Jon A. Franke
Site Vice President

PPL Susquehanna, LLC
769 Salem Boulevard
Berwick, PA 18603
Tel. 570.542.2904 Fax 570.542.1504
jfranke@pplweb.com

OCT 29 2014

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

**SUSQUEHANNA STEAM ELECTRIC STATION
REQUEST TO CONTINUE USE OF A RISK-INFORMED
INSERVICE INSPECTION ALTERNATIVE IN A PROPOSED
RELIEF REQUEST NO. 4RR-01 TO THE
FOURTH 10-YEAR INSERVICE INSPECTION
PROGRAM FOR SUSQUEHANNA UNITS 1 AND 2
PLA-7193**

**Docket No. 50-387
and No. 50-388**

Reference: 1. NRC Safety Evaluation (SE), "Third 10-Year Inservice Inspection (ISI) Interval Program Plan (TAC Nos. MC1181 and MC1182)," dated July 28, 2005 (Accession No. ML051990330)

2. PPL Letter PLA-7178, "Inservice Inspection Program Plan for the Fourth Ten-Year Interval," dated June 2, 2014

Pursuant to 10 CFR 50.55a(a)(3)(i), PPL Susquehanna, LLC (PPL) hereby requests NRC approval of the enclosed relief request associated with the Fourth Ten-Year Inservice Inspection (ISI) Interval for the Susquehanna Steam Electric Station (SSES), Units 1 and 2. Relief Request (RR) 4RR-01 will continue the use of the Risk-Informed Inservice Inspection (RI-ISI) program as an alternative to the American Society of Mechanical Engineers (ASME) Section XI, ISI Program for Class 1 and 2 (Examination Categories B-F, B-J, C-F-1, and C-F-2) piping welds. The Fourth Ten-Year ISI Interval inspection program uses the ASME Section XI, 2007 Edition through the 2008 Addenda for the examination of these components (Reference 2).

PPL is proposing the use of ASME Code Case N-578-1 for the Risk-Informed evaluation and inspection of Class 1 and 2 components at SSES. Use of Code Case N-578-1 has been approved by the NRC, which was in part the basis for the approved RI-ISI program for ASME Class 1 and 2 components for the Third Ten-Year Inspection Interval (Reference 1). SSES requests NRC's approval prior to the next scheduled refueling outage for Unit 2, in the spring of 2015.

There are no new regulatory commitments contained in this submittal.

If you have any questions or require additional information, please contact Mr. Duane L. Filchner (570) 542-6501.

Sincerely,

Jeffrey M Helsel for J.A. FRANKE

J. A. Franke

Attachments: 1. 10 CFR 50.55a Request 4RR-01
2. PRA Technical Adequacy Assessment

Copy: NRC Region I
Mr. J. Greives, NRC Sr. Resident Inspector
Mr. J. Whited, NRC Project Manager
Mr. L. Winker, PA DEP/BRP

Attachment 1 to PLA-7193

10 CFR 50.55a Request
4RR-01

Susquehanna Steam Electric Station, Units 1 and 2
Facility Operating License NPF-14 and NPF-22
NRC Docket Nos. 50-387 and 388

10 CFR 50.55a Request
4RR-01

Proposed Alternative In Accordance with 10 CFR 50.55a(a)(3)(i)
Alternative Provides Acceptable Level of Quality and Safety

1. ASME Code Component(s) Affected

System: Various ASME Code Class 1 and 2 Systems

Code Class: ASME Code Class 1 and 2

Component Description: ASME Code Class 1 and 2 Piping Welds

Components Affected:

Weld Numbers	Description	Code Category	Code Item Number
Various	ASME Code Class 1 Piping Welds	B-F	B5.10, B5.140
Various	ASME Code Class 1 Piping Welds	B-J	B9.11, B9.21, B9.31, B9.32, B9.40
Various	ASME Code Class 2 Piping Welds	C-F-1	C5.11
Various	ASME Code Class 2 Piping Welds	C-F-2	C5.51, C5.81

2. Applicable Code Edition and Addenda

The applicable ASME Code, Section XI, for the Fourth Ten-Year Interval of the Inservice Inspection (ISI) Program is the 2007 Edition through the 2008 Addenda.

3. Applicable Code Requirement

The following Code requirements are paraphrased from the 2007 Edition through the 2008 Addenda of ASME Section XI:

ASME Section XI 2007 Edition through the 2008 Addenda Edition, IWB-2411, requires examinations in each examination category shall be completed during each inspection interval. ASME Section XI 2007 Edition through the 2008 Addenda, IWB-2500 Examination and Pressure Test Requirements *(a)* Components shall be examined and tested as specified in Table IWB-2500-1. The method of examination for the components and parts of the pressure retaining boundaries shall comply with those tabulated in Table IWB-2500-1 except where alternate examination methods are used that meet the requirements of IWA-2240. Applicable category welds in table IWB-2500-1 are B-F

(Pressure Retaining Dissimilar Metal Welds in Vessel Nozzles) and B-J (Pressure Retaining Welds in Piping).

100% of Category B-F welds and 25% of Category B-J welds for the ASME Code, Class 1, non-exempt piping shall be selected for volumetric and/or surface examination based on existing stress analyses and cumulative usage factors.

ASME Section XI, 2007 Edition through the 2008 Addenda Edition, IWC-2411, requires examinations in each examination category shall be completed during each inspection interval in accordance with Table IWC-2411-1. Applicable category welds in Table IWC-2500-1 are C-F-1 (Pressure Retaining Welds in Austenitic Stainless Steel or High Alloy Piping) and C-F-2 (Pressure Retaining Welds in Carbon or Low Alloy Steel Piping).

For Category C-F-1 welds in Class 2 piping, the welds selected for examination shall include 7.5%, but not less than 28 welds, of all dissimilar metal, austenitic stainless steel or high alloy welds not exempted by IWC-1220. (Some welds not exempted by IWC-1220 are not required to be nondestructively examined per Examination Category C-F-1. These welds, however, shall be included in the total weld count to which the 7.5% sampling rate is applied.) The examinations shall be distributed as follows:

(a) the examinations shall be distributed among the Class 2 systems prorated, to the degree practicable, on the number of nonexempt dissimilar metal, austenitic stainless steel, or high alloy welds in each system (i.e., if a system contains 30% of the nonexempt welds, then 30% of the nondestructive examinations required by Examination Category C-F-1 should be performed on that system);

(b) within a system, the examinations shall be distributed among terminal ends, dissimilar metal welds, and structural discontinuities prorated, to the degree practicable, on the number of nonexempt terminal ends, dissimilar metal welds, and structural discontinuities in that system; and

(c) within each system, examinations shall be distributed between line sizes prorated to the degree practicable.

For Category C-F-2 welds in Class 2 piping the welds selected for examination shall include 7.5%, but not less than 28 welds, of all carbon and low alloy steel welds not exempted by IWC-1220. (Some welds not exempted by IWC-1220 are not required to be nondestructively examined per Examination Category C-F-2. These welds, however, shall be included in the total weld count to which the 7.5% sampling rate is applied.)

The examinations shall be distributed as follows:

(a) the examinations shall be distributed among the Class 2 systems prorated, to the degree practicable, on the number of nonexempt carbon and low alloy steel welds in each system (i.e., if a system contains 30% of the nonexempt welds, then 30% of the nondestructive examinations required by Examination Category C-F-2 should be performed on that system);

(b) within a system, the examinations shall be distributed among terminal ends and structural discontinuities prorated, to the degree practicable, on the number of nonexempt terminal ends and structural discontinuities in that system; and

(c) within each system, examinations shall be distributed between line sizes prorated to the degree practicable.

4. Reason for Request

In accordance with the provisions of 10 CFR 50.55a, "Codes and Standards," paragraph 10 CFR 50.55a(a)(3), Susquehanna requests relief from the requirement of ASME Code Section XI, Sub-article IWB-2500 and IWC-2500, Tables IWB-2500-1 and IWC-2500-1, Examination Categories B-F, B-J, C-F-1 and C-F-2, "Pressure Retaining Welds in Piping" welds.

ASME Section XI Examination Categories B-F, B-J, C-F-1, and C-F-2 currently contain the requirements for examination of piping components by means of nondestructive examination (NDE). The previously approved Risk-Informed In-service Inspection (RI-ISI) program (Reference 1) will be substituted for Class 1 and Class 2 piping (Examination Categories B-F, B-J, C-F-1, C-F-2) in accordance with 10 CFR 50.55a(a)(3)(i) by alternatively providing an acceptable level of quality and safety. Other non-related portions of the ASME Section XI Code will be unaffected.

5. Proposed Alternative and Basis for Use

Pursuant to 10 CFR 50.55a(a)(3), NRC approval of the Susquehanna Alternate RI-ISI program as an alternative to the current 2007 Edition through the 2008 Addenda Edition, ASME Section XI inspection requirements for Class 1, Examination Category B-F and B-J, and Class 2, Examination Category C-F-1 and C-F-2 piping welds is requested.

The Susquehanna RI-ISI Program has been developed in accordance with the EPRI methodology contained in EPRI TR-112657, "Risk-Informed In-service Inspection Evaluation Procedure" (Reference 2). It was approved for use at Susquehanna during the first inspection period of the Third Ten-year Inspection Interval and is still applicable for the Fourth In-service Inspection Interval. The Susquehanna specific RI-ISI program is summarized in Tables 1 for Unit 1 and Table 2 for Unit 2 (Attachment 2). The RI-ISI program has been updated consistent with the intent of NEI-04-05 (Reference 3) and continues to meet EPRI TR-112657 and Regulatory Guide 1.174 risk acceptance criteria.

Susquehanna will continue to implement the Risk-Informed Inservice Inspection Program in accordance with ASME Code Case N-578-1, "Risk-Informed Requirements for Class 1, 2, and 3 Piping, Method B, Section XI, Division 1." The ultrasonic examination volume to be used based on degradation mechanism and component configuration will be the examination figures specified in Section 4 of EPRI TR-112657. The ultrasonic examination procedures, equipment, and personnel used to detect and size flaws in piping welds will be qualified by performance demonstration in accordance with ASME Section XI Appendix VIII, "Performance Demonstration for Ultrasonic Examination Systems." The volumetric scanning will be in both the axial and circumferential directions to detect flaws in these orientations.

As part of the RI-ISI living program update, the delta risk assessment was re-evaluated and was determined to continue to meet the delta risk acceptance criteria of EPRI TR-112657. This update is based on the most recent Susquehanna PRA, which has been peer reviewed to Regulatory Guide 1.200, Rev 2 and updated accordingly. The PRA has been determined to be adequate for this application as described in Appendix A.

Pursuant to 10 CFR50.55a(a)(3)(i), relief is requested on the basis that the proposed alternative to continue using a RI-ISI Program would provide an acceptable level of quality and safety.

6. Duration of Proposed Alternative

Relief is requested for the Fourth Ten-Year Inspection Interval of the ISI Program, which was scheduled to begin on June 1, 2014 and end May 31, 2024.

7. Precedent

The NRC previously approved the Susquehanna Alternate RI-ISI Program in Reference 1.

Susquehanna considers both the plant and industry operating experience and updates the RI-ISI program during the re-evaluation process following each inspection period per our commitment in section 4 of our original relief request (Reference 4)

8. <u>Reference</u>

1. USNRC Letter dated July 28, 2005, "Susquehanna Steam Electric Station, Units 1 and 2, Third 10-year Inservice Inspection (ISI) Interval Program Plan (TAC Nos. MC1181 and MC1182)"

2. EPRI TR-112657, Electric Power Research Institute Report for Alternative Requirements of Risk-Informed In-service Inspection Evaluation Procedure, EPRI, Polo Alto, CA: 1999, Rev B-A.

3. NEI-04-05, "Living Program Guidance to Maintain Risk-Informed In-service inspection Programs for Nuclear Plant Piping Systems," dated April 2004.

4. PPL Letter PLA-5662, "Susquehanna Steam Electric Station Proposed Third Ten-year Inservice Inspection Interval Inservice Inspection Program Plan for Susquehanna SES Units 1 and 2," dated September 16, 2003

Susquehanna Unit 1
Facility Operating License No. NPF-14
NRC Docket Nos. 50-387

Table 1: SSES Unit 1 Inspection Location Selection Comparison between 1st RI-ISI Interval and New RI-ISI Interval by Risk Category

System*	Risk		Consequence Rank	Failure Potential		Code Category	1ST Approved RI-ISI Interval			New RI-ISI Interval		
	Category	Rank		DMs	Rank		Weld Count	RI-ISI	Other	Weld Count	RI-ISI	Other
CAC	4	Medium	High	None	Low	C-F-2	0	0		1	1	a
CAC	6	Low	Medium	None	Low	C-F-2	0	0		4	0	a
CRD	7	Low	Low	None	Low	C-F-1	37	0		37	0	
CS	2	High	High	IGSCC	Medium	B-J	2	0		2	0	
CS	2	High	High	TASCS	Medium	B-J	8	2		0	0	b
CS	4	Medium	High	None	Low	B-J,C-F-1	4	1		12	2	b
CS	5	Medium	Medium	IGSCC	Medium	B-J	2	0		2	0	
CS	6	Low	Medium	None	Low	B-J,C-F-1	177	0		177	0	
CS	7	Low	Low	None	Low	C-F-1	6	0		6	0	
FW	1	High	High	TASCS, FAC	High	B-J,C-F-1	42	6		44	11	c
FW	1	High	High	TASCS, TT, FAC	High	B-J,C-F-1	21	11		8	2	d
FW	1	High	High	FAC	High	B-J,C-F-1	33	0		34	0	e
FW	3	High	Medium	TASCS, FAC	High	B-J	2	0		6	2	f
FW	3	High	Medium	TASCS, TT, FAC	High	C-F-1	1	1		4	2	g
FW	3	High	Medium	TT, FAC	High	C-F-1	0	0		1	0	h
FW	5	Medium	Low	TASCS, FAC	High	B-J	0	0		1	0	i
FW	5	Medium	Low	TASCS, TT, FAC	High	B-J	0	0		1	0	j
HPCI	4	Medium	High	None	Low	B-J,C-F-1	22	3		9	1	k
HPCI	5	Medium	Medium	TT	Medium	C-F-1	24	3		3	1	l
HPCI	6	Low	Medium	None	Low	C-F-1	117	0		9	0	k

Susquehanna Unit 1
Facility Operating License No. NPF-14
NRC Docket Nos. 50-387

System*	Risk		Consequence Rank	Failure Potential		Code Category	1ST Approved RI-ISI Interval			New RI-ISI Interval		
	Category	Rank		DMs	Rank		Weld Count	RI-ISI	Other	Weld Count	RI-ISI	Other
HPCI	6	Low	Low	TT	Medium	C-F-1	0	0		21	0	l
HPCI	7	Low	Low	None	Low	B-J,C-F-1	0	0		121	0	k
MS	1	High	High	FAC	High	B-J,C-F-1	256	0		108	0	m, n, o
MS	3	High	Medium	FAC	High	B-J,C-F-1	20	0		120	0	m
MS	4	Medium	High	None	Low	B-J	0	0		4	1	n
MS	6	Low	Medium	None	Low	C-F-1	0	0		44	0	o
RBCW	7	Low	Low	None	Low	C-F-2	0	0		5	0	a
RCIC	1	High	High	FAC	High	B-J	18	0		13	0	p
RCIC	3	High	Medium	FAC	High	B-J	0	0		1	0	p
RCIC	5	Medium	Low	FAC	High	B-J	0	0		4	0	p
RCIC	5	Medium	Medium	TT	Medium	C-F-1	28	3		0	0	q, r
RCIC	6	Low	Low	TT	Medium	C-F-1	1	0		27	0	q, r
RCIC	7	Low	Low	None	Low	C-F-1	52	0		54	0	q, r
RHR	2	High	High	EC	Medium	C-F-1	12	3		0	0	s
RHR	2	High	High	IGSCC	Medium	B-J	4	0		14	0	t
RHR	2	High	High	TASCS	Medium	B-J	1	0		1	1	
RHR	2	High	High	TASCS, IGSCC	Medium	B-J	10	4		0	0	t
RHR	2	High	High	TASCS, TT	Medium	B-J	3	0		0	0	t
RHR	2	High	High	TT	Medium	B-J	1	0		4	1	t
RHR	4	Medium	High	None	Low	C-F-1	139	14		151	16	s
RHR	5	Medium	Medium	EC	Medium	C-F-1	6	1		0	0	s
RHR	5	Medium	Medium	IGSCC	Medium	B-J,C-F-1	23	0		16	0	s, x, w

Susquehanna Unit 1
Facility Operating License No. NPF-14
NRC Docket Nos. 50-387

System*	Risk		Consequence Rank	Failure Potential		Code Category	1ST Approved RI-ISI Interval			New RI-ISI Interval		
	Category	Rank		DMs	Rank		Weld Count	RI-ISI	Other	Weld Count	RI-ISI	Other
RHR	5	Medium	Medium	IGSCC, EC	Medium	C-F-1	1	0		0	0	s
RHR	5	Medium	Medium	TASCS, IGSCC	Medium	B-J	4	1		0	0	v
RHR	5	Medium	Medium	TT	Medium	B-J	0	0		7	1	u
RHR	6	Low	Low	IGSCC	Medium	B-J	7	0		19	0	v, w, x
RHR	6	Low	Medium	None	Low	B-J,C-F-1	283	0		318	0	s, w
RHR	6	Low	Low	TASCS, TT	Medium	B-J	7	0		0	0	u
RHR	7	Low	Low	None	Low	B-J,C-F-1	49	0		20	0	w
RPV-E	1	High	High	TASCS, TT, CC, FAC	High	B-J	6	6		0	0	y
RPV-E	1	High	High	TASCS, CC, FAC	High	B-J	0	0		6	2	y
RPV-E	1	High	High	FAC	High	B-J	4	0		4	0	
RPV-E	2	High	High	IGSCC	Medium	B-F,B-J	6	0		10	0	aa
RPV-E	2	High	High	IGSCC, CC	Medium	B-F	11	0		1	0	z
RPV-E	2	High	High	IGSCC, TT	Medium	B-J	0	0		10	3	z
RPV-E	2	High	High	TASCS, IGSCC	Medium	B-F,B-J	4	4		0	0	aa
RPV-E	2	High	High	TT	Medium	B-J	1	0		1	0	
RPV-E	4	Medium	High	None	Low	B-J	10	1		10	1	
RR	2	High	High	IGSCC	Medium	B-J	60	0		60	0	
RR	2	High	High	TT	Medium	B-J	0	0		20	5	bb
RR	4	Medium	High	None	Low	B-J	79	8		52	6	bb, cc
RR	6	Low	Medium	None	Low	B-J	0	0		7	0	cc
RWCU	1	High	High	FAC	High	B-J	55	0		60	0	dd, ee
RWCU	2	High	High	IGSCC	Medium	B-J	6	0		6	0	

Susquehanna Unit 1
Facility Operating License No. NPF-14
NRC Docket Nos. 50-387

System*	Risk		Consequence Rank	Failure Potential		Code Category	1ST Approved RI-ISI Interval			New RI-ISI Interval		
	Category	Rank		DMs	Rank		Weld Count	RI-ISI	Other	Weld Count	RI-ISI	Other
RWCU	3	High	Medium	FAC	High	B-J	0	0		1	0	ee
RWCU	4	Medium	High	None	Low	B-J	71	8		52	6	dd, ee
RWCU	6	Low	Medium	None	Low	B-J	0	0		13	0	ee
SBLC	4	Medium	High	None	Low	B-J	0	0		10	1	ff
SBLC	6	Low	Medium	None	Low	B-J	44	0		34	0	ff
SBLC	7	Low	Low	None	Low	B-J	9	0		9	0	
							1789	80		1799	66	

* Acronyms defined:

CAC – Containment Atmosphere Control
CRD – Control Rod Drive and Scram Discharge Volume
CS – Core Spray
DMs – Damage Mechanisms
FW – Feedwater
HPCI – High Pressure Coolant Injection
IGSCC – Intergranular Stress Corrosion Cracking
MS – Main Steam
RBCW – Reactor Building Closed Cooling Water
RC – Reactor Coolant System
RCIC – Reactor Core Isolation Cooling
RHR – Residual Heat Removal System
RI-ISI – Risk Informed Inservice Inspection
RPV-E – Reactor Pressure Vessel
RR – Reactor Recirculation
RWCU – Reactor Water Cleanup
SBLC – Standby Liquid Control
TASCs – Thermal Stratification
TT – Thermal Transients

Notes: (This table shows the systems that contain welds that are Class 1 or Class 2 category B-J, B-F, C-F-1, or C-F-2.)

a. New system scope
b. TASCS removed; 8 welds moved to RC 4 from RC 2 TASCS
c. Two additional RC 1 TASCS, FAC welds from the following changes:
   +18 from RC 1 TASCS, TT, FAC (TT removed)
   -8 to RC 1 TASCS, TT, FAC (TT added)
   -4 to RC 3 TASCS, FAC (consequence decrease)
   -4 to RC3 TASCS, TT, FAC (consequence decrease and TT added)

Susquehanna Unit 1
Facility Operating License No. NPF-14
NRC Docket Nos. 50-387

d. Thirteen welds removed from RC 1 TASCS, TT, FAC for the following changes:
   -18 to RC 1 TASCS, FAC (TT removed)
   -2 to RC 1 FAC (TASCS, TT removed)
   +8 from RC 1 TASCS, FAC (TT added)
   -1 to RC 3 TASCS, FAC (consequence decrease)
e. One weld added to RC 1 FAC from the following changes:
   +2 from RC 1 TASCS, TT, FAC (TASCS, TT removed)
   -1 to RC 3 TT, FAC (consequence decrease and TT added)
f. Four welds added to RC 3 TASCS, FAC from the following changes:
   +1 from RC 3 TASCS, TT, FAC (TT removed)
   +4 from RC 1 TASCS, FAC (consequence decrease)
   -1 to RC 5 TASCS, FAC (consequence decrease)
   -1 to RC 5 TASCS, TT, FAC (consequence decrease and TT added)
   +1 from RC 1 TASCS, TT, FAC (consequence decrease and TT removed)
g. Three additional RC 3 TASCS, TT, FAC welds from the following changes:
   -1 to RC 3 TASCS, FAC (TT removed)
   +4 from RC 1 TACS, FAC (consequence decrease and TT added)
h. One weld added to RC 3 TT, FAC from RC 1 FAC (consequence decrease and TT added)
i. One weld added to RC 5 TASCS, FAC from RC 3 TASCS, FAC (consequence decrease)
j. One weld added to RC 5 TASCS, TT, FAC from RC 3 TASCS, FAC (consequence decrease and TT added)
k. Consequence decreased; 2 welds moved to RC 6 from RC 4; 11 welds moved to RC 7 from RC 4; 110 welds moved to RC 7 from RC 6
l. Consequence decreased; 21 welds moved to RC 6 TT from RC 5 TT
m. Consequence decreased; 100 welds moved to RC 3 FAC from RC 1 FAC
n. FAC removed; 4 welds moved to RC 4 from RC 1 FAC
o. Consequence decreased & FAC removed; 44 welds moved to RC 6 from RC 1 FAC
p. Consequence decreased:
   1 weld moved to RC 3 FAC from RC 1 FAC
   4 welds moved to RC 5 FAC from RC 1 FAC
q. 28 RC 5 TT welds moved as follows:
   27 welds moved to RC 6 TT (consequence decrease)
   1 weld moved to RC 7 None (consequence decrease and TT removed)
r. Two additional RC 7 welds from the following changes:
   +1 from RC 5 TT (consequence decrease and TT removed)
   +1 from RC 6 TT (TT removed)

Susquehanna Unit 1
Facility Operating License No. NPF-14
NRC Docket Nos. 50-387

s. EC removed:
    12 welds moved to RC 4 from RC 2 EC
    6 welds moved to RC 6 from RC 5 EC
    1 weld moved to RC 5 IGSCC from RC 5 IGSCC, EC
t. TASCS removed:
    10 welds moved to RC 2 IGSCC from RC 2 IGSCC, TASCS
    3 welds moved to RC 2 TT from RC 2 TASCS, TT
u. Consequence increased and TASCS removed; 7 welds moved to RC 5 TT from RC 6 TASCS, TT
v. Consequence decreased and TASCS removed; 4 welds moved to RC 6 IGSCC from RC 5 TASCS, IGSCC
w. Consequence increased:
    29 welds moved to RC 6 from RC 7
    7 welds moved to RC 5 IGSCC from RC 6 IGSCC
x. Consequence decreased; 15 welds moved to RC 6 IGSCC from RC 5 IGSCC
y. TT removed; 6 welds moved to RC 1 TASCS, CC, FAC from RC 1 TASCS, TT, CC, FAC
z. CC removed and TT added; 10 welds moved to RC 2 IGSCC, TT from RC 2 IGSCC, CC
aa. TASCS removed; 4 welds moved to RC 2 IGSCC from RC 2 TASCS, IGSCC
bb. TT added; 20 welds moved to RC 2 TT from RC 4
cc. Consequence decreased; 7 welds moved to RC 6 from RC 4
dd. FAC added:
    6 welds moved to RC 1 FAC from RC 4
ee. Consequence decreased:
    13 welds moved to RC 6 from RC 4
    1 weld moved to RC 3 FAC from RC 1 FAC
ff. Consequence increased; 10 welds moved to RC 4 from RC 6

Susquehanna Unit 2
Facility Operating License No NPF-22
NRC Docket Nos. 50-388

Table 2: SSES Unit 2 Inspection Location Selection Comparison between 1st RI-ISI Interval and New RI-ISI Interval by Risk Category

System*	Risk		Consequence Rank	Failure Potential		Code Category	1ST Approved RI-ISI Interval			New RI-ISI Interval		
	Category	Rank		DMs	Rank		Weld Count	RI-ISI	Other	Weld Count	RI-ISI	Other
CAC	4	Medium	High	None	Low	C-F-2	0	0		1	1	a
CAC	6	Low	Medium	None	Low	C-F-2	0	0		4	0	a
CRD	7	Low	Low	None	Low	C-F-1	39	0		39	0	
CS	2	High	High	IGSCC	Medium	B-J	2	0		2	0	
CS	2	High	High	TASCS	Medium	B-J	7	2		0	0	b
CS	4	Medium	High	None	Low	B-J,C-F-1	5	1		12	2	b
CS	5	Medium	Medium	IGSCC	Medium	B-J	2	0		2	0	
CS	6	Low	Medium	None	Low	B-J,C-F-1	173	0		173	0	
CS	7	Low	Low	None	Low	C-F-1	6	0		6	0	
FW	1	High	High	TASCS, FAC	High	B-J,C-F-1	51	6		48	12	c
FW	1	High	High	TASCS, TT, FAC	High	B-J,C-F-1	24	14		8	2	d
FW	1	High	High	FAC	High	B-J,C-F-1	22	0		29	0	e
FW	3	High	Medium	TASCS, FAC	High	B-J	2	0		6	2	f
FW	3	High	Medium	TASCS, TT, FAC	High	C-F-1	1	1		5	2	g
FW	3	High	Medium	FAC	High	C-F-1	0	0		1	0	h
FW	3	High	Medium	TT, FAC	High	C-F-1	0	0		1	0	i
FW	5	Medium	Low	TASCS, FAC	High	B-J	0	0		1	0	j
FW	5	Medium	Low	TASCS, TT, FAC	High	B-J	0	0		1	0	k
HPCI	4	Medium	High	None	Low	B-J,C-F-1	19	2		11	2	l
HPCI	5	Medium	Medium	TT	Medium	C-F-1	22	3		3	1	l
HPCI	6	Low	Medium	None	Low	C-F-1	111	0		8	0	l

Susquehanna Unit 2
Facility Operating License No NPF-22
NRC Docket Nos. 50-388

System*	Risk		Consequence Rank	Failure Potential		Code Category	1ST Approved RI-ISI Interval			New RI-ISI Interval		
	Category	Rank		DMs	Rank		Weld Count	RI-ISI	Other	Weld Count	RI-ISI	Other
HPCI	6	Low	Low	TT	Medium	C-F-1	0	0		19	0	1
HPCI	7	Low	Low	None	Low	B-J,C-F-1	0	0		111	0	1
MS	1	High	High	FAC	High	B-J,C-F-1	276	0		108	0	m, n, o
MS	3	High	Medium	FAC	High	B-J,C-F-1	21	0		137	0	m
MS	4	Medium	High	None	Low	B-J,C-F-1	0	0		5	1	n
MS	6	Low	Medium	None	Low	B-J,C-F-1	0	0		47	0	o
RBCW	7	Low	Low	None	Low	C-F-2	0	0		5	0	a
RCIC	1	High	High	FAC	High	B-J	18	0		13	0	p
RCIC	3	High	Medium	FAC	High	B-J	0	0		1	0	p
RCIC	5	Medium	Low	FAC	High	B-J	0	0		4	0	p
RCIC	5	Medium	Medium	TT	Medium	C-F-1	24	3		1	1	p, q
RCIC	6	Low	Low	TT	Medium	C-F-1	0	0		22	0	p
RCIC	7	Low	Low	None	Low	C-F-1	67	0		68	0	q
RHR	2	High	High	EC	Medium	C-F-1	10	2		0	0	r
RHR	2	High	High	IGSCC	Medium	B-J	4	0		12	0	s
RHR	2	High	High	TASCS, IGSCC	Medium	B-J	8	4		0	0	s
RHR	2	High	High	TASCS, TT	Medium	B-J	3	0		0	0	s
RHR	2	High	High	TT	Medium	B-J	1	0		4	1	s
RHR	4	Medium	High	None	Low	C-F-1	131	14		141	15	r
RHR	5	Medium	Medium	EC	Medium	C-F-1	7	0		0	0	r
RHR	5	Medium	Medium	EC, IGSCC	Medium	C-F-1	1	1		0	0	r
RHR	5	Medium	Medium	IGSCC	Medium	B-J,C-F-1	27	0		13	0	r, v

Susquehanna Unit 2
Facility Operating License No NPF-22
NRC Docket Nos. 50-388

System*	Risk		Consequence Rank	Failure Potential		Code Category	1ST Approved RI-ISI Interval			New RI-ISI Interval		
	Category	Rank		DMs	Rank		Weld Count	RI-ISI	Other	Weld Count	RI-ISI	Other
RHR	5	Medium	Medium	TASCS, IGSCC	Medium	B-J	4	1		0	0	u
RHR	5	Medium	Medium	TASCS, TT	Medium	B-J	4	0		0	0	s, t
RHR	5	Medium	Medium	TT	Medium	B-J	0	0		3	1	s
RHR	6	Low	Low	IGSCC	Medium	B-J	0	0		19	0	u, v
RHR	6	Low	Medium	None	Low	B-J,C-F-1	315	0		323	0	r, t
RHR	7	Low	Low	None	Low	C-F-1	12	0		12	0	
RPV-E	1	High	High	TASCS, TT, CC, FAC	High	B-J	6	6		0	0	w
RPV-E	1	High	High	TASCS, CC, FAC	High	B-J	0	0		6	2	w
RPV-E	1	High	High	FAC	High	B-J	4	0		4	0	
RPV-E	2	High	High	CC, IGSCC	Medium	B-J	10	1		0	0	x
RPV-E	2	High	High	IGSCC	Medium	B-J	7	0		11	0	y
RPV-E	2	High	High	IGSCC, TT	Medium	B-J	0	0		10	3	x
RPV-E	2	High	High	TASCS, IGSCC	Medium	B-J	4	3		0	0	y
RPV-E	2	High	High	TT	Medium	B-J	1	0		1	0	
RPV-E	4	Medium	High	None	Low	B-J	10	1		10	1	
RR	2	High	High	IGSCC	Medium	B-J	62	0		64	0	z
RR	2	High	High	TT	Medium	B-J	0	0		20	5	aa
RR	4	Medium	High	None	Low	B-J	77	8		43	5	aa, bb
RR	6	Low	Medium	None	Low	B-J	0	0		14	0	bb
RWCU	1	High	High	FAC	High	B-J	66	0		70	0	cc, dd
RWCU	2	High	High	IGSCC	Medium	B-J	6	0		6	0	
RWCU	3	High	Medium	FAC	High	B-J	0	0		1	0	dd

Susquehanna Unit 2
Facility Operating License No NPF-22
NRC Docket Nos. 50-388

System*	Risk		Consequence Rank	Failure Potential		Code Category	1ST Approved RI-ISI Interval			New RI-ISI Interval		
	Category	Rank		DMs	Rank		Weld Count	RI-ISI	Other	Weld Count	RI-ISI	Other
RWCU	4	Medium	High	None	Low	B-J	65	7		50	5	cc, dd
RWCU	6	Low	Medium	None	Low	B-J	0	0		10	0	dd
SBLC	4	Medium	High	None	Low	B-J	0	0		6	1	ee
SBLC	6	Low	Medium	None	Low	B-J	35	0		29	0	ee
SBLC	7	Low	Low	None	Low	B-J	6	0		6	0	
							1778	80		1790	65	

* Acronyms defined:

CAC – Containment Atmosphere Control
CRD – Control Rod Drive and Scram Discharge Volume
CS – Core Spray
DMs – Damage Mechanisms
FW – Feedwater
HPCI – High Pressure Coolant Injection
IGSCC – Intergranular Stress Corrosion Cracking
MS – Main Steam
RBCW – Reactor Building Closed Cooling Water
RC – Reactor Coolant System
RCIC – Reactor Core Isolation Cooling
RHR – Residual Heat Removal System
RI-ISI – Risk Informed Inservice Inspection
RPV-E – Reactor Pressure Vessel
RR – Reactor Recirculation
RWCU – Reactor Water Cleanup
SBLC – Standby Liquid Control
TASCs – Thermal Stratification
TT – Thermal Transients

Notes: (This table shows the systems that contain welds that are Class 1 or Class 2 category B-J, B-F, C-F-1, or C-F-2.)

a. New system scope
b. TASCS removed; 7 welds moved to RC 4 from RC 2 TASCS.
c. Three welds removed from RC 1 TASCS, FAC for the following changes:
   +18 from RC 1 TASCS, TT, FAC (TT removed)
   -8 to RC 1 TASCS, TT, FAC (TT added)
   -11 to RC 1 FAC (TASCS removed)
   +2 from RC 1 FAC (TASCS added)
   -1 to RC 3 TASCS, TT, FAC (consequence decreased and TT added)
   -3 to RC 3 TASCS, FAC (consequence decreased)

Susquehanna Unit 2
Facility Operating License No NPF-22
NRC Docket Nos. 50-388

d. 16 welds removed from RC 1 TASCS, TT, FAC for the following changes:
 -18 to RC 1 TASCS, FAC (TT removed)
 +8 from RC 1 TASCS, FAC (TT added)
 -2 to RC 3 TASCS, FAC (consequence decreased and TT removed)
 -4 to RC 3 TASCS, TT, FAC (consequence decreased)
e. Seven welds added to RC 1 FAC for the following changes:
 +11 from RC 1 TASCS, FAC (TASCS removed)
 -2 to RC 1 TASCS, FAC (TASCS added)
 -1 to RC 3 TT, FAC (consequence decreased and TT added)
 -1 to RC 3 FAC (consequence decreased)
f. Four welds added to RC 3 TASCS, FAC for the following changes:
 +1 from RC 3 TASCS, TT, FAC (TT removed)
 -1 to RC 5 TASCS, TT, FAC (consequence decreased and TT added)
 +2 from RC 1 TASCS, TT, FAC (consequence decreased and TT removed)
 +3 from RC 1 TASCS, FAC (consequence decreased)
 -1 to RC 5 TASCS, FAC (consequence decreased)
g. Four welds added to RC 3 TASCS, TT, FAC for the following changes:
 -1 to RC 3 TASCS, FAC (TT removed)
 +1 from RC 1 TASCS, FAC (consequence decreased and TT added)
 +4 from RC 1 TASCS, TT, FAC (consequence decreased)
h. Consequence decreased; 1 weld moved to RC 3 FAC from RC 1 FAC
i. Consequence decreased and TT added; 1 weld moved to RC 3 TT, FAC from RC 1 FAC
j. Consequence decreased; 1 weld moved to RC 5 TASCS, FAC from RC 3 TASCS, FAC
k. Consequence decreased and TT added; 1 weld moved to RC 5 TASCS, TT, FAC from RC 3 TT, FAC
l. Consequence decreased:
 1 weld moved to RC 6 from RC 4
 7 welds moved to RC 7 from RC 4
 19 welds moved to RC 6 TT from RC 5 TT
 104 welds moved to RC 7 from RC 6
m. Consequence decreased; 116 welds moved to RC 3 FAC from RC 1 FAC
n. FAC removed; 5 welds moved to RC 4 from RC 1 FAC
o. Consequence decreased and FAC removed; 47 welds moved to RC 6 from RC 1 FAC

Susquehanna Unit 2
Facility Operating License No NPF-22
NRC Docket Nos. 50-388

p. Consequence decreased:
    1 weld moved to RC 3 FAC from RC 1 FAC
    4 welds moved to RC 5 FAC from RC 1 FAC
    22 welds moved to RC 6 TT from RC 5 TT
q. Consequence decreased and TT removed; 1 weld moved to RC 7 from RC 5 TT
r. EC removed:
    10 welds moved to RC 4 from RC 2 EC
    1 weld moved to RC 5 IGSCC from RC 5 EC, IGSCC
    7 welds moved to RC 6 from RC 5 EC
s. TASCS removed:
    8 welds moved to RC 2 IGSCC from RC 2 TASCS, IGSCC
    3 welds moved to RC 2 TT from RC 2 TASCS, TT
    3 welds moved to RC 5 TT from RC 5 TASCS, TT
t. TASCS, TT removed; 1 weld moved to RC 6 from RC 5 TASCS, TT
u. Consequence decreased and TASCS removed; 4 welds moved to RC 6 IGSCC from RC 5 TASCS, IGSCC
v. Consequence decreased; 15 welds moved to RC 6 IGSCC from RC 5 IGSCC
w. TT removed; 6 welds moved to RC 1 TASCS, CC, FAC from RC 1 TASCS, TT, CC, FAC
x. CC removed and TT added; 10 welds moved to RC 2 IGSCC, TT from RC 2 CC, IGSCC
y. TASCS removed; 4 welds moved to RC 2 IGSCC from RC 2 TASCS, IGSCC
z. Two welds added to scope, IGSCC assigned; 2 new welds in RC 2 IGSCC
aa. TT assigned; 20 welds moved to RC 2 TT from RC 4
bb. Consequence decreased; 14 welds moved to RC 6 from RC 4
cc. FAC added:
    5 welds moved to RC 1 FAC from RC 4
dd. Consequence decreased:
    1 weld moved to RC 3 FAC from RC 1 FAC
    10 welds moved to RC 6 from RC 4
ee. Consequence increased; 6 welds moved to RC 4 from RC 6

Susquehanna Steam Electric Station, Units 1 and 2
Facility Operating License NPF-14 and NPF-22
NRC Docket Nos. 50-387 and 388

Susquehanna PRA Summary

The PRA has been updated to maintain current with the plant design and operation and to support peer review. An industry Peer Review was conducted in October 2012 and the PRA model used in this evaluation is based on the latest PRA model that has been updated to resolve the important findings from this review.

The PRA Technical Adequacy Assessment is included in Attachment 2. This includes the findings and an explanation of their resolution and model impacts.

The original RI-ISI and numerous other RI-ISI evaluations have concluded external events are not likely to impact the consequence ranking. This position is further supported by Section 2 of EPRI Report 1021467, "Nondestructive Evaluation: Probabilistic Risk Assessment Technical Adequacy Guidance for Risk-Informed In-Service Inspection Programs" which concludes that quantification of these events will not change the conclusions derived from the RI-ISI process. As a result, there is no need to further consider these events.

Attachment 2 to PLA-7193

PRA Technical Adequacy Assessment

PRA TECHNICAL ADEQUACY ASSESSMENT

TABLE OF CONTENTS

1.0 PRA Technical Adequacy

The JUL12R1 update to the Susquehanna PRA model is the most recent evaluation of the risk profile at Susquehanna for internal event challenges [Ref. 6]. The Susquehanna PRA model is highly detailed, including a wide variety of initiating events, modeled systems, operator actions, and common cause events. The PRA model quantification process used for the Susquehanna PRA is based on the event tree/fault tree methodology, which is a well-known methodology in the industry. PPL employs a structured approach to establishing and maintaining the technical adequacy and plant fidelity of the PRA model for both Susquehanna operating units. This approach includes both a proceduralized PRA maintenance and update process, and the use of self-assessments and independent peer reviews. The following information describes this approach as it applies to the Susquehanna PRA.

1.1 PRA Maintenance and Update

The PPL PRA maintenance and update process ensures that the applicable PRA model remains an accurate reflection of the as-built and as-operated plants. This process is defined in PPL administrative procedure NDAP-QA-1002 [Ref. 5] and a subordinate implementing procedure. PPL procedure NFP-QA-201, "Internal Events At Power PRA Model Update and Configuration Control Process," delineates the responsibilities and guidelines for updating the full power internal events PRA model for Susquehanna Units 1 and 2 [Ref. 4]. The overall model update process, including NFP-QA-201, defines the process for implementing regularly scheduled and interim PRA model updates, for tracking issues identified as potentially affecting the PRA models (e.g., due to changes in the plant, errors or limitations identified in the model, industry operating experience), and for controlling the model and associated computer files. To ensure that the current PRA model remains an accurate reflection of the as-built, as-operated plants, the following activities are routinely performed:

- Design changes and procedure changes are reviewed for their impact on the PRA model.
- New engineering calculations and revisions to existing calculations are reviewed for their impact on the PRA model.
- Maintenance unavailabilities are captured, and their impact on CDF is assessed.
- Plant specific initiating event frequencies, failure rates, and maintenance unavailabilities are updated at least every 6 years.

In accordance with this guidance, regularly scheduled PRA model updates occur at least every six years with more frequent updates occurring based on the risk significance of permanent changes, initiating events, and failure data such that the PRA continues to adequately represent the as-built, as-operated plant.

PPL implemented the JUL12R1 update to the Susquehanna PRA in January 2014. This update incorporated resolution of comments received from the industry peer review of the Susquehanna PRA conducted in October 2012.

1.2 Identification of Parts of the PRA Not Meeting Capability Category II

PPL has had PRA Peer Reviews performed in 2003 and in 2012. The 2012 peer review was performed in October 2012 using the NEI 05-04 process, the ASME PRA Standard (ASME/ANS RA-Sa-2009) [Ref. 3], and Regulatory Guide 1.200, Revision 2 [Ref. 2]. The 2012 Susquehanna PRA Peer Review was a full-scope review of the technical elements of the internal events and internal flooding, at-power PRA.

The 2012 peer review resulted in 284 (89%) Supporting Requirements (SRs) meeting Capability Category II or higher, and 35 (11%) of the SRs not meeting Capability Category (CC) II or higher. Note that of the 35 SRs not meeting CC II or higher, 24 were associated with the internal flooding technical element. Therefore, excluding internal flooding, more than 95% of the SRs met CC II or higher. Table 1 lists all the SRs that do not meet CC II or higher and lists the SR, Facts and Observations (F&Os) gap with Significance, Resolution, and PRA Model Impact.

The peer review model and documentation were revised as described in the "Resolution" column. The revised model has been renamed JUL12R1 [Ref. 6]. Upon completion of the JUL12R1 model, excluding the internal flooding SRs, there are only 4 SRs that do not meet CC II or higher (i.e., HR-C3, DA-C6, DA-C12, and DA-C13). Additionally, it is noteworthy that there were ten best practices provided by the peer review team indicating the high level of quality of the Susquehanna PRA model.

1.3 PRA Impact from Internal Flooding

As noted in Table 1, several of the internal flooding SRs did not meet Category II requirements. However, internal flooding is not a significant contributor to CDF and LERF for Susquehanna. The PRA Quantification Summary Notebook [Ref. 6] lists internal flooding as contributing 4.6% to CDF and 1.9% to LERF and provides a comparison to Limerick Generating Station. Limerick is a very similar two-unit plant design but with the following notable hardware and operational differences.

- Limerick has four EDGs per unit whereas Susquehanna has four shared EDGs.
- Susquehanna has a spare 'E' EDG and also maintains the Blue Max portable DG.
- Limerick has procedural direction to cross-tie the 4 kV buses to get power from available EDGs to the safeguard buses as needed.
- Susquehanna does not inhibit ADS in non-ATWS scenarios whereas Limerick does direct inhibiting ADS in non-ATWS scenarios (both sites direct inhibiting ADS in ATWS scenarios).
- ECCS pump cooling and ECCS room cooling are normally supplied by SW at Limerick with backup provided by ESW. ECCS pump and room cooling is only provided by ESW at Susquehanna.

Other than the major differences highlighted above, the sites are very similar. The two sites are dual unit sites and have General Electric BWR/4 reactors. Bechtel was the architect engineer for both sites and the two sites are similar architecturally. Therefore, with the plant layouts being similar, similar internal flooding results can be expected. Limerick's flooding contribution to CDF and LERF as 5.9% and 3.6% respectively, which is comparable to Susquehanna's flooding contribution. It should also be noted that Limerick had only a few flooding SRs not meeting Capability Category II [Ref. 7]. Based on this industry comparison and small contribution of internal flooding to overall CDF and LERF, the Susquehanna internal flooding PRA can be applied to support the 4th 10 year inspection interval based on code case N-578-1. While the JUL12R1 model supports this application, PPL is addressing internal flooding F&O's through a focused model update and industry peer review.

1.4 Additional Peer Review Facts and Observations

Table 2 lists all the SRs meeting CC II or higher for which an F&O was written. Similar to Table 1, it also lists the SR, F&O gap with Significance, Resolution, and PRA Model Impact. As can be seen, all of the remaining facts and observations have been closed, or have otherwise been determined to have no or negligible impact on the PRA model results.

2.0 EVALUATION OF EXTERNAL EVENTS

The original RI-ISI and numerous other RI-ISI evaluations have concluded external events are not likely to impact the consequence ranking. This position is further supported by Section 2 of EPRI Report 1021467, "Nondestructive Evaluation: Probabilistic Risk Assessment Technical Adequacy Guidance for Risk-Informed In-Service Inspection Programs" [Ref. 1] which concludes that quantification of these events will not change the conclusions derived from the RI-ISI process. As a result, there is no need to further consider these events.

3.0 SUMMARY

The Susquehanna PRA maintenance and update processes and technical capability evaluations described above provide a robust basis for concluding that the PRA is suitable for use in risk-informed processes such as this Risk-Informed ISI application.

4.0 REFERENCES

[1] EPRI Report 1021467-A, *"Nondestructive Evaluation: Probabilistic Risk Assessment Technical Adequacy Guidance for Risk-Informed In-Service Inspection Programs,"* June 2012.

[2] Regulatory Guide 1.200, *"An Approach for Determining the Technical Adequacy of Probabilistic Risk Assessment Results for Risk Informed Activities,"* Revision 2, March 2009.

[3] American Society of Mechanical Engineers, *"Standard for Probabilistic Risk Assessment for Nuclear Power Plant Applications,"* (ASME RA-Sa-2009), Addenda to ASME/ANS RA-S-2008, "Standard for Level 1/Large Early Release Frequency Probabilistic Risk Assessment for Nuclear Power Plant Applications," February 2009.

[4] NFP-QA-201, "Internal Events at Power PRA Model Update and Configuration Control Process," Rev. 0.

[5] NDAP-QA-1002, "Maintenance and Update of the Susquehanna PRA," Rev. 1.

[6] EC-RISK-1164, Rev. 0, "Summary Notebook for the JUL12R1 PRA Model."

[7] Limerick Generating Station Units 1 and 2, License Amendment Request Supplemental Information, Proposed Changes to Technical Specifications Sections 3.5.1, 3.6.2.3, 3.7.1.1, 3.7.1.2, and 3.8.1.1 to Extend Allowed Outage Times, June 16, 2010 (ML101670319).

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IE-A5 (Met Cat I)	4-4: It appears that some maintenance rule systems may need to be evaluated in order to complete the systematic evaluation of each system, including support systems, to assess the possibility of an initiating event occurring due to a failure of the system. This is a finding because the SR requires that all systems must be evaluated. The requirement is to perform a systematic evaluation of EACH system, including support systems, to assess the possibility of an initiating event occurring due to a failure of the system. Not all maintenance rule plant systems appear to be identified as having been evaluated.	Each system had been evaluated but the documentation was not specifically included. Therefore, a Maintenance Rule System Table and Initiating Event evaluation was provided in new Section 2.8 of the IE Notebook	None, gap has been closed for the JUL12R1 model.
IE-A5 (Met Cat I)	6-29: A systematic approach to identify initiating events is documented in Section 2.4-5 and appears to be reasonably complete. However, no discussion on the effects of a loss of a single 13.8/4.16 kv transformer was found in the initiating events notebook. Refer to Section 2.4 of the IE Notebook for systems reviewed. It appears that some maintenance rule systems may need to be evaluated and therefore it does not meet CCII. However, a qualitative evaluation was performed to determine the systems that cause initiating events, but some systems were not explicitly addressed. This is a suggestion as discussions with Susquehanna PRA staff indicate that loss of a trnaformer would not result in a plant trip or need for a shutdown.	Additional discussion about loss of 13.8 and 4 kV transformers was added to Section 2.4.5 of the IE Notebook to address this F&O.	None, gap has been closed for the JUL12R1 model.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
SC-A5 (Not Met)	1-12: There was no evidence presented that would indicate that an evaluation was performed to determine if certain accident sequences should be extended beyond 24 hours. Such an evaluation should include: A) Instances where there will be an eventual depletion of finite inventory injection sources (RWST/CST). B) Justification for why room cooling dependencies are not necessary for cases where room temperatures will exceed equipment functionality or isolation temperatures after 24 hours. C) Justification for not extending the mission times for systems that are required to support long term DHR beyond the 24 hour mark. This is a finding because the SR is considered to be not met.	To address this F&O, a new section 2.1.17 was added to the event tree and success criteria notebookoutlining the dominant considerations contributing to the 24 hour PRA mission time. The section also outlines those systems/equipment with less than a 24 hour mission time.	None, gap has been closed for the JUL12R1 model.
SC-A5 (Not Met)	1-23: The EDG mission time is 24 hours. This is conservative compared to many plants which use the convolution integral method to justify a much shorter mission time. This is helpful for the improvement of MSPI margin. This is a suggestion because it is a modeling enhancement.	Open item	This open item is a provided suggestion for possible enhancement and does not by itself result in SC-A5 not being met. Therefore, there is no model impact

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
SC-A5 **(Not Met)**	1-24: Since the failure to start and run for 1st hour have been combined in the data, the fail to run events with a mission time of 24 hours actually give the PRA a mission time of 25 hours. The treatment is conservative and adds a very small increase in the failure probability, so it is presented as a suggestion.	Per the peer review team proposed resolution, the existing data was reviewed. It was determined and documented in the Component Data Notebookthat the use of 24 hours for the failure to run portion is slightly conservative and acceptable. Therefore, the total time represented is one hour for failure to start, and 24 hours for failure to run.	Negligible as the model is slightly conservative as is. The gap has been closed for the JUL12R1 model
SY-C3 **(Not Met)** Related SRs QU-E1 (Met Cat I/II/III) AS-C3 (Met Cat I/II/III) DA-E3 (Met Cat I/II/III) HR-I3 (Met Cat I/II/III) LE-F3 (Met Cat I/II/III) IE-D3 (Met Cat I/II/III) SC-C3 (Met Cat I/II/III)	1-18: Plant specific sources of modeling uncertainty are also addressed in the Summary Notebook Appendix D. However, there are only 4 candidate sources of uncertainty identified. Given the large number of modeling assumptions in the system notebooks (28 in the RHR system notebook alone) a more thorough evaluation of plant specific sources of uncertainty should be performed. This is a finding because it relates directly to a standard requirement.	All of the system notebook assumptions were reviewed for applicability as potential sources of model uncertainty. The large majority of the listed assumptions were determined to be standard assumptions or fell under the umbrella of level of detail issues. The few remaining items were added to Table D-2 in Appendix D of the Summary Notebook for further discussion.	None, gap has been closed for the JUL12R1 model.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
HR-B2 (Not Met)	7-4: Table F-1 in Attachment F lists identified pre-initiator HEP basic events which include CCF basic events. However, section 4.1.2.1 of the Human Reliability Notebook, Systems Review, says that due to staggered testing/maintenance practices, like components in different divisions are generally not susceptible to restoration error and "common mode" errors are screened. Common mode errors cannot be screened in this manner. Typically a plant's work planning process that prohibits cross divisional maintenance during normal operations are typically not in effect during plant shutdowns. The modeling of pre-initiator HFEs needs to include activities that occur during plant shutdowns. This is a finding because it is desired to not screen errors that can affect multiple trains of a redundant system or diverse systems.	This item was determined to be a documentation and terminology issue and the manner that SR HR-A3 redundant systems was treated in the HRA notebook, specifically the systems review in section 4.1.2.1. After further review, SR HR-A3 identifies that only single activities that simultaneously disable redundant trains or diverse systems require the development of events. Separate procedures/maintenance acts on different divisions or systems (even if they are performed in an outage) are NOT required in the development of events. The statement "Due to staggered testing/maintenance practices, like components in different divisions are generally not susceptible to restoration errors and 'common mode' errors are screened" is no longer applicable and was removed from the HRA notebook. Therefore, the potential condition described in the peer review comment is no longer applicable.	None, gap has been closed for the JUL12R1 model.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
HR-C3 (Not Met)	7-1: Section 4.1.2.1 of the HRA Notebook provides guidance towards the identification of restoration errors and miscalibration errors. In the subsection for Identification of Miscalibration Errors, Item 4 says: Identify I&C components the miscalibration of which will impact redundant system trains or redundant system components. Miscalibrations that impact a single component may be screened from further consideration. The Susquehanna HRA analysis assumes that miscalibration is included in the component failure rate data. However miscalibrations are not included in the failure rate data of NUREG-6928 and therefore there are potential failures that may have an adverse impact on equipment that has not been assessed in the Susquehanna HRA. Further in Section 4.1.4 of NUREG-1792, Good Practices for Implementing Human Reliability Analysis (HRA) it says: In practice it is best to include pre-initiator human actions even if the associated failure already may be included in the failure data for the affected equipment item (e.g., in the failure-to-start data). This is because it is often hard to determine if the failure databases include such human failures since data bases are typically insufficiently documented to know if the potential pre-initiator failure is already included. Generally, unless the failure can affect multiple equipment items, either missing the failure or double-counting the failure have small effects on the outcome of the PRA. Potential double-counting is the most conservative approach and yet typically does not result in a serious overestimation of the failure's significance. In addition, including all identified pre-initiators gives analysts the opportunity to identify the significance of potentially problematic actions such as those with procedural or training problems, those that do not require appropriate checks, etc. This is a finding. The impacts of miscalibration must be included as a mode of failure of initiation of standby systems and cannot be screened.	Open item As indicated in the finding discussion from NUREG-1792, "Generally, unless the failure can effect multiple items, either missing the failure or double-counting the failure have small effects on the outcome of the PRA." Therefore, adding this level of detail for single component miscalibration events is not warranted. The HRA documentation clarifies that these events are not included because they are low contributors. When this issue is fully addressed, it may be possible to use SR SY-A15 to demonstration that single sensor miscalibrations can be excluded.	Negligible effect on model results as per the provided resolution.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
HR-F1 (Not Met) Related SRs HR-G3 (Met Cat II & III)	1-2: There are few HRA events that are grouped together into a single HFE. However, the most risk significant example is MANOP_SPC_INJ_L-O. This event represents the opening of several valves related to the SPC function. The degree of difficulty of opening these valves is not necessarily the same nor are the performance shaping factors. There is little documentation in the HRA documentation or HRA calculator to justify this grouping. Also, the value for this HRA grouping appears to be extremely low for an in-field operator action (6.9E-4). This is a finding because this issue causes the SR HR-F1 to be 'Not Met.'	Redefined the risk significant MAN-OP_SPC_INJ_L-O into three new HEPs MAN-OP_SPC_E-O, MAN-OP_SPC_L-O, and MAN-OP_INJ_L-O, and performed detailed evaluations for each.	None, gap has been closed for the JUL12R1 model.
HR-F1 (Not Met)	1-3: For HRA MAN-OP_SPC_INJ_L-O, there is no analysis of how many "turns" that it takes to manually operate the valves that are to be operated. The valves within this grouped HEP are within large diameter piping segments with varying diameters and stroke characteristics. These characteristics can significantly affect the manipulation time. This is a finding, since it directly involves the manipulation time evaluation of a risk significant operator action.	Detailed timing evaluation added as part of the evaluation of the new HEPs MAN-OP_SPC_E-O, MAN-OP_SPC_L-O, and MAN-OP_INJ_L-O. References were added to the Timing and Assumptions sections of the three MAN-OP calculations in the HRA notebook.	None, gap has been closed for the JUL12R1 model.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
HR-G6 (Not Met)	7-9: While Table 5.1-2 does lists the actions by decreasing HEP value and includes comparison comments execution location, execution stress, performance shaping factors, timing information, the comparison comments are really directed more towards an internal assessment of the HFE itself, rather than it's comparison between events that have a similar HEP. However, the standard requires that a check of HEP values relative to each other be performed. It does not appear that this was done. This is evidenced by the fact that there are some local actions (with potentially negative performance shaping factors and lower likelihood of success) that have HEP values roughly equal to those of a similar in control room action. Examples of this include 159-CNTVNT-O and 159-CNTVNTLOCAL-O, as well as MAN-OP_SPC_INJ_L-O compared to other control room actions). Further, there is no discussion to relate location; timing, PSFs, etc. relative to each other and the values within a HFE range are highly variable. It is understood that the intent of this standard is to assess the HFEs relative to each other, i.e., for all of the HFEs that fall within a specific range, is the expected failure rate of the operators considered reasonable? For example, are all of the events that have a 1E-1 probability considered more difficult than the HFEs that have probabilities in the 1E-2 range? Similarly all of the HFE's that have probabilities on the 1E-3 range should be generally considered to have the same level of difficulties compared to the ones in the 1E-2 range. This is a finding because it is not apparent a comparison of events of like values, i.e., those with similar HEPs, has been conducted.	Added text to Section 5.1 to explain that the Table 5.1-2 actions were listed (along with their individual details) in decreasing HEP order in order to facilitate comparison between actions with similar HEPs. Inconsistencies were identified and corrected as needed. There are some local actions, as noted by the reviewer, with potentially negative performance shaping factors that have HEP values roughly equal to those of control room actions, but the similarity is justified in the comments section by stating that the time available for recovery for the ex-MCR action would allow multiple execution attempts and recovery opportunities.	None, gap has been closed for the JUL12R1 model.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
DA-C6 (Not Met) Related SRs DA-C7 (Cat II/III met)	4-9: As shown in Attachment B and Tables B-8 and B-9 of the Component Data Notebook, most estimated demands were determined from the MSPI and from plant experience. However, there is no documentation that it is collected in accordance with the requirements of this SR. This is a finding. The basis for collection of plant failure data is not provided except to indicate that the source was from MSPI data.	Open item	Negligible effect on model results. This F&O cites a lack of documentation that the estimated demands were collected in accordance with the SR.
DA-C12 (Not Met) **DA-C13 (Not Met)**	4-12: No evidence was found that the unavailability data obtained from MSPI was evaluated for issues of "double counting." Also, there was no consideration given to the handling of unavailability hours that occurred online versus during an outage. This is a finding because there was no evidence found that this requirement was considered.	Open item	Documentation item. Negligible effect on model results. MSPI unavailabilty data is by it's own program considered for reactor 'critical' hours. Unkown potential 'double counting' of MSPI data would be slightly conservative.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
QU-D4 **(Met Cat I)** <u>Related SRs</u> LE-F2 (Met Cat I/II/III)	5-7: No evidence of a comparison of CDF and LERF results with similar plants was found in the documentation. CC-II requires this comparison and identification of causes for significant differences. This is a finding because it causes QU-D4 to be a Cat I.	Attachment F was added to the quantification and summary notebook which includes a detailed comparison of the CDF and LERF results with Limerick. Limerick has been considered a sister plant to Susquehanna and is a very similar two unit BWR GE design site. The comparison results were similar and reasonable.	None, gap has been closed for the JUL12R1 model.
IFSO-A1 **(Not Met)** **IFSN-A16** **(Not Met)** <u>Related SRs</u> IFSO-A3 (Not Met) IFSN-A10 (Not Met) IFSN-A14 (Not Met) IFSN-A15 (Not Met) IFQU-A5 (Not Met) IFQU-B3 (Not Met)	6-2: Per discussion in Section B.2.1, a rupture of fire protection piping appears to be screened from further analysis, except in a few select areas. The given basis for this is that a fire protection rupture would be quickly identified, diagnosed, and isolated. However, it may not be an insignificant amount of time for operations to diagnose that a flood is occurring, rather than a fire. Once the flood condition is identified, it may take further time to isolate the flood (typically not able to simply stop the pump in the control room, but rather it must be shut down locally). It is possible for a significant amount of flooding to occur during this time period. While some flood scenarios are included in the analysis, it is unclear what criteria was used as to whether or not fire protection piping was excluded in a given area, and how much total fire protection piping was excluded. This is a finding because fire protection piping does not appear to be adequately addressed in the analysis. Floods resulting from fire protection piping ruptures can be significant contributors to CDF.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IFSO-A1 (Not Met)	6-3: Section 2.2.11 indicates that lagged and insulted piping was not considered as a spray source. There does not appear to be any justification for this assumption, and it is typically not used for industry IFPRAs. Furthermore, it is unclear from the documentation if spray effects from fire piping is included or not, based on the discussions in Section B.2.1 about excluding fire piping. Based on discussions with site and contractor personnel, a calculation was produced to demonstrate that lagged piping could not result in a spray impact. Furthermore, there are very few, if any, cases of insulated piping that is not also lagged. Finally, it was confirmed that fire protection piping was considered as a spray source. This is a suggestion to enhance the documentation.	Open item	Document-ation item. No impact
IFSO-A1 (Not Met)	6-4: Flood sources appear to be based on building elevations rather than individual flood areas. This is a finding as this SR requires flood sources to be identified on a flood area basis.	Open item.	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IFSO-A1 (Not Met) Related SRs IFSN-A8 (Met Cat II)	1-35: There is no evidence that a search for sources of flooding on the upper level of the control structure (where chiller units and service water piping is located) which could cause flooding of the control room, battery rooms, and/or relay rooms via propagation through ductwork was considered in the analysis. Susquehanna personnel looked at drawings during the Peer Review and found no evidence of such a scenario. However, this should be confirmed by a walkdown. This is a suggestion, since there is no evidence based upon Susquehanna evaluation during the Peer Review that this is a plausible scenario.	Open item. An interim walkdown was performed in and around the class 1E battery and DC distribution panel areas in the Control Structure. No ductwork was located in the immediate vicintiy of class 1E batteries, chargers, or distribution panels such that direct spray or deluge would cause inoperability.	Documentation item. No impact. The identified gap is a suggestion to provide additonal documentation on supporting the investigations perfromed during the peer review and additional walkdown.
IFSO-A1 (Not Met) **IFSO-A3 (Not Met)** **IFSN-A15 (Not Met)** Related SRs IFSN-A10 (Not Met)	6-41: Section 3.4 of the Internal Flooding notebook indicates that only >6 in (and in some cases >4 in) piping was considered for flood scenarios, and it appears that smaller diameter piping (in general) was not considered. Flood scenarios have been developed and are listed in Appendix C, and in Table 4-1 of Attachment E, of the Internal Flooding notebook. However, given the number of inappropriately screened flood sources, a significant number of potential flood scenarios have likely been missed in this analysis. This is a finding as potential flood sources may have been missed or not appropriately assessed, which causes several SRs to be "Not Met."	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IFSO-A4 (Not Met)	6-5: Failure modes of components appears to be included in the pipe rupture data used, as discussed in Section 2.2.9 of the Internal Flooding Notebook. Maintenance events are also assumed to be captured in this data (see also discussion in Section 3.7 of Attachment E). Inadvertent actuation of fire suppression system is discussed in Section B.2. While a review of industry OE was performed for maintenance induced flooding, no plant-specific review is documented. Furthermore, no review of plant test and maintenance procedures to identify potential errors resulting in a flood appears to have been performed. This is a finding as the plant-specific potential for maintenance-induced flooding does not appear to be appropriately addressed.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.
IFSO-A5 (Not Met)	6-6: The Reg Guide 1.200 Clarification states that a range of flow rates must be considered. This analysis considers only 'worst case' failure scenarios. This is a finding as a range of flow rates is required per the Reg Guide 1.200 clarification.	Open item	Negligible effect on model results. Bounding larger break flooding effects are considered in the model. See PRA Impact from Internal Flooding discussion, which precedes Table 1.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IFSO-A5 (Not Met)	6-7: Pressure and temperature information for flood sources was not found in the documentation. This is a finding as pressure and temperature information is not included in the Internal Flooding Analysis.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.
IFSO-B3 (Not Met) **IFSN-B3 (Not Met)** **IFEV-B3 (Not Met)** **IFQU-B3 (Not Met)** Related SRs IFPP-B3 (Met Cat I/II/III)	6-20: Assumptions are discussed in Section 2.2 of the Internal Flooding documentation. Discussion of uncertainty appears limited to discussion of flood initiator frequencies. Attachment D includes discussion of pipe failure modes but no other discussion of uncertainty is identified. No documentation exists for impacts of various assumptions on model uncertainty could be found. This is a finding as the SR requires a discussion of model uncertainty.	Open item	Documen-tation item. Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IFSN-A3 (Not Met) **IFSN-A14 (Not Met)** **IFQU-A5 (Not Met)**	6-9: Automatic and Operator actions appear to be identified throughout the notes in Appendix C, as well as the discussion in Section B. However, numerous concerns exist with the approach taken, as discussed below. There appears to be no justification/basis for crediting these actions. For example, a flood in C-604 (page C.2 credits operator action to isolate a domestic water pipe rupture prior to equipment damage. What indication exists to alert operations of the flood prior to the occurrence of equipment damage? Furthermore, no consideration is given to the likelihood of operator failure/in-action. This is a finding since while operator actions are credited to terminate flooding before equipment damage occurs, there appears to be insufficient basis for crediting these actions. This may result in erroneously screening some scenarios, which is non-conservative.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.
IFSN-A3 (Not Met) Related SRs IFQU-A5 (Not Met)	6-10: Section 4.2 states that no mitigation actions credited to limit the impacts from a flood. However, the comments contained in Appendix C do appear to credit operator action (as well as discussion in Section B.2.1 to isolate fire protection piping). This text is confusing/incorrect. This is a suggestion because it only pertains to documentation and is not an unanalyzed method.	Open item	Document-ation item. No impact

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IFSN-A6 (Not Met) **IFQU-A9 (Not Met)**	6-14: Susceptibility of SSCs to flood damage is discussed in Section 2.2 of the Internal Flood notebook. This discussion includes spray and submergence considerations. A qualitative discussion of additional impacts (jet impingement, pipe whip, humidity) is required for CC I/II per Reg Guide 1.200 clarification, but is not included here. Since medium and small bore fire protection piping is dismissed from the analysis and since spray sources greater than 10 feet away from the source are typically dismissed, the effects of pipe whip and jet impingement cannot be said to be evaluated in the quantification. This is a finding. A qualitative discussion of additional impacts (jet impingement, pipe whip, humidity) is required for CC I/II per Reg Guide 1.200 clarification to meet SR IFSN-A6. An evaluation of medium/small bore piping for pipe whip and jet impingement is required to meet SR IFQU-A9.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.
IFSN-A10 (Not Met) Related SRs IFSN-A5 (Met Cat I/II/III)	6-42: Flood scenarios have been developed and are listed in Appendix C, and in Table 4-1 of Attachment E, of the Internal Flooding notebook. There does not appear to be any consideration to the impact of water intrusion on control panels or junction boxes. This can result in additional failures to PRA-credited equipment that is otherwise not impacted by the flood. This is a finding as some potential failure modes (grounding of local control panels or junction boxes) were not considered in the analysis.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IFSN-A13 (Not Met)	6-17: Per Section 3.3.5 and Appendix E of the Internal Flooding documentation, flood areas were screened if no scram or 72 hour shutdown was required OR no significant source of water exists in the room. This is not sufficient per the standard. This is a finding since it causes the associated SR to be not met.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.
IFSN-A17 (Not Met) **IFQU-A11 (Not Met)** Related SRs IFSO-A6 (Met Cat I/II/III) IFQU-B2 (Met Cat I/II/III)	1-40: Credited plant walkdowns were conducted at various times and were separated by a period of many years. There was not a systematic walkdown plan that was applied to this process and thus the requisite information could not be gleaned to form the basis for scenario development. Walkdowns were deemed to not be complete with respect to their evaluation of flood-induced HRA and (implicit or explicit) screening decisions. This is a finding because it causes SRs to be not met.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.
IFSN-A17 (Not Met) Related SRs IFSN-A12 (Met Cat I/II/III) IFSN-B1 (Met Cat I/II/III)	4-17: Qualitative screening of areas is discussed in Appendices B and C of the Internal Flood notebook. Flood areas appear to screened on the basis of either no significant flood sources or no mitigation equipment is present in the flood area. However, except for Table 4-1 for unscreened flood areas, sufficient information is not provided to determine which SSCs are in each flood area and what flood heights or spray considerations should have been included. This is a suggestion since it involves documentation. There is insufficient information provided about the SSCs in each flood area.	Open item	Document-ation item. No impact

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IFSN-B2 (Not Met)	6-18: The Internal Flooding notebook discusses propagation pathways, accident mitigation features, assumptions and calculations, flood scenarios considered, screened, and retained, and results of plant walkdowns. No information was found regarding listing of SSCs in each flood area, height of floor, vulnerability to spray, etc. This is a finding as information used in the analysis is not clearly referenced to verify accuracy.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.
IFSN-B2 (Not Met) Related SRs IFSO-B2 (Met Cat I/II/III)	6-19: The Internal Flooding notebook discusses propagation pathways, accident mitigation features, assumptions and calculations, flood scenarios considered, screened, and retained, and results of plant walkdowns. Only limited information was found regarding pipe lengths, diameters, insulation, etc. This is a finding as piping information is required to verify the results of the assessment, including max flow rate and pipe rupture frequencies.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IFSN-B2 (Not Met) Related SRs IFSN-A2 (Met Cat I/II/III)	6-8: Presence of alarms is discussed in individual room analysis in Appendix B of Internal Flooding notebook. Curbs, drains, sump pumps, etc. appear to be accounted for in calculations in Appendix C. Appendix D lists all water tight doors in plant. Lists/tables of such features in each plant area would aid in review, as well as walkdown verification. This is a suggestion since while the required information appears to be incorporated in the analysis, including lists of such features for each flood area would be beneficial for review.	Open item	Document-ation item. No impact.
IFSN-B2 (Not Met) Related SRs IFSN-A4 (Met Cat I/II/III)	6-12: Drains/sumps are discussed throughout the documentation, but no indication of drain size or sump pump capacity was found. Drains were not credited in hydraulic calculations. The presence of drains/sumps was credited to screen out some flood scenarios with low volume sources in Appendix C. The presence of curbs appears to be included in hydraulic calculations. This is a suggestion as floor drains and sumps typically do not have a major impact on flood scenarios.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.
IFSN-B2 (Not Met) Related SRs IFSN-A5 (Met Cat I/II/III)	6-13: Table 4-1 of Attachment E of the Internal Flooding notebook documents the impacted SSCs. However, it is not always clear what the impacted components are, as often times only the System (e.g., RBCCW or HPCI) is identified. This is a suggestion as it should not impact the results of the model.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IFEV-A1 (Not Met)	4-14: Per Section B of Internal Flooding notebook, flood scenarios are mapped to existing plant initiators or are treated as new initiators. However, flood-induced LOCAs were not considered a credible event and were excluded from consideration LOCAs were addressed in the Initiating Events notebook. This is a finding since the potential for flood-induced LOCAs was not included.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.
IFEV-A5 (Not Met)	1-42: The pipe rupture frequencies used for development of the flood initiating event frequencies did not use the latest data (published in November 2010). Since the Internal Flooding Analysis was updated in early 2012, it was expected that justification would be provided to show that not using latest industry frequency data complies with the requirements. Therefore this SR is not met. This is a finding since it causes the SR to be "Not Met."	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.
IFEV-A6 (Met Cat I)	1-41: No consideration of material condition, water hammer, or maintenance induced flooding is included in the analysis. This is finding since it causes the SR to be of Cat I only.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.

TABLE 1
SUPPORTING REQUIREMENTS NOT MEETING CAPABILITY CATEGORY II OR GREATER

SUPPORTING REQUIREMENT	F&O #, DESCRIPTION OF GAP, AND SIGNIFICANCE	RESOLUTION	MODEL IMPACT
IFQU-A6 (Not Met)	1-30: There are some flooding events which cause flooding of areas without the potential for draining the area in greater than four hours. Therefore, this screening criterion is questionable. This is a finding because it causes the SR to be "Not Met."	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.
IFQU-A6 (Not Met)	1-31: There was no consideration given for increased stress level for both in control room actions and ex-control room actions that were are not failed by the flooding scenario. There was no adjustment of HEPs related to this finding. This is a finding because it causes the SR to be not met.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.

1.3 ADDITIONAL PEER REVIEW FACTS AND OBSERVATIONS

Table 2 lists all the SRs meeting CC II or higher for which an F&O was written. Similar to Table 1, it also lists the SR, F&O gap with Significance, Resolution, and PRA Model Impact. As can be seen, all of the remaining facts and observations have been closed, or have otherwise been determined to have no or negligible impact on the PRA model results.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
IE-A1 (Met Cat I/II/III)	4-2: The Manual Shutdown initiator for 'unplanned events' was included in the model even though section 2.3.4 clearly states that 'the scope of the PSA is for at-power conditions'. This F&O is a suggestion. Planned shutdowns that do not result in failures that would cause an initiating event would not challenge plant safety and would not result in an LER. Therefore, it should not be counted as an initiating event. The current estimate is overly conservative. Unsuccessful planned shutdowns would be captured in the review of plant events, reviewed for impact and included in the initiating events modeled. The ASME Standard interpretations #5 and #6 indicate that the Manual Shutdown initiator is not included in the PRA, but should be included in transition risk or low power risk models. Interpretation 5 states; "Question: Is it a requirement to include "non-forced" manual trips which are part of the normal shutdown procedure when counting initiating events. Reply: No, a normal controlled shutdown would not present the same challenges as a trip from full power. This event is more appropriate for a transition model and outside of the scope of the standard". This position is repeated in Interpretation 6; "Question: Is it a requirement to include "forced" (e.g., technical specification 3.03 actions) or "non-forced" (e.g., manual shutdowns for refueling) when the resulting shutdown follows normal plant procedures with no off-normal conditions requiring a reactor scram? Reply: No, the risk needs to be captured in a transition risk or low power risk model, which is outside the scope of RA-Sb-2005.	At power conditions for the online PRA risk model is defined to be plant modes 1, 2, and 3. Supporting Requirement IE-A1 states to "Identify those initiating events that challenge normal plant operation and that require successful mitigation to prevent core damage using structured, systematic process for identifying initiating events that accounts for plant specific features." As described in the summary notebook, "The manual shutdowns are included in the analysis because of their frequency and because they represent changes in operating state which result in the demand on available equipment to reach a safe shutdown condition. The manual shutdowns are controlled evolutions that have different characteristics than a SCRAM challenge. The manual shutdowns generally represent a reduced challenge relative to that of a turbine trip; however, also possible is a manual shutdown resulting from equipment unavailability where accident mitigation capability has been reduced prior to the demand for the shutdown." Therefore, the peer review suggestion is noted, but no changes were made to delete manual shutdowns from the initiating events given any shutdown can on some level challenge normal plant operation.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
IE-A2 **(Met Cat I/II/III)**	1-16: The loss of control room ventilation is not considered to be an initiator in the model. The initiating events notebook states that this initiator was dismissed, but there is no detailed discussion why this was done. Upon discussion with Susquehanna personnel, it was determined that there is a basis for dismissing this initiator, but it was not documented. This is a suggestion because it is a documentation concern only.	Per discussion with the peer review evaluator, the identified condition can be resolved with additional documentation. Information regarding the Appendix R fire calculation and loss of control room ventilation was added to the Initiating Events Notebook, Section 2.4.2, to support that no new initiator is needed.	Documentation item. The gap has been closed for the JUL12R1 model.
IE-A9 **(Met Cat II)**	6-28: The process by which LER reports are searched to identify precursors needs to be documented. This is a suggestion because it involves documentation only.	Per discussion with the peer review evaluator, it was desired to have additional documentation outlining the LER review. Section 2.3.8 of the Initiating Events Notebook was expanded to provide more detail to the LER review process and whether or not the events described needed to be included in the PRA.	Documentation item. The gap has been closed for the JUL12R1 model.
IE-C3 **(Met Cat I/II/III)** <u>Related SRs</u> IE-C11 (Met Cat I/II/III)	4-3: Use of NUREG-0666 includes a generic recovery estimate. No indication of Susquehanna adjustment. Section 3.5.2 of the IE Notebook uses the credit for recovery for loss of DC bus events from NUREG-0666. This is a finding. Use of NUREG-0666 is a very old reference and a more contemporary reference (NUREG-6928) should be used.	The Initiating Events Notebook Section 3.5.2 was revised to remove credit for DC bus repair recovery. Accordingly, the initiating event frequency was also changed in Table 4-1 and in the JUL12R1 model.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
IE-C6 (Met Cat I/II/III)	6-21: No potential Initiating Events appear to be screened based on criteria (a) or (b). A loss of River Water intake and Loss of the Spray Pond (UHS) are screened on the basis that it would not result in an immediate plant shutdown. However, this credits operator actions to remove any debris blocking the intake structure, and states that failure of this action would result in an initiating event similar to a loss of condenser heat sink. Per discussions with PRA staff, debris/fouling/ice are unlikely (no recorded plant events), and there appear to be no common suction lines that would impact multiple systems. A loss of a 13.8 kV bus was screened on the basis that it would appear like a loss of feedwater with some impacts on service water/instrument air. The notebook then states that this IE is screened as it is assumed to be adequately included in as a turbine trip transient initiator with subsequent failure of a 13.8 kV AC bus. An estimation of this IE frequency should be made to verify it conforms with the Screening Criteria given in this SR. This is a suggestion as the frequencies of the screened IEs are likely low enough to support their being screened.	The proposed resolution from the peer reviewer evaluator was to estimate the frequencies for loss of the river water intake and loss of the 13.8 kV bus to confirm that they are appropriately screened out under the guidance of SR IE-C6. The screening determined that these system losses should be added to the risk model. The river water makeup discussion inthe Initiating Events Notebook, section 2.4.5 was revised. The river water makeup system is now an input to the service water initiating event fault tree. CCF screen and pump terms were also added to the model loss of service water support system initiating event fault tree and are documented in the Component Data Notebook. Also added loss of 13.8 kV buses as special initiators to the initiating event notebook.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
IE-C8 **(Met Cat I/II/III)** <u>Related SRs</u> IE-D1 (Met Cat I/II/III)	4-1: Section 3.5 of the IE Notebook provides the fault tree method and results of the support system initiating events. The initiating event fault trees were developed from the mitigation fault tree. Only the Service Water tree is found in the system notebook. The support system dependencies were removed from the mitigation tree to develop the initiating event fault tree. The support system initiating event fault trees developed for loss of off-site power, loss of CIG, loss of SW, loss of IA, loss of TBCCW, and loss of RBCCW are found in the Susquehanna CAFTA fault tree under gates identified for each system. The cutset results are shown in Appendix F of the IE Notebook for each system IE. This is a finding because Appendix F states that the System IE fault trees are located in the respective system notebooks, however, this was not found to be the case for RBCCW, TBCCW, IA and CIG.	The peer review finding noted that the special initiating events fault trees described in the initiating events notebook were not located in the referenced individual system notebooks. The peer review finding specifically questions the documentation of the special initiating events fault trees since the frequency is calculated within the model. The special initiating event fault trees have been added directly to the Initiating Events Notebook in Appendix F.	None, gap has been closed for the JUL12R1 model.
IE-C14 **(Met Cat I/II)**	6-25: Appendix H of the Initiating Events notebook addresses the ISLOCA frequency calculation and appears to address most of the items required by this SR. However, no discussion of interlocks of relevant surveillance tests and procedures was found. This is a finding. Consideration of protective interlocks and plant surveillance procedures is required by this SR.	Per the referenced possible resolution, Appendix H of the Initiating Events Notebook was updated to address the identified gap. A discussion of surveillances and interlocks has been added to Appendix H for ISLOCAs.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
IE-D3 (Met Cat I/II/III)	6-26: Assumptions are discussed throughout the IE notebook. Sources of Uncertainty regarding initiating events are included in the discussion in Section D.1.4 of the Summary Notebook. A single section/list of all assumptions made was not found, such a list may be beneficial. This is a suggestion as all assumptions made appear to be captured throughout the documentation.	Open item	Documentation item. No impact.
AS-A9 (Met Cat III)	2-1: Section 2.1.16 of Event Tree / Success Criteria Notebook, Thermal-Hydraulic Code Limitations, states that MAAP4 does not calculate peak fuel temperature well. However, fuel temperature calculated in MAAP is used to define core damage. Analysis and justification for the use of MAAP4 to define core damage is provided in Section 2.1.1 of the, Performance Requirements for Maintaining Core, Vessel, and Containment Integrity During Severe Accidents notebook. Section 2.1.1 of the performance requirements notebook should be referenced in the Event Tree / Success Criteria Notebook to avoid confusion on the use of MAAP4 with the limitation described. This is a suggestion to clarify documentation in the Event Tree / Success Criteria Notebook.	Reference to MAAP limitations have been incorporated in the Event Tree / Success Criteria Notebook.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
AS-B3 (Met Cat I/II/III)	1-20: There is no separate success criteria notebook in the Susquehanna documentation. Rather, the plant uses the event tree notebook for both AS and SC technical elements. This results in some of the success criteria information being scattered through the event tree sequence descriptions. This is a suggestion, since it is a potential documentation enhancement.	Open item	Documentation item. No impact
AS-B5 (Met Cat I/II/III)	1-21: Expanded documentation of the FFT model top logic would facilitate greater understanding of the model by PRA engineers new to the group and would further enhance the scrutinizing of the model. This is a suggestion since it involves model documentation only.	Open item	Documentation item. No impact

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
AS-C1 **(Met Cat I/II/III)** Related SRs AS-A11 (Met Cat I/II/III)	1-13: The accident sequence model is constructed using a very large number of transfers. This made the model difficult to review. It is also constructed in a manner such that the CDF tree and the Level 2 tree are integrated. While there is no evidence from the peer assessment that was performed that the model fails to accurately model the as-built, as-operated plant (the quantification results are reasonable given the operation and design of the plant). However, the event tree structure does not lend itself readily to evaluation. This should not hamper the ability to pursue PRA applications. However, as more hazards are added to the spectrum of the PRA (internal fire, seismic, etc.) the event tree structure may become difficult to deal with. This is a suggestion because it primarily addresses potential issues that may arise in the future.	Open item	Documentation item. No impact
AS-C1 **(Met Cat I/II/III)**	1-46: Consider the creation of a separate LOOP tree. This would allow for increased model readability and would diminish the need for the use of recoveries. This is a suggestion, since the as-built, as-operated plant is effectively represented by the current model.	Open item	No impact. The F&O suggests a different method to model the Loss Of Off-Site Power.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
SC-A3 (Met Cat I/II/III) <u>Related SRs</u> SC-C1 (Met Cat I/II/III) AS-A2 (Met Cat I/II/III)	3-2: Section 2.6.2 of the Event Tree/Success Criteria Notebook describes the core protective functions identified in the AS and SC Notebook. Table 3.3.1 through 3.3.11 (LOCA) and Table 3.4.1 through 3.4.10 (TRANSIENT) provide the functional level SC for the key critical safety functions for each initiator category. Attachment M provides key results of MAAP runs to support the SC. However, no similar Tables as LOCA and TRANSIENT key safety functions were found that described the key safety functions for ATWS and ISLOCA. This is a document suggestion.	Open item	Documentation item. No impact

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
SC-A6 **(Met Cat I/II/III)**	3-3: The success criteria given are consistent with the features described in the system notebook document. The MAAP input deck and runs use flows, pressures, and other parameters that are consistent with the values described in the station system description documents and in the PSA system notebooks. The success criteria are also tied to plant's procedures. However, there is a plant modification on the Fire Water System to replace a 50 foot 3 inch hose with 200 foot of 5 inch hose. System flow is potentially increased, and SC might need to be updated to reflect the plant as-build condition. This may improve the plant over SC as well. This a finding since the unanalyzed modification may impact overall model success criteria and implemented logic.	System flow used for MAAP analysis is conservative (i.e. lower) relative to predicted post-modification system flow. Therefore, the current credit for fire water makeup based on the MAAP analyses are conservative. No modeling changes are made at this time, but this should be considered in a future PRA model update.	Negligible, the current analyses are conservative. However, using a higher fire water pump flow has the potential to yield success for re-flooding the core after depressurization. If this is successful, the fire pump, injection flow path and operator action for the fire water injection alignment would become more important.
SC-B4 **(Met Cat I/II/III)** <u>Related SRs</u> AS-A9 (Met Cat III)	2-2: Event Tree / Success Criteria Notebook Section 2.1.6 describes Thermal-Hydraulic Code Limitations. There is no discussion of the MAAP4 limitation concerning its use in analysis of large break LOCAs. This is a suggestion since the large LOCA MAAP calculations were compared to existing BWRSAR calculations and found acceptable for use in the PRA.	Documentation issue. Reference to BWRSAR/MAAP comparison was added to the Event Tree/Success Criteria Notebook section 2.1.6.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
SY-A3 **(Met Cat I/II/III)**	5-4: PRA model system functions documented in Section 1.2 of the system notebooks are based on Maintenance Rule functions. Did not find a reference for the source of these functions (e.g., Maintenance Rule basis document) identified in the system notebooks. This is a suggestion because it pertains primarily to documentation.	Open item	Documentation item. No impact.
SY-A10 **(Met Cat I/II/III)** <u>Related SRs</u> HR-F2 (Met Cat III) SY-A2 (Met Cat I/II/III) SY-C2 (Met Cat I/II/III)	5-3: The effect of variable success criteria was not clearly documented for three system notebooks RCIC), CRD and CST and RWST. For example, success of RWST is defined simply as to provide manual makeup to the Unit 1 CST and the Unit 2 CST. Timing information is found in the event tree notebook for different scenarios. The evaluation of 037-N-N-RWST-O in the HRA notebook indicates a different timing than found in the event tree notebook. It is not clear from the CRD system notebook what CRD flow is credited and the basis in success criteria. It would be clearer if this and other success criteria are documented in a separate notebook to tabulate various combinations of criteria applicable to accident scenarios. This is a suggestion because it applies to documentation only.	Open item	Documentation item. No impact.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
SY-A13 (Met Cat I/II/III)	6-31: Assumption 2 of Section 2.2 (general assumptions) in the System Notebook Template discusses screening potential flow diversion paths if the diameter of the pathway is less than 1/3rd the diameter of the primary pathway. This assumption may not necessarily be true and requires more justification on a system-by-system basis. Per discussion with PRA staff, the general assumption on 1/3rd pipe diameter is not actually used. Flow diversion are analyzed on a system by system basis, and are documented in Section 2.1.3 of each notebook discusses the identified flow paths. This is a suggestion to remove the unused assumption from the notebook.	Open item	Documentation item. No impact.
SY-A15 (Met Cat I/II/III)	6-32: Per the system notebook template, several components/failure modes have been screened (plugging of components, leakage/rupture of a components, etc.). This appears to be in accordance with the requirements of this SR. However, some additional discussion to verify appropriate screening should be added to the documentation. This is a finding since quantitative criteria were not cited.	Open item	Documentation item. No impact. .

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #*, DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
SY-A16 (Met Cat I/II)	6-33: Discussion of these events was not found in the system notebooks and were expected to be found in Section 2.3.2 (example, discussion of pre-initiator events such as 054-I-AC-PMP-H was not found in the ESW notebook, outside the "copy-paste" of the fault tree and cutsets). This is a suggestion as the pre-initiator events are included in the model and the HRA documentation but are not described in the system notebooks.	Open item	Documentation item. No impact.
SY-A21 (Met Cat I/II/III)	1-25: The RHR System Notebook contains a reference point estimate probability for the RHR water hammer event that is postulated in NEDO-33150-NP (BE 149-II-N-H20_PART). An expanded discussion of this phenomenology should be presented and details of its injection accident sequence model should be presented. This is a suggestion since it is a documentation enhancement.	Open item	Documentation item. No impact.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
SY-B3 (Met Cat I/II/III)	1-17: Check valve CCF is slightly more than 2 orders of magnitude lower in CCF probability than MOV failures, but less than 2 orders below pump failure to start and failure to run CCF terms. Therefore, it is not appropriate to screen check valve CCF unless there are MOVs (or other high CCF failures) in the system. Of particular concern are check valves which are within injection pathways to the reactor shared by multiple systems (such as one injection line through with HPCI and FW inject and the opposite injection line inject RCIC and FW) in which the shared lines only have check valves. CCF modeling of such check valves is important to incorporate. This is a finding because there is a potentially significant common cause failure that was not added to the model.	Upon review, it was determined that check valve CCF basic event terms for the HPCI/RCIC Feedwater (FW) injection paths and ESW paths should be included in the risk model. The basic events and CCF data is as documented in the component data notebook.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
SY-B3 (Met Cat I/II/III)	6-34: Selection of CCF groups is discussed in Data Notebook Section 3.0. CCF groups follow guidance in NUREG/CR-5485 and are based on similarities in service conditions, environment, design or manufacturer, maintenance. CCF groups included pumps, MOVs, air compressors, etc. However, per discussion in Section 3 of Data Notebook, some component types, such as filters, check valves, and circuit breakers, were screened due to low probability. This may not necessarily be true. For example, based on Table 4-1 the probability for 2 of 4 RHR pumps failing to start is 8.4E-7. With a probability of a check valve failing to open of 1E-5 and assuming a Beta factor of 8.5E-3, a probability of 2 of 4 pump discharge check valves failing to open would be ~1E-7, which is less than 2 orders of magnitude lower than the pump failure to start CCF term. In addition, plugging of strainers/HXs/etc. can have CCF probabilities that are within an order of magnitude or two less than their independent probabilities. This is a finding as some CCF terms may have been inappropriately screened from the model. Possible Resolution Demonstrate that screened CCF terms were appropriately screened, or incorporate them into the model.	Section 4.3.24 of Component Data Notebook evaluates the CCF for check valves in the RHR, CS and RHRSW systems. The conclusion is the CCF of check valves in these systems is not required since their CCF is more two orders of magnitude lower than the highest failure probability of the other components in the same system train that results in the same effect on system operation. Strainer (filter) plugging for the RHR and Core Spray Pumps is modeled. The CCF of circuit breakers for motor driven equipment is not modeled since the failure of the circuit breaker for motor driven equipment is included in the failure rate of the driven equipment (NUREG/CR-6928).	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
SY-B15 (Met Cat I/II/III)	5-6: Section 2.3.2 in each of the system notebooks discusses human interactions and lists HRA basic events. Also refer to the HRA notebook. An example of operator interface dependencies across systems is 037-N-N-XTIE-O, OPERATOR FAILS TO XTIE RWST TO CST, which provide CST makeup from the RWST. This HRA basic event is among the events listed in Section 2.3.2 of the RCIC system notebook, but was not included in Section 2.3.2 of the HPCI and Core Spray system notebooks. *Documentation of operator interface dependencies across systems in the systems notebooks is not complete.* *This is a suggestion because it only pertains to documentation.*	Open item	Documentation item. No impact.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
HR-A3 (Met Cat I/II/III)	5-2: Statement in Section 4.1.2.1 on page 60: Due to staggered testing/maintenance practices, like components in different divisions are generally not susceptible to restoration errors and "common mode" errors are screened. This is a finding. Need basis for not identifying the work practices identified above (HR-A1, HR-A2) that involve a mechanism that simultaneously affects equipment in either different trains of a redundant system or diverse systems [e.g., use of common calibration equipment by the same crew on the same shift, a maintenance or test activity that requires realignment of an entire system (e.g., SLCS)].	This item was determined to be a documentation and terminology issue and the manner that SR HR-A3 redundant systems was treated in the HRA notebook, specifically the systems review in section 4.1.2.1.After further review of SR HR-A3, it was determined that only single activities that simultaneously disable redundant trains or diverse systems require the development of common mode failure events, as exemplified in SR HR-A3. Maintenance acts that are directed by separate procedures on different divisions or systems, even if they are performed in an outage, are NOT required to be identified as common mode failure events. The identification process used in the SSES pre-initiator HRA is consistent with SR HR-A3. The documentation was updated to provide clarification.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #*, DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
HR-B1 (Met Cat II/III)	7-2: Although some screening criteria are identified in selected sentences throughout the document, a succinct section outlining screening criteria is not reiterated in the HRA Notebook. Although Section 4.1.2.1 of the HRA Notebook, largely identifies components that are to be included in the analysis, this section does not succinctly identify the criteria under which components and actions can be screened from the analysis. Note that it is stated in section 4.1.2.1 that "Miscalibrations that impact a single component may be screened from further consideration and assumed to be inherent in the component failure rate." Screening calibration activities on that basis is not a screening criteria of ASEP as identified in this associated supporting requirement: SR-B1. Therefore since unique screening criteria have been used in the Susquehanna HRA analysis that is not part of the ASEP process, a succinct and comprehensive listing of all pre-initiator screening criteria is required. Later, Section 4.1.2.5 refers to the procedures used for the pre-initiator analysis of HFEs identified as 'risk-significant', which are listed in Attachment C. It is not noted however, if these procedures provide the post maintenance functional tests that would reveal misalignment It is noted that Attachment F of the HRA notebook defines some screening criteria for pre-initiator identification which presents screening of plant experience related to potential restoration errors or miscalibration errors to identify additional pre-initiator actions worthy of inclusion in the model. This is a finding because a complete set of screening criteria for Type A events was not found in the documentation.	The HRA notebook, Section 4.1.2.1, has been updated to include a specific set of screening criteria. The text has been updated to clarify what the test needs to do in order for it to be credited (identify the error). The description of the potential recovery mechanisms has also been enhanced to clarify that mechanisms described in section 4.1.2.5 are the same as those listed for each procedure review section.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
HR-C2 **(Met Cat II/III)**	7-5: Restoration errors screened on the basis of an administrative work practice procedure which may not be applicable during all stages of low power and shutdown modes. This is a finding because it is possible to have restoration errors during low power and shutdown modes that affect equipment across system trains.	SR HR-C2 is attempting to ensure that specific failure modes are addressed for the unscreened activities. SSES does not have unscreened common mode misalignment events. In addition, based on the clarification and further review of SR HR-A3, the HR-A3 requirement identifies that only single activities that simultaneously disable redundant trains or diverse systems require the development of events. Separate procedures / maintenance acts on different divisions or systems (even if they are performed in an outage) are NOT required in the development of events. Clarification was provided in the HRA notebook in Revision 5.	None, gap has been closed for the JUL12R1 model.
HR-D2 **(Met Cat II)** <u>Related SRs</u> HR-G1 (Met Cat II) QU-F6 (Met Cat I/II/III)	7-7: A detailed analysis has been performed for the HFEs that had a risk achievement worth (RAW) greater than or equal to 2.0 or a risk reduction worth (RRW) greater than or equal to 1.005. Consideration should be given to using the FV directly per the ASME Standard wording rather than indirectly through RRW. This is a suggestion because it pertains to more direct correlation with the standard. Use the ASME Standard and RG 1.200 parameter of a FV = 0.005 rather than the RRW to avoid confusion.	Expanded and/or corrected discussion was provided in the HRA notebook, sections 4.2.3 and 4.2.1.4.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
HR-D2 **(Met Cat II)**	5-1: The screening criteria and values used need to be more clearly defined within the Susquehanna HRA as also noted in SR HR-B2. The nominal ASEP methodology has been used in the Susquehanna HRA as the detailed methodology. This is a suggestion, since there is no direct evidence that important contributors have been missed.	Scoping values of 0.01 for independent pre-initiator events and 0.001 for common cause pre-initiators are judged as reasonable scoping estimates as described in Section 4.1.2.4 of the HRA Notebook.. The 1E-2 value that SSES employed is per the NRC's guidance in NUREG-1792 document.	None, gap has been closed for the JUL12R1 model.
HR-E4 **(Met Cat II/III)**	1-1: Simulator observations should be conducted to further confirm the validity of assumptions in modeled operator actions. This is a suggestion, since there is no requirement for such observations if a 'talk-through' was performed.	Open item	Negligible, F&O is a suggestion that would enhance the HRA analysis.
HR-F2 **(Met Cat III)** Related SRs AS-B3 (Met Cat I/II/III)	1-19: RHRSW is credited for external injection past containment venting. It was noted that the injection path must lined up (MOVs opened) before venting by procedure. However, there is no step in the execution or cognitive portion of the HEP 013-N-N-RHRSWXTIE This is a finding, since it may affect the value for the HEP and the quantification.	013-N-N-RHRSWX_L-O was added to the model as a late RHRSW crosstie action to maintain alternate injection after PC venting. The venting procedure steps to open the RHRSW crosstie valves prior to venting are included in the execution error. The execution error for both 013-N-N-RHRSWXTIE and 013-N-N-RHRSWX_L-O reflects RHRSW alignment as alternate RPV injection.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
HR-G1 (Met Cat II)	1-10: Basic Event 054-01222AB-24AB1-O uses a screening HEP value. While this is by definition not a risk significant function by RAW or FV, the action does appear in some cutsets above 1E-9. This is a suggestion, since screening values are allowed by the standard for non-significant events for Cat II.	Open item.	Negligible, F&O is a suggestion that would enhance the HRA analysis.
HR-G2 (Met Cat I/II/III)	7-8: The combination sum technique presented in the HRAC has no theoretical basis. Although all of the HFE methodologies have limitations, it is more defensible to choose an industry reviewed methodology that most closely models the scenario according to the known limitations of the methodology rather than adding the cognitive errors of two unlike methodologies to compensate for timing uncertainties. This is a suggestion. While the HRA Calculator allows this approach, its basis may be subject to challenge.	The Peer Review suggestion questions the combination sum technique used in the EPRI HRA calculator and recommends consideration of another approach. It was determined acceptable to retain the combined method for actions with limited time available for recovery because the combined method provides both the detailed assessment of the CBDTM PSFs and accounts for the expected increase in Pc if the time available for recovery is limited. The method is retained because it allows detailed PSF (Performance Shaping Factors) assessment and accounts for the expected increase in cognitive error associated with limited time available for recovery and is allowed within the use of the HRAC	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
HR-G4 (Met Cat II)	1-8: The description for event 013-N-N-RHRSWXTIE-O is OPERATOR FAILS TO TIE IN FIRE MAIN OR RHRSW WITHIN 29 MINUTES. The mission time for this event, however, is 100 minutes. This is a suggestion because the timing analysis for the event is correct.	The title of 013-N-N-RHRSWXTIE-O was corrected in the HRAC database and in the HRA Notebook.	None, gap has been closed for the JUL12R1 model.
HR-G5 (Met Cat II)	1-4: There are several instances in the HRA Notebook where the previous HRA analysis (Notebook) is quoted as a reference for the manipulation time. The basis for these manipulation times should be carried forward to the new documentation. This is a suggestion, since there is a basis for the manipulation time and this issue pertains only to documentation.	The basis for manipulation times was carried forward in the HRA Notebook.	None, gap has been closed for the JUL12R1 model.
HR-G5 (Met Cat II)	1-5: There is no documented basis for the manipulation time for 013-N-N-RHRSWXTIE-O. Note that the utility staff subsequently noted an accurate basis for the timing. This is a suggestion, since the utility stated a basis for the manipulation time.	The manipulation time for 013-N-N-RHRSWXTIE-O was obtained via PPL operator interviews and reference was. added to the HRA Notebook.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
HR-G7 **(Met Cat I/II/III)** <u>Related SRs</u> QU-C1 (Met Cat I/II/III)	1-7: Dependent HEPs MAN-OP_SPC_INJ_L-O and 159-CNTVNT-O are found in a dependent HEP Group with three elements. However, they are not in a dependent HEP Group by themselves (two event combination). This appears to be inconsistent. Table 5.3-1 gives an explanation that there is zero dependency between the actions. However, it appears that the timing information for 159-CNTVNT-O in that table does not match that in the HRA Calculator Database. If the timing in the HRA calculator database for that event is used, it would appear that there is, in fact, some level of dependency between these events. This combination is important to the mitigation of long term DHR related sequences. This is a finding because it has quantitative impact.	The HRA dependency analysis has been completely re-performed with the JUL12R1 model. Additionally, F&O 1-7 has 2 parts: the dependency analysis question with regard to the manual MOV operation with containment venting actions, and the timing differences in the dependency analysis file (DAF) and the HRAC. The second part of the explanation addresses the need for the timing differences between the DAF and the HRAC in order to force the actions into their expected chronological order. The first issue starts with MAN-OP_SPC_INJ_L-O which was broken into 2 actions: MAN-OP_SPC_L-O and MAN-OP_INJ_L-O. The revised HRA dependency analysis includes a dependent HEP for the new SPC action and both versions of containment venting. The 159-CNTVNT-O action is in Combination 52. Combination 51 has MAN-OP_SPC_L-O and 159-CNTVNTLOCAL-O. Additionally, since MAN-OP_SPC_INJ_E-O is not credited due to the timing constraints (i.e., HEP value = 1.0 and it is set to TRUE prior to quantification), there are no dependent HEPs which involve this early action.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
HR-G7 (Met Cat I/II/III)	1-9: The HEP values that are part of a dependent group are sometimes assigned and HEP in the RR file that is arbitrarily high. After performing the quantification, a post processing recovery is applied to these non-dependent HEPs to return them to their "true" value. Although the true HEP value is seen in the HEP description, it is somewhat confusing to someone not familiar with the model; it can also cause issues when using the RR file to perform query operations for data extraction from the model. This is a suggestion because it does not affect quantification.	The processing of the HEPs has been revised. A JUL12R1 model flag file has been created to elevate the HEPs prior to quantification, and the real values are maintained in the JUL12R1.RR file.	None, gap has been closed for the JUL12R1 model.
HR-H2 (Met Cat I/II/III)	1-48: A spot check of several HFEs within the Susquehanna 2011 HRA Update in V 411 used with the DAF. HRA file reveals that individual operator actions are selectively credited where appropriate for recovery of potential execution errors. However the dependency values are often not used with the HRA calculator for the cognitive decision trees when a LD is assessed. While the use of "N/A" produces realistic results in the case of ZD it provides unrealistic low values for cases where a higher dependency is suggested. This is a suggestion, since it is not deemed to be quantitatively significant.	Open item	Negligible, this F&O is quantitatively insignificant.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
HR-I2 **(Met Cat I/II/III)**	7-12: The Susquehanna HRA Notebook, PA-B-NA-041, documents the process used to characterize the HFEs used in the model. It is noted however that some documentation is provided within the notebook which does not actually reflect the process used. For example, assessing recovery factors based on time phasing appears not to have been done as is described in Table 4.2.1-11 [INCREMENTAL(1) CONDITIONAL FAILURE PROBABILITIES (NON-RECOVERY PROBABILITIES WITHIN EACH TIME PHASE)]. Rather, the recovery factors that are inherent within the HRA Calculator appear to be used in the actual modeling of the HFEs and such recovery factors do not account for time phasing. This is a suggestion because it relates to updating the documentation within the HRA notebook to reflect only what is done in the system models.	Expanded and/or corrected discussion was provided in the HRA notebook, sections 4.2.3 and 4.2.1.4.	None, gap has been closed for the JUL12R1 model.
DA-A1 **(Met Cat I/II/III)** <u>Related SRs</u> DA-A4 (Met Cat I/II/III)	4-6: There is no clear statement documenting that the system analysis or the overall model was used to determine which basic events were identified that required development of data. This is a finding since identification of the basic events from the system analysis is required by the ASME standard.	Documentation was added to the Component Data Notebook.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
DA-C4 **(Met Cat I/II/III)**	4-8: The Component Data Notebook evaluates the unavailability in Appendix B using plant data taken from Maintenance Rule and/or MSPI as shown in Table B-8. Table B-10 shows the Maintenance Rule Functional Failure Data that was evaluated for inclusion in the Bayes update. However, there is no clear basis documented in Section B.2 for how events were screened to identify failures to be included in the model for the data analysis. This is a finding since the requirement is to provide a clear basis for identification of failures for inclusion in the data analysis.	Added discussion for evaluation of failures to Section B.4 of the Component Data Notebook and added cross-reference to categories to the PRA comments field in Table B-10. This revision is in line with the proposed resolution provided by the peer review team and documents the method used for analysis of data applicability.	None, gap has been closed for the JUL12R1 model.
DA-C14 **(Met Cat I/II/III)** Related SRs SY-A20 (Met Cat I/II/III)	1-22: Coincident maintenance unavailability is well accounted for in the Susquehanna PRA. However, there is a maintenance combination of risk significant equipment which may occur that is not accounted for in the PRA model that is allowed by the 13 week schedule. That combination is in Week for of the Table G-1 work matrix, which is the Blue Max portable diesel generator and the B/D ESW HVAC system. This is a suggestion, since the equipment is not considered to be redundant per strict interpretation of the ASME Standard requirement.	A sensitivity case is now discussed in the component data notebookSection B.3.3 which indicates that this additional combination is not warranted due to very low risk impact. Other combinations were not identified.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
DA-E1 (Met Cat I/II/III) <u>Related SRs</u> AS-C1 (Met Cat I/II/III) SY-C1 (Met Cat I/II/III)	4-7: Sections in the Summary Notebook and in the Component Data Notebook are identified as "Appendices..." when in fact the notebooks identify the corresponding sections as "Attachments." Table B-1 in the Component Data Notebook refers to sections of the notebook and to the Systems Notebooks as "Appendix..." when in fact they are identified as "Attachment..." This is a suggestion since it involves documentation only. The roadmap designation of "Appendix..." led to confusion and difficulty in finding the correct section in the notebook.	The Component Data Notebookwas revised to incorporate the title Attachment instead of Appendix where appropriate.	None, gap has been closed for the JUL12R1 model.
QU-B7 (Met Cat I/II/III)	1-47: There is a general discussion regarding the rationale for the combinations in the mutually exclusive file. However, the rationale for each combination is not explicitly discussed in the documentation. This is a suggestion because it pertains to documentation only.	The JUL12R1 model Quantification and Summary Notebook, , section A.2 and Table A.2-1, provide the mutually exclusive basic event combinations and the basis for exclusion.	None, gap has been closed for the JUL12R1 model.
QU-B9 (Met Cat I/II/III)	1-38: It was noted that there are several negated events with a probability of 0.0 that appear in the CDF cutsets (specifically, events like -EFORB). These events, while useful for the cutset readability and debugging, should be set to false in a flag file for "production" quantifications. This does not have a significant impact on the quantification (it only adds an insignificant conservatism) and therefore is a suggestion.	Added 0.0 probability events to flag file as false to be assigned prior to quantification.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
QU-D1 **(Met Cat I/II/III)** Related SRs QU-D5 (Met Cat I/II/III)	6-35: Only the top 10 cutsets are listed or described in any detail. The percent contribution to total CDF of these cutsets was not give, although the individual contributions are (the total appears to be ~30% of CDF). A listing of those cutsets selected for in-depth review for the non-significant cutset review process would enhance the documentation. This is a suggestion as the review of cutsets appears to be thorough, based on discussions with PRA staff.	This peer review suggestion is directed to SR requirements QU-D1 and QU-D5. Requirement QU-D1 requires reviewing a sample of the significant accident sequences/cutset sufficient to determine that the logic is correct. QU-D5 involves reviewing a sample of non-significant accident cutsets or sequences to determine they are reasonable and have physical meaning. Instead of selecting a random number of cutset to review, the top cutsets contributing > 1% to the overall CDF/LERF were reviewed. This constitutes a review of significant cutsets. A sampling of non-significant cutsets was selected for review of reasonableness and meaning. These cutsets and their description were added to the summary notebook where in the past, only conclusion of reasonableness was provided.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
QU-D2 (Met Cat I/II/III)	6-38: Section 3.4 of Attachment A of the Summary Notebook discusses dominant core damage sequences and provides a description of why these sequences result in CDF/LERF. However, further review and discussion of the results would help verify model reasonableness. Section 4 includes a review of basic event importance, initiator contributions to CDF/LERF, and significant operator actions. The discussion is focused on what items changed since the previous revision, rather than the reasonableness of the results (i.e., why is LOOP ~50% of CDF when the plant has a 5th diesel and the Blue Max diesel for charging batteries?). This is a finding as further documented review and discussion of results is needed to verify the reasonableness of the model.	The item identified requests additional discussion and justification to the statements of reasonableness. The Quantification and Summary Notebook was revised to include additional sequence discussion and justification of reasonableness given plant operation. Additional discussion for LERF differences found in section 3.5 was also provided. Section 4.1, important systems, was also enhanced by providing a discussion of the component basic event importances. In general, where appropriate, additional discussion was added to results sections to better demonstrate statements of reasonableness.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
QU-D6 (Met Cat II/III)	6-37: Importance of Operator actions are given in terms of RAW and RRW. However, the quantification process appears to remove dependent HEPs from the cutsets and replace them with a single basic event containing the total dependent failure probability. No discussion was found regarding how this might impact Importance Measures for HEPs. This is a suggestion as it does not directly impact the model or quantification process, but can distort model results if the effects are not accounted for.	The dependent operator action basic event nomenclature that was provided in the JUL12 risk model was determined not complete. During the peer review, the noted operator actions provided to the peer review team were only independent actions. Upon review of the basic events, it was determined that the dependent operator action nomenclature did not include the -O at the end of the basic event name. Therefore, upon data sorting, the complete list of operator actions was not initially provided to the peer review team. The dependent operator actions are identified by a beginning letter Z annotation and now end with a -O annotation. Therefore any future assessment and search for operator actions and their importance will be complete. All operator actions both independent and dependent now end with -O.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
QU-D7 (Met Cat I/II/III)	6-36: Importance measures for basic events are given in Table 4.1-1, and appears to be based on RRW > 0.1. The Summary Notebook indicates that these results were reviewed and appear reasonable. Importance measures for all basic events are given in Attachment B for CDF (both units), and Attachment C for LERF (both units). While Table 4.1-1 is titled 'Important Components to Reduction in Risk (RRW),' this appears to be a misnomer as the items listed in the table are basic events. No component importance measures were found in the documentation. This is a finding as reviewing component importance is required by this SR.	Section 4.1 of the Quantification and Summary Notebookprovides a review of component/system basic event importance. The importance measures reviewed in the notebook were revised to include Fussell-Vesely and Risk Achievement Worth (RAW). The listed basic events are those having importance measures FV greater than 0.005 and RAW greater than 2. A discussion supporting a reasonable results conclusion was provided. The results were determined to be acceptable when considering plant configuration and the changes made to the PRA model during the latest data update.	None, gap has been closed for the JUL12R1 model.
QU-E2 (Met Cat I/II/III)	1-44: With the exception of the system notebooks, assumptions tend to be scattered throughout the documents. Consider consolidating all assumptions into a single section of each technical notebook. This is a suggestion since it applies to documentation only.	Open item	Documentation item. No impact

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
QU-E3 (Met Cat III) Related SRs DA-D3 (Met Cat II)	1-26: There are several classes of basic events which do not have associated error factors. These include: internal flooding initiators, unavailabilities, and certain operator actions. This causes the distribution calculated by Uncert to be narrower than it would be had error factors been included for these parameters. This is a finding because it relates to the results of the parametric uncertainty.	Error Factors were added for all basic events or type codes in the risk model reliability database file	None, gap has been closed for the JUL12R1 model.
QU-E3 (Met Cat III)	1-45: No discussion of the results of the Parametric Uncertainty Analysis was found. No calculation of the Error Factor (95%/50%) was found. No statement regarding the reasonableness of the CAFTA mean value was found. This is a finding since it relates to fundamental information necessary for most application submittals.	The JUL12R1 model uncertainty analysis provided in the Quantification and Summary Notebookwas updated to include a full discussion of uncertainty including the provision of a mean value comparison table, additional uncertainty graphs for 1CDF, 1HE, 2CDF, and 2HE, and a specific conclusion section discussing results, mean, and skewness.	None, gap has been closed for the JUL12R1 model.
QU-F3 (Met Cat II/III)	6-40: No initiating event pie chart was given for Unit 2 results. The Summary Notebook states that Unit 2 results are similar. No importance measures for components or systems were given in the documentation. This is a suggestion to enhance the model documentation.	The Quantification and Summary Notebook was revised to include initiating events pie charts for 1CDF, 2DF, 1HE, and 2HE.	None, gap has been closed for the JUL12R1 model.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
LE-C10 (Met Cat II) <u>Related SRs</u> LE-C12 (Met Cat II)	3-5: Per discussion with plant staff, although a review of sequences was not performed "after the fact" to try to further reduce LERF. Rather, the event trees were built to credit equipment operation and operator actions as would be warranted given the conditions. The sequences were reviewed in this process. That is, only actions from the control room and equipment that could be reasonably assumed for success were credited. In this fashion, no additional engineering analyses were warranted to support continued operation of equipment or operator actions during accident progression that could reduce LERF. It was determined that this process should be documented in the AS/SC notebook. It was determined that documentation of the process that was utilized to evaluate the accident sequence procession is necessary to affirm for PRA applications that an evaluation was performed.	The process for evaluating accident sequence progression was added to the Quantification and Summary Notebook.	None, gap has been closed for the JUL12R1 model.
LE-F3 (Met Cat I/II/III)	1-43: Understanding LERF uncertainty in the Susquehanna model would be improved by having LERF related assumptions were clearly identified and listed in a single place (e.g., a section of the summary notebook or elsewhere). This is a suggestion because it applies to documentation only.	Open item	Documentation item. No impact.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #*, DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
LE-G5 **(Met Cat I/II/III)**	2-4: Appendix E, Section E.6 of the Summary Notebook evaluates the limitations of the LERF evaluations related to the quantification process. This does not address the limitations of the LERF analysis due to assumptions or modeling choices. This is a suggestion to provide a more complete description of the LERF analysis limitations for applications.	Section E is related to quantification limitations, and would not be appropriate for incorporation of limitations due to modeling choices. Therefore, Section 2.10.1 was added to the JUL12R1 Quantification and Summary Notebook for a discussion of potential limitations that could influence LERF results in applications.	None, gap has been closed for the JUL12R1 model.
IFPP-A1 **(Met Cat I/II/III)** Related SRs IFPP-B1 (Met Cat I/II/III)	6-1: Based on discussion in Section 3.1 and contents of Appendix C of the Internal Flooding notebook, flood areas are based on plant rooms, which appear to be generally independent of other areas regarding flood propagation. Many buildings and structures were eliminated from further consideration on the basis that they do not contain any SSCs modeled in the PRA, as identified in Section 3.1.1.2 However, it is not clear if there exists a potential for a flood in one of these areas to propagate to a building/area that does contain flood susceptible PRA equipment. Based on discussions with PRA staff and review of the plant layout drawing, only the Radwaste building is connected to the main portion of the plant. This is a suggestion as the list of screened buildings appears reasonable.	Open item	Negligible effect on model results. See PRA Impact from Internal Flooding discussion, which precedes Table 1.

TABLE 2
SUPPORTING REQUIREMENTS MEETING CAPABILITY CATEGORY II OR GREATER WITH ASSOCIATED FACTS AND OBSERVATIONS

SUPPORTING REQUIREMENT	*F&O #,* DESCRIPTION OF GAP, AND *SIGNIFICANCE*	RESOLUTION	IMPACT
IFQU-A2 **(Met Cat I/II/III)**	1-28: Consider using the FRANX or other declarative modeling tool for the injection of flooding initiators (and other spatially oriented initiators, such as internal fire, or external event initiators such as seismic). This is a suggestion, since there is no requirement to use a declarative modeling technique for injection of flooding initiators.	Open item	None, F&O suggests a way of adding flood initiators to the model and is an enhancement.
MU-C1 **(Met Cat I/II/III)** Related SRs MU-E1 (Met Cat I/II/III)	1-27: There is no requirement to issue the development model as the updated model based upon the quantitative impact on PRA applications (such as MSPI) in the Susquehanna model maintenance procedures. This is a finding because it causes the SR to be not met. *(This F&O may be a finding, however, both of the associated SRs were noted as met.)*	Open item	None, F&O addresses the PRA Maintenance and Update Procedure.