-06	C	Y	A generic error of omission term from the PLG database (ZHEO1A) was used for all misalignment HEPs without regard for procedural or operational failure barriers such as independent verification, peer checks, walkdowns, etc. However, plant specific data was used for test and maintenance frequencies. Therefore, the overall misalignment errors were a hybrid of generic and plant specific data. This was used for systems which are important to CDF (e.g., AF, SI).	This F&O was written against an obsolete HRA PRA model (BV2REV3B) and is considered to be resolved by the updated HRA PRA model incorporated in BV2REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1,	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	
HR-10	HR-18	C	Y	The number of operators interviewed for the performance shaping factors was stated to be 3 operators, 3 training staff and 3 PRA staff. This is a low number of operators for the FLIM method to succeed. Having the PRA staff fill out the PSF forms dilutes the operator input to the process.	This PRA Peer Review observation was dispositioned by acknowledging that, while technically only 3 operators were interviewed, the training staff personnel were former operators that still held a senior reactor operator's license at the time of the interview. Therefore, a total of six licensed personnel were used in developing the PSFs. Additionally, as a final resolution to this observation, future BVPS PRA models will use the EPRI HRA Calculator, which uses a more current and robust methodology to identify human action dependencies. This F&O was written	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					against an obsolete HRA PRA model (BV2REV3B) and is considered to be resolved by the updated HRA PRA model incorporated in BV2REV4, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during the week of October 29, 2007, by Westinghouse. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 1-3.	
IE-01	IE-04	C	Y	In section 3.3 of the Initiating Events Notebook, there is a discussion about the justification for the exclusion of Random RCP Seal LOCAs as a separate IE that is based on the RCP floating ring seals and the assumption of limited leak flow. The justification provided to account for assuming this is a discussion by FENOC with Westinghouse. No documentation of this discussion is provided and no further technical justification is given as to why random seal failure should have the frequency and be included in Category G1/QG9 under RTRIP.	In response to this observation, Section 3.3 of the Initiating Events Analysis PRA Notebook was revised to add further clarification based on the floating ring seals (per Reference 15) as to why random RCP seal LOCAs were eliminated from the Beaver Valley PRA model. Additionally, this Section was revised to provide justification as to why a random RCP seal failure at Beaver Valley	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					that resulted in a reactor trip would be captured under the RTRIP initiating event frequency.	
IE-02	IE-13	C	Y	In the discussion of the process used for Initiating Event frequency update, BWR data and other NSSS vendor PWRs are excluded from the update without sufficient documentation.	In response to this observation, Section 2.3 of the Initiating Events Analysis PRA Notebook was revised to provide a brief explanation for why BWR and other PWR NSSS vendor data were excluded from the BVPS initiating event frequency update.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
IE-03	IE-10	C	Y	The Support System Faults that are used as Initiating Events are assigned a Code Designator. The System Codes and Top Events for these designators are not explained. The System Notebook does not clearly explain how the System is considered to cause an Initiating Event in the Model.	In response to this observation Tables A1 and A9 in the Initiating Events Analysis PRA Notebook were revised to include a cross-reference from the initiating event "Code Designator" to the applicable PRA System Notebook. In addition, Table A2 of this notebook provides a failure modes and effects analysis of the key BVPS Unit 2 support systems and why they were considered for initiating events, so it was not judged to be necessary to duplicate this information in the	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					System Notebooks. It was not the intent of the PRA System Notebooks to be stand-alone documents, but rather to be supplemented by the PRA analysis notebooks.	
IE-06	IE-16	C	Y	Plant trip trends in the recent years are showing a general decrease in trips/year. A simple trend analysis (like a histogram) showing number of trips versus years for each unit should be considered as a subsection in the initiating events section. This would possibly allow better estimation of plant specific transient event frequency. Currently, there appears to be no analysis to show whether there is a positive or negative trend (or a lack of it). Also, a trend analysis fits well with the concept of plant-specific nature of analysis in question. For example, consider a plant with 10 years of trip data; the first 5 years each have 5 trips/year; the last 5 years have 1 trip per year. This would result in an average of 3 events per year over a ten-year period. Now consider another plant where the two numbers are interchanged; it has 1 event per year for the first five years and 5 events per year for the next five years. The overall average is still 3 events per year. In both cases, there are definite trends; the first plant should actually use a frequency of 1 trip per year; the second plant should use 5 trips per year. In any case, neither plant should use 3	In response to this observation, Figure 3-1 was generated to present a plan trip trend histogram and Section 3.2 of the Initiating Events PRA Notebook was revised to include a discussion of the plant trip trend analysis performed for BVPS Unit 2.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				trips per year.		
IE-07	IE-03	C	Y	There was not enough information in the initiating event report to reproduce the results. 1. The prior distributions were not available. 2. the screening of the WCAP IE report was not available 3. The derivation of prior means was not available.	In response to this observation, Table A11 was generated in Appendix A of the Initiating Events Analysis PRA Notebook to show the set of input data used in the creation of each first stage (prior) distribution identified in Table A4, as well as, the resultant RISKMAN distribution parameters for the mean, median, 5th and the 95th percentiles. This data was input into the RISKMAN Data Module, using the "First Stage of Two Stage" distribution option to create the resultant prior distributions. The derivation of how RISKMAN generates these prior distributions using this option is contained in the RISKMAN Software Users Manual, and does not need to be reproduced in this notebook. Additionally, there was no screening of the Westinghouse WCAP-	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					15210 initiating event data, since each individual utility performed a through review of their plant's trip events to ensure that the data was valid.	
L2-02	L2-08	C	Y	Most containment phenomena are either excluded via generic, or plant specific analyses, or are modeled as a point estimate. Other issues such as whether the containment is inerted are more directly quantified. For example, the L1/L2 interface directly quantifies those end states when the sprays are operating; operation of the sprays is considered to de-inert containment.	Ultimately resolved by GAP F&O LE-F2-01 (see Table 2-2).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
L2-04	L2-21	C	Y	Top Event 10 - Containment Failure Prior to Vessel Breach (C1) states that because the Beaver Valley Unit 2 containment normally operates at subatmospheric conditions, the existence of large pre-existing leaks is believed to be negligible. Current L2 analysis would not support containment conversion application	Ultimately resolved by GAP F&O LE-D6-01 (see Table 2-2).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
MU-01	MU-04	C	Y	Plant changes that may impact the PRA model are documented, and resolved via Risk Evaluation Review (RER) forms. Continuing training is used to educate engineering (includes procedure writers) on when an RER is required vs. direct procedural guidance. The update process could be improved by adding a similar review process into other plant change procedures.	Ultimately resolved by procedure NOBP-CC-6001 and Design Interface Evaluation (DIE) process that evaluates changes for PRA impact.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
MU-03	MU-11	C	Y	When the PRA model is updated for plant modifications or for decreases in CDF all areas of applications should be evaluated.	Ultimately resolved by procedure NOBP-CC-6001, Section 7 lists RI-	No impact to Fire PRA, because this issue was

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				Certain applications can be adversely impacted by decreases in CDF. For example, credit taken for examining segments in a RI-ISI program could decrease with a decrease in CDF (or even an unrelated CDF increase, depending on changes to the risk profile.) Additionally more than just the change in CDF needs to be evaluated. The risk profile may change drastically without a corresponding change in the CDF. For example CDF due to one IE may go up by 30% in conjunction with another change in CDF due to a different IE decreasing by 25%. This would cause only a 5% change in CDF but significant changes to the risk profile.	applications that need updated following a new ERM (Effective Reference Model).	addressed in the base PRA model prior to building the Fire PRA.
QU-01	QU-07	C	Y	PRA Peer Review Subtier Criteria for this sub-element describes the need for documentation of the limitations of simplified models. This documentation could not be found for Beaver Valley Unit 2.	As resolution to this PRA Peer Review observation it should be noted that the RISKMAN model is used for purposes for risk sensitivities (e.g., SDP findings) and risk-informed applications (e.g., BVPS-2 SSPS Slave Relay STI Extension), as such, there are no simplified model used for these purposes and hence nothing to document. Additionally, the intent of the PRA Notebooks was to document the	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					development process and results of the RISKMAN PRA model, not to document the Safety Monitor model or its process that currently uses pre-solved sequence, or to document other risk-informed sensitivities and programs. Moreover, future versions of the Safety Monitor for RISKMAN users are to incorporate a full requantification of the sequences in place of pre-solved sequences.	
QU-05	QU-23	C	Y	RISKMAN allows the user to apply a cutoff at the system (i.e., top event) level. This cutoff is applied prior to the event tree quantification. In general, no truncation (i.e., a value of 0) is used in the systems cutset generation. But non-zero values are used for a handful of top events. Of these most use very low cutoffs (<1E-12). The one exception to this (as best this reviewer could determine) is the quantification of Top Event WC where a cutoff of 5E-7 was used. Top Event WC is an intermediate top used to quantify Top Event WA and WB. Split Fraction WC1 has an unavailability of about 3E-9. The SW system notebook discusses the system level cutoff and when it is used.	This truncation problem is expected to go away when BVPS updates the PRA software with the RISKMAN version that contains binary decision diagrams (BDD). The BDD software has the ability to solve fault trees without using cutsets, so that no truncation values are necessary. Therefore, including additional discussions on this topic would not be of any value to analysts in future updates using the BDD	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement[1]	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				However, the potential quantitative impacts associated with the truncated results are not discussed.	methodology. Ultimately resolved by quantifying the split fractions using the BDD methodology, starting with the revision 4 PRA model.	
SY-04	SY-27	C	Y	It would be desirable to reference the success criteria source in the system notebook. Success criteria are specified in the "Success Criteria" notebook, and the reviewers found it difficult to flip from one source to another, especially when using the electronic documentation CD.	Ultimately resolved in Revision 5 PRA model System Notebooks, Section 3 "SYSTEM SUCCESS CRITERIA"	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-05	SY-12	C	Y	The system notebooks do not specifically discuss the dependencies that may be present regarding HVAC / room cooling. However, review of the HVAC notebook identified the various spatial locations that may require HVAC and indicated the various analyses that have been completed to either require HVAC dependencies or not.	Ultimately resolved in Revision 5 PRA model System Notebooks, Section 4 "SUPPORT SYSTEMS"	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-07	SY-26	C	Y	The Beaver Valley Unit 2 system notebooks have no indication of system engineering reviews. These reviews help ensure that systems are model in accordance with day-to-day plant operations and additionally expand the PRA knowledge of the system engineers.	Ultimately resolved by GAP F&O F&O SY-C1-02 (see Table 2-2).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-08	SY-01	C	Y	The guidance did not provide for more complete description of the actual boundary conditions used in the system analysis. It did talk about support, but the actual details are not required (i.e. what AC bus is needed for which pump for that boundary condition for	Boundary conditions were developed using the dependency matrices, which are located in Appendix B of the Level 1 Event Tree Analysis PRA	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				the split fraction). As a result most of the notebooks do not give a good description of what each split fraction means and its usage. The only place this appears to be actually documented is the description on the split fraction in the RISKMAN split fraction.	Notebook.	Fire PRA.
SY-09	(*sic* SY-14)	C	Y	System Diagrams contained in System Notebooks do not have explanation of color highlighting. Figures are difficult to read and many component IDs are not legible. There also does not appear to be a discussion of 'Operating experience for the system' required in the guidance document.	Each System Notebook has had a note added prior to the links for the System drawings. This note explains the color scheme used on the drawings. Some parts of some of the drawings are difficult to read, but using the zoom function does make it easier to read most of the smaller print. This is a limitation of the scanner used for this project. In all notebooks however, the drawing number is very easy to read, making retrieval of a larger and more legible drawing very easy. This is a Level 'C' F&O and is considered as a recommendation. The actions defined here are considered appropriate for closure of this F&O. Operating experience for the system is subsumed	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					in the system engineer's review.	
SY-10	(*sic* SY-14)	C	Y	The Fault Trees for IA, IC have Transfer Gates and page numbering that is confusing. IA page 6 transfers to page 7 but page 7 top gate transfers to age 1. In IC, page 1 is a transfer from page 5 which is the Top Event IC. This is confusing and is easily fixed.	Resolved in Revision 5 PRA models that have Fault Trees redrawn so Top Gate is on page 1. NOTE: The BV2REV5A FTs are not organized due to the addition of NFPA 805 basic events.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA. Also, this is a documentation-only issue.
SY-12	SY-17	C	Y	The Service cooling water system notebook assumption #7 has 10 minutes to trip the RCP's on loss of cooling. However, in the Miscellaneous system notebook, top event OC has 5 minutes to trip the RCP's. Note, this time might be important in quantifying an HEP.	Ultimately resolved by GAP F&O F&O SY-B7-01 (see Table 2-2).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-13	SY-13	C	Y	Several systems appeared to be modeled as point estimate only, AMSAC and the Switchyard. This is acceptable, per the peer review guidance, but consideration could be given to adding some detail to these models.	The AFW pump macros were revised in the BV2REV3B PRA model to include credit for AMSAC to start the AFW pumps (in addition to the SSPS signal), given that the signal is generated during non-ATWS events. The Switchyard (Top Event OG) was modeled as a single basic event. However, it used a lognormal distribution to quantify Monte Carlo	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					values in addition to the point estimate value. Furthermore, the PRA model already addressed transient induced LOSP events due to failures of the USST/SSST and Switchyard breakers in the normal bus top events. The current methods to address the AMSAC and Switchyard failure probabilities are deemed acceptable as is.	
SY-15	SY-10	C	Y	HVAC support analysis appears to only consider 8 hours versus 24 hours. The analysis was extended to 24 hours based upon the fact that the curves were essentially flat after 8 hours. Some of the curves are straight and increasing and not flat and constant.	As a resolution to this PRA Peer Review observation Table 6 in the Ventilation and Room Cooling Analysis PRA Notebook was revised to show the expected area temperature at 24 hours following the loss of ventilation. Areas that exceed their EQ temperature limits are discussed in the Section 6 and Appendix A of this notebook.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
AS-05	AS-17	D	Y	The success criteria for top event TT is missing from Table 3.3-2 of the Event Tree Notebook although it is described on page 58 of the notebook.	Ultimately resolved in Revision 5 PRA model Level 1 Accident Sequence Analysis	No impact to Fire PRA, because this issue was addressed in the

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					Notebooks, Table 3.3-2 & Table 3.4-2.	base PRA model prior to building the Fire PRA.
AS-06	AS-17	D	Y	The success criteria for top event NM is missing from Table 3.3-6 of the Event Tree Notebook although it is described on page 67 of the notebook.	Top Event NM is a switch to query if early core damage has occurred during the SI injection phase, and does not have any success criteria per se, so is not included in the Success Criteria Tables.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
DA-01	DA-19	D	Y	Appendix B of the Data Analysis Notebook is titled incorrectly. It includes reference to "Common Cause Data Sources" in the title, but the appendix contains no CCF information.	Ultimately resolved in Revision 5 PRA model Data Analysis Notebook, renamed Appendix B title	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
DE-01	DE-01	D	Y	The guidance for including spatial information in the system notebooks could not be found in the system notebook guidance document. However, it appears that most, if not all, the system notebooks did have a section on spatial considerations for flooding, fire and seismic.	Ultimately resolved in Revision 5 PRA model Systems Analysis Overview and Guidance Notebooks, Section 5 "SPATIAL CONSIDERATIONS"	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-11	SY-15	D	Y	The AC power system calculation notebook, has top event OG which has a split fraction for generic loss of power after a plant trip. The basic event report for this was missing from the system notebook, but the system notebook listed a database variable "OG1X" used. This variable could not be found in the data notebook. It was in the RISKMAN model with no references from where it came from.	Ultimately resolved in Revision 5 PRA model Data Analysis Notebooks, Tables A-1 and A-2.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-1. Summary of BVPS-2 2002 Internal Events PRA Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement[1]**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				It was determined that it came from the PLG-0500 revision 1, 1989.		

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IE-A6-01	IE-A6	B	Y	There is no documentation of interviews of plant personnel (e.g., operations, maintenance, engineering, safety analysis) to determine if potential initiating events have been overlooked. This is required to meet capability category II	Documentation of interviews with system engineering plant personnel to determine if potential system descriptions have been overlooked is located in Unit-2 PRA Notebook (PRA-BV2-AL-R05a) Systems Analysis Overview and Guidance, Appendix B. Credit was taken for the system review in the notebook PRA System Review as a checklist for relevant combinations of events that might have been unnoticed. Review of the initiating events section in the system notebooks was also included as review of the system description by system engineers. Also, review of AOPs (e.g., D5X, 2OM-53C.4.2.28.1) can be credited.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IE-C8-01	IE-C8	C	Y	All the relevant combinations of events involving the annual frequency of one component failure combined with the unavailability (or failure during the repair time of the first component) of other components are not available in the support system notebooks. The support system notebooks list which initiators are developed from the fault trees and provide a diagram of the fault tree, however there is no narrative explanation of how these fault trees are modified and what assumptions are used to develop the support system initiator frequencies. RISKMAN reports, provided as System Notebook appendices, list the details of the system IE models (i.e. cutsets, modified basic event equations, etc.), however there is no discussion of which component failures were considered, what mission time assumptions are used, or description of the development of the system IE models. Therefore it is difficult to determine if all relevant combinations of events have been considered.	The Initiating Events section of the system notebooks now contains a description of the development of the support system initiating events. Except as noted, the mission time for normally running equipment is changed from 24 hours to 8760 hours times the plant availability factor. Portions of the system fault tree logic which is not used to quantify support system initiating event frequency is also noted.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
IE-C9-01	IE-C9	B	Y	Plant-specific information used in the assessment and quantification of recovery actions included in the support system initiating event	The Recovery Considerations section of the System Notebooks now documents the operator actions that were modified in the quantification of	No impact to Fire PRA, because this issue was addressed in the

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				analysis is not included in the support system notebooks. Analysis of the recovery actions should be consistent with the applicable requirements in the Human Reliability Analysis	the system initiating event frequency. No new recovery actions are credited in the analysis of initiating event frequency.	base PRA model prior to building the Fire PRA.
IE-C10-01	IE-C10	B	Y	There is no comparison of the initiating event analysis with generic data sources or explanation of differences to provide a reasonableness check of the results.	In the Initiating Events Analysis Notebook, Table A6 demonstrates a comparison of initiating event frequencies for the Westinghouse 3-loop PWR. The industrial events are from WOG Rev 7 PSA comparison database. Comparably Beaver Valley 2 to other Westinghouse 3-loop PWR plants has most initiating events frequencies close to order of magnitude. Some differences in plant frequency include MLOCA with a higher frequency than comparable plants by an order of magnitude and interfacing systems LOCA (VSX) with a frequency one magnitude lower than similar plants. MLOCA initiating event frequency has been updated for PRA-BV2-AL-R05a to a new methodology	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					based on NUREG-1829 (April 2008) and lowering the effective break size therefore lowering the frequency. The WOG Rev 7 of other Westinghouse 3-loop PWRs was developed before the methodology of NUREG-1829 was used. The lower order of magnitude difference for the initiator, VSX, is due to the difference of the amount of valves that are required. For BV 2, an occurrence would require at least three normally closed valves, which isolate the RCS from low pressure piping, to fail in the open position. Whereas, BV 1 would require at least two normally closed valves in this event and a difference of one order of magnitude for the frequency of the initiator. Blank gaps in Table A6 do not have data for that plant from the WOG database.	
DA-C4-01	DA-C4	B	Y	A clear basis for the identification of events as failures is not included in the Data Analysis Notebook. This basis could be used to distinguish between those degraded states for which a failure, as modeled in the PRA, would have occurred during the mission and those for which a failure would not have occurred (e.g., slow pick-up to rated speed).	Documentation of this is now included in Section 3.3 of the Unit 2 Data Analysis Notebook (PRA-BV2-AL-R05a).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				It could not be determined from the Data Analysis Notebook if any failures were screened out or if the maintenance rule MPFFs are used as the data source.		
DA-C5-01	DA-C5	B	Y	There is no listing or description in the Data Analysis Notebook of repeated component failures that were counted as a single failure. Repeated component failures occurring within a short time interval should be counted as a single failure if there is a single, repetitive problem that causes the failures. In addition only one demand should be counted.	For Beaver Valley Unit 2, repeated plant specific component failures occurring within a short time interval were counted as a single failure during implementation of the Maintenance Rule. PRA data is taken from Maintenance Rule sources and therefore meets the requirements of the ASME PRA standard."	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
DA-C8-01	DA-C8	B	Y	Plant records should be used and documented to determine the time that components are configured in their standby status. This is required to change SR DA-C8 from Capability Category I to III	Maintenance Rule plant specific unavailability data is incorporated into the PRA model. Documentation of this can be found in the Presentation of Plant-Specific Data section of the Data Analysis notebook under sub-section Component Maintenance Data and is evidenced by the Prior Maintenance Data of Appendix B."	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
DA-C10-01	DA-C10	B	Y	Decompose failure modes into sub-elements and count demands/failures individually in the sub-elements.	Component failure modes have been handled appropriately to meet this Supporting Requirement at the CC-II level. Failures of sub-elements of a component that are modeled explicitly in the PRA are associated with the sub-element and not the component itself. Documentation of this can be	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					found in the Presentation of Plant-Specific Data section of the Data Analysis Notebook (PRA-BV2-AL-R05a) under sub-section Component Failure Event Allocation and is evidenced by the data in Table A-1.	
HR-B1-01	HR-B1, HR-D2	B	Y	This F&O is a carry-over from the peer review (F&O HR-2). A generic error of omission term from the PLG database (ZHEO1A) was used for all misalignment HEPs without regard for procedural or operational failure barriers such as independent verification, peer checks, walkdowns, etc. However, plant specific data was used for test and maintenance frequencies. Therefore, the overall misalignment errors were a hybrid of generic and plant specific data. This was used for systems which are important to CDF (e.g., Auxiliary Feedwater, Safety Injection).	As outlined in HRA Notebook Section 2.2, testing and maintenance procedures were evaluated to identify potential misalignments. These potential misalignments were evaluated using the EPRI HRA Calculator 4.1.1 to develop specific HEPs for each potential misalignment as documented in HRA Notebook Table 3.5.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
HR-D3-01	HR-D3	B	Y	While the discussion in the system notebooks (AFW and QS/RS notebooks were reviewed) references the procedures, no documentation of quality of those procedures or administrative controls was found.	Procedure quality has been incorporated into human error probability assessments. Documentation of this can be found throughout the HRA Notebook, particularly the Dynamic Actions section and tables of Section 3.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-I2-01	HR-I2	B	Y	The BV HRA does document a process to perform a systematic search for dependent human actions credited on individual sequences. It is clear from the human action identifier sheets documented in the BVPS-2 HRA notebook that such an evaluation has been performed, but there is no evidence of the process documented in the HRA notebook. To be consistent with current HRA methods, there must be a systematic process to identify, assess and adjust dependencies between multiple human errors in the same sequence, including those in the initiating events.	Section 2.3 of the Unit 2 HRA notebook (PRA-BV2-AL-R05a) has been created to document that PRA Analysis No. PRA-BV2-12-002-R00, "BVPS-2 HRA Dependency Analysis," Revision 0 provides the process used for the dependency analysis evaluation. The results of this human action dependency analysis did not reveal any new dependencies that were not already analyzed.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-I3-01	HR-I1, HR-I3, AS-C3, IE-D3,	B	Y	The HRA notebook sporadically discusses assumptions and uncertainties. Per the Clarification to regulatory Guide 1.200 Revision 1,	A new Assumptions section has been added to the Unit 2 HRA notebook (PRA-BV2-AL-R05a). All major assumptions and sources of	No impact to Fire PRA, because this issue was addressed in the

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
	IF-F3, LE-F3, LE-G4, SC-C1, SC-C3, QU-F4			there is an increased importance in the industry to identify assumptions and uncertainties in the PRA model. In reviewing the HRA notebook, it is difficult to locate the assumptions and uncertainties.	uncertainty are listed in this location.	base PRA model prior to building the Fire PRA.
HR-I1-01	HR-I1, HR-I2	C	Y	The Beaver Valley Unit 2 system and data notebooks have been updated and exist in draft form, but there is no record of formal review and approval. Furthermore, only a subset of the total PRA notebooks have been updated for this revision of the PRA.	The BVPS Units 1 & 2 PRA and System notebooks were formally reviewed and signed off as part of the update process.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-I2-02	HR-I2	C	Y	There is no evidence in the HRA or Success Criteria notebooks that an operator review of the HRA has been performed.	During the Extended Power Uprate evaluation, plant operations did review the operator actions and timings. These reviews are documented in FENOC Letters L-06-003 and L-06-018. Furthermore, several operator action scenarios were evaluated using the plant simulator.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
IF-A1a-01	IF-A1a	B	Y	It is not clear from the documentation that a comprehensive assessment has been conducted to finalize the combined rooms including propagation, barriers, etc. The IF assessment is based on large flood areas but there is no description of the process used to define those areas with respect to flood propagation and barriers.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	
IF-A3-01	IF-A3	B	Y	There is no evidence in the IF Notebook that it represents the current as-built-as operated plant (circa 2007). Rev4 documentation in another document may include the information to show that the IF assessment is current, but it is not in this Notebook, IF-A3-01 was written as a B level F&O to provide documentation that the IF assessment still represents the as-built as operated plant in 2007, This probably also applies to other PRA elements from the ASME PRA Standard (e.g., SY, SC, HR, etc.) and should be addressed generically for the BVPS PRA. This would facilitate future reviews and development of PRA applications.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
IF-B1-01	IF-B1	B	Y	The ASME PRA Standard states "for each flood area, identify the potential sources of flooding." Section C3.1 identifies flood sources in each area but clear documentation of each source in an area is lacking. The Standard expects a more systematic approach for identifying potential flood sources and then later screening them. The IF assessment	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				here includes initial screening without written justification. It is suggested that a complete discussion of potential sources be documented and the basis for screening potential sources.	Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	
IF-B1-02	IF-B1	B	Y	Section C3.1 states that major flood sources were reviewed to identify potential flood locations. The ASME standard suggests that first you identify flooding areas then identified all flooding sources in that area. This method used for BVPS may have lead to overlooking other sources of flooding within each area.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
IF-B2-01	IF-B2,	B	Y	The SR B-2 of the PRA Standard requires "For each source of flooding, identify the flooding mechanisms that would result in a fluid release including failure models, human-induced mechanisms, and other events resulting in a release into the flood area." In addition, SR	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
	IF-B3			B-3 requires "For each source and its identified failure mechanism, identify the characteristic of release and the capacity of the source." Section C3.1 of the IF Notebook does not provide enough detail to judge whether these requirement is met. One example is that although a few human error induced floods (e.g., testing or maintenance errors) were considered, there is no evidence of a systematic assessment of potential test and maintenance errors.	NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IF-C2b-01	IF-C2b	B	Y	Section C3.1 does not have enough detail to show that the capacity of the drains and the amount of water retained by the sumps, berms, dikes, and curbs was estimated. The reviewer notes that it is likely that this was performed but there is no record of the assessment. The capacity of drains and the amount of water retained by sumps, etc. should be documented in the IF Notebook.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
IF-C3-01	IF-C3	B	Y	The PRA Standard states "for each SSCs identified in IF-C2c identify the susceptibility of each SSC in the flood area to flood-induced failure mechanism". Also, the SR-C3a states, "to determine susceptibility of SSC to flood-induced failure mechanism, take credit for the operability of SSC identified in IF-C2c with respect to internal flood impact only if supported by an appropriate combination of: 1) test or operational data, 2) engineering analysis, and 3) expert judgment." It is likely that flood-induced failure mechanisms were considered in the IF assessment but are not identified in the IF Notebook. Section C3.1 does not provide enough detail on the impact of the flood on SSCs.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
IF-C3b-01	IF-C3a, IF-C3b	B	Y	The IF-C3b SR requires that all potential mechanisms that can create interconnections between flooding areas be considered for CCII and that barrier unavailability also be considered for CCIII. There is no evidence in the Appendix C of the Initiating Events Notebook that any mechanism other than open obvious pathways (e.g., vents in doors, tunnels, etc.) were considered. This may be just a	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				documentation issue for CCII. Also, the RI-ISI program did a comprehensive assessment of flooding potential for various break locations. A comparison should be performed between the RI-ISI flooding assessment and the PRA IF assessment to ensure consistency. Note that upgrading to CCIII requires the additional consideration of barrier unavailability, for example due to maintenance activities or maintenance unavailability.	*as their resolutions are presented in* Table 2-4.	
IF-C3c-01	IF-C3c	B	Y	Develop engineering calculations for ALL flooding scenarios, not just the "worst case" scenarios. This is likely just a documentation issue, but since it is missing from the IF Notebook, SR IF-C3c is not met.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	
IF-C4-01	IF-C4, IF-C6, IF-C8	B	Y	The operator actions credited in the IF flooding assessment are based on detailed HRA assessments for two operator actions. Cues, procedures, etc. are detailed in the HRA assessment. It is not clear if these actions are also applied to scenarios other than those used to quantify the HEP in the HRA Notebook. In addition, there are a number of other instances in which the operators are assumed to be highly reliable. There is also no indication that these are validated by operator interviews. Cleaner documentation of the operator actions that are credited (as well as those not credited), and their basis, should be completed to assist in future reviews and for risk applications in which the performance of operators is important. Also a clear linkage between the IF and HRA Notebooks should be documented for the basis of the important HRA input and some of the operator actions to screen scenarios is based on highly	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				reliable operator actions.		
IF-C4-02	IF-C4	B	Y	SR-IF-C4 requires the development of flood scenarios by examining the equipment and relevant plant features in the flood area and area in potential propagation paths, taking credit for appropriate flood mitigation systems or operator actions, and identifying susceptible SSCs. No flood scenarios are developed in the IF Notebook.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
IF-C5-01	IF-C5, IF-C5a, IF-C7, IF-D7	B	Y	The screening methodology documented in Section C3.1 does not follow the systematic methodology described in the Standard. For the IF assessment, the screening is performed at the source and location level and, in some cases, without adequate basis as discussed in a previous F&O (IF-B1-01). The method used in the IF flooding assessment may be technically adequate, if the basis is better documented, even though it does not meet the Standard SRs for C-5, C5a and C7.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IF-D1-01	IF-D1	B	Y	The FENOC response to DE-06 from the OG Peer Review is incomplete. The F&O is concerned about the vintage of the data used to estimate pipe break frequencies and the FENOC response talks about walkdowns.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
IF-D5-01	IF-D5, IF-D5a	B	Y	The IF pipe and tank break frequencies used in the IF assessment are based on 1988 and 1990 data. The prior pipe break frequencies should be updated to reflect more recent experience and should include plant specific experience. In estimating pipe break frequencies, it is recommended that experience with safety related vs. BOP piping be considered along with active pipe degradation mechanisms. Credit for condition monitoring programs should also be applied where applicable.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IF-E1-01	IF-E1	B	Y	The Standard states "for each flood scenario, review the accident sequences for the associated plant-initiating event group to confirm applicability of other accident sequences model." A spot check was made to provide reasonable confidence that the overall results are correct. However, there is no record that EACH scenario was reviewed.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
IF-F1-01	IF-F1, SY-A4	B	Y	The Internal Flooding documentation does not include the results of the walkdowns performed during the original assessment. FENOC response to OG Peer Review F&O DE-4 indicates that the RI-ISI walkdowns are documented and cover the issues required for an Internal Flooding walkdown. To facilitate future maintenance and reviews of the internal flooding assessments, the use of the RI-ISI walkdowns for internal flooding should be documented in the Internal Flooding Notebook and a direct reference to a retrievable copy the RI-ISI walkdowns should also be included.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IF-F2-01	IF-F2	B	Y	The documentation of the processes to identify flood areas, sources, pathways, scenarios, etc. are not clearly documented. For example, the rules used to screen out sources and areas are not defined and the bases for eliminating or justifying propagation pathways is either not clearly defined or not provided at all.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
IF-F2-02	IF-F2	B	Y	The IF Notebook states that the annual frequency of a flood scenario in location X is Rx = Fi*fx,i*fs,x*fp,x and the quantify scenarios in which recover actions can be included is Sx=Rx (Dx + Ix). However, the frequency is never quantified using these equations. This is confusing for a reviewer – what is the purpose of these statements if they are not used? or if they are used, an explanation is needed.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IF-A1-01	IF-A1b, IF-B1a, IF-C4a, IF-D4	C	Y	Although it is apparent that dual unit impacts for internal flooding were considered, the details are buried in the individual assessments. To assist future reviews and the development of risk informed applications, it is recommended that a separate section of the Internal Flooding documentation be created to summarize the search for and results of an assessment of dual unit internal flooding impacts.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
IF-A4-01	IF-A4, IF-C9,	B	Y	The OG Peer Review F&O DE-3 documented the lack of documentation of a walkdown for internal flooding and other PRA purposes. The F&O response by FENOC is incorrect and does not address the F&O. As a result, the walkdown documentation is still not identified. The walkdown needs to be documented and reviewed from the perspective of internal floods in order to assign a CC to several of the SRs for Internal Flooding.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
	IF-D4			It is noted that in response to OG F&O DE-04, FENOC used the RI-ISI documentation in place of the original walkdown documentation. Based on the scope of the RI-ISI walkdowns, this is considered to be an acceptable substitute for the Internal Flooding assessment since the same considerations are being investigated (e.g., drain locations, equipment elevations, etc.). However, a retrievable walkdown document needs to be identified in the IF Notebook.		
IF-D1-02	IF-D1, IF-D3, IFD3a	C	Y	The IF assessment does not rely on grouping of IEs, sources, locations, etc. The screening methodology discussed in the IF Notebook and assessed under the IF-C-xx SRs methodology resulted in only a handful of flooding events to be considered. These were individually assessed in the overall PRA quantification using RISKMAN. The methodology used may be technically adequate in spite of not meeting the ASME Standard SRs for grouping if it can be justified that only a handful of events are important.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IF-D4-01	IF-D4	C	Y	The PRA documentation should include a discussion of the potential impact of floods on systems that are shared between the two units. This impact is expected to be minimal. One example is the potential impact on the electric power crosstie to Unit 1 availability due to floods in the service water intake structure. Is the Unit 1 diesel dependence on service water correctly accounted for when the flood impacts the availability of the Unit 1 service water system?	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
IF-D5-02	IF-D5	C	Y	The IEF for pipe breaks is based on a generic 80-% capacity factor. There are two issues with this method: a) current capacity factors are typically greater than 80% so that the IEFs are slightly lower, and b) the method is inconsistent with the method used to calculate other IEFs. It is recommended that the calculation for IF IEF be revised to be consistent with the method used for other IEFs.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IF-D6-01	IF-D6	C	Y	The IF flooding assessment uses screening criteria to limit the operator induced floods during maintenance (e.g., due to operator errors such as inadvertently opening isolation valves which maintenance is occurring). One of the screening criteria is whether the maintenance activity is performed during power operation or at shutdown. The application of these criteria to potential floods should be re-assessed in light of recent practices to perform more maintenance at power to shorten the shutdown periods. It is expected that this will have a small to negligible impact on the IF assessment and is therefore assigned a Level C.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
IF-E5-01	IF-E5	C	Y	There are a number of operator actions credited in the IF assessment that are used to screen potential flooding events based on the operator's ability to diagnose the pipe break and isolate the leak thereby preventing the flood. However, these operator actions are based on judgment. For others, one of the two HEPs that are analyzed is used based on judgment. Examples include:	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				1) In Section C4.3.6 it is stated that operator will receive sump alarms and be alert to the loss of RWST tank level ... the possibility that the operators do not locally isolate the tank ... is estimated as 6.7E-03 from ZHEFL2. 2) In Section C3.2.1 it is stated that a flood from the fan room should be detected quickly since this room is next to the control room. The control building sump high-level alarm would alert operators. Failure of the air conditioning would also alert operators. It is recommended that a better basis for these operator actions be developed to ensure consistency with the remainder of the PRA.\	Table 2-4.	

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IF-E5a-01	IF-E5a	C	Y	Several operator actions in the IF assessment use the HEPs documented by detailed analysis for ZHEFL1 and 2. These assume that the cues, procedures steps, action, timing, etc. are similar enough to that for ZHEFL1 or 2 but this is not documented in the IF Notebook or the HR Notebook. To be consistent with the operator action assessments for the remainder of the PRA, it is recommended that better documentation be developed to support the use of ZHEFL1 or 2 for these operator actions, or new HEPs be developed as appropriate.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.
IF-F1-02	IF-F1	C	Y	If the current IF methodology is retained, a comparison of the current methodology to the ASME Standard is recommended to facilitate future reviews.	This F&O was written against an obsolete Internal Flooding PRA model (BV2REV4) and is considered to be resolved by the updated Internal Flooding PRA model incorporated in BV2REV5A, which underwent a focused Peer Review in accordance with the guidance in Appendix B of NRC RG 1.200, Rev.1, conducted during June 6-9, 2011, by the PWR Owners Group. The F&Os as a result from this focused Peer Review, as well as their resolutions are presented in Table 2-4.	This F&O was resolved in the submitted BVPS-2 Fire PRA model, which used BV2REV5A as its basis.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
LE-C2a-01	LE-C2a, LE-C2b, LE-C3, LE-C6	B	Y	SR LE-C2a is assigned a capability category I because BVPS 2 does not use operator actions post core damage. This is considered conservative treatment of operator actions following the onset of core damage. To meet capability category III for this SR, BVPS 2 level 2 analysis must contain realistic operator actions, based on SAMGs, EOPs, etc. such as WCAP-16657-P.	The Level 2 LERF Analysis Notebook Section 2.5 "General Discussion of Level 2 Operator Actions" discusses operator actions considered for this model. WCAP-16657-P suggests seven potential operator actions (OA) for inclusion in a Level 2 PRA model. Each of these actions along with two others were reviewed specifically for Beaver Valley Unit 2. The Level 2 OA to restore feedwater to a dry steam generator was added to the PRA model.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-C2b-01	LE-C2b	B	Y	Only recovery of AC power after UTAF is discussed in the Level 2 notebook. It is concluded that not enough time exists to assign a high success probability. No other recoveries are discussed.	Section 2.5 of the Level 2 LERF Analysis Notebook discusses the use of Level 2 Operator Actions for recovery; specifically recovery of feedwater to a dry steam generator is included in the CET Top Event OL. AC electric power recovery is included in the Level 1 Top Event RE	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-C9a-01	LE-C9a, LE-C9b	B	Y	Level 2 and LERF analysis stopped at containment failure and continued operation of equipment and operator actions were not modeled. Operation of mitigating systems after containment failure is not modeled either. Justify the lack of credit of	A discussion has been added to the Level 2 LERF Analysis PRA Notebook Section 2.4 General Modeling Assumptions and Criteria for Level 2 Analysis to justify the significance of the containment spray system on LERF mitigation following containment	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				equipment survivability.	failure. Details of equipment survivability can also be found in Appendix A.	
LE-C10-01	LE-C10	B	Y	SGTR and containment bypass did not take credit for scrubbing. WCAP-16657 suggests that scrubbing for tube rupture events can be credited by an operator action restart auxiliary feedwater to the ruptured steam generator.	A discussion has been added to the Level 2 LERF Analysis Notebook Section 3.3 "Containment Event Tree," Top Event OL to credit SGTR scrubbing and the basis for the decontamination factor.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-D5-01	LE-D5	B	Y	Beaver Valley Thermal Induced SGTR is based on a 1995 Fauske and Associates report and Westinghouse Calculation CN-RRA-02-38. Recent investigations suggest that these results may be too optimistic. A more reasonable approach may be implementing WCAP 16341, "Simplified LERF Model," and characterizing the uncertainties based on that latest EPRI, PWROG, and NRC interactions.	The PI-SGTR and TI-SGTR methods are included in Appendix F of the Level 2 LERF Analysis Notebook.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
LE-D6-01	LE-D5	B	Y	The CI analysis for BV2REV3b is based on a sub-atmospheric containment. BV2 has been converted to atmospheric so this analysis must be revisited. BV1REV4 does account for the atmospheric containment conversion in the Containment Isolation notebook. The results of a similar assessment for BV-2 need to be incorporated in the LERF notebook.	Following the Beaver Valley Unit 2 Atmospheric Containment Conversion modification, the containment still normally operates at slightly sub-atmospheric conditions. A discussion has been added in the Level 2 LERF Analysis Notebook Section "Condensed Plant Damage State Matrix for Beaver Valley Unit 2" to outline the Beaver Valley Unit 2 containment change from sub-atmospheric to atmospheric and the impact on the Level 2 analysis.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-E4-01	LE-E4	B	Y	The BV2 LERF model is quantified using RISKMAN. Only point-estimates for each top event are used and there are no uncertainty estimates or uncertainty propagation.	The Level 2 phenomena split fraction distributions are included in Table 3-26 of the Level 2 LERF Analysis Notebook. This table contains Beaver Valley Unit 2 plant specific Level 2 phenomena distributions along with the mean, median, 5th%ile, and the 95th%ile. A discussion on how these distributions were developed is provided in Section 3.4 of this notebook.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-F2-01	LE-F2	B	Y	The PRA Peer Review Team suggested in F&O L2-02 using uncertainty analysis for the LERF top events to ensure that future applications are not affected by use of point estimates.	The LERF uncertainty analysis was performed as part of the quantification process using Monte Carlo sampling of the Level 2 split fraction distributions. The result of this analysis is provided in the BVPS-2 Quantification Notebook, Revision 5, Section 1.5.6	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				This F&O was entered into the BVPS Corrective Action Program as CA 02-09043-26 (Reference 16) to track and resolve the issues. The suggested PRA Peer Review Team resolution to this observation was not addressed in the BV2REV3B PRA model update, but will be evaluated sometime later in a future PRA model update. This update has not yet been completed. At the time, it was a "C" level F&O but the PRA standard raises the requirements for PRA quality and this F&O is now a "B" level.	"Results of Containment Performance Analysis."	
LE-G5-01	LE-G5	B	Y	Limitations of the LERF analysis are identified throughout the BV2 Level 2 notebook. However, they need to be gathered into a single location to facilitate future usage.	Section "Limitations of the Level 2 Model" has been added to the Level 2 LERF Analysis Notebook to include limitations of the Level 2 analysis.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
LE-B3-01	LE-B3	C	Y	In Section 2.1 of the LERF Notebook, it is stated that MAAP, STCP, and MELCOR are used to characterize the timing of important events. There is no evidence that STCP and MELCOR are ever used.	Level 2 LERF Analysis Notebook Section 2.1 "Guidelines on Grouping Core Damage Sequences into Plant Damage States Based on Their Accident Progression Attributes" has been updated to include a discussion of the codes used and their applicable analyses.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
LE-D3-02	LE-D3	C	Y	The LERF assessment for ISLOCA is self contained in the Appendix D of the Initiating Event Analysis notebook. There is no reference to the ISLOCA assessment in the LERF notebook. It is not readily apparent from reading the LERF notebook that an ISLOCA assessment was done.	The ISLOCA analysis is reported in the Initiating Event Notebook. The Level 2 LERF Analysis notebook contains a pointer to the ISLOCA analysis in Section 1.2 "Interrelationship with Other Parts of PRA."	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
QU-F4-01	QU-F4, QU-E4, IE-D3	A	Y	The Revision 3B Quantification notebook Section 5 states that the PRA notebooks..."include an estimation of the uncertainty introduced by the data used to quantify the PRA model...This uncertainty estimation does not, however, reflect possible effects on the results from other sources of uncertainty. Such sources may include such things as: optimism or pessimism in definitions of sequence, component, or human action success criteria; limitations in sequence models due to simplifications (for example, not modeling available systems or equipment) made to facilitate quantification; uncertainty in defining human response within the emergency procedures...; degree of completeness in selection of initiating events; assumptions regarding phenomenology or	Documentation of a more rigorous uncertainty analysis for the Beaver Valley Unit 2 Revision 5a PRA model is presented in Section 5 and Appendix B of the Quantification Notebook	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				structures, systems, and components (SSC) behavior under accident conditions... While it is difficult to quantify the effects of such sources of uncertainty, it is important to recognize and evaluate them because there may be specific PRA applications where their effects may have a significant influence on the results. QU-F4 requires that these sources of uncertainty be characterized regardless of the difficulty of the evaluation. By Beaver Valley's own admission (above), it is important to recognize and evaluate them because there may be specific PRA applications where their effects may have a significant influence on the results. Furthermore, the documentation provided in Chapter 5 of the Quantification notebook makes a start at identifying the sources of model uncertainty. PWROG guidance suggests the number of identified sources of uncertainty typically is on the order of 50 items. it is also suggested the BVPS perform a more rigorous search to complete a fairly complete list of sources of uncertainty.		

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
QU-B9-01	QU-B9	B	Y	Component boundary conditions are not well defined. The Data Analysis Notebook, as well as several system notebooks (AFW & SWS) were reviewed and there is no discussion of component boundary (a pump fail to start, for example...does the component boundary include the local circuitry?). There are assumptions made regarding system boundaries, but no discussion of component boundaries. As a result, module definitions can not be determined.	A table of component boundaries was added to section A.4 of the Unit 2 PRA Data Analysis Notebook (PRA-BV2-AL-R05a).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
QU-F4-02	QU-F4, QU-F5	B	Y	A detailed description of the RISKMAN quantification process is provided. However, the Revision 3B Quantification notebook does not discuss limitations in the methodology.	Documentation of the RISKMAN software quantification limitations are presented in Appendix A, Section A.1.1 "RISKMAN Software Limitations" of the Quantification Notebook	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
QU-D5a-01	QU-D5a	B	Y	Significant contributors to CDF have been identified, but there is no identification of SSCs and operator actions that contribute to initiating event frequencies and event mitigation	Documentation of the significant contributors to CDF, including initiating events, accident sequences, basic events (containing common cause failures), components, systems, and operator actions are included in Section 3 "Results" of the Quantification notebook. The System Notebooks also provide information on SSC and operator action (i.e., basic event) contribution to initiating event	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					frequencies and event mitigation, in the cutset listing reports.	
QU-F6-01	QU-F6	B	Y	Beaver Valley does list important operator action basic events; however, there is no documented definition of "significant". The Revision 3B Quantification notebook lists top accident sequences but provides no definition of whether they are "significant" or not. The only discussion is that there is "no single sequence makes up a large fraction of the CDF".	The definition of significant accident sequences in provided in Section 3.1 of the Quantification Notebook. Section 3.1.4 provides the definition of significant systems. The top 10 basic events, components, and operator actions ranked by Birnbaum importance are also considered significant.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				The Revision 3B Quantification notebook states the following definition for important systems: "The system rankings for determining High Importance is based on having an F-V Importance greater than 5.0E-02 or a RAW greater than 10, while the Low Importance is based on having an F V Importance less than 5.0E-03 and a RAW less than 2. Medium Importance systems are comprised of everything else in between these importance measures." This definition agrees with the Regulatory Guide 1.200 definition for "significant contributors." However, there is no documented justification (no reference to a standard definition, such as R.G. 1.200 or the EPRI PRA Applications Guide).		
QU-D5-02	QU-D5b	C	Y	The BVPS-2 system importance rankings are based on component importances; however there is no specific discussion of component or basic event importances (excluding operator actions).	Documentation of the basic event and component importances are provided in Section 3.1.3 "Basic Event and Component Importance Rankings," of the Quantification Notebook. A complete listing CDF importance measures for all basic events and components are provided in the linked files "CDF Basic Event Importance.xls" and "BV2R5L1 CDF Component Importance.xls."	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
SC-A5-01	SC-A5	B	Y	This SR requires that for sequences in which stable plant conditions would not be achieved by 24 hr using the modeled plant equipment and human actions, PERFORM additional evaluation or modeling by using an appropriate technique.	A discussion has been added in the medium LOCA Top Event MU to address containment flooding and supply of make water. Containment flooding is a severe accident mitigating strategy used to flood up to the lower head of the RPV to significantly delay, and possibly prevent vessel failure. The consequences of containment flooding have been addressed in BVPS-2 SAMG CA-5, "Containment Water Level and Volume," to determine when water levels are jeopardizing vital equipment and monitoring capabilities. A review of Figures 1 & 2 and Table 6 of this document revels that no significant core damage mitigating equipment or instrumentation would be impacted, even if 3 RWST volumes are injected. There is an unlimited supply of makeup water via the Ohio River.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				The MU top event for medium LOCA and Small LOCA/General Transient uses RWST makeup as part of the success path when recirculation has failed. While a mission time of 24 hours is assumed, the plant is not at a safe stable state because another action is required for long term success. The RWST refill results in additional water to the containment which eventually will result in the design basis flooding level being exceeded and the potential for subsequent loss of instrumentation and control. The impact of continued RWST makeup and injection into containment needs to be discussed in relation to the achievement of a safe stable state where no additional operator actions are required. A similar situation exists for SGTR and ISLOCA where RWST refill is being used to maintain core cooling, but the justification for mission time of only 24 hours is not apparent given that the plant is not in a safe stable state by traditional definitions.	Furthermore, if a significant volume of service water is added to the Spent Fuel Pool, makeup procedure 2OM-7.4.O recommends the addition of boric acid to the Spent Fuel Pool to maintain adequate shutdown margin. Therefore, at BVPS actions to add makeup to the RWST and use the HHSI pumps in SI injection mode for continued RCS makeup are determined to result in a safe stable plant condition. This would be true for all accidents identified in the F&O (i.e., medium LOCA, small LOCA, General Transient, SGTR, and ISLOCA).	

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
SC-C2-01	SC-C2	B	Y	No discussion of the limitations of the MAAP code for Success Criteria are provided in the Success Criteria Notebook. Two known limitations are the use of MAAP for early phase large LOCAs and the use of MAAP for SG dryout assessments without benchmarking to design basis codes (e.g., bleed and feed initiation). It was observed in the Success Criteria Notebook that MAAP runs were made to justify only 1 accumulator (but that 2 of 2 intact accumulators appear to have been actually used as stated to be used in Section 3.1 of the Notebook). It is recommended that a discussion of MAAP limitations (similar to that provided in the EPRI assessment for MAAP 3) be documented or referenced in the Success Criteria Notebook.	Section "MAAP-DBA Limitations" has been added to the Success Criteria Analysis Notebook to identify the limitations of the MAAP-DBA code.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SC-A5-02	SC-A5	C	Y	The success criteria for top event WM for the SGTR states that 400 gpm makeup to the RWST is sufficient to maintain HHSI for RCS inventory control at full RCS pressure despite leakage through a ruptured SG tube.	A discussion has been added to the Success Criteria Analysis Notebook in Section 3.5 "Steam Generator Tube Rupture" Top Event WM to address RWST makeup.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				The maximum RCS inventory loss through a single SGTR is on the order of 600 gpm if the primary side is at normal operating pressure and the secondary side of the SG is not depressurized. This is in excess of the 400 gpm makeup and therefore appears to invalidate the success criteria as stated. Also, if continued HHSI at full system pressure is required, SG overfill is likely to occur and the SG will be depressurized and the leakage through the ruptured tube will even be higher.		
SC-B1-01	SC-B1	C	Y	Reviewer Note R7 for TH states that MAAP limitations were observed and MAAP was not used for Large LOCA early success criteria such as accumulators. It was observed in the Success Criteria Notebook that MAAP runs were made to justify only 1 accumulator but that 2 of 2 intact accumulators was stated to be used in Section 3.1 of the Notebook. This may be confusing for future use because no discussion of MAAP limitations is presented in the Appendix containing the MAAP analyses (e.g., at page C-8 of the U2 Success Criteria Notebook).	Section "MAAP-DBA Limitations" has been added to the Success Criteria Analysis Notebook to identify the limitations of the MAAP-DBA code.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
SC-B5-01	SC-B5	C	Y	The ASME PRA requirement for SC-B5 includes the possibility of comparison to check the reasonableness of the success criteria. It is recommended that such as effort be undertaken, possibly as a PWROG or EPRI effort.	Attachment D has been added to the Success Criteria Notebook to compare the Beaver Valley Unit 2 results with North Anna Unit 1. Furthermore, the Beaver Valley PRA model success criteria developed using MAAP were compared with the NUREG-1953 Surry success criteria (a similar plant), which used the MELCOR computer code and were found to be in good agreement.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SC-C1-02	SC-C1, SY-C1	C	Y	The ASME PRA Standard for SC-C1 requires that Success Criteria be documented in a manner that facilitates applications, upgrades, and peer reviews. The current state of the BVPS PRA Success Criteria is that the accident sequence success criteria are gathered in the Success Criteria Notebook, but other success criteria are scattered about though the PRA. Examples include the SW success criteria and ISLOCA success criteria for U1. It is recommended that FENOC consider gathering all success criteria in the Success Criteria Notebook to facilitate future usage.	Section "System Success Criteria" has been added to the Success Criteria Analysis Notebook to show where the system specific success criteria are contained in each system notebook. This was believed to be the best place to locate support system success criteria.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
SC-B1-02	SC-B1	S	Y	CCIII of the standard requires that plant specific analyses be used to determine success criteria with plant specific analyses. The large number of MAAP analyses for success criteria meet this requirement and the BVPS U1 and U2 PRAs are considered to be exemplary in this respect.	No response required for F&O SC-B1-02.	No impact to Fire PRA, because this was identified as a strength of the model.
SY-A14-01	SY-A14, SY-A12, SY-C1	B	Y	The DRAFT Revision 4 System notebooks (AFW, SWS, CCS, CCP, MFW were reviewed) discuss failure modes and contributors to system unavailability and unreliability that are excluded from the systems analysis. However, the SY-A14 criteria does not appear to have been applied consistently throughout the analysis. The only exceptions found where the SY-A14 criteria are explicitly met is in the CCS notebook, Section 14, c, Assumption #2, and the AFW notebook Section 14, c, Assumption #3. In some instances, such as the CCP notebook Section 14, c, Assumption #1, there was no explanation given for why the contributor was not modeled.	Instances of excluded failure modes and contributors to unavailability for the applicable systems were reviewed and compiled into a single location in their respective System Notebooks. When warranted, justification for the excluded failure mode or unavailability contributor was made more thorough. This information is located in the Excluded Failure Modes and Unavailability Contributors section of the notebooks.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
SY-C1-01	SY-C1	B	Y	In providing the response to peer review F&O DA-09, which deals with providing documentation of the CCF groupings, Beaver Valley noted that the Systems Analysis Overview and Guidance notebook provides the process used to identify CCF groupings. The response further suggests details of the common cause groups that were retained in the PRA system models and presented in Appendix C of the BVPS Unit 2 PRA System Notebooks, under the common cause sections of the RISKMAN System Notebook files are adequately documented and can be found by knowledgeable personnel. The reviewer agrees that one can review Appendix C of the Systems notebooks and see what the CCF groupings are and how the CCF probabilities were generated. The reviewer also agrees that high level guidance is provided in the Systems Analysis Overview and Guidance notebook. However, it appears a link between the two documents is missing.	The Common Cause section of the System Notebooks now references the Common Cause Modeling section, Table A-1, and Table 1 of the Systems Analysis Overview and Guidance Notebook to thoroughly document the methodology and grouping of the common cause modeled in the PRA.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				For example, the guidance states "When identical, nondiverse, and active components are used to provide redundancy, they should be considered for assignment to common cause groups, one group for each identical redundant component". When the Systems notebook Appendix C is reviewed, the components contained in the CCF group is clearly identified, but there is no documentation that states that those components are "identical, and/or non-diverse" or used to provide redundancy. Further examination of other sections System notebooks (such as Section 3 "System Success Criteria", or Section 6 "Operating Features" would lead a reviewer to find this type of information. But this documentation is not always intuitively obvious and makes peer review difficult at times.		
SY-A11-01	SY-A11	C	Y	The system notebooks do not specifically discuss the dependencies that may be present regarding HVAC / room cooling. However, review of the HVAC notebook identified the various spatial locations that may require HVAC and indicated the various	An additional response has been added to the evaluations of the areas that are represented by the actual top event equipment whether the HVAC dependency is required or not and is located in Support Systems section in the system notebooks.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				analyses that have been completed to either require HVAC dependencies or not.		
SY-B1-01	SY-B1	C	Y	At the time of the BVPS Unit 2 common cause MGL data update during Revision 3, the NRC update to NUREG/CR-5497 was still not available. As such, a decision was made during the update process to keep the existing generic MGL data, which is almost exclusively based on the PLG generic database dated circa 1989. There is no documentation to illustrate that the Beaver Valley considered NUREG/CR-5497 during the Revision 4 PRA update.	Up-to-date generic MGL CCF data has been updated in PRA-BV2-AL-R05 using WCAP-16672-P (Section 3.6 and Table C-5 in the Data Analysis Notebook). In June 2008, Westinghouse issued WCAP-16672-P which covers 1980 – 2003 in order to provide guidance to address the concerns that were raised regarding the consistency and correctness of the CCF events included in the NRC CCF database. The WCAP data source contains CCF parameter estimates for the majority of risk-significant components whose performance are potentially applicable to PWROG utilities only in the U.S. designed by either Westinghouse or Combustion Engineering. The parameter estimates for failure modes of significant components that are generally included in the PRA are provided for the Alpha factors that are converted to the Multiple Greek Letter approach (MGL) by the method in NUREG/CR-	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					5485 and to allow for quantifying CCF probabilities.	
SY-B7-01	SY-B7	C	Y	The Service cooling water system notebook assumption #7 lists 10 minutes to trip the RCPs on loss of cooling. However, in the Miscellaneous system notebook, top event OC has 5 minutes to trip the RCPs. Note, this time might be important in quantifying HEP for RCP trip.	The Miscellaneous Top Events Notebook, Top Event OC models the operator actions to trip the RCPs during situations that exist for greater than 5 minutes, in which either CCP is lost to the RCPs, or both RCP seal injection and thermal barrier cooling are lost. Both of these conditions would be covered in the abnormal operating procedure 2OM-53C.4.2.6.8 "Abnormal RCP Operation", and RCP parameters would be monitored to identify situations that warrant an immediate RCP shutdown. If either of these conditions exist for greater than 5 minutes, the human reliability analysis for operator actions OPROC1 (loss of CCW) and OPROC2 (Loss of RCP seal Cooling) assume that the operators would trip the RCPs at 5 minutes, and that the RCPs seals would be damaged in 13 minutes if	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					they were not tripped, leading to a 480 gpm per RCP seal LOCA. These timing assumptions and consequences are based on BVPS AOPs and WCAP-16141.	
SY-B13-01	SY-B13	C	Y	There does not appear to be a detailed room heatup analysis to support the evaluation for Area 7 in the Revision 3B HVAC notebook. There are several qualitative arguments in addition to crediting manual actions for SBO.	This F&O only applies to BVPS Unit 2. A detailed BVPS Unit 1 room heatup analysis of the main steam valve room following an SBO (8700-DMC-2312, Revision 0, Addendum 2), which determined that the steady-state ambient air temperature is expected to be 133°F (with roof louvers open). It was judged that the Unit 2 main steam valve room would have a similar steady state ambient air temperature, so a detailed room heatup analysis was not warranted since this temperature is well below the equipment qualification temperature of 348°F for the area. Additionally, cooling vests are available for operators to wear while performing any actions located in the main steam valve room. A subsequent search of Unit 2 calculations, revealed that a room heatup analysis of the Unit 2 main steam valve room following an SBO was performed (10080-DMC-56,	No impact to Fire PRA, because this issue was determined to have no effect on the BVPS PRA model.

Table 2-2. Summary of BVPS-2 RG 1.200 Gap Analysis – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					Revision 0, Addendum 1), which determined that the steady-state ambient air temperature is expected to be <120°F (with roof louvers open).	
SY-C1-02	SY-C1	C	Y	The Beaver Valley Unit 2 system notebooks have no indication of system engineering reviews. These reviews help ensure that systems are model in accordance with day-to-day plant operations and additionally expand the PSA knowledge of the system engineers.	System Engineers reviewed the system notebooks for PRA-BV2-AL-R05, in which they had to present comments and provide input for the top event system review. System Engineering comments have been incorporated into BVPS-2 PRA corresponding system notebooks. A table that contains the comments is located in Appendix B in the System Analysis Overview for BVPS-2.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
SY-B5-01	SY-B5, SY-B6, SY-B10, SY-B11	D	Y	The system notebooks do not specifically discuss the dependencies that may be present regarding HVAC / room cooling. However, review of the HVAC notebook identified the various spatial locations that may require HVAC and indicated the various analyses that have been completed to either require HVAC dependencies or not.	An additional response has been added to the evaluations of the areas that are represented by the actual top event equipment whether the HVAC dependency is required or not and is located in Support Systems section in the system notebooks. Since this F&O is essentially the same as F&O SY-A11-01, it was also resolved by it	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-3. Summary of BVPS-2 HRA Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
HR-PR-001	HR-D5, HR-G7, HR-H3, HR-I1, HR-I2(d)3	Finding	Y	BVPS does not have a written process for evaluating dependencies between multiple HEPs occurring in a single accident and does not provide a summary of HEPs that were explicitly evaluated for dependencies and the associated levels of dependencies and joint HEPS. The BVPS HRA notebooks do not have a single summary table of the preinitiator human actions and the documentation of the evaluation of pre-initiator human actions in the system notebooks, which make it difficult to identify which actions were actually evaluated.	Section 2.2 of the HRA Notebook documents the methodology and evaluation of the pre-initiator HEPs. A summary of the EPRI HRA Calculator results can be found in Table 3.5 which supplements the detailed calculations documented in Appendix E. Section 2.3 of the HRA notebook has been created to provide a summary of HEPs that were explicitly evaluated for dependencies and to document that PRA Analysis No. PRA-BV2-12-002-R00, "BVPS-2 HRA Dependency Analysis," Revision 0 provides the process used for the dependency analysis evaluation (See F&O HR-I2-01 in Section 6).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-PR-002	HR-G6, HR-I2	Finding	Y	BVPS does not appear to have evaluated their HEPs for internal consistency consistent with the requirements of HR-G6 and does not have a documented process to do so.	An internal consistency check for pre-initiator HEPs is documented in Section 3.4 of the Unit 2 HRA notebook (PRA-BV2-AL-R05a). The original post-initiator HRA was developed using the SLIM/FLIM process, and as such were grouped with respect to similar performance shaping factors and weights (e.g.,	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-3. Summary of BVPS-2 HRA Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
					actions where time and preceding actions are most important were grouped together) to have internal consistency during the HEP development. As a final check of overall consistency, the HEPs from each group were then compared with those of other groups to determine if the differences in the HEPs were warranted by the differences in the scenarios and PSF ratings. The BV2REV4 PRA model revised the HRA methodology from the SLIM/FLIM process to the EPRI HRA Calculator. The HRA Calculator is a software program that is designed to implement consistency within the field of human action analysis by creating a standard methodology for quantification and documentation of HEPs in the context of the PRA. After this conversion was complete, the resulting HEP values were then compared to the previous BV2REV3B SLIM/FLIM HRA model (see Table 3-4 of the HRA Notebook, Revision 1 drafted for BV2REV4), to verify consistency in overall trends between events. Since these BV2REV3B PRA Model SLIM/FLIM HEPs were compared to	

Table 2-3. Summary of BVPS-2 HRA Focused Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
					the BV2REV4 PRA Model HRA Calculator HEPs to check their reasonableness, there is a de facto consistency check in the HEPs.	
HR-PR-003	HR-D2, HR-D3, HR-D4, HR-I1, HR-I2	Finding	Y	The method for quantifying pre-initiator misalignment errors as described on page 8 of the "Beaver Valley Power Station Unit 2 PRA Notebook – Human Reliability Analysis," Revision 2, dated 10/01/07, relies on the use of a generic Error of Omission rate that does not reflect any detailed assessment of the HEPs. The process also does not consider the quality of plant-specific written procedures, administrative controls or the man-machine interface and does not include an explicit assessment of the potential for recovery that specifically delineates which procedures and processes influence the potential for identification and recovery. Furthermore, the method for quantifying post-maintenance miscalibrations relies on a single generic error of omission rate.	Pre-initiators are now quantified using the THERP methodology as presented in the EPRI HRA Calculator. This is documented in Sections 2.2 & 3.4 and Table 3-5 of the HRA Notebook. The pre-initiator human error probabilities were determined using BVPS operator input and BVPS specific procedures and processes. The process now considers the plant specific written procedures, administration controls, and man-machine interface. A list of the pre-initiator HFEs and their probabilities was added to Section 3 in Table 3 5.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-3. Summary of BVPS-2 HRA Focused Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				A complication in reviewing the pre-initiator Human Failure Events (HFEs) was that the HRA notebook does not include a list of the pre-initiator HFEs or their probabilities. The system notebooks provide evidence of the search for and identification of misalignments but they do not present a list of such events or their probabilities.		
HR-PR-004	HR-C2	Finding	Y	Post-maintenance misalignments were excluded for normally operating system based on the assumption that misalignments on normally operating systems would be quickly detected and corrected. Post-maintenance unavailabilities were included for standby systems as appropriate. However, nowhere in the HRA notebook or the system notebooks that were reviewed was there any indication that BVPS had performed a review of their operating/maintenance data to look for post-maintenance misalignments.	Section 2.2 and Appendix C of the HRA Notebook document the review of BVPS procedures (OSTs, BVTs, and MSPs) to identify potential misalignments. Section 2.2 and Appendix D of the HRA Notebook documents the review of historical event data for misalignment identification. A search of the BVPS 1&2 Corrective Action Program (CAP) was performed to identify pre-initiators that have occurred at BVPS. A review was also performed with the BVPS operator	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-PR-005	HR-I3	Finding	Y	The BVPS HRA is documented in the "Beaver Valley Power Station Unit 2 PRA Notebook – Human Reliability Analysis", Revision 2, dated 10/01/07. This notebook does not have an explicit assumptions section to identify and characterize assumptions. A review of this	Section 7of the Unit 2 HRA notebook (PRA-BV2-AL-R05a) was added to document HRA assumptions.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-3. Summary of BVPS-2 HRA Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				notebook revealed assumptions scattered throughout the text.		
HR-PR-006	HR-F2	Finding	Y	In reviewing the set of post-initiator HFEs in Table 3-1, It was noted that for the HFE ZHEMA2, the specified time window, 13.26 hours, was not consistent with the information provided in the "Success Criteria/ Basis of Timing" for that HFE. A review of the referenced MAAP case indicates that the 13.26 hours is the appropriate timing. Furthermore, continued review of table 3-1 indicated that this seemed to be an isolated event.	The "Success Criteria/ Basis of Timing" for ZHEMA2 was revised to reflect the proper timing basis. The present BV2REV5A value for HFE ZHEMA2 is 795.6 minutes = 13.26 hours (based on MAAP-DBA Run U2_SBO2) which is consistently stated in both Table 3-1 and Appendix B of this notebook	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
HR-PR-007	HR-B1	Finding	Y	In general, BVPS excludes virtually all miscalibration events based on the assumption that events related to instrument miscalibrations are captured in the equipment failure rate data and the On-line Maintenance program precludes common-cause miscalibration by scheduling work on opposite trains in different weeks. Post-maintenance misalignments were excluded for normally operating system based on the assumption that	ASME/CNRM Inquiry 09-56 states that miscalibrations are included in the Common Cause Failure (CCF) events for the NRC CCF Database. Since BVPS includes miscalibrations in the CCF events, it would be double counting to also include them as pre-initiators. As a result, it is believed that BVPS's current treatment of miscalibrations as part of the CCF events and not pre-initiators meets Capability Category	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-3. Summary of BVPS-2 HRA Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				misalignments on normally operating systems would be quickly detected and corrected. While these rules seem reasonable, they are applied to classes of maintenance and test activities to screen them from further consideration. This is sufficient for Capability Category I but not for Capability Category II.	II (instead of Capability Category I). An exception to this is the SSPS model, which did include instrument string miscalibration errors in the fault tree model. A search of the Corrective Action database in April 2010 did not reveal any such miscalibration errors between trains at Beaver Valley Unit 2 to date.	

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
IFPP-B1-01	IFPP-B1, IFSO-B1, IFSN-B1, IFEV-B1, IFQU-B1	Finding	Y	The documentation generally does not facilitate peer review. The technical aspects of the analysis are documented in a manner that cannot be readily understood by individuals outside the staff. The ordering of the documentation is significantly different from the standard; a detailed graphical roadmap of the analysis process would enable peer reviewers to relate the order of the documentation to the standard.	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 17, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 2 of the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) was revised in order to facilitate the Peer Review process. Figure 2-1 provides an overview of the ASME/ANS PRA Standard requirements and their relationships to the analysis and information contained in the various sections/appendices/tables of the report. This documentation mapping is consistent with that presented in the EPRI Final Report 1019194, Guidelines for Performance of Internal Flooding Probabilistic Risk Assessment.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
IFPP-B2-01	IFPP-B2	Finding	Y	The process described the identification of site buildings and flood areas, but the documentation does not clearly establish the basis for the set of buildings considered in the analysis. The references to source material are not sufficiently specific to allow replication of the process. The documentation will be easier to follow if the basis for the selection of buildings	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 6, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, the intent of Table 3-1 was clarified prior to Section 3.1 (Identify Flood Areas) in the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) to plainly indicate the table represents a complete list of plant buildings/structures based on referenced materials and that it includes the preliminary building screening.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions

F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
				considered in the analysis is enhanced. There is reference to review of plant documentation including the fire analysis, but no statement that the list of buildings in Table 3-1 is the complete list of buildings.		
IFPP-B3-01	IFPP-B3	Finding	Y	The process used to determine the plant partitioning requires some level of assumptions concerning how the plant partitions are established. The current plant partitioning has no discussion of the uncertainties and assumptions associated with the plant design features used to create flood areas.	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 7, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, plant partitioning assumptions were documented in Section 3.5 of the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a).	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IFSO-A4-01	IFSO-A4	Finding	Y	The potential flooding effects is not listed within any of the tables documenting the potential flooding sources. The ASME/ANS standard requires the inclusion of the potential flooding mechanisms when describing the flood sources used in the model.	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 3, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 4.1 (Flood Source Failure Mechanisms and Failure Modes Summary) was added to the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) to specifically address: a) a discussion of failure modes and mechanisms associated with each flood source with direct reference to latter documentation sections for further discussion, and b) the EPRI methodology which embeds failures of all piping system components as part of the piping segment failures averaged on a per linear foot basis. Furthermore, Section 4.2 was added to address any flood source identification assumptions with direct reference to latter documentation sections for further discussion.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
IFSO-A5-01	IFSO-A5	Finding	Y	This supporting requirement identifies information used to characterize the flooding sources. Most of the information is provided in Sections 4 and 7 of the internal flooding PRA reports. The information identified by this SR was not provided in its entirety. For	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 5, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, all normal operating flooding sources documented in the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) (Table 4-1. Water Sources) have updated system flow information	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				example, system temperatures are not captured in the documentation and some systems (primarily oil) pump HP and RPM are captured but not the flow rates.	(including normal operating temperatures) based on available information provided in the references noted in the table.	
IFSO-B3-01	IFSO-B3	Finding	Y	No clear documentation was provided of related assumptions for the identification of flood sources. The sources of model uncertainty are documented in Section 12 of the internal flooding PRA reports, 2294706-R-001, Rev. 0 and 2294706-R-002, Rev. 0, but it could not be determined how these sources of model uncertainty were connected to the various assumptions.	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 4, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, section 12.4.5 of the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) contains a review of the impact of all assumptions mapped to uncertainty along with sensitivity analysis that was evaluated. Table 12-7 contains a cross reference of all the assumptions in the development of the BVPS-2 internal flooding notebook related to the frequency uncertainties in Table 12-2.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	Supporting. Requirement	Significance Level	Status Closed Y/N	Fact & Observation	BVPS-2 Final Resolution	Impact to Fire PRA
IFSN-A1-01	IFSN-A1	Finding	Y	The description of the propagation paths is not complete. Table E-1 identifies the "source" location and the next locations to which it water can propagate. To determine the complete propagation path, these source/next pairs can be combined until the water reaches the accumulation point (no "next" location). However, the scenario descriptions in Table E-2 do not consistently account for the propagation paths identified in Table E-1. For example, scenario PA3C FWLP-3 propagates to several locations per Table E-2 (PA-3C, PA-3, PA-3I, PA-3H) but Table E-1 indicates that PA-3 can propagate to PA-S2, PA-S6, PA-3G, PA-3A, PA-3B, PA-3C, PA-3H, PA-3I; several of these are not accounted for in the propagate path in Table E-2. If the missing locations are not possible due to plant features, that should be stated to	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 14, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 7.3 of the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) was augmented to clearly explain with an example the differences in Table E-1 and E-2 due to subsuming of flood propagation paths, and a separate column was added to Table E-2 to indicate all of the flood propagation pathways that were subsumed for each documented flooding scenario so that it will be clear that all pathways have been accounted.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				complete the accounting. Other examples of this deficiency were observed (PA4-FWLP-1, PT1-FWLP-1 from Unit 2, and PA1A-FWLP-1, FA1A-FWMP-1 from Unit 1). The propagation paths must account for the various possible flow paths. Combination presented in the documentation that are not considered brings into question the completeness of the analysis.		
IFSN-B2-01	IFSN-B2, IFSN-A5,	Finding	Y	The process to identify scenarios lacks several of	This F&O was entered into the BVPS Notification System as BV2 Notification	No impact to Fire PRA, because this issue was

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
	IFSN-A6			the suggested areas that should be included (recognizing that the SR list is NOT a required set). The propagation pathways description is not complete in that it does not include all potential propagation paths identified in Table E-1 of the PRA reports. The impacted (failed) SSCs for each scenario are not clearly referenced (identified as needing to be "addressed" in a REMARKS column in Table E-2). Assumptions used in the scenario discussions are incomplete. Scenario screening is not clearly documented. The documentation has many weaknesses in capturing the suggested types of information to adequately document this topic.	#600689091, Task 15, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, a graphical depiction of the overall flood scenario development was provided as Figure 7-1 in Section 7 of the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a).	addressed in the base PRA model prior to building the Fire PRA.

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IFSN-B3-01	IFSN-B3, IFSN-A4	Finding	Y	The use of the Excel VBA code to predict flow rates and failures of equipment has provided a great deal of realistic insight to plant flood response. Section 9.0 of the internal flooding PRA reports does not explicitly discuss all assumptions regarding the use of equations to predict flood heights, and the scenarios modeled in Appendix H of the PRA reports have some assumptions applied to each analysis.	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 8, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 9.5 (Summary of Assumptions) of the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) was expanded to include Microsoft EXCEL VBA program specific assumptions and documentation pointers to flooding scenario specific assumptions.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
IFEV-A7-01	IFEV-A7	Suggestion	Y	Maintenance and human-induced errors causing a flooding event can be important to the overall plant risk. A more detailed analysis of those activities within the plant that could lead to a system breach potential should be analyzed. Maintenance activities which could potentially breach pressurized systems could lead to internal flooding events. By not evaluating all potential online maintenance activities for	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 9, to track and resolve the issues. As a resolution to this IFPRA Peer Review suggestion, an Operating Manual (OM) procedure review of at-power open maintenance was produced as Table 7-4 in the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) that evaluates systems 15, 26, 28, 29, 30, 31, and 33 for potential actions on equipment that could cause human-induced flooding scenarios. Some of the systems (i.e., 26 and 29) are indirectly reviewed based on other systems. The OM procedures for the condenser waterbox, CCR heat	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				the potential breaches, the flood-induced risk associated with these activities could be underestimated.	exchangers, and CCT heat exchangers are based on a frequency that is based on SAP work order record queries. The screening categories for the open maintenance and human-induced review are shown in Table 7-5.	
IFEV-B2-01	IFEV-B2	Suggestion	Y	Documentation of the process that identifies applicable flood-induced initiating events is required to satisfy this SR. The flood scenario frequencies are provided in Tables 8-10, F-1, and J-1 of the internal flooding analysis reports (2294706-R-001, Rev. 0 and 2294706-R-002, Rev. 0). The associated HEPs for isolating the flood and adjustment factors used to refine the flood frequencies are also provided in Table F-1. A qualitative screening value of 1.0E-12 was used. The process does not clearly identify the relationship of the information provided in the various tables.	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 18, to track and resolve the issues. As a resolution to this IFPRA Peer Review suggestion, and as part of an expanded analysis to address probabilistic pipe failure during the 24-hour mission time after an initiator and for system-based initiators, Section 8.1.3 and Tables 8-11 and 8-12 of the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) illustrate the scope of flooding elements (pipe, expansion joints) contained within the existing internal events model.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IFEV-B3-01	IFEV-B3	Finding	Y	The different values that go into the calculation of the internal flooding initiating event frequency are subject to uncertainties. These uncertainties need to be well documented to address all of the model impacts. The current flooding frequency calculations use factors to determine the actual initiating event frequency used within the model. The pipe lengths, location factors, directional factors, and operator action failures all have some levels of assumptions and uncertainties associated with them. These need to be addressed in order to meet the SR.	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 10, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 12.4.5 of the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) contains a summary of the review of the impact of all assumptions mapped to uncertainty along with sensitivity analysis that was evaluated. Table 12-7 contains a cross reference of all the assumptions in the development of the BVPS-2 internal flooding notebook related to the frequency uncertainties in Table 12-2.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
IFQU-A5-01	IFQU-A5	Finding	Y	It appears that no inter-HEP dependency analysis (between flood and non-flood HEPs) was performed. Dependency between HEPs can significantly increase the probabilities of combinations of HEPs. However, Section 10.4 of the internal flooding PRA	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 16, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, Section 10.4.6 (Dependencies between Human Interactions) of the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) was revised to state that an HRA dependency analysis was performed	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				reports states "Dependencies between the flood mitigation human actions and the non-flood human actions modeled in the remaining part of the PRA model were judged to be minimal due to the significant difference in the nature of the actions (e.g., flood mitigation actions require field investigation by the auxiliary operators, etc.) and separation in time, etc., and as such no additional dependency treatment was considered needed." An evaluation of the HEP combinations should be documented to demonstrate this conclusion.	(documented in Reference 13.4) and that a discussion on the "HFE Dependencies in Internal Flooding PRA Accident Sequences" is provided in the Human Reliability Analysis PRA Notebook, Section 2.3. Section 10.4.6 was also expanded to reiterate Section 10.4.3 (Screening and Detailed Analysis) discussion on the multiplier factor applied to HEPs included in the Internal Events PRA based on such factors as the location of the action, the timing of the action, and stress, etc., and to include a discussion of the Riskman modeling analysis approach which human actions included are evaluated conditionally based on the success or failure status of the preceding human action(s). As such, dependencies among the human failure events in the Internal Events model (i.e., non-flood human actions) were fully accounted.	
IFQU-A7-01	IFQU-A7	Finding	Y	Performance of the internal flood events quantification should be consistent with the quantification of the internal events PRA. The quantification of the internal flooding requires that applicable requirements	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 12, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, analysis and discussion has been provided for performance of quantification with the applicable	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
				from the Internal Events Quantification section be met. The current section on Internal Flooding does not include a discussion of the topics addressed in Section 2-2.7 of the ASME/ANS Combined PRA Standard.	requirements. QU-B3 requirements have been documented in Section 12.4.4 of the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a), Truncation Evaluation. The QU-B7 requirements have been documented in Section 12.5.3, Mutually Exclusive Events. QU-C1 & QU-C2 requirements have been documented in Section 12.5.4, HFE Dependency (see References 13.4 and 13.5). QU-D1 & QU-D2 requirements have been documented in Section 12.5.5 Significant CDF Sequences and Accident Category (for CDF) and Section 12.5.8 Significant LERF Sequences and Accident Category (for LERF). QU-D4 requirements have been documented in Section 12.5.2 Internal Flooding Comparison Between Plants and Table 12-5. QU-D6 requirements have been documented in Sections 12.5.5 - 12.5.7, and 12.3 for significant contributions to CDF. QU-D7 requirements have been documented in Section 12.5.6 for system importance that is based on importance for components and basic events.	

Table 2-4. Summary of BVPS-2 Internal Flooding Focused Peer Review – Facts and Observations Resolutions						
F&O ID	**Supporting. Requirement**	**Significance Level**	**Status Closed Y/N**	**Fact & Observation**	**BVPS-2 Final Resolution**	**Impact to Fire PRA**
IFQU-A10-01	IFQU-A10	Suggestion	Y	Internal flooding contribution to LERF should be documented in some way so that the apparent impacts on LERF from the flooding events could be reviewed. The discussion concerning the impacts on LERF for internal flooding events could be improved to discuss flooding impact on the different features used to mitigate releases.	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 11, to track and resolve the issues. As a resolution to this IFPRA Peer Review suggestion, Section 12.5.8 of the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) contains a review of internal flooding LERF sequences and accident categories which describes impacts that are evaluated in internal flooding LERF analysis.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.
IFQU-B2-01	IFQU-B2, IFQU-B1	Finding	Y	The process used for quantification documents the calculation, screening, scenarios deleted and walkdowns. However, there is not enough documentation of the quantification process specifically concerning the PRA Standard requirements listed in HLR-QU-D. The SR requires that documentation must be consistent with the requirements described in HLR-QU-D. These requirements are not discussed at any point in the internal flooding PRA reports.	This F&O was entered into the BVPS Notification System as BV2 Notification #600689091, Task 13, to track and resolve the issues. As a resolution to this IFPRA Peer Review finding, the supporting requirements listed in HLR-QU-D have been completed in the Internal Flooding Analysis Notebook (PRA-BV2-AL-R05a) Section 12.5 Results and Insights.	No impact to Fire PRA, because this issue was addressed in the base PRA model prior to building the Fire PRA.