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Title: **SDP Assessment of Service Water Pump P-7C Coupling Failures**		
Approval: See signature page.		

<u>Purpose</u>

This analysis assesses the increase in risk during the period Palisades service water (SW) pumps had line shaft couplings installed which had increased susceptibility to intergrannular stress corrosion cracking (IGSCC). Two coupling failures occurred on service water pump P-7C; one failure on September 28, 2009 and a second on August 9, 2011. On both occasions the couplings that failed were of the same material specification and in an area of the pump exposed to a wet-dry cyclic environment that exacerbated the IGSCC process. Following the second failure, the couplings were replaced with a material more suited to the operating environment.

<u>Conclusion</u>

Based on the review of the metallurgical studies, data analysis, and model quantification, the following conclusions were reached:

- The coupling failure events are considered repeated independent failures of a single component. The events occurred too far apart in time to have more than a negligible impact on the common cause failure probability.
  - This is based on the application of NUREG/CR-6268, and
  - The review of draft "Common-Cause Failure Analysis in Event and Condition Assessment: Guidance and Research" [38], Attachment 11.
- Although the failures of interest were treated as independent in this analysis, the fraction of the elevated failure rate due to common cause (i.e. the beta factor for pump failure to run) was assumed to be the same as in the base case model. The beta factor used is viewed to be highly conservative for normally operating pumps as there is very little historical evidence of common cause failures of normally operating components. Due to the conservative treatment of common cause failures in this evaluation, the calculated change in CDF is actually dominated by the initiating event frequency estimation involving common cause failure of the two normally operating pumps. A more realistic assessment that takes credit for the fact that the two pump failures are independent failures would result in a much smaller increase in CDF than what has been estimated in this analysis.
- With respect to the technical specification allowed repair time of 72 hours for a single pump out of service, there would be approximately 20 LCO periods between the P-7C failure on August 9, 2011 and the metallurgical report predicted failure time of the P-7B couplings on October 9, 2011 (if the pump were to remain in continuous operation). This span would significantly reduce the potential for concurrent pump failures within the LCO repair time. No cracking was found in the P-7A pump couplings.
- A conservative time dependant convolution analysis was performed that concludes the failure probability of the P-7A and P-7B pumps during the P-7C allowed outage time was small (Attachment 10). These results demonstrate that the common cause term applied in the initiating event frequency calculation in this analysis is conservative by over an order of magnitude.

- The analysis characterized the risk during the period the shaft couplings were constructed from material that was more susceptible to inter-granular stress corrosion cracking (the degraded state period). It was estimated that the SW pump mean failure rate for failure to run increased by a about a factor of 15 compared to the currently employed failure rate.
- The analysis also characterized the risk impact due to the increase in loss of service water initiating event frequency during the degraded state period. The pump failure contribution to initiating event frequency during this period was estimated to increase by 30%.
- The impact of the service water pump increased independent failure probability on core damage frequency due to flooding, seismic, and fire initiating events was evaluated and was determined to be negligible.

In summary;

The observed failures are considered independent and have a negligible impact on the common cause failure probability. Therefore, based on the random nature of the stressors that contribute to IGSCC, as described in the coupling metallurgical reports, the rate and timing of the failures, and 3rd party expert analyses; the coupling failures contribution to the common cause failure to run probability and loss of service water initiating event frequency, is also negligible. The increase in core damage frequency, while the 416 stainless steel couplings were installed in the Palisades service water pumps is quantified as <1.0E-6 (Green).

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1.0 PURPOSE

This analysis assesses the increase in risk during the period Palisades' service water pump couplings had increased susceptibility to intergrannular stress corrosion cracking (IGSCC). Two coupling failures occurred on service water pump P-7C; one failure on September 28, 2009 and a second on August 9, 2011. On both occasions the couplings that failed were of the same material specification and in an area of the pump exposed to a wet-dry cyclic environment that exacerbated the IGSCC process.

2.0 BACKGROUND

2.1 Service Water Pump P-7C Coupling Failure Events and Metallurgic Analysis

Palisades has three vertical service water pumps (P-7A, P-7B, and P7C) that take suction from the intake basin (Lake Michigan) and supply water to the two critical and one non-critical supply header. The pumps are approximately 40 feet tall, with a two stage impeller at the bottom, and connect to the motor via 6 line shafts and 7 couplings (Figure 2.3-1).

In December 2007, the specification for the shaft couplings for P-7A, P-7B, and P-7C was changed from carbon steel to 416 SS under engineering change (EC) 5000121762 [13]. The new material was selected due to its strength, wear resistance and corrosion resistance. The couplings were also redesigned to increase the diameter by 3/16" and incorporate a 1/8" vent hole in the center of the coupling to aid in disassembly and reinstallation as shown in Figure 2.1-1.

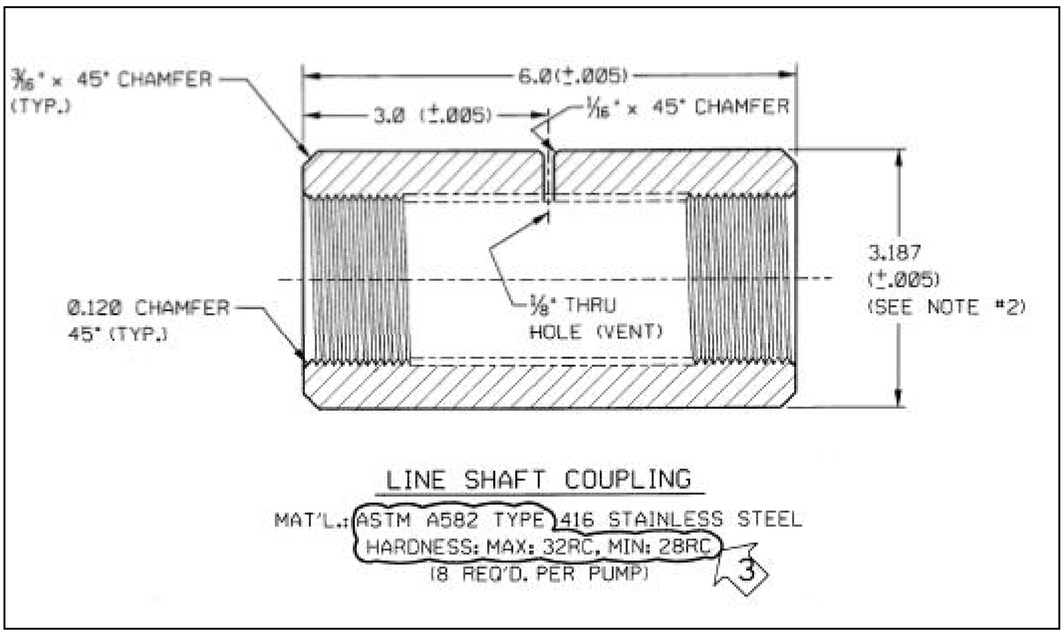

Figure 2.1-1

In April and May of 2009, Palisades replaced the carbon steel components of the P-7A and P-7B rotating assemblies with the new material (see Table 2.1-1 for events timeline). The P-7C pump couplings were replaced in June of 2009; on September 29, 2009 the first of two failures occurred. The root cause evaluation for this failure determined the #7 coupling failed due to intergrannular stress corrosion cracking (IGSCC) which resulted from high hardness that was beyond specification [4]. The pump was repaired with couplings that were validated as within the proper hardness specification and placed back in service in October 2009.

In August of 2011, the second failure occurred on P-7C at one of the couplings that was installed in October of 2009. In this event, the #6 (see Figure 2.3-1) coupling failed this failure was also attributed to IGSCC [12]; however, the hardness of the steel was within specification. Further evaluation by the metallurgists determined that, although the hardness was adequate, the heat treatment applied to the coupling, given the environmental and mechanical stresses to which it was exposed, made it particularly susceptible to IGSCC. It was also determined that couplings #5, #6, and #7 experience intermittent cycles of wet and dry conditions depending on if the pump is in operation. This condition exacerbates the environmental contribution to IGSCC.

Table 2.1-1, Service Water Pump Coupling Replacement and Failure Timeline

Pump	416 SS Coupling Installation Date	Coupling Failure Date	Couplings replaced with 17-4PH SS	Projected Failure Date of 416 SS Couplings from Metallurgy Report	Notes
P-7A					
	4-Apr-2009	N/A	24-Aug-2011	>54 days, 17-Oct-2011	The 416 SS couplings did not fail on P-7A and showed no signs of cracking. The metallurgy report concluded the heat treatment applied to the P-7A couplings made them less susceptible to IGSCC. The additional Neolube grease applied to the coupling's threads may also have been a factor in preventing IGSCC [3]. The projected failure date was based on the assumption cracking had started although none was found.
P-7B					
	12-May-2010	N/A	30-Aug-2011	40 days, 9-Oct-2011	The 416 SS couplings did not fail on P-7B. The metallurgy report indicated that IGSCC was beginning to occur and, at the predicted crack propagation rate, the coupling would not have failed for 40 days from the date of removal if the pump were in continuous operation [3].
P-7C					
(1st Failure)	12-Jun-2009	29-Sep-2009	N/A	N/A	The evaluation of the first failure stated the couplings failed due to IGSCC. The cause was improper tempering resulting in excessive hardness of the material [3]. Failure occurred approximately 3 months after initial installation.

Table 2.1-1, Service Water Pump Coupling Replacement and Failure Timeline					
Pump	416 SS Coupling Installation Date	Coupling Failure Date	Couplings replaced with 17-4PH SS	Projected Failure Date of 416 SS Couplings from Metallurgy Report	Notes
(2nd Failure)	2-Oct-2009	9-Aug-2011	18-Oct-2011	N/A	This failure occurred approximately 21 months after installation. Further evaluation of the couplings following the second failure in 2011 concluded that the out of specification hardness was not the root cause. The report completed in October 2011 concluded that both the 2009 and 2011 failures were due to IGSCC exacerbated by improper heat treatment and the wet-dry cyclic environment of the #5 - #7 couplings [12][5].

2.2 P-7A and P-7B Coupling Metallurgic Analysis

The 416 stainless steel couplings were also installed in the P-7A and P-7B pumps in April and May of 2009. When the couplings were removed in August 2011, they were sent for metallurgical evaluation. The report concluded that the P-7A couplings had no visual indication of cracking, and if a flaw had initiated on the day the couplings were removed, it would conservatively have required at least 54 days of pump operation for the flaw to propagate through wall. Cracks were found in the #5, #6, and #7, couplings (exposed to the wet-dry environment) of the P-7B pump. The report stated it would require approximately 40 additional days of pump operation beyond they day they were removed for the cracks to propagate through wall [3].

2.3 Affects of Neolube and Heat Treatment on IGSCC

Two differences were noted in the metallurgical reports [3] and [5] between the P-7A pump couplings, which had no indication of cracking, and the P-7B and P-7C couplings which had cracking.

1. The heat treatment, for purposes of tempering the steel, applied to each coupling varied in timing, temperature, and number of heat treatments. The P-7A couplings were single tempered, whereas the P-7B and P-7C couplings were double tempered in order to achieve the appropriate hardness. The temperature range of the heat treatment applied to the P-7B and P-7C couplings made them more susceptible to IGSCC.
2. The P-7A coupling threads had a greater amount Neolube grease applied relative to the couplings examined from pumps P-7B and P-7C. It was postulated that this additional grease may have enhanced the coupling's pitting resistance by protecting the threads from corrosive agents in the operating environment. The lubricant is applied to the shaft threads in accordance with the pump reinstallation work instruction, but the amount of grease to apply is not specified.

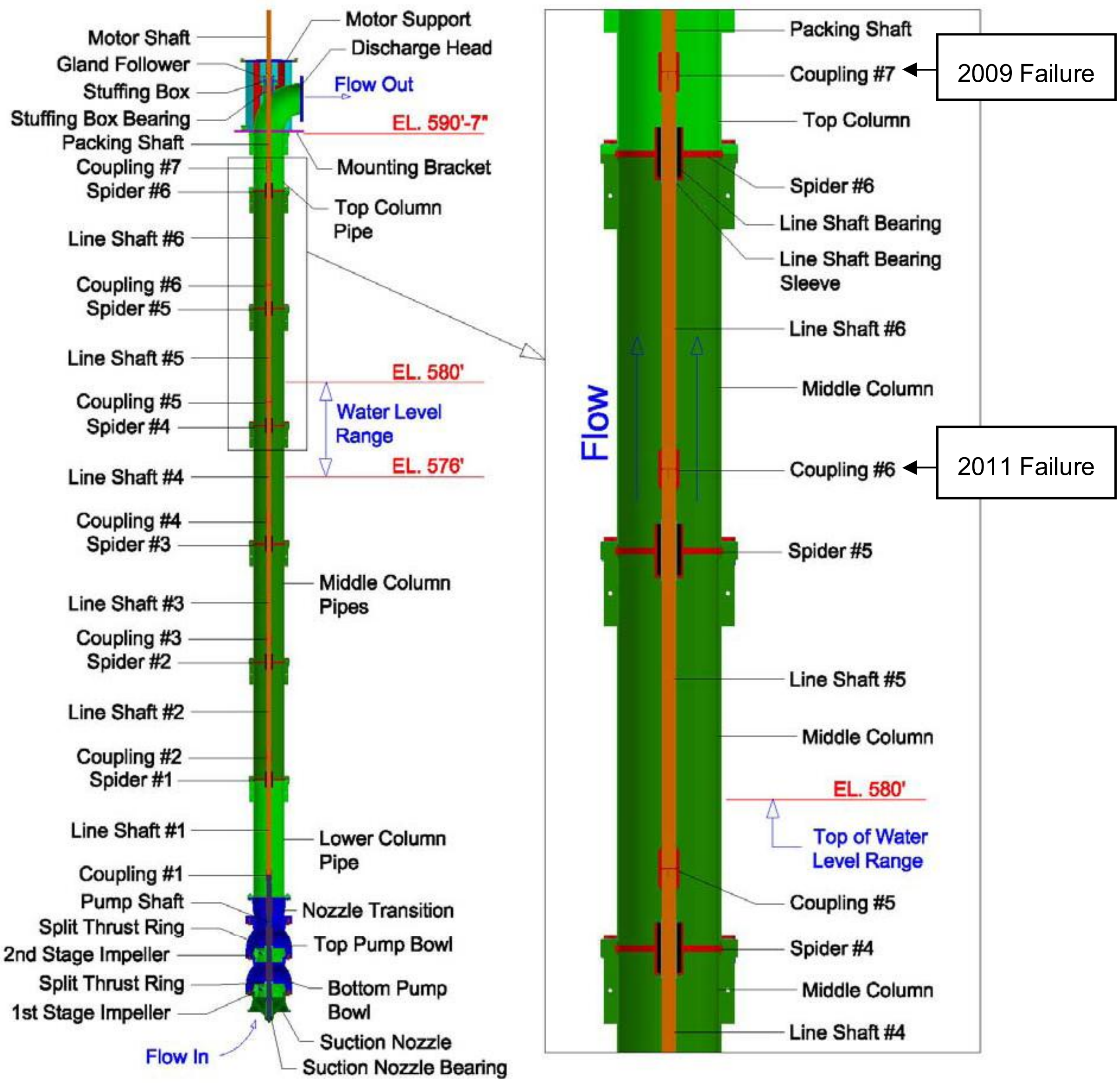
Motor Shaft
Gland Follower
Stuffing Box
Stuffing Box Bearing
Packing Shaft
Coupling #7
Spider #6
Line Shaft #6
Coupling #6
Spider #5
Line Shaft #5
Coupling #5
Spider #4
Line Shaft #4
Coupling #4
Spider #3
Line Shaft #3
Coupling #3
Spider #2
Line Shaft #2
Coupling #2
Spider #1
Line Shaft #1
Coupling #1
Pump Shaft
Split Thrust Ring
2nd Stage Impeller
Split Thrust Ring
1st Stage Impeller
Flow In
Motor Support
Discharge Head
Flow Out
EL. 590'-7"
Mounting Bracket
Top Column
Pipe
EL. 580'
Water Level
Range
EL. 576'
Middle Column
Pipes
Lower Column
Pipe
Nozzle Transition
Top Pump Bowl
Bottom Pump
Bowl
Suction Nozzle
Suction Nozzle Bearing
Flow
Packing Shaft
Coupling #7
2009 Failure
Top Column
Spider #6
Line Shaft Bearing
Line Shaft Bearing
Sleeve
Line Shaft #6
Middle Column
Coupling #6
2011 Failure
Spider #5
Line Shaft #5
Middle Column
EL. 580'
Top of Water
Level Range
Coupling #5
Spider #4
Middle Column
Line Shaft #4

Figure 2.3-1

2.4 Corrective Actions

Based on the analyses following the second coupling failure, Palisades decided to suspend the development of an improved 416 SS coupling specification and change the material of the line shaft couplings from 416 SS to 17-4PH SS [4]. The replacements were started in August 2011 and were completed in October 2011. This material is less susceptible to IGSCC.

3.0 DATA COLLECTION

3.1 Data Collection Background

Data for Service Water pump start demands and run-time was obtained from the PI data archive. PI is a classified category “C” (important to business) system in accordance with Entergy procedure EN-IT-104 [17]. The PPC is its source of data which is a SQA category “B” system (regulatory commitments). Most PPC points are calibrated via technical specification surveillance procedure or by preventive maintenance and controlled calibration sheets.

Part of the PI server system runs on the plant process computer (PPC). This portion monitors selected points every second to test against the exception threshold change value. If the change value is exceeded, the data is passed to the PI server and recorded. The PI server also compares the new value against previous values to see if it still fits on a line within the compression limit. If yes, the data is discarded, otherwise it is added to the archive. For pump starts, the compression limit is simply a change in state (on-off or start-stopped), if 8 hours have passed without an archive update, one is made regardless. PI will generally provide accurate long term values and greater amounts of data when events are changing rapidly.

For this analysis, PI server tags YSP7A_D (Service Water Pump P-7A), YSP7B_D (Service Water Pump P-7B), and YSP7C_D (Service Water Pump P-7C) were used to extract sampled data from the PI archive for the period in which each of the pumps were operating with the replacement 416 stainless steel line shaft couplings (date ranges as shown in Table 2.1-1).

The data was imported into, Microsoft Excel™ 2007, using the PI DataLink add-on module. A visual basic macro was developed to count the pump starts and stops and sum the accumulated run time. The macro processed each data point in chronological order to find when the pump state changed from “Stopped” to “Started”. When a change in state was found, a pump start (demand) was recorded as well as the date/time stamp and the cell shaded yellow. The macro then determined when the pump state was changed from “Started” to “Stopped”, calculated the run time for the demand and shaded the cell light blue. If the calculated run time was less than one minute, the data was assumed erroneous, and the demand as well as the run-time was not counted; in these cases the cell color was changed from light blue to green. Discarded erroneous runs were typically seconds in duration. This assumption is somewhat conservative as the pumps may have been bumped for rotation checks or strainer basket clearing. The macro input data and a portion of the detailed result of the PI data collection are provided in Attachment 2.

The compiled run-hours data is provided in Table 4.1-1.

3.2 Data Validation

As validation of the final accumulated data, a portion of the results were reviewed against System Engineering records (Maintenance Rule Availability Database). It was noted that several additional start demands were recorded in the PI archive data, but this is expected as the PI server records a start each time a pump is bumped for testing or maintenance; whereas the system engineer manually logs several post maintenance test motor bumps into a single record for a pump run. Other than the increased number of pump demands, there was excellent agreement between the macro derived data and the manually recorded data.

4.0 QUALITATIVE RISK CHARACTERIZATION

To evaluate the impact of the events on component independent failure probability, common cause probability, and initiating event frequency, an independent analysis was performed [22] and is enclosed as Attachment 1.

4.1 Stressors of the IGSCC Failure Mode

The time to failure of a given material due to stress corrosion cracking in a given environment is dependent on the applied tensile stress as described in Section 4.4 of the October 2011 metallurgy report [5]. The report states that the time of crack initiation is:

> *"…highly alloy-environment and applied stress dependant and thus is an unknown without specific test data. The initiation time is also highly dependent upon pre-existing flaws that may have been introduced during heat treatment or thread fabrication. Therefore, predicting initiation time is difficult. Unless there are preexisting flaws, a distribution of 80% initiation and 20% propagation is considered reasonable for the life of a component subject to SCC process…"*

This statement implies that the time to failure due to IGSCC is a function of multiple stressors that each provides an unknown or random contribution to the crack propagation rate. Evidence of the variability in each of the couplings geometry and material properties is shown in Tables 3-1 – 3-8 of the metallurgical report. Variability of the hardening and tempering heat traces is shown in Figures 4-1 and 4-2 of the report [5] (the report is enclosed as Attachment 8).

In addition to differences in the couplings physical properties, the tensile stress applied to each coupling varied due to differences in run time from pump to pump as shown in Table 4.1-1.

Table 4.1-1, Service Water Pump Run Time and Number of Failures

Pump	Run Time With 416 SS Couplings	Number of Run Failures
P-7A	14,999	0
P-7B	8,909	0
P-7C	17,521	2
TOTAL	41,429	2

4.2 Qualitative Risk Characterization of SW Pump Failures

A review of NUREG/CR-6268, "Common-Cause Failure Database and Analysis System: Event Data Collection, Classification, and Coding" [21] was performed to evaluate the potential impact on common cause probability based on the following facts:

- Between the times the carbon steel couplings were replaced by 416 Stainless steel, and when they were replaced with 17-4PH SS, the SW pumps were in a degraded state that could potentially increase the likelihood of service water pump failure. This in turn could increase the likelihood of pump failures contributing to a loss of service water initiating event and loss of SW mitigation functions following other initiating events.
- The pumps ran for a combined 41,429 hours with the 416 SS couplings installed, and over this time 2 failures occurred.
- Both failures occurred on one pump as opposed to failures on a redundant pair of pumps.
- The root causes of IGSCC are due to conditions that are random within each component and do not exhibit correlation of the factors between components. While the mechanisms for causing IGSCC may be similar, the specific conditions that give rise to IGSCC are unique to each

component making them unlikely to be correlated.

- The coupling failures were nearly two years apart (September 29, 2009 and August 9, 2011).
- Following both failures, the plant remained at full power and the pumps were returned to service within the 72-hour limiting condition for operation

The criteria, stated in Section 5.1.7.1 of NUREG/CR-6268 for the timing classification of announced common cause failures is stated as follows:

> *"For announced failures, the timing factor is based on a time-based model. Thus, the timing factor is assigned values based upon a PRA mission time (the period of time the component is usually required to perform its function in a PRA or individual plant examination [IPE], usually 24 hours). The following classifications may be used for two consecutive degradations of two components contained in a CCF event:*
>
> *High (1.0): The component events are separated by no more than the PRA mission time.*
>
> *Medium (0.5): The component events did not occur within the PRA mission time and two times the PRA mission time.*
>
> *Low (0.1): The component events are separated by more than two times the PRA mission time and less than three times the PRA mission time.*
>
> *Not CCF: More than three times the PRA mission time or during the interval between the component events, the component (which was detected, failed, or degraded later) has undergone maintenance, overhaul, or other action that can be regarded as a renewal event for the failure mechanisms. (Note: In this case, the event is not classified as a CCF event.)*

Using these criteria, the coupling failure events occurred too far apart in time to be considered common cause failures. With respect to the technical specification allowed repair time of 72 hours for a single pump out of service, there would be approximately 20 LCO periods between the P-7C failure on August 9, 2011 and the metallurgical report predicted failure time of the P-7B couplings on October 9, 2011 (if the pump were to remain in continuous operation). This span would preclude the potential for concurrent pump failures within the LCO repair time. (A quantitative evaluation of the failure probability of the P-7A and P-7B pumps during the allowed outage time, based on crack propagation rate, is provided in Section 5.5. and Attachment 10)

In addition, due to the random aspects of the IGSCC failure mode, it would be very unlikely that the coupling failures would have more than a negligible impact on common cause failure probability;

1. Refer to Attachment 1,
2. Refer to Attachment 10, time-dependent convolution analysis, and
3. Refer to Attachment 11, comments on the draft "Common-Cause Failure Analysis in Event and Condition Assessment: Guidance and Research", ML111890290.

Irrespective of the common cause failure assessment, consideration still must be given to an increase in loss of service water initiating event frequency and an increase of the failure to run basic event probability; which is evaluated in the following sections.

5.0 QUANTITATIVE ANALYSIS OF RISK SIGNIFICANCE

This section presents the quantification of the service water pump failure-to-run probability, and loss of service water initiating event frequency, during the degraded state period when the pumps were equipped with couplings which had an increased susceptibility to IGSCC. In addition, the results of a time dependant convolution analysis of the failure probability of the P-7A and P-7B during the P-7C allowed outage time is presented.

The data analysis presented in Sections 5-1 – 5.4 [22], is repeated in its entirety, in Attachment 1. The detailed convolution analysis, summarized in Section 5.5, is provided in Attachment 10.

5.1 Service Water Pump Failure Rate

5.1.1 Failure Rate Prior to Installation of 416SS Pump Shaft Couplings

The PRA analysis-of-record is based on plant specific operating experience and service data for the SW pumps from 1994 through 1998. During this period, there were no pump failures to run in 68,571 hours of pump operation [23] and [24].

The uncertainty distribution for the SW pump failure to run failure rate, based on this PRA analysis-of-record, was developed using generic parameter references from PLG-0500 [15] as a prior and then updated using the above listed run time with zero failures. Details of this update are in Table 5.1.1-1.

Table 5.1.1-1 Parameters for Analysis-of-record [2] SW Pump Failure Rate Update Based On Prior from PLG-0500 (Case 1)		
Parameter	Prior Distribution from [15]	Posterior Distribution
Data Collection Period	-	1994 through 1998
Number of Failures	-	0
Pump-hours of Operation	-	68,571
Distribution Type	Lognormal	Non-Parametric fit to lognormal
Mean	3.42E-5	1.23E-5
RF = SQRT(95%tile/50%tile)	5.0	3.4
5%tile	4.24E-6	2.62E-6
50%tile	2.12E-5	9.82E-6
95%tile	1.06E-4	3.03E-5

The most recent update of the Palisades PRA Data Notebook [28] was completed in 2009 prior to the occurrence of the SW pump failures in question. The update covers the period of January 1, 2005 to January 23, 2008 [Note: Palisades has not yet issued this data as the analysis of record]. During this period there were no SW pump failures to run and the run times associated with each of the SW pumps is indicated in the following table:

Table 5.1.1-2 SW Pump Run Data 1-1-05 Through 1-23-2008		
Component	Pump Run Failures	Run Time (hours)
SW Pump P-7A	0	18,658
SW Pump P-7B	0	17,640
SW Pump P-7C	0	19,490
Total	0	55,788

The uncertainty distribution for the SW pump failure to run in this more recent update was developed using generic parameter estimates from NUREG/CR-6928 [21] as a prior and Bayes' updated with the service data in Table 5.1.1-2. Since the generic distribution is a Gamma Distribution and a Poisson likelihood function was used, the posterior distribution is also a Gamma Distribution. The parameters of the prior and updated Gamma distributions for the SW pump failure rate are shown in Table 5.1.1-3.

Table 5.1.1-3 Parameters for Recent PRA SW Pump Failure Rate Update Based On Prior from NUREG/CR-6928 (Case 2)

Parameter	Prior Distribution from [20]	Posterior Distribution
Data Collection Period	-	1-1-05 through 1-23-08
Number of Failures	-	0
Pump-hours of Operation	-	55,788
Distribution Type	Gamma	Gamma
Alpha Parameter	1.66	1.66
Beta Parameter	3.65E+05	4.20E+05
Mean	4.54E-06/hr.	3.95E-06/hr.
RF (=95%tile/50%tile)	3.30	4.9

Each of the plant specific data updates described above covers a rather limited amount of operating experience. To examine a more complete record of the service experience with the SW pumps prior to the installation of the 416 SS pump shaft couplings, a special case was defined to reflect all the experience back to 1980 covering more than 28 years of experience, which again had zero failures in about 490,000 pump hours of operation. The parameters of this update are presented in Table 5.1.1-4. Because much of this time period pre-dates EPIX and the maintenance rule, the prior used here reverts back to PLG-0500 rather than NUREG/CR-6928 because this reference better represents industry generic data over this longer and earlier time period.

In Section 5.2 all three cases of failure rate estimates are used to evaluate the change in risk during the degraded state period.

Table 5.1.1-4 Parameters for More Complete SW Pump Failure Rate Update Based on Prior from PLG-0500 (Case 3)

Data Collection Period	-	1980 through 4-3-2009
Number of Failures	-	0
Pump-hours of Operation	-	495,360
Distribution Type	Lognormal	Non-Parametric fit to lognormal
Mean	3.42E-5	3.91E-6
RF = SQRT(95%tile/50%tile)	5.0	2.7
5%tile	4.24E-6	1.17E-6
50%tile	2.12E-5	3.43E-6
95%tile	1.06E-4	8.31E-6

5.2 Service Water Pump Failure Rate During Degraded State Period

The degraded state period is defined for the purposes of this analysis as the time frame when the SW pumps were operating with 416 SS couplings installed. The 416 SS couplings were installed on the first component on April 4, 2009 (P-7A) and were replaced on the last component in October 2011 (P-7C). During this period there were two pump failures to run, both on Pump P-7C, and 41,429 pump hours of operation (see Table 4.1-1). Obviously, during the degraded state period, the conditions were substantially different than was the case prior to or following this period. The failure rate distribution for the degraded state period was developed based on the following considerations.

The evidence used to develop the current PRA failure rate distribution, including the generic prior evidence from NUREG/CR-6928 and the Palisades service data prior to the installation of the 416 SS couplings has questionable relevance to estimating the failure rate during the degraded state period and hence is not used.

There is a large degree of uncertainty in establishing an appropriate prior distribution and therefore a non-informative prior distribution is selected. Keeping with the Gamma distribution family of distributions, the Jeffrey's non-informative prior distribution is used. This is characterized by an alpha parameter of 0.5 and a beta parameter of 0 [25]. This is updated using 2 failures in 41,429 pump-hours of operation to produce the parameters of the degraded state SW pump failure rate as shown in the following table.

Table 5.2-1, Degraded State SW Pump Failure Rate Distribution	
Parameter	Posterior Distribution
Distribution Type	Gamma
Prior Basis	Jeffrey's Non-informative Prior (α=0.5, β=0)
Alpha Parameter	2.5
Beta Parameter	41,429
Maximum Likelihood Estimation	4.82E-5/hr
Mean	6.10E-5/hr
5%tile	1.40E-5/hr
50%tile	5.30E-5/hr
95%tile	1.35E-5/hr

A comparison of the Base Case 1, 2, and 3 and Degraded State failure rate parameters is provided in Table 5.2-2 and Figure 5.2-1. Case 3 is viewed as the most realistic model of the SW pump performance prior to the degraded state period as it uses a more complete representation of the service experience. It can be seen from these comparisons that the failure rate during the degraded period is significantly higher than that used in the Base Case PRA model for each of the three analyzed cases. The mean failure rate increases by a factor of more than 5, 15, and 15 compared to the Base Cases 1, 2, and 3, respectively. In addition, the conservative approach taken to throw out the generic industry evidence and the prior Palisades experience in establishing the prior during the degraded state period is seen to have a large impact in the sense that the updated mean is actually greater than the maximum likelihood estimate of the service data during the degraded operation period. This is regarded as a conservative evaluation of the increased SW pump failure rate during the degraded state period.

Table 5.2-2, Comparison of Base Case and Degraded State Failure Rate Parameters				
Parameter	Palisades PRA Base Case 1	Palisades PRA Base Case 2	Palisades PRA Base Case 3	Palisades Degraded State Case
Distribution Type	Non-Parametric fit to lognormal	Gamma	Non-Parametric fit to lognormal	Gamma
Mean	1.23E-5	3.95E-6	3.91E-6/hr	6.10E-5/hr
5%tile	2.62E-6	5.44E-7	1.17E-6/hr	1.40E-5/hr
50%tile	9.82E-6	3.19E-6	3.43E-6/hr	5.30E-5/hr
95%tile	3.03E-5	9.96E-6	8.31E-6/hr	1.35E-5/hr

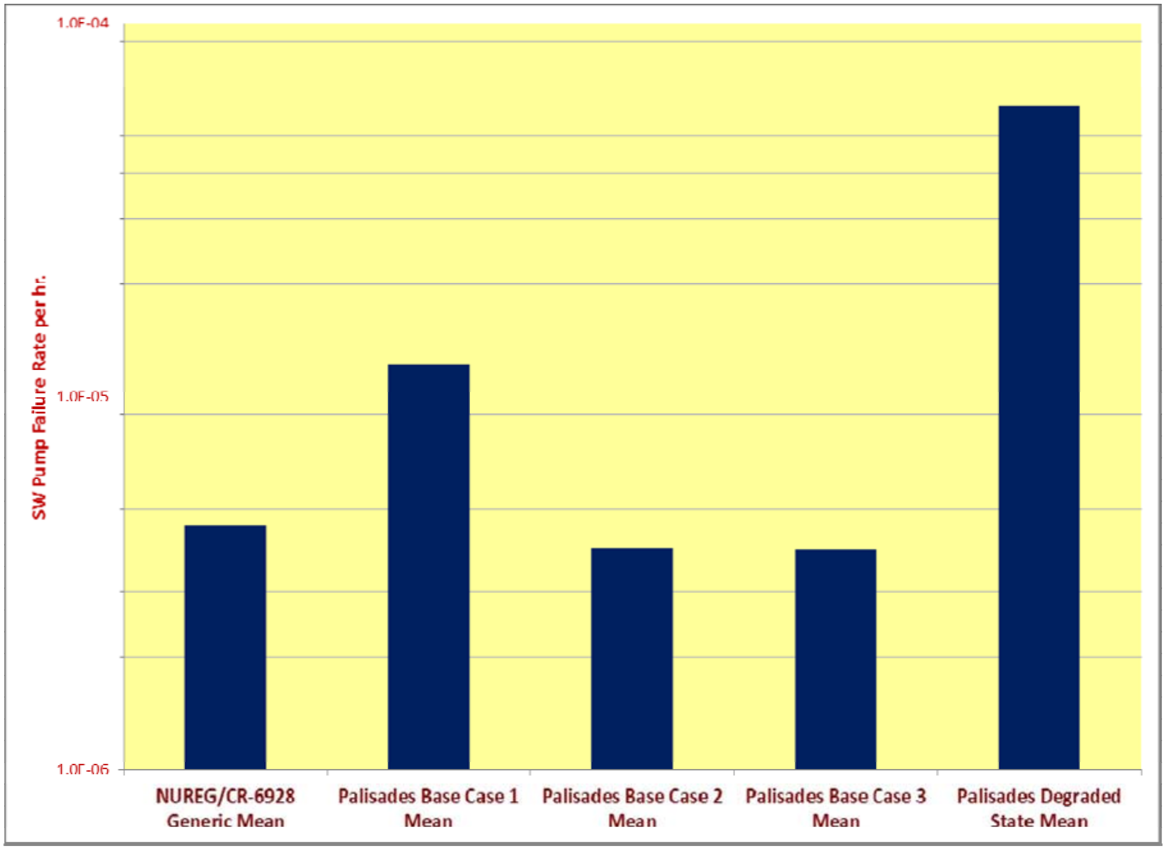

Figure 5.2-1, Comparison of SW Pump Failure Rate Estimates

5.3 Loss of Service Water Initiating Event Frequency

The current Palisades PRA model uses a single point data value, which accounts for loss of service water due to all causes, to model the loss of service water initiating event frequency. This is reasonable for the baseline PRA model but it does not lend itself to evaluating the impact of the increased failure rate of the pumps. Hence to support this evaluation, a model of the contributions to the loss of SW initiating event frequency due to SW pump failures is developed. The SW pump induced loss of SW model is developed based on the following considerations.

A SW pump induced loss of service water can be caused by failure of the two normally running pumps and failure or unavailability of the standby pump.

Failure of the two normally running pumps can occur as a result of a common cause failure of both pumps, or failure of one of the pumps followed by failure of the other running pump during the time frame when the first pump is down for repairs.

The standby pump can fail to start, fail to continue running while both of the normally operating pumps are down for repairs, or be unavailable for maintenance.

These considerations yield the following simple model for SW pump induced loss of SW.

$$F(LOSWS) = 8766\lambda_{LOSWSIE} A \quad [5.1]$$

$$\lambda_{LOSWIE} = \lambda_{CCFR}(\lambda_S + \lambda_{FR}\tau_{CCF} + Q_{MSP}) + 2\lambda_{IFR}(\lambda_{FR}\tau_{IF})(\lambda_S + \lambda_{FR}\tau_{IF} + Q_{MSP}) \quad [5.2]$$

Where:

$F(LOSWS) =$	Frequency per reactor-calendar-year of loss of service water
$\lambda_{LOSWSIE} =$	Frequency per operating hour of loss of service water
$A =$	Plant availability
$\lambda_{CCFR} = \beta_{FR}\lambda_{FR}$	Failure rate for common cause failures of the two normally running pumps
$\lambda_{S} =$	Failure rate for failure of the standby pump to start on demand
$\beta_{FR} =$	Common cause beta factor for failure to run of two normally operating pumps
$\lambda_{FR} =$	Failure rate for failure of the standby or operating pump to run
$\lambda_{IFR} = (1-\beta_{FR})\lambda_{FR}$	Failure rate for independent failure to run for each normally running pump
$\tau_{CCF} =$	Mean time to repair of at least one pump after a common cause failure to run
$\tau_{IF} =$	Mean time to repair of a normally operating pump after an independent failure to run
$Q_{MSP} =$	Maintenance unavailability of a Standby pump while plant in operation (Due to technical specification requirements, maintenance that is performed with the plant at power is performed on each pump separately. Therefore, this is the total maintenance unavailability of all three pumps.)

The change in CDF due to changes in the pipe induced loss of SW initiating event frequency can then be estimated using:

$$\Delta CDF_{\Delta LOSWIE} = (F(LOSW_{DS}) - F(LOSW_{Base}))CCDP_{LOSW} \quad [5.3]$$

Where:

$\Delta CDF_{\Delta LOSWIE} =$	Change in CDF due to Change in Pump Induced Loss of SW frequency
$F(LOSW_{DS}) =$	Loss of SW initiating event frequency evaluated with λ_{FR} evaluated using degraded state version of the SW pump failure rate
$F(LOSW_{Base}) =$	Loss of SW initiating event frequency evaluated with λ_{FR} evaluated using Base Case version of the SW pump failure rate
$CCDP_{LOSW} =$	Conditional core damage probability given loss of SW initiating event

The data parameters needed to quantify Equation [5.3] include the different versions of the failure rates defined earlier and other parameters from the Palisades PRA and these are summarized in Table [5.3-1].

The models in Equations 5.1 through 5.3 were quantified using Microsoft Crystal Ball™ and Excel 2010 software using 100,000 Monte Carlo samples. The results are shown in Tables 5.3-2, 5.3-3, 5.4-1 and Figures 5.3-1, 5.3-2, and 5.3-3.

Table 5.3-1, Data Parameters Used to Evaluate LOSW IE Frequency

Parameter	Mean Value	Uncertainty Treatment	Reference
$A =$	.92	None, very little uncertainty	NRC Performance Indicator Data
$\lambda_S =$	1.19E-3	Lognormal Distribution with mean = 1.19E-3; RF = 4.0	PLG-0500 [15]
$\beta_{FR} =$	.0243	Beta Distribution with α = 16.5 and β = 661.5	Palisades CCF Analysis [28]
$\lambda_{FR-DS} =$	6.1E-05/hr	Gamma Distribution with α = 2.5 and β = 41,429	Table 5.2-1
$\lambda_{FR-Base} =$	1.23E-5/hr, Case 1	Lognormal Distribution with mean = 1.23E-5 and RF=3.4	Table 5.1.1-1
	3.95E-6/hr, Case 2	Gamma Distribution with α=1.66 and β = 4.2E+05	Table 5.1.1-3
	3.91E-6/hr, Case 3	Lognormal Distribution with mean = 3.91E-6 and RF=2.7	Table 5.1.1-4, , this estimate best represents the SW pump performance prior to installation of 416SS couplings
$\tau_{CCF} =$	6hr	None	Technical specifications limit operation to 6 hours
$\tau_{IF} =$	72hr	None	Technical specifications limit operation to 72 hours
$Q_{MSP} =$ For Base PRA	P-7A = 4.516E-03 P-7B = 5.387E-03 P-7C = 5.533E-03 Total=1.55E-02	Lognormal Distribution with mean = 1.55E-2 RF=10.0	Maintenance Unavailability Analysis [29]
$Q_{MSP} =$ For Degraded State Period	P-7A =117.2 hrs P-7B=107.1 hrs P-7C=256.6 hrs Total = 480.9 hrs over 2.5 year degraded state period	Lognormal Distribution with mean =1.57E-02 RF=1.5	Maintenance Rule Unavailability Database; very little uncertainty justifies small range factor
CCDP Given LOSW=	2.68E-3	Uncertainty not included; not affected by change	Reference [2]
LOSW per PRA=	1.22E-3/yr	Uncertainty not included; not affected by change	Reference [11]

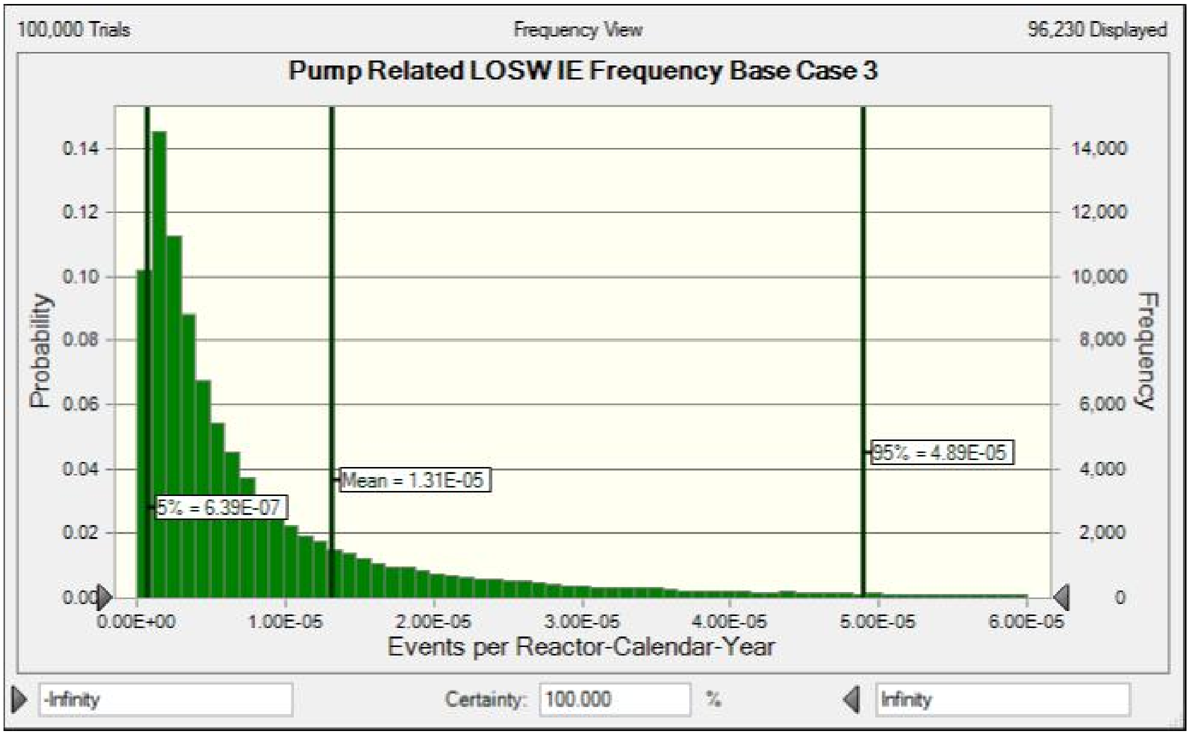

Figure 5.3-1, LOSW Initiating Event Frequency for Base Case 3

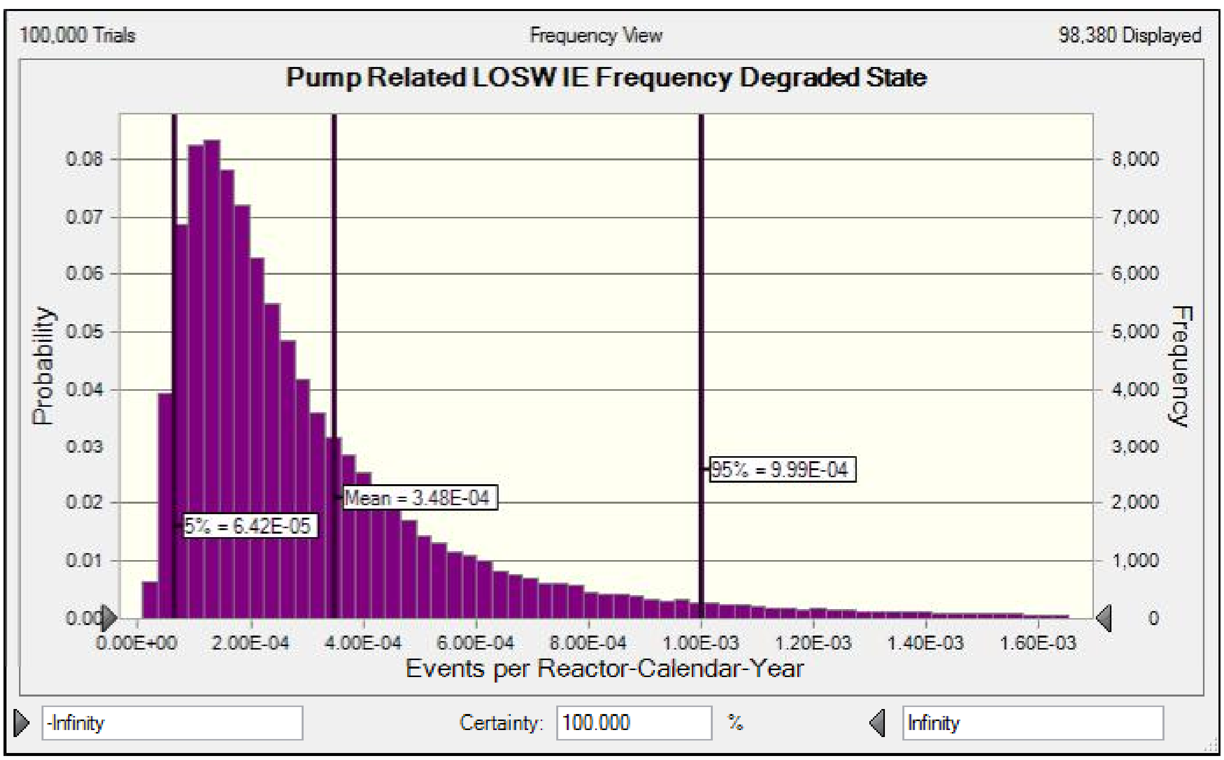

Figure 5.3-2, LOSW Initiating Event Frequency for Degraded State

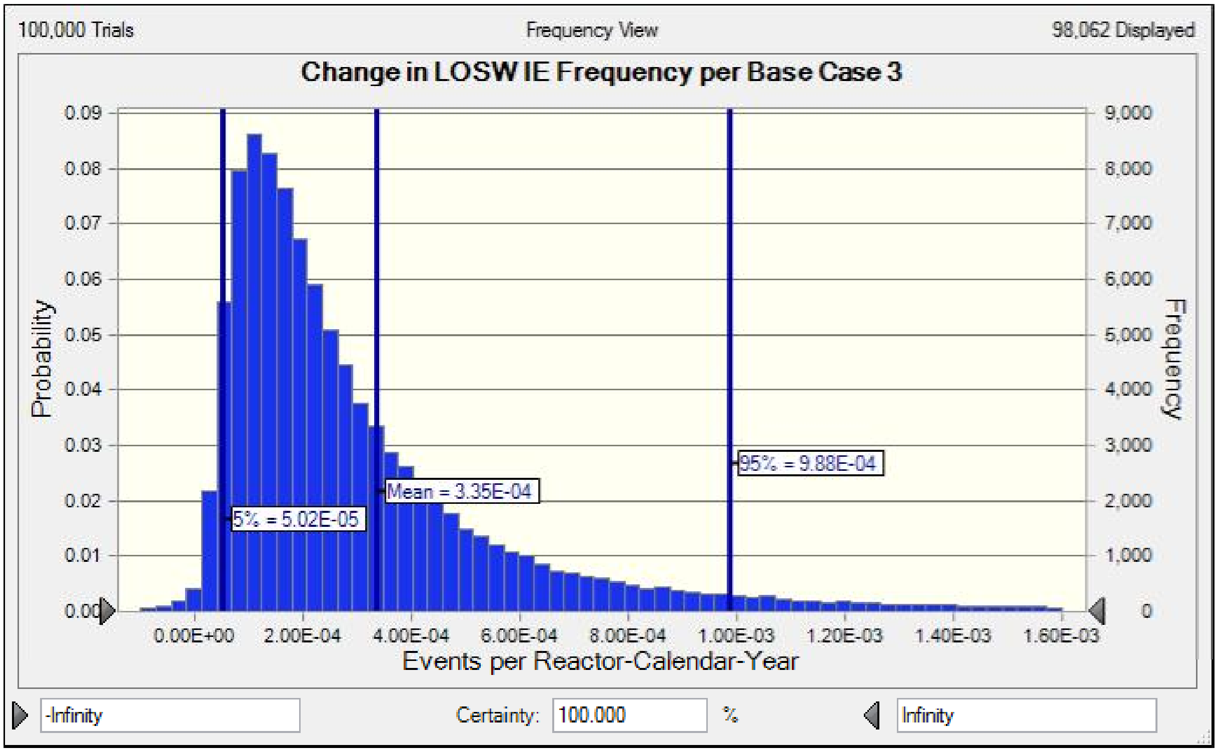

Figure 5.3-3, Uncertainty in Change in LOSW IE Frequency per Base Case 3

In Table 5.3-2 the major contributors to loss of SW initiating event frequency are compared between the Base Case 3 and the degraded state period based on mean point estimates of the listed quantities. The results are seen to be dominated by common cause failure to run of the two normally operating pumps with the standby pump in maintenance. This stems in part from the conservative assumption that the fraction of operating pump common cause failures (beta factor) is assumed to be the same as that assessed in the base PRA model for SW failures in the mitigation of other initiating events. There are two reasons why this is conservative. One is that the increase in the failure rate during the degraded period is due to two independent failures so keeping the ratio of common cause failures to the total failure rate is conservative. The second is that the applied beta factor was developed for the SW system in the mitigation mode and there is substantial evidence to support the hypothesis that the fraction of common cause failures in normally operating systems is much smaller than that for systems that need to operate on demand.

The probability of failure the P-7A and P-7B pumps during the allowed outage time of P-7C was conservatively quantified using a time dependant convolution analysis as described in Section 5.5. The result of this analysis (see page 5 of Attachment 10) was a probability of 2.65E-05 over the 72 hour period, or a rate of 3.68E-07/hr. The common cause failure rate used in the initiating event frequency calculation presented above (equation 5.2 term λ_{CCFR}) for the degraded state is $\beta_{FR}\lambda_{FR}$ = .0243 * 6.1E-05/hr = 1.482E-06/hr. Therefore, the common cause term applied in initiating event frequency calculation is conservative by over an order of magnitude.

Table 5.3-2, Major Contributors to LOSW IE Frequency (Point Estimate)				
Contributing Cutsets	Events per Operating hour		Events per Reactor-Calendar Year	
	Case 3	Degraded	Case 3	Degraded
CCF-FR*QMSP	1.47E-09	3.12E-08	1.18E-05	2.51E-04
2xIFR*IFR*QMSP[1]	3.24E-11	1.06E-08	2.61E-07	8.57E-05
CCF-FR*SFS	1.13E-10	1.75E-09	9.12E-07	1.41E-05
CCF-FR*SFR	2.23E-12	5.32E-10	1.80E-08	4.29E-06
2xIFR*IFR*SFS[1]	2.49E-12	5.95E-10	2.01E-08	4.80E-06
2xIFR*IFR*SFR[1]	5.90E-13	2.17E-09	4.76E-09	1.75E-05
Total	1.62E-09	4.68E-08	1.31E-05	3.78E-04
CCF-FR = Common cause failure of both operating pumps IFR = Independent failure to run of an operating pump SFS= Standby pump failure to start SFR=Standby pump failure to run until operating pump failure restored QMSP= Fraction of time plant operates with Standby SW pump in maintenance Note [1]: Combination of two identical cutsets				

Table 5.3-3 shows the contributors to the LOSW initiating event frequency with the SW system in different alignments. One alignment, which occurs a fraction of the time equal to QMSP is with two operating pumps and the third in maintenance, and the other alignment has the third pump available. It is seen from this table that the pump induced LOSW IE frequency increases by almost a factor of 30 as the system alignment changes from the standby pump being in service to out of service.

Table 5.3-3, Major Contributors to LOSW IE Frequency with SW System in Different Alignments (Point Estimate)				
Contributing Cutsets	Events per Operating hour		Events per Reactor-Calendar Year	
	Case 3	Degraded	Case 3	Degraded
Results in Alignment with Standby Pump in Maintenance which occurs QMSP fraction of the time				
CCF-FR	9.50E-08	1.47E-06	7.66E-04	1.18E-02
2xIFR*IFR[1]	2.10E-09	5.00E-07	1.69E-05	4.03E-03
Total	9.71E-08	1.97E-06	7.83E-04	1.59E-02
Results in Alignment with Standby Pump Available which occurs (1-QMSP) fraction of the time				
CCF-FR*SFS	1.13E-10	1.75E-09	9.12E-07	1.41E-05
CCF-FR*SFR	2.23E-12	5.32E-10	1.80E-08	4.29E-06
2xIFR*IFR*SFS[1]	2.49E-12	5.95E-10	2.01E-08	4.80E-06
2xIFR*IFR*SFR[1]	5.90E-13	2.17E-09	4.76E-09	1.75E-05
Total	1.18E-10	5.05E-09	9.55E-07	4.07E-05
CCF-FR = Common cause failure of both operating pumps IFR = Independent failure to run of an operating pump SFS= Standby pump failure to start SFR=Standby pump failure to run until operating pump failure restored Note 1. Combination of two identical cutsets				

5.4 Impact of Increased SW Pump Failure Rate on PRA Mitigation Functions

The other source of potential risk impacts comes from increased SW pump failure rates in the mitigation functions for initiating events other than loss of SW. This is best evaluated by revising the PRA model with the revised failure rate and then comparing the results. However an estimate of the risk impact from such changes can be estimated using the Fussell-Vesely importance metric for basic events involving SW pump failure to run (9.09E-06). Since the F-V importance is approximately equal to the fraction of the CDF with basic events involving SW pump failure, the change in CDF can be estimated using the following equations:

$$\Delta CDF_{SWP} = (CDF_{New} - CDF_{old}) = FV_{SWP}CDF_{BASE}\left(\frac{\lambda_{FR-DS}}{\lambda_{FR-Base}}\right) - FV_{SWP}CDF_{Base}$$

$$= FV_{SWP}CDF_{Base}\left(\frac{\lambda_{FR-DS}}{\lambda_{FR-Base}} - 1\right) \qquad [5.4]$$

Using the data above for the Fussell-Vesely value, the data developed previously for the failure rates, and a baseline CDF value of 2.83×10^{-5}, the change in CDF due to changes in the PRA mitigation model from increased SW failure rates is estimated to be an increase of 3.7×10^{-9} per reactor calendar year using the Case 3 failure rate model, which is about 0.1% of the current baseline CDF. Hence there is no significant risk increase from the mitigation side of the model.

In Table 5.4-1 the results of the quantitative uncertainty analysis are presented for various cases and metrics. The change in LOSW initiating event frequency from the base case to the degraded state period is seen to be an increase of less than about 30% and does not vary appreciably among Cases 1, 2, and 3. Using these results and the CCDP values from Table 5.2-1, it is seen that the increase in CDF due to changes in the SW pump failure rate in the LOSW initiating event frequency is less than 3% based on the mean change in LOSW IE frequency, and only as high as 94% when the 95%tile values for the change in LOSW IE frequency is assumed. The mean change in CDF is seen to be less than 10^{-6} per reactor-year. The Base Case 3 results provide the largest increase and the most accurate reflection of the SW pump performance prior to the degraded period. However, it is seen from Table 5.4-1 that the overall results are not particularly sensitive to which version of the Base Case results are used.

Table 5.4-1, Evaluation of LOSW Initiating Event Models and CDF Impacts

Parameter[4]	Point Estimate[1]	Mean[2]	5%tile	50%tile	95%tile	RF[3]
Pump Related LOSW IE Freq. Case 1	4.32E-05	4.56E-05	1.67E-06	1.44E-05	1.70E-04	10.1
Pump Related LOSW IE Freq. Case 2	1.32E-05	1.37E-05	5.66E-07	4.56E-06	5.03E-05	9.4
Pump Related LOSW IE Freq. Case 3	1.31E-05	1.31E-05	6.39E-07	4.66E-06	4.89E-05	8.8
Pump Related LOSW IE Freq. - Degraded	3.78E-04	3.48E-04	6.42E-05	2.27E-04	9.99E-04	3.9
Change in LOSW IE Freq. Case 1	3.35E-04	3.02E-04	4.18E-06	1.94E-04	9.63E-04	15.2
Change in LOSW IE Freq. Case 2	3.65E-04	3.34E-04	4.99E-05	2.15E-04	9.87E-04	4.4
Change in LOSW IE Freq. Case 3	3.65E-04	3.35E-04	5.02E-05	2.15E-04	9.88E-04	4.4
Change in LOSW IE Freq. Case 1 %	27.4%	24.8%	0.3%	15.9%	78.9%	15.2
Change in LOSW IE Freq. Case 2 %	29.9%	27.4%	4.1%	17.6%	80.9%	4.4
Change in LOSW IE Freq. Case 3 %	29.9%	27.4%	4.1%	17.7%	81.0%	4.4
Change in CDF Case 1	8.97E-07	8.11E-07	1.12E-08	5.21E-07	2.58E-06	15.2
Change in CDF Case 2	9.78E-07	8.96E-07	1.34E-07	5.76E-07	2.65E-06	4.4
Change in CDF Case 3	9.78E-07	8.98E-07	1.35E-07	5.78E-07	2.65E-06	4.4
Change in CDF Case 1 (%)	3.2%	2.9%	0.0%	1.8%	9.1%	15.2

Table 5.4-1, Evaluation of LOSW Initiating Event Models and CDF Impacts						
Parameter[4]	Point Estimate[1]	Mean[2]	5%tile	50%tile	95%tile	RF[3]
Change in CDF Case 2 (%)	3.5%	3.2%	0.5%	2.0%	9.3%	4.4
Change in CDF Case 3 (%)	3.5%	3.2%	0.5%	2.0%	9.4%	4.4

Notes:
[1] Point estimate based on mean values of input parameters
[2] Mean and Percentiles calculated via Monte Carlo on Crystal Ball with 100,000 trials
[3] RF = SQRT(95%tile/5%tile)
[4] Change in CDF results do not include the uncertainty in the CCDP given loss of service water

5.5 Service Water Pumps P-7A and P-7B Failure Rates Following Failure of Pump P-7C

The analysis summarized here provides additional perspective on the concurrent failure probability of pumps P-7A and P-7B within the allowed LCO time following failure of P-7C using a time dependant convolution analysis based on the crack growth rate from the metallurgical report [3]. The complete evaluation is provided in Attachment 10.

Using the as-found condition of the P-7A and P-7B pump couplings and conservative assumptions about the crack growth rate (based on the shortest time to failure of the P-7C pump), an estimate of the remaining life for these couplings was provided by the LPI report [3]. From that information, a distribution for the failure to run rate was produced by fitting a generalized gamma distribution to that data. A convolution of the resulting failure rate curves produced a curve representing the probability of failure of both the P-7A and P-7B couplings as a function of time after the couplings were initially installed. Comparing the probability at the time of P-7C failure and the probability three days later (based on the TS allowed outage time) demonstrates that the likelihood of a total loss of service water during that interval was small (2.65E-05). The figure below is a combination of the degraded failure rates based on as-found conditions along with the convolution curve for those failure rates. It also includes the "delta" curve which shows the difference between the convolution curve value at the time of P-7C failure and the convolution curve at various times after P-7C failure. This evaluation indicates that the likelihood of total loss of service water following failure of the P-7C pump was low for a considerable period of time following the failure of the P-7C pump even with degraded failure rates in the remaining pump couplings.

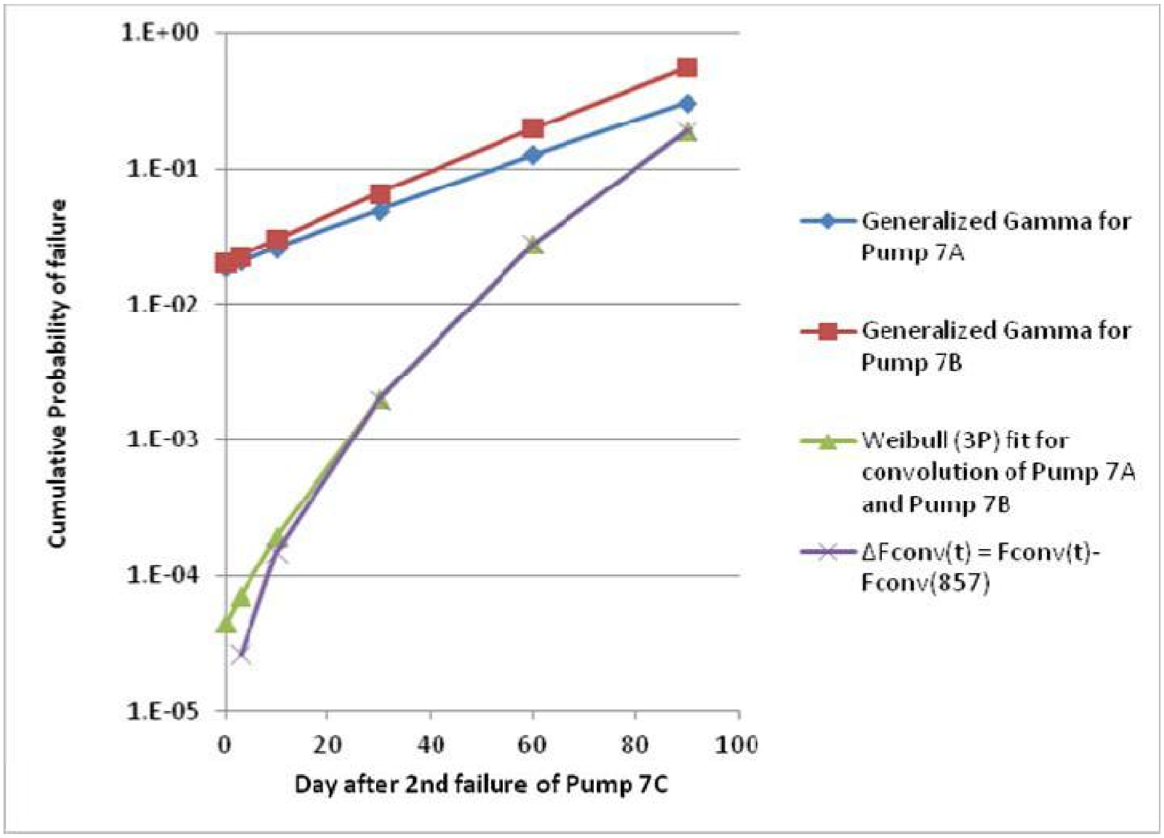

Figure 5.5-1, Failure Probability of P-7A and P-7B within P-7C Allowed Outage Time

6.0 INPUT

Inputs in this evaluation are separated into several categories: those involving the PRA software tools and existing PRA models and evaluations, and those involving the configuration of the plant during planned maintenance activities. PRA tools and models input define the starting point of the evaluation. Plant configuration inputs define critical configuration that exists during the maintenance activities.

In this analysis, the full power internal events (FPIE) analysis evaluates the current analysis-of-record [2].

6.1 PRA Tools and Models

6.1.1 The SAPHIRE software application used for FPIE PRA model quantification in this analysis is listed in Table 6.1.1.

Table 6.1.1 [1]			
Filename	Date	Time	Size
SAPHIRE-7-27-852878059.exe	6/24/2008	11:48a	18,303 KB

6.1.2 The CAFTA software application is used for creating and viewing PRA model logic. The baseline CAFTA model serves as the starting point of the core damage fault tree model evaluated in this analysis. Table 6.1.2 below lists the baseline CAFTA files used in the FPIE analysis.

Table 6.1.2 [2]

Filename	Description	Date	Time	Size - KB
PSAR2c.be	PSAR2c CAFTA Basic Event File	6/26/2006	1:42p	1,248
PSAR2c.caf	PSAR2c CAFTA Fault Tree File	6/26/2006	1:36p	449
PSAR2c.gt	PSAR2c CAFTA Gate Type File	6/24/2006	1:31p	1,024
PSAR2c.tc	PSAR2c CAFTA Type Code File	5/27/2004	9:03a	30
PSAR2c CAFTA Files.zip	PSAR2c CAFTA zip file	6/29/2006	8:47a	289

6.1.3 The SAPHIRE project model is used for PRA model quantification. Table 6.1.3 lists the PSAR2c SAPHIRE project files used as the initial data set for the FPIE analysis.

Table 6.1.3 [2]

Filename	Date	Time	Size - KB	Description
Caf2Sap PSAR2c.txt	6/29/2006	8:59a	11	Text rules file used by caf2sap.exe to create MAR-D files.
Caf2Sap.exe	3/24/2003	8:16a	28	Visual basic application for creating SAPHIRE MAR-D fault tree files.
Creation of Rules File PSAR2c.xls	6/26/2006	2:42p	2,162	EXCEL spreadsheet that creates the *.txt rules file for SAPHIRE MAR-D fault tree assembly.
PSAR2c FTree Logic.ftl	6/29/2006	9:16a	3,421	MAR-D fault tree file created from the PSAR2c CAFTA master fault tree.
SAPHIRE v7.26 PSAR2c Ftree Files.zip	6/29/2006	9:43a	1,099	Above listed supporting files.

6.1.4 Table 6.1.4 defines the house event configuration used in the FPIE evaluation:

Table 6.1.4

House Event		House Event	
A-HSE-CST-MAKEUP	F	I-HSE-M2LEFT-INS	T
C-HSE-P-52A-STBY	T	I-HSE-M2RGHT-INS	F
C-HSE-P-52B-STBY	T	M-HSE-P-2A-TRIP	T
C-HSE-P-52C-STBY	F	M-HSE-P-2B-TRIP	F
D-HSE-CHGR1-INS	T	M-HSE-SJAE1-INS	T
D-HSE-CHGR2-INS	T	M-HSE-SJAE2-INS	F
D-HSE-CHGR3-INS	F	U-HSE-P-7A-STBY	F
D-HSE-CHGR4-INS	F	U-HSE-P-7B-STBY	F
E-HSE-AIR-GT-75F	T	U-HSE-P-7C-STBY	T
E-HSE-AIR-LT-75F	F	X-HSE-2SG-BLDN	1
E-HSE-BYPASS-REG	T	X-HSE-2SG-BLDN-A	1
E-HSE-EDG11-DEM	T	X-HSE-2SG-BLDN-B	1
E-HSE-EDG11-RUN	T	X-HSE-SGA-BLDN	1
E-HSE-EDG12-DEM	T	X-HSE-SGB-BLDN	1

Table 6.1.4			
House Event		House Event	
E-HSE-EDG12-RUN	T	Y-HSE-LOOP1A-BRK	T
I-HSE-C-2AC-INS	T	Y-HSE-LOOP1B-BRK	F
I-HSE-C-2B-INS	F	Y-HSE-LOOP2A-BRK	F
I-HSE-F-12A-INS	T	Y-HSE-LOOP2B-BRK	F
I-HSE-F-12B-INS	F	Y-HSE-RAS-POST	F
I-HSE-F-5A-INS	T	Y-HSE-RAS-PRE	F
I-HSE-F-5B-INS	F	X-HSE-DOOR-167B	T
X-HSE-DOOR-167	T		

7.0 ASSUMPTIONS

Assumptions in this evaluation are classified as major or minor as to potential impact on the analysis results. These assumptions are specific to this evaluation. All assumptions of other risk evaluations (e.g., full power internal events, flooding, etc.) are applicable unless specifically noted.

7.1 Major Assumptions

7.1.1 The loss of service water initiating event (LOSW-IE) frequency applied to quantify the increase in risk due to the service water pump coupling failures is conservative.

Basis:

The existing LOSW-IE in the analysis-of-record [2] (1.22E-03/yr) is based on data from NUREG/CR-5750 and combines data from both partial and complete loss of service water events [11]. The base calculated LOSW-IE frequency attributed to pump failures from Section 5.4 for Case 3, which uses plant evidence of 495,000 hours of pump operation without a failure to run, is 4.18E-06/yr. The LOSW-IE frequency for the degraded state, while the 416 SS couplings were installed, was calculated as 1.35E-04/yr.

A conservative time dependant convolution analysis was performed that concludes the failure probability of the P-7A and P-7B pumps during the P-7C allowed outage time was small (Attachment 10). These results, when compared to the common cause term applied in the initiating event frequency calculation, demonstrate the value used is conservative by over an order of magnitude (see Sections 5.3 and 5.5).

Bias:

This approach is conservative, as the Section 5.4 calculated values demonstrate that the NUREG/CR-5750 value derived from the combined partial and complete loss of SW initiating events are conservative for Palisades. The further addition of the difference in the calculated baseline and degraded frequencies adds further conservatism.

7.2 Minor Assumptions

7.2.1 Large Early Release Frequency (LERF) is not quantified for this analysis.

Basis:

Though not quantified it is considered that LERF would be two orders of magnitude less than the estimated CDF cited herein.

Bias:

This assumption is neutral.

8.0 METHODOLOGY

This evaluation employs the analytical procedures defined in References [2], [6], [7], [8], and [9] and the recommendations from Section 3.4 of [22] (Attachment 1), as described below:

- Modify the current LOSW initiating event frequency by adding a variable for the increase in the LOSW IE frequency using the data for Case 3 in Table 5.4-1 (7th row of data). When reporting a single value, the mean of the distribution is used as all relevant CDF acceptance criteria refer to mean values.
- Change the failure rate distribution for "SW pump failure to run" to reflect the degraded conditions by using the Gamma Distribution parameters in Table 5.2-1.
- Keep all remaining data parameters the same as in the base case.
- Calculate the increase in CDF due to these changes; they should be comparable to those estimated in Section 5.4.

A time dependent conditional probability analysis, using the Lucius Pitkin Inc. (LPI) metallurgical and failure analysis is also presented (Attachment 10). This is followed by comments on the current draft NRC, "Common-Cause Failure Analysis in Event and Condition Assessment: Guidance and Research" template (Attachment 11).

8.1 Acceptance Criteria

The Reactor Oversight Process (ROP) acceptance criteria based on quantitative results is presented below:

Evaluated Configuration	Color
$\Delta CDF < 10^{-6}$	Green
$\Delta CDF > 10^{-6}$	White
$\Delta CDF > 10^{-5}$	Yellow
$\Delta CDF > 10^{-4}$	Red

9.0 PRA MODEL QUANTIFICATION OF INCREASED RISK

This section describes the analysis, assessment and evaluation employed. Summary results are presented in Section 10.

9.1 Full Power Internal Events (PSAR2c)

The current analysis-of-record [2] model was employed to evaluate the significance of the additional service water pump failures with respect to the full power internal events analyses. Attachment 3 provides a high level PRA model history description since the IPE submittal.

To support the risk evaluation, the SAPHIRE code [1] was employed to evaluate the affects of the increased failure rate. The following change set data was prepared based on the quantitative data analysis and recommendations described in Section 5.0.

9.1.1 SAPHIRE Change Set Development

To support the full power internal events random failure analysis, the following SAPHIRE change set data were employed;

PSAR2C P7C COUPLING.CSD=

DELTA_SW_416SS Updated SW Pump Failure Prob and IE Frequency

DELTA_SW_416SS_FTR Updated SW Pump Failure Prob

```
PSAR2C_P7C_COUPLING, DELTA_SW_416SS =
^PROBABILITY
U-PMMG-P-7A ,1, , 1.464E-003, , , , , , ,
U-PMMG-P-7B, 1, , 1.464E-003, , , , , , ,
U-PMMG-P-7C, 1, , 1.464E-003, , , , , , ,
IE_LOSWS, 1, , 1.560E-003, , , , , , ,
^CLASS
^EOS
```

```
PSAR2C_P7C_COUPLING, DELTA_SW_416SS _FTR=
^PROBABILITY
U-PMMG-P-7A ,1, , 1.464E-003, , , , , , ,
U-PMMG-P-7B, 1, , 1.464E-003, , , , , , ,
U-PMMG-P-7C, 1, , 1.464E-003, , , , , , ,
^CLASS
^EOS
```

The loss of service water initiating event frequency and pump fail to run probabilities applied to the change sets were derived as shown in the table below.

Table 9.1.1-1, Initiating Event Frequency and SW Pump Fail to Run Probability Applied to SAPHIRE Change Sets

Description	Value	Source
Palisades base model loss of service water initiating event frequency	1.22E-03/yr	References [6] and [11]. Note: This value combines the frequency for both partial and complete loss of service water.
Increase in loss of service water initiating event frequency	3.35E-04/yr	Table 5.4.1, Change in LOSW-IE from Case 3 (failure rate based on 0 SW pump failures from 1980 – 2009) to Degraded State
Initiating Event Frequency Applied to Change Set "DELTA_SW_416SS"	**1.56E-03/yr**	= 1.22E-03 + 3.35E-04
Service Water Pump failure to run probability based on performance during degraded state period	6.10E-05 / hr	Table 5.2-1, Gamma distribution from Jeffry's non-informative prior.
PRA Mission Time	24 hours	Reference [6]
Service Water Pump Fail-to-Run probability applied to change sets "DELTA_SW_416SS" and "DELTA_SW_416SS_FTR"	**1.464E-03**	= 6.10E-5/hr x 24 hours

9.1.2 Equipment Rotation

The assumed plant configuration cited in Reference [2] and is repeated below;

PSAR2C P7C COUPLING.CSD =

HEVENTS(LGCLS-NRML-CNF) House Events w/Normal Plant Rotation Set to True

PSAR2C P7C COUPLING.CSI =

C-HSE-P-52A-STBY	, T, , , , , , , , ,	M-HSE-SJAE1-INS	, T, , , , , , , , ,
C-HSE-P-52B-STBY	, T, , , , , , , , ,	M-HSE-SJAE2-INS	, F, , , , , , , , ,
C-HSE-P-52C-STBY	, F, , , , , , , , ,	U-HSE-P-7A-STBY	, T, , , , , , , , ,
D-HSE-CHGR1-INS	, T, , , , , , , , ,	U-HSE-P-7B-STBY	, F, , , , , , , , ,
D-HSE-CHGR2-INS	, T, , , , , , , , ,	U-HSE-P-7C-STBY	, F, , , , , , , , ,
D-HSE-CHGR3-INS	, F, , , , , , , , ,	X-HSE-SGA-BLDN	, 1, , 1.000E+000, , , , , , ,
D-HSE-CHGR4-INS	, F, , , , , , , , ,	X-HSE-SGB-BLDN	, 1, , 1.000E+000, , , , , , ,
E-HSE-AIR-LT-75F	, F, , , , , , , , ,	X-HSE-2SG-BLDN	, 1, , 1.000E+000, , , , , , ,
E-HSE-AIR-GT-75F	, T, , , , , , , , ,	X-HSE-2SG-BLDN-A	, 1, , 1.000E+000, , , , , , ,
I-HSE-M2LEFT-INS	, T, , , , , , , , ,	X-HSE-2SG-BLDN-B	, 1, , 1.000E+000, , , , , , ,
I-HSE-M2RGHT-INS	, F, , , , , , , , ,	Y-HSE-LOOP1A-BRK	, T, , , , , , , , ,
I-HSE-F-12A-INS	, T, , , , , , , , ,	Y-HSE-LOOP1B-BRK	, F, , , , , , , , ,
I-HSE-F-12B-INS	, F, , , , , , , , ,	Y-HSE-LOOP2A-BRK	, F, , , , , , , , ,
I-HSE-F-5A-INS	, T, , , , , , , , ,	Y-HSE-LOOP2B-BRK	, F, , , , , , , , ,
I-HSE-F-5B-INS	, F, , , , , , , , ,	Y-HSE-RAS-PRE	, F, , , , , , , , ,
I-HSE-C-2AC-INS	, T, , , , , , , , ,	Y-HSE-RAS-POST	, F, , , , , , , , ,
I-HSE-C-2B-INS	, F, , , , , , , , ,	A-HSE-CST-MAKEUP	, F, , , , , , , , ,
M-HSE-P-2A-TRIP	, T, , , , , , , , ,	X-HSE-DOOR-167B	, T, , , , , , , , ,
M-HSE-P-2B-TRIP	, F, , , , , , , , ,	X-HSE-DOOR-167	, T, , , , , , , , ,

9.2 Internal Flooding

To evaluate the impact of the increased service water pump independent failure probability on internal flooding events, the model developed in references [31][32][33] was employed. Although the model referenced has not been formally issued as the analysis-of-record, it was recently developed based on current ASME standards, peer reviewed, and more accurately characterizes flooding risk at Palisades relative to the IPEEE flooding analysis.

The approach to evaluating the increase in flooding risk was to apply change set 'PSAR2C_P7C_COUPLING, DELTA_SW_416SS _FTR' as presented in Section 9.1.1 and calculate the change in core damage frequency relative to the base model. The results of this evaluation are presented in Section 10.2.

9.3 Fire Events

This section describes the steps taken to re-create the IPEEE fire analysis. The recreated IPEEE analysis is built upon the Palisades 2004 PSAR2 model [36] as well as that documented in Reference [35].

This analysis resurrected the Reference [35] and [36] analyses and applied the IPEEE data, fault tree and event tree logic.

What follows is a summary description that describes how the IPEEE model was changed.

To create the IPEEE fire model using PSAR2, the Reference [35] analysis performed the following:

1. Converted the basic events representing component fire damage in the fire IPEEE to basic event names currently used in the PSAR2 analysis.
2. Modify the PSAR2 fault tree logic to reflect assumptions made in the fire IPEEE.
3. Add fire related failure modes to the PSAR2 fault tree logic.
4. Recreated fire area initiating events.
5. Developed fire accident sequences (1,776).

9.3.1 Basic Event Conversion

The fire IPEEE was based on a Palisades internal events PSA model that was current as of 1995. Updates to the 1995 PSA model have been performed since the IPEEE submittal. Among the changes was a restructuring of the format of the basic event names.

Attachment 4 provides a listing of the basic event names that were selected in the fire IPEEE to represent component failures that would occur as a result of fire damage in the various fire areas of the plant.

9.3.2 Modifications to the PSAR2 [36] Fault Trees [35]

As noted above, the fire IPEEE was based on a Palisades internal events PSA model that was current as of 1995 and updates subsequently have been made to the PSA models. These updates reflect plant design changes that have occurred since the fire IPEEE, modifications to the models to address comments by external peer reviewers, changes resulting from a technical adequacy self assessment performed in accordance with Regulatory Guide 1.200, and updates to reliability data. Attachment 6 provides an overview of PRA model changes since the IPEEE submittal.

Changes made to PSAR2 logic to recreate the IPEEE are summarized below and in Attachment 5.

Modifications to Reflect Logic in the Fire IPEEE

A number of local operator actions were credited in the fire IPEEE that are not included in the internal events PSA fault tree logic. These operator actions generally take place as a result of loss of power or control circuits due to fire damage in specific fire areas. These recovery actions generally include local closure of breakers or operation of control valves. Attachment 5 provides a complete listing.

Modifications to the PSAR2 logic to reflect logic in the fire IPEEE were implemented in a manner that the fault trees could be quantified in one of three ways:

1. Implement the fire IPEEE logic specifically for the fire area for which the change was intended. For example, local closure of the breaker for P7B was credited in the fire IPEEE only for control room fires. Gate U973-DG-FIRE was developed to include a local operator action (U-PMOE-PUMP) for closure of this breaker ANDed with all control room fires (gate A69A5-FIRE under OR gate U973-DGA2-FIRE). By setting any of the control room cabinet fire initiating event house events to True, this recovery logic is enabled.
2. Implement the fire IPEEE logic for all fire areas. This is performed using a house event created for this purpose. For example, HSE-ANYFIRE is set to True enabling the U-PMOE-PUMP logic under gate U973-DGA2-FIRE. The HSE-ANYFIRE house event appears ANDed with all fire IPEEE logic incorporated in the PSAR2 fault tree and enables the fire IPEEE logic for all fire

areas.

3. Disable the fire IPEEE logic in the quantification of the fire accident sequences using the PSAR2 logic. This is performed using the HSE-NOTANY house event. By setting this event to True and the HSE-ANYFIRE to False, fire IPEEE changes are disabled and the fault trees quantified without this recovery logic. The purpose of the HSE-NOTANY house event was to facilitate comparison of the effects of the fire IPEEE changes with the PSAR2 logic.

Modifications to Assure Logic Reflects Correct Plant Transient Response to a Fire

The PSAR2 fault tree models include house events to activate fault tree logic associated with plant response to transient initiators. As fire initiators are not a part of the list of internal events in PSAR2, a house event is added to the list of transient initiators representing plant trip due to a fire initiator.

Addition of Fire Areas Initiators to the Fault Tree Logic

The Palisades PSA models are quantified using house events to represent the various initiating events. For a given initiating event, setting its house event to True and all other initiator related house events to False enables the appropriate logic in the fault trees for that given initiating event.

Fire initiator house events were added to the PSAR2 model using the information in Attachment 4. Each basic event listed as representing a component failure for a given fire area in Attachment 4 was ORed with a house event representing that fire area. The AddEvent program [14] was used to incorporate the house events into the fault trees.

Quantification of the fault trees for a given fire area can then be performed by setting a selected fire area house event to True and all other fire area house events to False.

Attachment 6, lists the IPEEE Ignition Frequencies, Fault Tree Names/Frequencies and Fire Area Assigned/Associated Logical Event.

Event Tree Diagrams

Two types of event trees were developed. The first type of event tree simply distributes a given fire area into the different sub areas that were developed for that fire area in the Fire IPEEE. For example, the Control Room can be distributed among 18 different control cabinets or an exposure fire that, if unsuppressed, can affect equipment in the entire room. Attachment 7, Figure A7.1 is an example of the event tree that distributes the fires among the various sub areas for the Control Room. The second event tree type defines plant accident sequence response to a given fire and includes important functions and system logic that are developed by the fault trees.

This second linked event tree transfers to the appropriate sub area. Figure A7.8 is an example of an event tree used to quantify control room fires.

Event Tree Rules

Attachment 7, Tables A7.1 through A7.10 list rules for quantification of the accident sequences for each fire area.

Accident Sequence Generation and Solution

Four steps were performed to quantify the event tree accident sequences.

1. Convert the PSAR2 fire fault tree to SAPHIRE format
2. Develop Change Sets to perform the accident sequence quantification
3. Generate accident sequences using the SAPHIRE “link” command
4. Quantify all the accident sequences

Conversion of the PSAR2 fire CAFTA fault tree to a MAR-D format described in the above steps was performed using the Caf2sap program [14].

9.3.3 Risk Impact of Increased Fail to Run Probability on Fire Events

The impact on fire events of the increased service water pump fail to run probability was performed by evaluating the change in fire CDF frequency by applying change set 'PSAR2C_P7C_COUPLING, DELTA_SW_416SS _FTR' as presented in Section 9.1.1. The results of this analysis are presented in Section 10.3.

9.4 Seismic

9.4.1 Palisades Seismic Design

Palisades seismic design standard for safety related equipment was determined by considering the effects of historical earthquakes in the region. Three historical earthquakes have occurred within 100 miles of the site, the largest being an event in 1947 centered in Southern-Central Michigan which was recorded as "VI" on the Modified Mercalli scale or 4.6 on the Richter scale.

The anticipated maximum earthquake intensity at Palisades is between VI and VII (Mercalli Scale). It was recommended originally that Palisades be designed for a surface acceleration value of 0.05 g; however, a value of 0.20 g was used for systems needed to achieve safe shutdown. All safety related equipment is designed to withstand such an event [34].

No faults have been mapped in the vicinity of the site. The nearest inferred large scale faulting is the Tekonsha and Albion-Scipio Trends located about 50 and 60 miles east of the site respectively. These are considered to be post Devonian to pre Pleistocene with most activity occurring in the late Paleozoic [34]. The most recent earthquake detected at the site was on April 18, 2008. It occurred near Olney, Illinois and it measured 5.4 on the Richter scale at that location, approximately 200 miles SSW of Palisades.

Per the NRCs August 2010 NUREG presentation, Palisades was not in the preliminary list of sites that warranted further evaluation under GI-199.

9.4.2 IPEEE Seismic Evaluation

In the Palisades IPEEE (Individual Plant Examination of External Events), a seismic risk assessment was performed. The risk assessment was a hybrid of the conventional PSA and seismic margins analysis.

The seismic analysis has not been updated since that originally developed for the Individual Plant Examination of External Events (IPEEE) submittal [30]. A review of the results of the IPEEE submittal indicated that the core damage frequency was 8.88E-06 with a high confidence low probability of failure (HCLPF) of 0.217g PGA (peak ground acceleration). There were no specific seismic events identified as dominant contributors to the core damage frequency. Important seismic induced failures identified were; the Fire Protection System, Main Steam Isolation Valves, Diesel Generator Fuel Oil Supply, and an under voltage relay for 2400 volt ac Bus 1D. Several important random failures were identified in the report as important because of their contribution in combination with seismically induced failures. The important random failures (not seismically induced) identified in the report were: diesel generator 1-2, auxiliary feedwater (AFW) pump, P-8C, and atmospheric dump valves.

As noted, the fire protection system is an important contributor to seismic analysis due to the probability of seismically induced failure of fire protection system components and the condensate storage tank (CST). Seismically induced failure of the condensate storage tank results in an earlier need for alignment of an alternate suction source for the operating auxiliary feedwater pump. The fire protection system provides an alternate suction source to AFW pumps P-8A and P-8B. The seismically induced failures of the fire protection system result in long term failure of auxiliary feedwater pumps P-8A and P-8B due to the unavailability of a suction source. Auxiliary feedwater pump P-8C is important to long term makeup to the steam generators should the fire system become unavailable following a seismic event (as discussed in the results for Accident Classes IA & IB, Section 3.6.5.3.1 [30].

The fire protection system has a low fragility and is a significant contributor to seismic risk once the contents of the condensate storage tank (T-2) are depleted and a long term suction source is required for continued operation of the AFW pumps. The seismically induced failure of the fire protection system represents a higher probability of failure of the long term suction to motor-driven auxiliary feedwater pump P-8A and turbine-driven auxiliary feedwater pump P-8B after the depletion of the available tank T-2 inventory. This increased probability of failure of heat removal via the A and B pump trains results in an increased importance of motor-driven auxiliary feedwater pump P-8C. The importance of pump P-8C is a consequence of the fact that service water (a much more seismically rugged system) is more likely to remain available as a long term suction source to pump P-8C.

9.4.3 Evaluation of Increased Service Water Pump Failure Probability on Seismic Risk

As the Palisades seismic PRA hasn't been updated since the IPEEE, a characterization of the impact on seismic events of the increased service water pump fail to run probability was performed by evaluating the change in failure probability of the service water system fault tree (gate sws-mspi) by applying change set 'PSAR2C_P7C_COUPLING, DELTA_SW_416SS _FTR' as presented in Section 9.1.1. The results of this analysis are presented in Section 10.4.

10.0 RESULTS

10.1 Full Power Internal Events

As described in Sections 5.0 and 8.0 above, the ΔCDF/yr was calculated using the Palisades full power internal events analysis-of-record. The results of this analysis are presented in Table 10.1-1.

Table 10.1-1, Change in Risk due to Increased Failure Probability of SW Pump Couplings

Case #	SAPHIRE Project	Change Set(s)	CDF/yr (unsubsumed/subsumed) (Truncation @ 1E-10)	# Cutsets	Comments
base	PSAR2c	1. HEVENTS(LGCLS-NRML-CNF)	2.832E-05 / 2.696E-05	10,697 / 8,619	Analysis-of-record with house events set to normal plant rotation
1	PSAR2C_P7C_COUPLING	1. HEVENTS(LGCLS-NRML-CNF) 2.DELTA_SW_416SS_FTR	2.832E-05 / 2.696E-05	10,712 / 8,621	Normal plant rotation, and increased SW pump fail to run probability per Table 5.2-1
2	PSAR2C_P7C_COUPLING	1. HEVENTS(LGCLS-NRML-CNF) 2. DELTA_SW_416SS	2.924E-05 / 2.787E-05	10, 736 / 8,641	Normal plant rotation, increased LOSW IE frequency per Table 5.4-1, and increased SW pump fail to run probability per Table 5.2-1
Change in Core Damage Frequency Relative to Base Case					
1	**ΔCDF/yr**		**ε**		Case 1 ΔCDF/yr with increased pump fail to run probability
2	**ΔCDF/yr**		**(2.787E-05 - 2.696E-05) = 9.1E-07[1]**		Case 2 ΔCDF/yr with increased LOSW IE frequency and pump fail to run probability

[1] This value is deemed conservative based on the common cause factors applied to the change in initiating event frequency calculation as described in Section 5.3 and summarized in Section 11.

10.2 Internal Flooding

The flooding model calculated a ΔCDF/yr of 1.0E-08 using the change set DELTA_SW_416SS_FTR (increased SW pump failure to run probability) as described in Section 9.1.1.

10.3 Fire

The fire results were obtained by solving the SAPHIRE change sets 'PSAR2C_P7C_COUPLING, DELTA_SW_416SS _FTR', discussed in 9.1.1.

The results in Table 10.3-1 indicate that the change in core damage frequency for those sequences with SW pump cutset elements is small (<1E-08/yr). This is consistent with the IPEEE [37] fire results in that the core damage frequency was dominated by secondary side random heat removal failures; specifically, auxiliary feedwater and once-through-cooling (OTC) failures.

Table 10.3-1, Change in Core Damage Frequency from Fire Events with Increased SW Pump Fail to Run Probability

Case #	SWS Pump Core Damage Frequency (Truncation @ 1E-10) /yr
IPEEE Modified Fire Model - Base Case	7.26E-10
IPEEE Modified Fire Model - w/SWS Coupling Failure Included	7.69E-09
Change in System Failure Probability Relative to Base Case	
ΔCDF/yr	(7.69E-09 - 7.26E-10) = 6.96E-09

10.4 Seismic

To evaluate the potential impact on the seismic analysis, the relative increase in system failure probability using the DELTA_SW_416SS_FTR change set (increased SW pump failure to run) was calculated. It was fond that the system failure probability (failure of all three service water pumps) increased from 3.399E-05 to 3.508E-05, or a Δ of 1.09E-06.

As the change in the system failure probability is small; the impact on the service water system functional importance in a seismic event would also be relatively insignificant, as this increase is a result of random independent failures, whereas the seismic CDF is primarily a function of components that have failed due to the seismic event.

10.5 Total Change in Core Damage Frequency

The total increase in core damage frequency, due to the increased failure rate of the service water pumps, is the sum of the changes in risk contribution from the full power internal events, fire, flooding, and seismic results presented in Sections 10.1 – 10.4.

$$Total\ \Delta CDF = (9.1E-07) + (1.0E-08) + (6.96E-09) + \epsilon = \mathbf{9.3E-07/yr}$$

As the results demonstrate, the primary contribution to the increase in core damage frequency is from the increase in loss of service water initiating event frequency (LOSW-IE) applied to the full power internal events model.

The approach applied to develop the magnitude of the LOSW-IE increase in considered conservative. As presented in Section 5.3, the fraction of the elevated failure rate due to common cause (i.e. the beta factor for pump failure to run) was assumed to be the same as in the base case model. The beta factor used is viewed to be highly conservative for normally operating pumps as there is very little historical evidence of common cause failures of normally operating components. Due to the conservative treatment of common cause failures in this evaluation, the calculated change in CDF is actually dominated by the initiating event frequency estimation involving common cause failure of the two normally operating pumps. A more realistic assessment that takes credit for the fact that the two pump failures are independent failures would result in a much smaller increase in CDF than what has been estimated in this analysis.

In addition, the probability of failure the P-7A and P-7B pumps during the allowed outage time of P-7C was conservatively quantified using a time dependant convolution analysis as described in Section 5.5. The result of this analysis (see page 5 of Attachment 10) was a probability of 2.65E-05 over the 72 hour period, or a rate of 3.68E-07/hr. The common cause failure rate used in the initiating event frequency calculation presented above (equation 5.2 term λCCFR) for the degraded state is $\beta_{FR}\lambda_{FR}$ = .0243 * 6.1E-05/hr = 1.482E-06/hr. Therefore, the common cause term applied in initiating event frequency calculation is conservative by over an order of magnitude.

11.0 CONCLUSION

Based on the review of the metallurgical studies, data analysis, and model quantification, the following conclusions were reached:

- The coupling failure events are considered repeated independent failures of a single component. The events occurred too far apart in time to have more than a negligible impact on the common cause failure probability.
    - This is based on the application of NUREG/CR-6268, and
    - The review of draft "Common-Cause Failure Analysis in Event and Condition Assessment: Guidance and Research" [38], Attachment 11.
- Although the failures of interest were treated as independent in this analysis, the fraction of the elevated failure rate due to common cause (i.e. the beta factor for pump failure to run) was assumed to be the same as in the base case model. The beta factor used is viewed to be highly conservative for normally operating pumps as there is very little historical evidence of common cause failures of normally operating components. Due to the conservative treatment of common cause failures in this evaluation, the calculated change in CDF is actually dominated by the initiating event frequency estimation involving common cause failure of the two normally operating pumps. A more realistic assessment that takes credit for the fact that the two pump failures are independent failures would result in a much smaller increase in CDF than what has been estimated in this analysis.
- With respect to the technical specification allowed repair time of 72 hours for a single pump out of service, there would be approximately 20 LCO periods between the P-7C failure on August 9, 2011 and the metallurgical report predicted failure time of the P-7B couplings on October 9, 2011 (if the pump were to remain in continuous operation). This span would significantly reduce the potential for concurrent pump failures within the LCO repair time. No cracking was found in the P-7A pump couplings.
- A conservative time dependant convolution analysis was performed that concludes the failure probability of the P-7A and P-7B pumps during the P-7C allowed outage time was small (Attachment 10). These results demonstrate that the common cause term applied in the initiating event frequency calculation in this analysis is conservative by over an order of magnitude.
- The analysis characterized the risk during the period the shaft couplings were constructed from material that was more susceptible to inter-granular stress corrosion cracking (the degraded state period). It was estimated that the SW pump mean failure rate for failure to run increased by a about a factor of 15 compared to the currently employed failure rate.

- The analysis also characterized the risk impact due to the increase in loss of service water initiating event frequency during the degraded state period. The pump failure contribution to initiating event frequency during this period was estimated to increase by 30%.
- The impact of the service water pump increased independent failure probability on core damage frequency due to flooding, seismic, and fire initiating events was evaluated and was determined to be negligible.

In summary;

The observed failures are considered independent and have a negligible impact on the common cause failure probability. Therefore, based on the random nature of the stressors that contribute to IGSCC, as described in the coupling metallurgical reports, the rate and timing of the failures, and 3rd party expert analyses; the coupling failures contribution to the common cause failure to run probability and loss of service water initiating event frequency, is also negligible. The increase in core damage frequency, while the 416 stainless steel couplings were installed in the Palisades service water pumps is quantified as <1.0E-6 (Green).

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[37] Consumers Power, Palisades Nuclear Plant, "Individual Plant Examination of External Events for Severe Accident Vulnerabilities," Response to Generic Letter 88-20, Supplement 4, Final Report, June 1995.

[38] Song-Hua Shen et.al.,"Common-Cause Failure Analysis in Event and Condition Assessment: Guidance and Research", ML111890290, draft.

13.0 LIST OF ATTACHMENTS

Attachment 1	Risk Significance Evaluation of Service Water Pump Failures for Palisades Nuclear Power Station, Karl N. Fleming, November 2011 (29 pages)
Attachment 2	Service Water Pump Run Time PI Data Analysis (6 pages)
Attachment 3	PRA Model History (6 pages)
Attachment 4	Fire IPEEE to PSAR2 Basic Event Translation (66 pages)
Attachment 5	Modifications to PSAR2 Logic for Fire Model (16 pages)
Attachment 6	IPEEE Ignition Frequency, Fault Tree Names, Fire Areas (9 pages)
Attachment 7	Fire Event Tree Accident Sequences (22 pages)
Attachment 8	Lucius Pitkin Inc. (LPI) report F11358-R-001 Rev.0, “Metallurgical and Failure Analysis of SWS Pump P-7C Coupling #6”, October 2011 (report body, does not include attachments*) (83 pages)
Attachment 9	Lucius Pitkin Inc. (LPI) report F11358-LR-001 Rev. 0, “Past Operability Assessment of Service Water Pumps P-7A and P-7B associated with As-found Evaluation of Pump Shaft Couplings – Palisades Nuclear Plant”, Lucius Pitkin, Inc., September 28, 2011 (41 pages)
Attachment 10	Evaluation of Service Water Pumps P-7A and P-7B Failure Rates Following Failure of Pump P-7C *(15 pages)*
Attachment 11	Comments on Draft NUREG “Common-Cause Failure Analysis in Event and Condition Assessment: Guidance and Research” *(29 pages)*
Attachment 12	Comments on NRC Inspection Report Preliminary White Finding (5 pages)

*Attachments A-X of LPI P-7C report available upon request

A: Miscellaneous Inputs
B: Receipt Inspection Reports
C: Visual Inspection
D: Magnetic Particle Testing
E: Hardness Survey Data
F: Tensile Test Data
G: Charpy Test Data
X: Rev. 0 Comment and Resolution

RISK SIGNIFICANCE EVALUATION OF SERVICE WATER PUMP FAILURES FOR PALISADES NUCLEAR POWER STATION

Final Report

Prepared for

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1. INTRODUCTION

1.1 *Purpose*

This report documents a risk significance evaluation of two service water (SW) pump failures that occurred at the Palisades Nuclear Power Station on September of 2009 and August of 2011. This independent evaluation is based on information provided to the author on the event descriptions and corrective actions that is presented in Section 2 of this report.

1.2 *Objectives*

The objectives of this study are to:

- Review the available evidence on the SW pump failures including the licensee event reports [1][2], root cause evaluations [3][4], and metallurgical evaluations [5][6] to develop an understanding of the failure modes, mechanisms, and corrective actions.
- Provide an appropriate risk evaluation of the events by establishing the appropriate cause and effect relationships between the events and the Palisades PRA models.
- Estimate the risk impact of the events and the conditions that produced them. This includes a characterization of the time frames and a quantitative estimate of change in risk associated with the events and the conditions that produced them. This is to provide input to the Risk Informed Oversight program on the quantitative risk significance of the events.

1.3 *Report Guide*

A qualitative evaluation of the SW pump failures is provided in Section 2. In Section 3 a quantitative risk evaluation is presented. A limited review of the NRC Preliminary Significance Determination is found in Section 4. The conclusions of these evaluations are provided in Section 5.

2. REVIEW OF SERVICE WATER PUMP FAILURES

2.1 *Summary of Service Water Pump P-7 Coupling Failure Events*

The following summary of the SW pump failures is based on information provided by Palisades to the author. More details on the description of the events may be found in the Licensee Event Reports in References [1] and [2], for the 2009 and 2011 events, respectively, and in the root cause evaluation reports in References [3] and [4], for the 2009 and 2011 events, respectively.

2.2 *Service Water Pump Configuration at Palisades*

The following excerpt from Reference [4] provides a good description of the SW pump configuration at Palisades.

> *The Service Water System (SWS) at Palisades is comprised of three motor driven vertical multistage pumps supplying water from Lake Michigan to three service water headers. Two of the headers are termed critical headers A and B, which provide cooling to safety and non-safety related components. Each critical header supplies cooling water to one set of the redundant components including emergency diesel generator lube oil and jacket water coolers, a control room air-conditioning unit, an air compressor after-cooler and an engineered safeguards room cooler. In addition, critical header A supplies cooling water to the component cooling water heat exchangers while critical header B supplies cooling water to the containment air coolers.(Note that headers A and B are normally cross tied during normal plant operation and would be in this alignment during accident conditons) For accident conditions, either train fed by its associated diesel, is sufficient for accident mitigation. The third header is termed non-critical and provides cooling to non-safety related equipment.*
>
> *Palisades Technical Specifications require that all three pumps be operable. The failure of a single pump requires entry into a 72 hour shutdown LCO Action Statement. A single header combining return streams from the three supply headers discharges into the cooling tower makeup basin. Leakage of radioactive contamination into the SWS is detected by a radiation monitor installed in the discharge line.*
>
> *The three Service Water Pumps (SWPs), P-7A, P-7B, and P-7C, are modified Layne and Bowler pumps. They are comprised of a two stage pump end with stainless steel impellers connected to a discharge head by seven columns for a total height of over 40 feet from suction to discharge. The pump end is coupled to the motor through six line shafts, a packing shaft, and a motor shaft connected by eight couplings all of the same design.*

2.3 *Service Water Pump Failure Event Descriptions*

From April to May of 2009, Palisades replaced the carbon steel components of all three pump rotating assemblies with 416 stainless steel in order to improve corrosion resistance, A timeline of events is presented in Table 2-2 below. The P-7C pump couplings were replaced in June of 2009; on September 29, 2009 the first of two failures occurred. The root cause evaluation for this failure determined the #7 coupling failed due to inter-granular stress corrosion cracking (IGSCC) which resulted from the material having hardness beyond specification [3]. The pump was repaired with couplings that were validated as within the proper hardness specification and placed back in service in October 2009. This coupling is near the top of the pump shaft and in an area that experiences wet conditions when the pump is in operation and dry when the pump is in a shutdown standby mode of operation. Couplings #5, 6, and 7 share these conditions whereas the remaining couplings are always wet.

In August of 2011, the second coupling failure occurred on P-7C, the same pump that failed in 2009. In this event, the #6 coupling failed and again the failure mode was attributed to IGSCC, however, the hardness of the steel was within specification. Upon further evaluation it was determined that out-of-specification hardness was not the root cause of the failures and cracks observed in 2009, although it may have been a contributing factor. It was also discovered that couplings #5 - #7 experienced intermittent cycles of wet and dry conditions depending on if the pump is in operation or standby. This environment in conjunction with the shear stresses on the coupling was identified as root cause of both failures [6]. The metallurgists determined that 416 SS should not be used for this application given the environmental and mechanical stresses on the coupling and the susceptibility of the material to IGSCC [6].

Following the second failure, Palisades has replaced the couplings on all three pumps with 17-4PH stainless steel. The replacements were started in August 2011 and were completed in October 2011 (see Table 2-2 for replacement dates).

2.4 *Root Cause Evaluation*

The 416 stainless steel couplings installed in the P-7A and P-7B pumps in April and May of 2009 were of the same 416 stainless steel as installed in P-7C. When the couplings were removed in August 2011, for replacement with the new material specification, they were sent for metallurgical evaluation. The report concluded that the P-7A couplings had no visual indication of cracking, and if a flaw had initiated on the day the couplings were removed, it would have required at least 54 days for the flaw to propagate through wall (considering the pump remained in continuous operation). Cracks were found in the #5, #6, and #7, couplings (exposed to the wet-dry environment) of the P-7B pump. The report stated it would require approximately 40 additional days of pump operation beyond the day they were removed for the cracks to propagate through wall [5].

It was noted in the 2011 metallurgical reports [5][6] that the P-7A coupling threads had a greater amount Neolube grease applied relative to the couplings examined from pumps P-7B and P-7C. It was postulated that this additional grease enhanced the coupling's pitting resistance by protecting the threads from corrosive agents in the operating environment. The lubricant is applied to the shaft threads in accordance with the pump reinstallation work instruction, but the amount of grease to apply is not specified. The report stated that the maintenance procedure for pump P-7A directed maintenance personnel to avoid lubrication of the last three shaft threads on either side of the coupling, yet it appeared all of the threads were fully lubricated. The maintenance procedure for pumps P-7B, and P-7C did not direct avoiding lubrication of the last three threads, yet these couplings were found with less grease on the threads relative to the P-7A couplings [6].

The time to failure of a given material due to stress corrosion cracking in a given environment is dependent on the applied tensile stress as described in Section 4.4 of the October 2011 metallurgy report [6]. The report states that the time of crack initiation is:

"…highly alloy-environment and applied stress dependent and thus is an unknown without specific test data. The initiation time is also highly dependent upon pre-existing flaws that may have been introduced during heat treatment or thread fabrication. Therefore, predicting initiation time is difficult. Unless there are preexisting flaws, a distribution of 80% initiation and 20% propagation is considered reasonable for the life of a component subject to SCC process…"

This statement implies that the time to failure due to IGSCC is function of multiple stressors that each provides a random contribution to the crack growth rate. Further evidence of the variability in each of the couplings geometry and material properties is shown in Tables 3-1 through 3-8, and variability of the hardening and tempering heat traces is shown in Figures 4-1 and 4-2 of the report [6]. As explained more fully in these supporting reports, the shaft couplings are subject to high tensile stresses during operation due to hydrodynamic forces and are always subjected to tensile stresses due to the weight of the pump shaft and impeller, especially near the top of the pump shafts.

Prior to these two pump failures there had been no actual failures of SW pumps during operation that would have qualified for a failure to run according to the PRA success criteria. As documented in the root cause reports in References [3] and [4], there had been previous instances where a SW pump failed to meet the required flow rate during in-service testing. However the two events in the 2009 to 2011 time period are the only events where an operating SW pump failed to continue operating. In Table 2-1, the operating experience with the SW pumps since January 1, 2005 is summarized. The time line of pump conditions at each of the three pumps is shown in Table 2-2.

Table 2-1 Service Water Pump Operating Time and Experienced Failures to Run

Pump	Pump Run Hours Between Install of 416 SS Couplings and Replacement with 17-4PH SS	Pump Run Hours between 1-1-2005 and 10-18-2011	Number of Run Failures
P-7A	14,999	41,818	0
P-7B	8,909	37,580	0
P-7C	17,521	43,717	2
TOTAL	41,429	123,116	2

Table 2-2 Summary and Timeline of Events

Event	416 SS Coupling Installation Date	Coupling Failure Date	Couplings replaced with 17-4PH SS	Projected Failure Date of 416 SS Couplings from Metallurgy Report	Notes
SW Pump P-7A					
	4-Apr-2009	N/A	24-Aug-2011	>54 days, 17-Oct-2011	The 416 SS couplings did not fail on P-7A. The metallurgy report concluded the additional Neolube applied to the threads may have prevented IGSCC [5].
SW Pump P-7B					
	12-May-2010	N/A	30-Aug-2011	40 days, 9-Oct-2011	The 416 SS couplings did not fail on P-7B. The metallurgy report indicated that IGSCC was beginning to occur and, at the predicted crack propagation rate, the coupling would not have failed for 40 days from the date of removal if the pump were in continuous operation [5].
SW Pump SW Pump P-7C					
1st Failure	12-Jun-2009	29-Sep-2009	N/A	N/A	The evaluation of the first failure stated the couplings failed due to IGSCC. The cause was improper tempering resulting in excessive hardness of the material [3]. Failure occurred approximately 3 months after installation. Further evaluation of the couplings following the second failure in 2011 concluded that the out of specification hardness was not the root cause. The report completed in October 2011 concluded that both the 2009 and 2011 failures were due to IGSCC exacerbated by the wet-dry environment of the #5 - #7 couplings [4] [6]

Event	416 SS Coupling Installation Date	Coupling Failure Date	Couplings replaced with 17-4PH SS	Projected Failure Date of 416 SS Couplings from Metallurgy Report	Notes
2nd Failure	2-Oct-2009	9-Aug-2011	18-Oct-2011	N/A	The couplings met the hardness specification after the second failure, but again failed due to IGSCC. It was found that material toughness was inadequate, and cycle of wet-dry environment in #5 – #7 bearings exacerbated the condition [6]. Recommended change to new material with better toughness (17-4PH SS). This failure occurred approximately 21 months after installation.

2.5 *Qualitative Risk Characterization of SW Pump Failures*

Upon review of the above event descriptions and the supporting references the following conclusions can be reached.

- During the period starting when the carbon steel couplings were replaced by 416 Stainless steel and ending when the 416 stainless steel couplings were replaced with material 17-4PH SS, the SW pumps were in a degraded state in which their failure to run failure rates were elevated in relation to the previous excellent service experience. There is significant evidence from the metallurgical reports to support the conclusion that this period of degraded performance ended with the installation of 17-4PH SS couplings. The plant specific evidence for estimating the SW pump failure rate is 2 failures in 41,429 component-hours of SW pump operation.
- These pump failures are not in any way shape or form to be regarded as common cause failures for three important reasons.

    1. Both failures occurred on one pump as opposed to failures on a redundant pair of pumps. This is a case of repeated failures on the same component due to the failure to correctly diagnose the cause of the first failure. The failed SW pump was not restored to "as good as new" status as assumed in the PRA models.
    2. Even if these two failures occurred on redundant pumps, the times of failure were too far apart to be considered a candidate for a common cause failure. According to the guidelines used by INL to classify events as common cause failure, a self-announced pair of failures would need to occur within 3 mission times to be given any consideration for even a potential common cause failure. Even if one assumes a mission time of 30 days, the failures in this case were separated by almost 23 mission times. This is evidenced by the following criteria listed in Reference [7] with the key part indicated in bold font (author's emphasis):

"For announced failures, the timing factor is based on a time-based model. Thus, the timing factor is assigned values based upon a PRA mission time (the period of time the component is usually required to perform its function in a PRA or individual plant examination [IPE], usually 24 hours). The following classifications may be used for two consecutive degradations of two components contained in a CCF event:

• High (1.0): The component events are separated by no more than the PRA mission time.

• Medium (0.5): The component events did not occur within the PRA mission time and two times the PRA mission time.

• Low (0.1): The component events are separated by more than two times the PRA mission time and less than three times the PRA mission time.

• Not CCF: More than three times the PRA mission time or during the interval between the component events, the component (which was detected, failed, or degraded later) has undergone maintenance, overhaul, or other action that can be regarded as a renewal event for the failure mechanisms. (Note: In this case, the event is not classified as a CCF event.)

3. The root causes of these failures, inter-granular stress corrosion cracking are inherently linked to independent failure modes. Although this damage mechanism was active on all three pumps, the metallurgical reports indicated that a minimum of 40 additional days of operation could be assured on the remaining pumps.

- In the current Palisades PRA model there are two areas where the risk impacts of these events need to be considered: 1). a potential increase in the loss of service water initiating event frequency; and 2) a potential increase in the SW pump failure rate used in a number of PRA model basic events involving failure to run. Even though the SW pump failures did not involve a total loss of service water, under different circumstances the failure of one pump could occur and the remaining pumps could also be unavailable due to various combinations of independent failures, common cause failures, and maintenance unavailability involving the remaining pumps. These failure and unavailability combinations could lead to a total loss of service water. Hence, an increased pump failure rate could result in an increase in the loss of service water initiating event frequency.

3. Quantitative Analysis of Risk Significance

It was concluded in Section 2 that the risk impact of the SW pump failures is best characterized as a change to the SW pump failure rate for failure to continue running while in operation. This in turn may influence the loss of service water initiating event frequency and the basic events in the PRA model for failure to run to complete the various missions following an initiating event. The impact on the pump failure rate is addressed in Section 3.1. An evaluation of the impact of the change in failure rate on the loss of service water initiating event frequency is presented in Section 3.2. Finally, an estimate of the additional risk impacts due to the increase in the failure rate on the safety function mitigation functions modeled in the PRA is provided in Section 3.3.

3.1 *Service Water Pump Failure Rate*

3.1.1 Failure Rate Prior to Installation of 416SS Pump Shaft Couplings

The Palisades PRA data base is in the process of being updated. The PRA model of record is based on a database that was completed in 2001 and includes Palisades plant specific operating experience and service data for the SW pumps from 1994 through 1998. During this period, there were no pump failures to run in 68,571 hours of pump operation [16][17].

The uncertainty distribution for the SW pump failure to run failure rate based on this PRA model of record was developed using generic parameter references from PLG-0500 [19] as a prior and then updated using the above listed run time with zero failures. Details of this update are in Table 3-1.

Table 3-1 Parameters for Model of Record SW Pump Failure Rate Update (Case 1)

Parameter	Prior Distribution from [19]	Posterior Distribution
Data Collection Period	-	1994 through 1998
Number of Failures	-	0
Pump-hours of Operation	-	68,571
Distribution Type	Lognormal	Non-Parametric fit to lognormal
Mean	3.42E-5	1.23E-5
RF = SQRT(95%tile/50%tile)	5.0	3.4
5%tile	4,24E-6	2.62E-6
50%tile	2.12E-5	9.82E-6
95%tile	1.06E-4	3.03E-5

The most recent update of the Palisades PRA Data Notebook was completed in 2009 prior to the occurrence of the SW pump failures in question [9]. The update covers the period of January 1, 2005 to January 23, 2008. During this period there were no SW pump failures to run and the run times associated with each of the SW pumps is indicated in the following table:

Table 3-2 SW Pump Run Data 1-1-05 Through 1-23-2008

Component	Pump Run Failures	Run Time (hours)
SW Pump P-7A	0	18,658
SW Pump P-7B	0	17,640
SW Pump P-7C	0	19,490
Total	0	55,788

The uncertainty distribution for the SW pump failure to run in this more recent update was developed using generic parameter estimates from NUREG/CR-6928 [12] as a prior and Bayes' updated with the service data in Table 3-2. Since the generic distribution is a Gamma Distribution and a Poisson likelihood function was used, the posterior distribution is also a Gamma Distribution. The parameters of the prior and updated Gamma distributions for the SW pump failure rate are shown in Table 3-3.

Table 3-3 Parameters for Recent PRA SW Pump Failure Rate Update (Case 2)

Parameter	Prior Distribution from [12]	Posterior Distribution
Data Collection Period	-	1-1-05 through 1-23-08
Number of Failures	-	0
Pump-hours of Operation	-	55,788
Distribution Type	Gamma	Gamma
Alpha Parameter	1.66	1.66
Beta Parameter	3.65E+05	4.20E+05
Mean	4.54E-06/hr.	3.95E-06/hr.
RF (=95%tile/50%tile)	3.30	4.9

The author has reviewed these data analysis updates, has reproduced the results, and concurs that it meets the applicable requirements of the ASME/ANS PRA Standard for data analysis [13].

Each of the plant specific data updates described above covers a rather limited amount of operating experience. To examine a more complete record of the service experience with the SW pumps prior to the installation of the 416 SS pump shaft couplings, a special case was defined to reflect all the experience back to 1980 covering more than 28 years of experience, which again had zero failures in about 490,000 pump hours of operation. The parameters of this update are presented in Table 3-4. Because much of this time period pre-dates EPIX and the maintenance rule, the prior used here reverts back to PLG-0500 rather than NUREG/CR-6928 because this reference better represents industry generic data over this longer and earlier time period.

In Section 3.2 all three cases of failure rate estimates are used to evaluate the change in risk during the degraded state period.

Table 3-4 Parameters for More Complete SW Pump Failure Rate Update (Case 3)

Parameter	Prior Distribution from [19]	Posterior Distribution
Data Collection Period	-	1980 through 4-3-2009
Number of Failures	-	0
Pump-hours of Operation	-	495,360
Distribution Type	Lognormal	Non-Parametric fit to lognormal
Mean	3.42E-5	3.91E-6
RF = SQRT(95%tile/50%tile)	5.0	2.7
5%tile	4,24E-6	1.17E-6
50%tile	2.12E-5	3.43E-6
95%tile	1.06E-4	8.31E-6

3.1.2 SW Pump Failure Rate During Degraded State Period

The degraded state period is defined for the purposes of this analysis as the time frame when the SW pumps were operating with 416 SS couplings installed. The 416 SS couplings were installed on the first component on April 4, 2009 (P-7A) and were replaced on the last component in October 2011 (P-7C). During this period there were two pump failures to run, both on Pump P-7C, and 41,429 pump hours of operation (see Table 2-1). Obviously, during the degraded state period, the conditions were substantially different than was the case prior to or following this period. The failure rate distribution for the degraded state period was developed based on the following considerations.

- The evidence used to develop the current PRA failure rate distribution, including the generic prior evidence from NUREG/CR-6928 and the Palisades service data prior to the installation of the 416 SS couplings has questionable relevance to estimating the failure rate during the degraded state period and hence is not used.
- There is a large degree of uncertainty in establishing an appropriate prior distribution and therefore a non-informative prior distribution is selected. Keeping with the Gamma distribution family of distributions, the Jeffrey's non-informative prior distribution is used. This is characterized by an alpha parameter of 0.5 and a beta parameter of 0 [15]. This is updated using 2 failures in 41,429 pump-hours of operation to produce the parameters of the degraded state SW pump failure rate as shown in the following table.

A comparison of the Base Case 1, 2, and 3 and Degraded State failure rate parameters is provided in Table 3-6 and Figure 3-1. Case 3 is viewed by the author as the most realistic model of the SW pump performance prior to the degraded state period as it uses a more complete representation of the service experience. It can be seen from these comparisons that the failure rate during the degraded period is significantly higher than that used in the Base Case PRA model for each of the three analyzed cases. The mean failure rate increases by a factor of more than 5, 15, and 15 compared to the Base Cases 1, 2, and 3, respectively. In addition, the conservative approach taken to throw out the generic industry evidence and the prior Palisades experience in establishing the prior during the degraded state period is seen to have a large impact in the sense that the updated mean is actually greater than the point estimate of the service data during the degraded operation period. This is regarded by the author as a conservative evaluation of the increased SW pump failure rate during the degraded state period.

Table 3-5 Degraded State SW Pump Failure Rate Distribution

Parameter	Posterior Distribution
Distribution Type	Gamma
Prior Basis	Jeffrey's Non-informative Prior (α=0.5, β=0)
Alpha Parameter	2.5
Beta Parameter	41,429
Point Estimate	4.82E-5/hr
Mean	6.10E-5/hr
5%tile	1.40E-5/hr
50%tile	5.30E-5/hr
95%tile	1.35E-5/hr

Table 3-6 Comparison of Base Case and Degraded State Failure Rate Parameters

Parameter	Palisades PRA Base Case 1	Palisades PRA Base Case 2	Palisades PRA Base Case 3	Palisades Degraded State Case
Distribution Type	Non-Parametric fit to lognormal	Gamma	Non-Parametric fit to lognormal	Gamma
Mean	1.23E-5	3.95E-6	3.91E-6/hr	6.10E-5/hr
5%tile	2.62E-6	5.44E-7	1.17E-6/hr	1.40E-5/hr
50%tile	9.82E-6	3.19E-6	3.43E-6/hr	5.30E-5/hr
95%tile	3.03E-5	9.96E-6	8.31E-6/hr	1.35E-5/hr

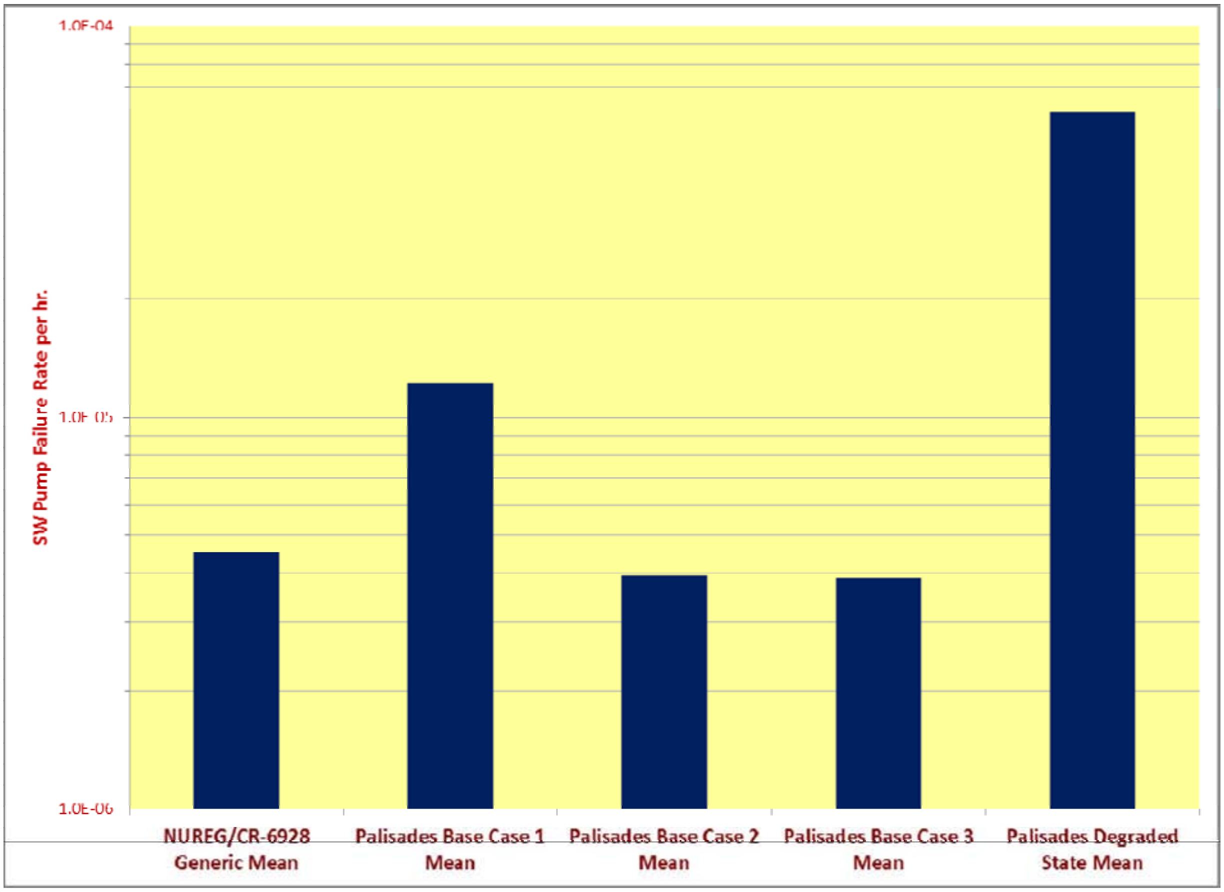

Figure 3-1 Comparison of SW Pump Failure Rate Estimates

3.2 *Loss of Service Water Initiating Event Frequency*

The current Palisades PRA model uses a data based approach to model the loss of service water initiating event frequency. This is a reasonable approach for the baseline PRA but it does not lend itself to evaluating the impact of the increased failure rate. Hence to support this evaluation, a model of the contributions to the loss of SW initiating event frequency due to SW pump failures is developed. The SW pump induced loss of SW model is developed based on the following considerations.

- A SW pump induced loss of service water can be caused by failure of the two normally running pumps and failure or unavailability of the standby pump.
- Failure of the two normally running pumps can occur as a result of a common cause failure of both pumps, or failure of one of the pumps followed by failure of the other running pump during the time frame when the first pump is down for repairs.
- The standby pump can fail to start, fail to continue running while both of the normally operating pumps are down for repairs, or be unavailable for maintenance.

These considerations yield the following simple model for SW pump induced loss of SW.

$$F(LOSWS) = 8766\lambda_{LOSWSIE} A \qquad (3.1)$$

$$\lambda_{LOSWIE} = \lambda_{CCFR}(\lambda_S + \lambda_{FR}\tau_{CCF} + Q_{MSP}) + 2\lambda_{IFR}(\lambda_{FR}\tau_{IF})(\lambda_S + \lambda_{FR}\tau_{IF} + Q_{MSP}) \quad (3.2)$$

Where:

$F(LOSWS) =$	Frequency per reactor-calendar-year of loss of service water
$\lambda_{LOSWSIE} =$	Frequency per operating hour of loss of service water
$A =$	Plant availability
$\lambda_{CCFR} = \beta_{FR}\lambda_{FR}$	Failure rate for common cause failures of the two normally running pumps
$\lambda_S =$	Failure rate for failure of the standby pump to start on demand
$\beta_{FR} =$	Common cause beta factor for failure to run of two normally operating pumps
$\lambda_{FR} =$	Failure rate for failure of the standby or operating pump to run
$\lambda_{IFR} = (1-\beta_{FR})\lambda_{FR}$	Failure rate for independent failure to run for each normally running pump
$\tau_{CCF} =$	Mean time to repair of at least one pump after a common cause failure to run
$\tau_{IF} =$	Mean time to repair of a normally operating pump after an independent failure to run
$Q_{MSP} =$	Maintenance unavailability of a Standby pump while plant in operation, not to be confused with the maintenance unavailability of a single SW pump; due to technical specifications and prudent operational practice; any maintenance on all three pumps that is performed with the plant at power is performed on each pump separately while in standby. Hence this is the total maintenance unavailability of all three pumps.

The change in CDF due to changes in the pipe induced loss of SW initiating event frequency can then be estimated using:

$$\Delta CDF_{\Delta LOSWIE} = (F(LOSW_{DS}) - F(LOSW_{Base}))CCDP_{LOSW} \quad (3.3)$$

Where:

$\Delta CDF_{\Delta LOSWIE} =$	Change in CDF due to Change in Pump Induced Loss of SW frequency
$F(LOSW_{DS}) =$	Loss of SW initiating event frequency evaluated with λ_{FR} evaluated using degraded state version of the SW pump failure rate
$F(LOSW_{Base}) =$	Loss of SW initiating event frequency evaluated with λ_{FR} evaluated using Base Case version of the SW pump failure rate
$CCDP_{LOSW} =$	Conditional core damage probability given loss of SW initiating event

The data parameters needed to quantify Equation (3.3) include the different versions of the failure rates defined earlier and other parameters from the Palisades PRA and these are summarized in Table 3-7. The author has reviewed these parameters and finds that they are appropriate for this analysis.

The models in Equations (3.1) through (3.3) were quantified using Microsoft Crystal Ball™ and Excel 2010 software using 100,000 Monte Carlo samples. The results are shown in Table 3-8, 3-9, and 3-10 and Figures 3-2, 3-3, and 3-4. In Table 3-8 the major contributors to loss of SW initiating event frequency are compared between the Base Case 3 and the degraded state period based on mean point estimates of the listed quantities. The results are seen to be dominated by common cause failure to run of the two normally operating pumps with the standby pump in maintenance. This stems in part from the conservative assumption that the fraction of operating pump common cause failures (beta factor) is assumed to be the same as that assessed in the base PRA model for SW failures in the mitigation of other initiating events. There are two reasons why this is conservative. One is that the increase in the failure rate during the degraded period is due to two independent failures so keeping the ratio of common cause failures to the total failure rate is conservative. The second is that the applied beta factor was developed for the SW system in the mitigation mode and there is substantial evidence to support the hypothesis that the fraction of common cause failures in normally operating systems is much smaller than that for systems that need to operate on demand.

Table 3-9 shows the contributors to the LOSW initiating event frequency with the SW system in different alignments. One alignment, which occurs a fraction of the time equal to Q_{MSP} is with two operating pumps and the third in maintenance, and the other alignment has the third pump available. It is seen from this table that the pump induced LOSW IE frequency increases by almost a factor of 30 as the system changes alignment changes from the standby pump being in service to out of service.

In Table 3-10 the results of the quantitative uncertainty analysis are presented for various cases and metrics. The change in LOSW initiating event frequency from the base case to the degraded state period is seen to be an increase of less than 30% and does not vary appreciably among Cases 1, 2, and 3. Using these results and the CCDP values from Table 3-5, it is seen that the increase in CDF due to changes in the SW pump failure rate in the LOSW initiating event frequency is less than 3% based on the mean change in LOSW IE frequency, and only as high as 9% when the 95%tile values for the change in LOSW IE frequency is assumed. The mean change in CDF is seen to be less than 10^{-6} per reactor-year. The Base Case 3 results provide the largest increase and the most accurate reflection of the SW pump performance prior to the degraded period. However, it is seen from Table 3-10 that the overall results are not particularly sensitive to which version of the Base Case results are used.

Table 3-7 Data Parameters Used to Evaluate LOSW IE Frequency

Parameter	Mean Value	Uncertainty Treatment	Reference
$A =$	.92	None, very little uncertainty	Provided by Palisades for degraded state period
$\lambda_S =$	1.19E-3	Lognormal Distribution with mean = 1.19E-3; RF = 4.0	PLG-0500 [19]
$\beta_{FR} =$	.0243	Beta Distribution with α = 16.5 and β = 661.5	Palisades CCF Analysis [11]
$\lambda_{FR-DS} =$	6.1E-05/hr	Gamma Distribution with α = 2.5 and β = 41,429	Table 3-5
$\lambda_{FR-Base} =$	1.23E-5/hr, Case 1	Lognormal Distribution with mean = 1.23E-5 and RF=3.4	Table 3-1
	3.95E-6/hr, Case 2	Gamma Distribution with α=1.66 and β = 4.2E+05	Table 3-3
	3.91E-6/hr, Case 3	Lognormal Distribution with mean = 3.91E-6 and RF=2.7	Table 3-4, this estimate best represents the SW

Parameter	Mean Value	Uncertainty Treatment	Reference
			pump performance prior to installation of 416SS couplings
$\tau_{CCF} =$	6hr	None	Technical specifications limit operation to 6 hours
$\tau_{IF} =$	72hr	None	Technical specifications limit operation to 72 hours
$Q_{MSP} =$ For Base PRA	P-7A = 4.516E-03 P-7B = 5.387E-03 P-7C = 5.533E-03 Total=1.55E-02	Lognormal Distribution with mean = 1.55E-2 RF=10.0	Palisades Maintenance Data [18]
$Q_{MSP} =$ For Degraded State Period	P-7A =117.2 hrs P-7B=107.1 hrs P-7C=256.6 hrs Total = 480.9hrs over 2.5 year degraded state period	Lognormal Distribution with mean =1.57E-02 RF=1.5	Provided by Palisades; very little uncertainty justifies small range factor
CCDP Given LOSW=	2.68E-3	Uncertainty not included; not affected by change	Provided by Palisades
LOSW per PRA=	1.22E-3/yr	Uncertainty not included; not affected by change	Provided by Palisades

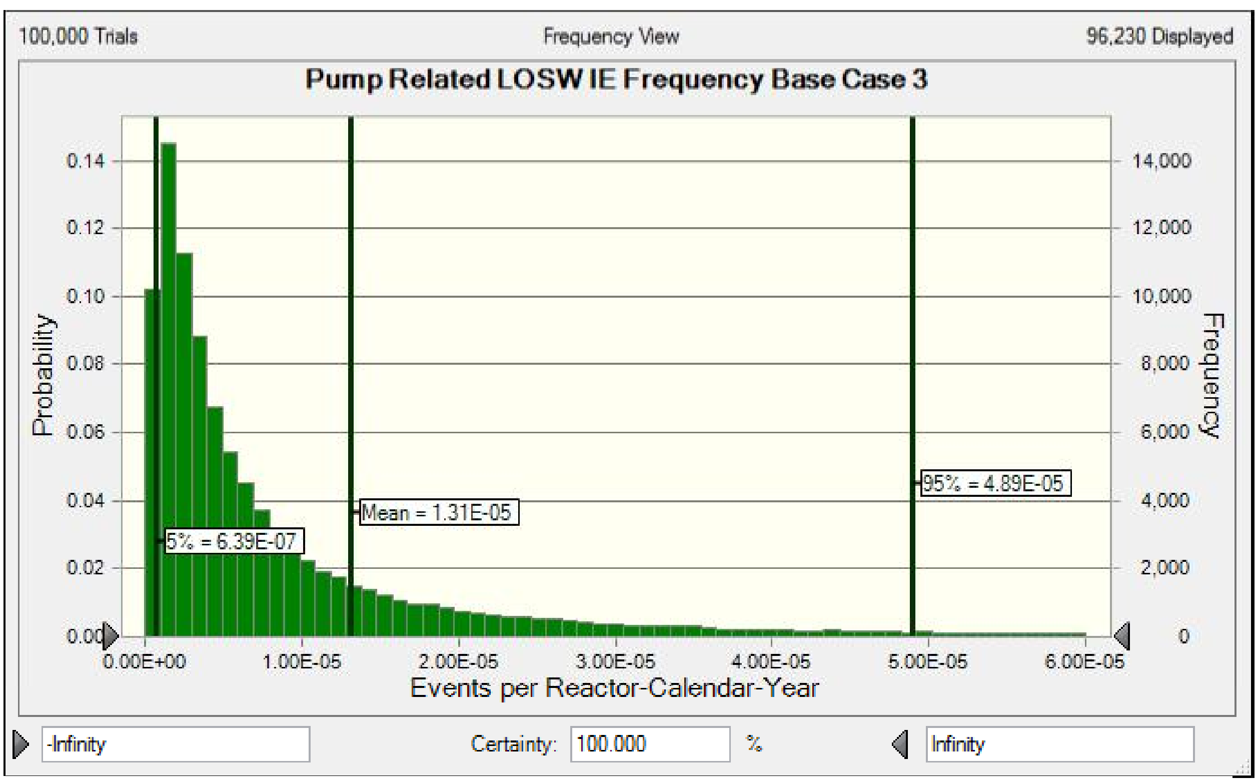

Figure 3-2 LOSW Initiating Event Frequency for Base Case 3

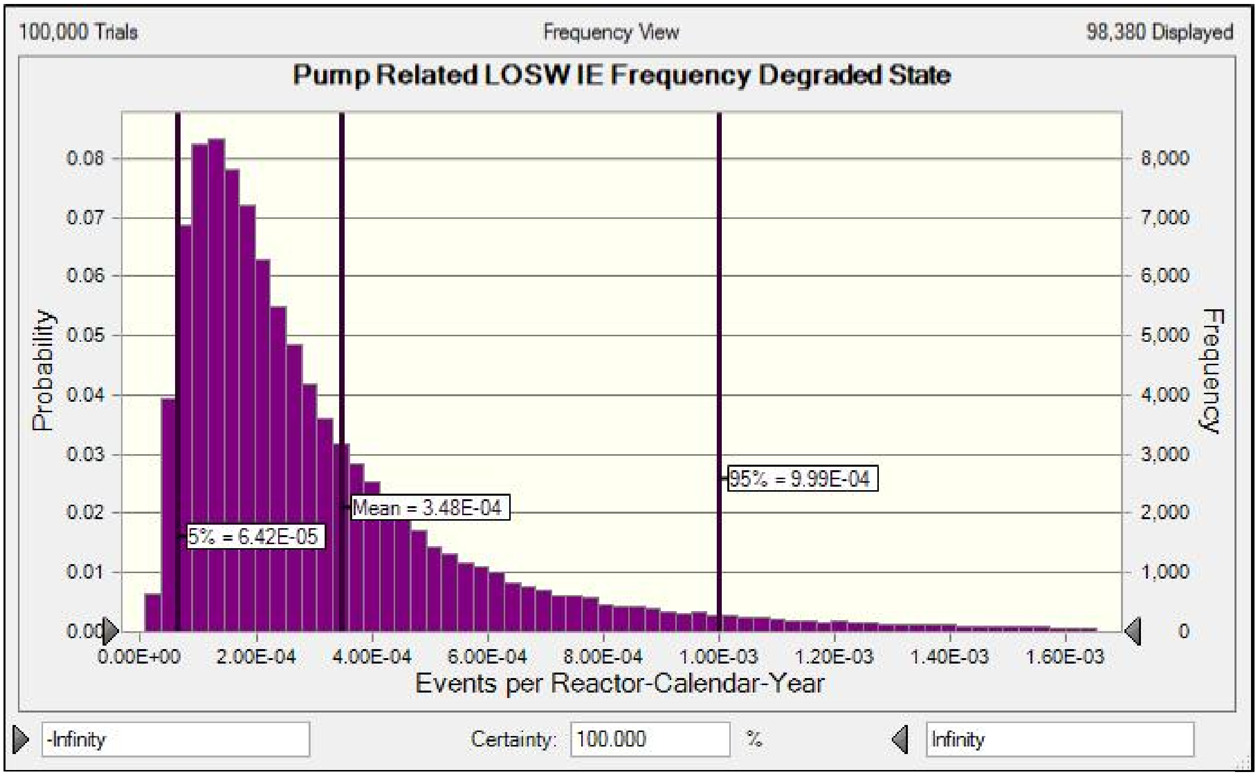

Figure 3-3 LOSE Initiating Event Frequency for Degraded State

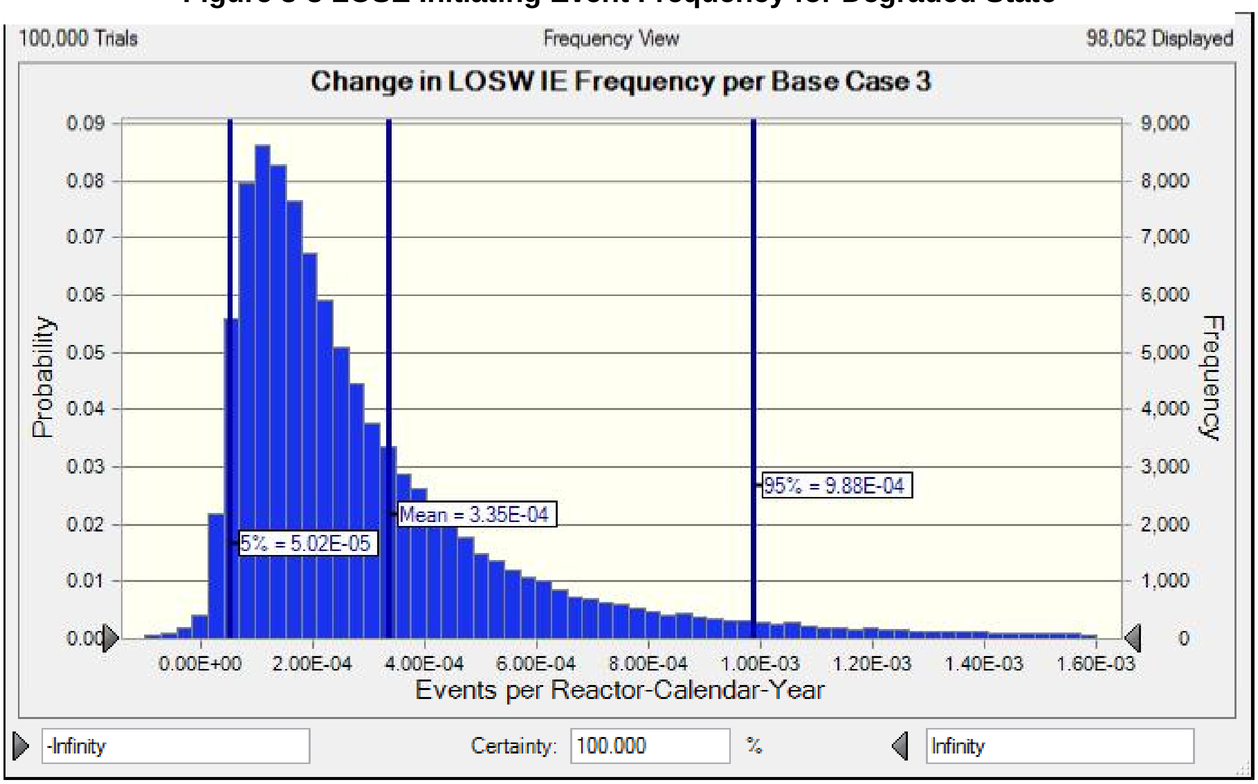

Figure 3-4 Uncertainty in Change in LOSW IE Frequency per Base Case 3

Table 3-8 Major Contributors to LOSW IE Frequency (Point Estimate)

Contributing Cut-sets	Events per Operating hour		Events per Reactor-Calendar Year	
	Case 3	Degraded	Case 3	Degraded
CCF-FR*QMSP	1.47E-09	3.12E-08	1.18E-05	2.51E-04
2xIFR*IFR*QMSP[1]	3.24E-11	1.06E-08	2.61E-07	8.57E-05
CCF-FR*SFS	1.13E-10	1.75E-09	9.12E-07	1.41E-05
CCF-FR*SFR	2.23E-12	5.32E-10	1.80E-08	4.29E-06
2xIFR*IFR*SFS[1]	2.49E-12	5.95E-10	2.01E-08	4.80E-06
2xIFR*IFR*SFR[1]	5.90E-13	2.17E-09	4.76E-09	1.75E-05
Total	1.62E-09	4.68E-08	1.31E-05	3.78E-04

CCF-FR = Common cause failure of both operating pumps
IFR = Independent failure to run of an operating pump
SFS= Standby pump failure to start
SFR=Standby pump failure to run until operating pump failure restored
QMSP= Fraction of time plant operates with Standby SW pump in maintenance
Note 1. Combination of two identical cut-sets

Table 3-9 Major Contributors to LOSW IE Frequency with SW System in Different Alignments (Point Estimate)

Contributing Cut-sets	Events per Operating hour		Events per Reactor-Calendar Year	
	Case 3	Degraded	Case 3	Degraded
Results in Alignment with Standby Pump in Maintenance which occurs QMSP fraction of the time				
CCF-FR	9.50E-08	1.47E-06	7.66E-04	1.18E-02
2xIFR*IFR[1]	2.10E-09	5.00E-07	1.69E-05	4.03E-03
Total	9.71E-08	1.97E-06	7.83E-04	1.59E-02
Results in Alignment with Standby Pump Available which occurs (1-QMSP) fraction of the time				
CCF-FR*SFS	1.13E-10	1.75E-09	9.12E-07	1.41E-05
CCF-FR*SFR	2.23E-12	5.32E-10	1.80E-08	4.29E-06
2xIFR*IFR*SFS[1]	2.49E-12	5.95E-10	2.01E-08	4.80E-06
2xIFR*IFR*SFR[1]	5.90E-13	2.17E-09	4.76E-09	1.75E-05
Total	1.18E-10	5.05E-09	9.55E-07	4.07E-05

CCF-FR = Common cause failure of both operating pumps
IFR = Independent failure to run of an operating pump
SFS= Standby pump failure to start
SFR=Standby pump failure to run until operating pump failure restored
Note 1. Combination of two identical cut-sets

3.3 *Impact of Increased SW Pump Failure Rate on PRA Mitigation Functions*

The other source of potential risk impacts from increased SW pump failure rates is in the mitigation functions for initiating events other than loss of SW. This is best evaluated by revising the PRA model with the revised failure rate and then comparing the results. However an estimate of the risk impact from such changes can be estimated using the Fussell-Vesely importance metric for basic events involving SW pump failure to run. Palisades has provided this value which is 9.09E-6. Since the F-V importance is approximately equal to the fraction of the CDF with basic events involving SW pump failure, the change in CDF can be estimated using the following equations:

$$\Delta CDF_{SWP} = (CDF_{New} - CDF_{old}) = FV_{SWP} CDF_{BASE}\left(\frac{\lambda_{FR-DS}}{\lambda_{FR-Base}}\right) - FV_{SWP} CDF_{Base}$$
$$= FV_{SWP} CDF_{Base}\left(\frac{\lambda_{FR-DS}}{\lambda_{FR-Base}} - 1\right) \quad (3.4)$$

Table 3-10 Evaluation of LOSW Initiating Event Models and CDF Impacts

Parameter[4]	Point Estimate[1]	Mean[2]	5%tile	50%tile	95%tile	RF[3]
Pump Related LOSW IE Freq. Case 1	4.32E-05	4.56E-05	1.67E-06	1.44E-05	1.70E-04	10.1
Pump Related LOSW IE Freq. Case 2	1.32E-05	1.37E-05	5.66E-07	4.56E-06	5.03E-05	9.4
Pump Related LOSW IE Freq. Case 3	1.31E-05	1.31E-05	6.39E-07	4.66E-06	4.89E-05	8.8
Pump Related LOSW IE Freq. - Degraded	3.78E-04	3.48E-04	6.42E-05	2.27E-04	9.99E-04	3.9
Change in LOSW IE Freq. Case 1	3.35E-04	3.02E-04	4.18E-06	1.94E-04	9.63E-04	15.2
Change in LOSW IE Freq. Case 2	3.65E-04	3.34E-04	4.99E-05	2.15E-04	9.87E-04	4.4
Change in LOSW IE Freq. Case 3	3.65E-04	3.35E-04	5.02E-05	2.15E-04	9.88E-04	4.4
Change in LOSW IE Freq. Case 1 %	27.4%	24.8%	0.3%	15.9%	78.9%	15.2
Change in LOSW IE Freq. Case 2 %	29.9%	27.4%	4.1%	17.6%	80.9%	4.4
Change in LOSW IE Freq. Case 3 %	29.9%	27.4%	4.1%	17.7%	81.0%	4.4
Change in CDF Case 1	8.97E-07	8.11E-07	1.12E-08	5.21E-07	2.58E-06	15.2
Change in CDF Case 2	9.78E-07	8.96E-07	1.34E-07	5.76E-07	2.65E-06	4.4
Change in CDF Case 3	9.78E-07	8.98E-07	1.35E-07	5.78E-07	2.65E-06	4.4
Change in CDF Case 1 (%)	3.2%	2.9%	0.0%	1.8%	9.1%	15.2
Change in CDF Case 2 (%)	3.5%	3.2%	0.5%	2.0%	9.3%	4.4
Change in CDF Case 3 (%)	3.5%	3.2%	0.5%	2.0%	9.4%	4.4

Notes:
[1] Point estimate based on mean values of input parameters
[2] Mean and Percentiles calculated via Monte Carlo on Crystall Ball with 100,000 trials
[3] RF = SQRT(95%tile/5%tile)
[4] Change in CDF results do not include the uncertainty in the CCDP given loss of service water; All frequencies in units of events per reactor-calendar-year

Using the data above for the Fussell-Vesely value, the data developed previously for the failure rates, and a baseline CDF value provided by Palisades of $2.83\text{x}10^{-5}$, the change in CDF due to changes in the PRA mitigation model from increased SW failure rates is estimated to be an increase of $3.7x10^{-9}$ per reactor calendar year using the Case 3 failure rate model, which is about 0.1% of the current baseline CDF. Hence there is no significant risk increase from the mitigation side of the model.

3.4 *Guidance for More Accurate Estimate of Risk Impacts*

It is recommended that Palisades re-run their current baseline PRA model with the following instructions.

- Modify the current LOSW initiating event frequency by adding a variable for the increase in the LOSW IE frequency using the data for Case 3 in Table 3-8 (7th row of data). When reporting a single value, the mean of the distribution should be used as all relevant CDF acceptance criteria refer to mean values.
- Change the failure rate distribution for “SW pump failure to run” to reflect the degraded conditions by using the Gamma Distribution parameters in Table 3-5.
- Keep all remaining data parameters the same as in the base case.
- Calculate the increase in CDF due to these changes; they should be comparable to those estimated in the previous sections.

4. Review of NRC Preliminary Significance Determination

At the request of Palisades, a limited review was performed of the NRC Preliminary Significance Determination of the SW pump coupling which included an estimate of the impact of the degraded pump performance on the core damage frequency as documented in Reference [20] It is noted that these comments are based solely on the information presented in that reference as the details of the supporting calculations were not available to support the review. This review resulted in the following comments and a limited comparison that is provided in Table 4-1.

1. The loss of SW initiating event frequency calculation described in Reference [20] is suspect. The NRC analysts are using a ratio of calculated unavailability from a fault tree of the SW system developed for the mitigation function of the system in response to initiating events other than LOSW, and then multiplying the ratio of unavailabilities calculated using different failure rates times the existing IE frequency. In the opinion of this author, this method is incorrect and is not capable of estimating the loss of SW initiating event frequency. The method does not appear to be capable of meeting ASME/ANS PRA Standard Supporting Requirements IE C-9 and IEC-10. It is well known among PRA practitioners that fault tree models that are developed for establishing the unavailability of a system in response to an initiating event cannot be manipulated this way to produce a correct estimate of the initiating event frequency. Both the structure of the tree and the computational algorithm must be modified to provide an appropriate model. This in fact the motivation behind SRs IEC-9 and IE C-10. In addition the success criteria and mission time assumptions are fundamentally different.
2. The SW system has a different configuration during normal operation than is the case following most initiating events. In the mode of normal operation there are two normally operating pumps and one pump in standby which may or may not be in maintenance at the time of the initiating event. Which pumps are in which mode are rotated periodically. After most initiating events, the configuration is changed due to various signals yielding a symmetrical configuration. The common cause models, success criteria, and mission times all need to be modified when converting from one configuration to another.
3. The NRC model evaluates the CDF over a one year period, whereas this analysis covers the entire period when the wrong SS material was in which is about 2.5 years. The configurations looked at in the NRC analysis only covered one of the pump failures whereas this analysis covered both pump failures and other periods of pump maintenance unavailability.
4. The NRC analysis is only point estimate whereas this analysis includes a quantification of uncertainty. This is important for the run-run cutsets due to the state of knowledge correlation.
5. It appears that the NRC analysis did not adequately isolate the contributions to LOSW IE frequency from pump related and non-pump related failure causes whereas the current analysis did. This is critical to the question of how much of an impact changes in pump performance impact the LOSW IE frequency.
6. It is not clear that the NRC analysis is calculating the change in the average CDF due to pump issues. This is evidenced by the fact that they add up two different CDF cases for two different pump alignments but do not discuss how or whether the fraction of time in each alignment is taken into account. Adding up two configuration specific CDF estimates that are not weighted by the fraction of time in that configuration is not appropriate. If one is to estimate the change in CDF both CDF estimates should be on

the same basis. This concern may be due to insufficient details provided to explain how the numbers were calculated.

7. While they state that they assessed some kind of common cause potential to the two SW pump failures, there is insufficient information to understand how they modeled that potential. A reasonable way to do this would be to assess an impact vector for each SW pump failure event in the same format as is done when CCF events are coded into INL CCF database. If they just assumed that the two failure events were common cause failures of all three pumps that would be inconsistent with the engineering evaluations that were performed by Palisades. Each event obviously involved failure of a single pump. Such an impact would express the probability that if similar failures occurred in the future that the other SW pumps would also be failed at the same time or same time frame. The probability that reoccurrence of a pump failure would have resulted in failures of 1 or both additional pumps must be extremely low. In summary the method and weight given to the common cause potential is not available to review. In the current analysis in this report, common cause failures dominate the estimated change in CDF and the assumptions behind this are clearly documented.
8. The approach taken to evaluate the revised SW pump failure rate is very similar to that described in this report which was developed prior to the receipt of the NRC letter in Reference [20]. Not clear what the reason is for the small discrepancy in the assumed pump exposure.

Of the comments listed above, Item 1 is most important and needs to be resolved before meaningful numerical comparisons can be made.

Table 4-1 Comparison of Service Water Pump Evaluations

Parameter	Palisades per This Report	NRC per Reference [20]
SW pump failure rate base case per hour	3.91E-06	Not provided
SW pump failure rate in degraded period per hour	6.04E-05	6.15E-05
Prior used for degraded state failure rate estimate	Jeffreys non-informative	Jeffreys non-informative
Evidence used for Bayes' update	2 failures in 41,429 hrs.	2 failures in 40,505 hrs
Period over which change in CDF is evaluated	2.5 years	≈ 1 year
Base CDF per RCY	2.83E-05	Not provided
Base CDF due to LOSW IE per RCY	3.27E-06	Not provided
Base CDF due other IE per RCY	2.50E-05	Not provided
CCDP given LOSW IE Base	2.68E-03	Not provided
CCDP given LOSW IE in degraded period	2.68E-03	Not provided
Base LOSW IE Frequency (average) per RCY	1.22E-03	2.50E-04
Base LOSW IE Frequency due pumps per RCY	1.31E-05	Not provided
Base LOSW IE Frequency due non pump related causes per RCY	1.21E-03	Not provided
Base LOSW IE Frequency with 3rd pump OOS per RCY	1.99E-03	Not provided
Base LOSW IE Frequency with 3rd pump in service per RCY	1.21E-03	Not provided
Degraded LOSW IE Frequency per RCY	1.58E-03	Not provided but can be estimated at 3.68E-03
Increase in LOSW IE Frequency in degraded period per RCY	3.65E-04	Not provided but can be estimated at 3.43E-03
Degraded LOSW IE Frequency with 3rd pump OOS per RCY	1.71E-02	4.00E-01
Degraded LOSW IE Frequency with 3rd pump in service per RCY	1.25E-03	8.06E-04
Common Cause Treatment	Beta factor for two running pumps assumed to be the same as for the base case unavailability model	Some potential is assessed but how this is quantified is unknown
Change in CDF due to degraded SW couplings	8.98E-07	4.70E-06

5. CONCLUSIONS

Based on the evaluation performed in this study, the following conclusions are reached.

- The two SW pump failures are clearly random independent failures of the same pump and are not in any way shape or form to be regarded as common cause failures. The nature of the cause, the capability of the pumps that did not fail to continue to operate for a minimum of 40 days after the second failure and the separation in time of the two failures by more than 22 30-day mission times are more than sufficient evidences to support this conclusion.
- The appropriate risk characterization of the SW pump failures evaluated in this study is an increase in the SW pump failure rate for failure to continue running during the time frame when SW shaft couplings were using 416 SS material that was susceptible to inter-granular stress corrosion cracking (Degraded State Period). It is estimated in this study that the SW pump mean failure rate for failure to run increased by a factor of about 15 compared to the failure rates used in the current PRA model of record (Case 2) and that based on the more complete set of plant specific data (Case 3).
- Even though the SW pump failures of interest were clearly independent failures, the fraction of the elevated failure rate due to common cause (i.e. the beta factor for pump failure to run) was assumed to be the same as in the base case model. Furthermore, that beta factor is viewed to be highly conservative for normally operating pumps. There is scant historical evidence of common cause failures of normally operating components. It should be noted that due to the conservative treatment of common cause failures in this evaluation, the change in CDF calculated in this study is actually dominated by cut-sets involving common cause failure of the two normally operating pumps. A more realistic assessment that took credit for the fact that the two pump failures are clearly classified as independent failures would result in a much smaller increase in CDF than what has been estimated in this study.
- There are two areas in the risk model where an increased SW pump failure rate may contribute to increases in CDF and LERF. One area is a potential increase in the loss of service water initiating event due to SW pump failures and the other is an increase in basic event probabilities associated with SW pump failure to operate during each mission modeled as part of a service water mitigating function. It is estimated in this study that the LOSW initiating event frequency increased by about 30% during the degraded state period.
- The total risk impact of the increased SW pump failure rate during the applicable degraded state period is conservatively estimated in this study to be an increase of about 3% mostly arising from an increase to the LOSW initiating event frequency. Even if the 95%tile value is used, the increase is only as high as about 9%. The changes in CDF due to changes in the mitigation part of the model are much smaller than those from the initiating event model due to the extremely small Fussell-Vesely value for the SW pump failure to run in the mitigating side of the model. The small increase in CDF during the degraded state period of the SW pumps is consistent with a GREEN finding in the Significance Determination Process.
- A set of instructions has been developed to perform a confirmatory estimate of the risk impact by adding a term to the LOSW initiating event frequency model and by changing the SW failure rate distribution for failure to run.

- Based on a limited review, the methodology used in the NRC evaluation does not appear to be capable of providing an accurate estimate of the change in CDF due to the SW pump issues addressed in this report.

6. REFERENCES

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[20] Letter from Steven West U.S. Nuclear Regulatory Commission to Anthony Vitale. Entergy Nuclear Operations, Inc, " Palisades Nuclear Plant, NRC Inspection Report 05000255/2011016; Preliminary White Finding", November 29, 2011

Attachment 2: Service Water Pump Run Time PI Data Analysis

Run Hours Calculation Macro

```
Sub valve_pos_0()
'Modified to extract service water pump run time only
'routine to extract pump change states and run time from PI
'  10/19/2011 by smongea
'when setting up the sheet use a tag with a large number of values in column B
'when entering a new PI into the inital array PI cannot make the array larger
'only smaller.  After running the macro make sure the last rows data is not cut off.

'
Dim Count As Integer
Dim reposition As Integer
Dim changetag As String
Dim compstates As String
Dim currentstate As String
Dim checkvalue As String
Dim checkminusone As String
Dim runchange As String
Dim Time1 As Date
Dim Time2 As Date
Dim TimeDiff As String
Dim TimeTot As Variant

Application.ScreenUpdating = False

Count = 1

'start Get pump Tag from 'pump tags' sheet loop
'loop count is the number of tags
Do Until Count = 2  'set count to 37 to run all pumps
    Sheets("Pump Tags").Select
    Range("A1").Select
    ActiveCell.Offset(Count, 0).Range("A1").Select
    Selection.Copy
    Sheets("PI Archive Data").Select
    Range("B2").Select
    ActiveSheet.Paste

    'Find pump change state to look for
    compstates = Range("B7")
    currentstate = Range("B8")


    changetag = "Stopped"
    runchange = "Started"

    Range("B9").Value = changetag
    Range("C12").Select
    checkvalue = Range("C12")
```

```
reposition = 0
TimeTot = 0

 If ActiveCell.Value = runchange Then
    ActiveCell.Offset(0, -1).Activate
    Time1 = ActiveCell.Value
    ActiveCell.Offset(0, 1).Activate
    ActiveCell.Offset(1, 0).Activate
 End If



'check down data column until a change state is found
'eval previous cell to ensure a change state has occurred
'color change states yellow and increase reposition count
'record change state time (start or stop)
Do Until checkvalue = " " Or checkvalue = Null Or checkvalue = ""
    checkvalue = ActiveCell.Value
    checkminusone = ActiveCell.Offset(-1, 0).Value
    If ActiveCell.Value = runchange And checkminusone = changetag _
        And checkminusone <> "Shutdown" _
        And checkminusone <> "Invalid Data" _
        And checkminusone <> "Pt Created" _
        And checkminusone <> "I/O Timeout" Then
        reposition = reposition + 1
        ActiveCell.Select
        With Selection.Interior
        .ColorIndex = 6
        .Pattern = xlSolid
        End With
        ActiveCell.Offset(0, -1).Activate
        Time1 = ActiveCell.Value
        ActiveCell.Offset(0, 1).Activate
        ActiveCell.Offset(1, 0).Activate
    Else:
        ActiveCell.Offset(1, 0).Activate
    End If
'Continue down data column until oppostie change state is found
'eval previous cell to ensure a change state has occurred
'color change states and record start stop time
'add start stop time difference to total run time
    checkminusone = ActiveCell.Offset(-1, 0).Value
    If ActiveCell.Value = changetag And checkminusone = runchange _
        And checkminusone <> "Shutdown" _
        And checkminusone <> "Invalid Data" _
        And checkminusone <> "Pt Created" _
        And checkminusone <> "I/O Timeout" Then
        ActiveCell.Offset(0, -1).Activate
        Time2 = ActiveCell.Value
        ActiveCell.Offset(0, 1).Activate
        ActiveCell.Select
        TimeDiff = (Time2 - Time1) * 24
        TimeTot = TimeTot + TimeDiff
```

```
            ' Filter short run times less than 1 minute
            If TimeDiff > 0 And TimeDiff < 0.0167 Then
            reposition = reposition - 1
            TimeTot = TimeTot - TimeDiff
               With Selection.Interior
               .ColorIndex = 10
               .Pattern = xlSolid
               End With
            Else:
               With Selection.Interior
               .ColorIndex = 8
               .Pattern = xlSolid
               End With
            End If
          End If
      Loop

      'paste total stop-start count and run time at top of column
      Range("B1").Value = reposition
      Range("B10").Value = TimeTot
      'copy and paste PI data as "values" into next available column
      Columns("B:C").Select
      Selection.Copy
      Range("B12").Select
      Selection.End(xlToRight).Select
      ActiveCell.Offset(-11, 1).Range("A1").Select
      Selection.PasteSpecial Paste:=xlPasteValues, Operation:=xlNone, SkipBlanks _
         :=False, Transpose:=False
      Selection.PasteSpecial Paste:=xlPasteFormats, Operation:=xlNone, _
         SkipBlanks:=False, Transpose:=False
      Columns("C:C").Select
      Selection.Interior.ColorIndex = xlNone
      Count = Count + 1
Loop


End Sub
```

Input and Output of Run-Hours Calculation Spreadsheet

Number of Pump StartsThrough 10-18-2011	**108**		137		77		108	
Minus Starts After 17-4PH SS Coupling Replacemnt			**132**		**69**		**108**	
Tag Name	YSP7C_D		YSP7A_D		YSP7B_D		YSP7C_D	
Tag Description	Service Water Pump P-7C		Service Water Pump P-7A		Service Water Pump P-7B		Service Water Pump P-7C	
Start Date	06/12/09		04/04/09		05/12/10		06/12/09	
Number of Data Points to Retrieve	59000		59000		59000		59000	
Date Tag Made Active	4/23/2001		4/23/2001		4/23/2001		4/23/2001	
Digitalset	STOPPEDSTARTED		STOPPEDSTARTED		STOPPEDSTARTED		STOPPEDSTARTED	
Current Status	Started		Started		Started		Stopped	
Change Position	Stopped		Stopped		Stopped		Stopped	
Total Run Hours Through 10-18-2011	17520.80		16184.44		10000.11		17520.80	
Minus Hours After 17-4PH SS Coupling Replacemnt			**14998.64**		**8909.4**		**17520.8**	
	12-Jun-09 05:05:00	Stopped	04-Apr-09 00:59:13	Stopped	12-May-10 05:26:18	Stopped	12-Jun-09 05:05:00	Stopped
	12-Jun-09 12:22:52	Started	04-Apr-09 08:49:16	Stopped	12-May-10 13:16:22	Stopped	12-Jun-09 12:22:52	Started
	12-Jun-09 12:23:06	Stopped	04-Apr-09 16:49:16	Stopped	12-May-10 17:43:22	Started	12-Jun-09 12:23:06	Stopped
	12-Jun-09 15:03:17	Started	05-Apr-09 00:49:16	Stopped	12-May-10 17:43:27	Stopped	12-Jun-09 15:03:17	Started
	12-Jun-09 15:33:59	Stopped	05-Apr-09 08:39:19	Stopped	12-May-10 17:49:43	Started	12-Jun-09 15:33:59	Stopped
	12-Jun-09 15:34:18	Started	05-Apr-09 14:07:00	Started	12-May-10 17:56:15	Stopped	12-Jun-09 15:34:18	Started
	12-Jun-09 23:24:21	Started	05-Apr-09 14:07:11	Stopped	12-May-10 22:58:16	Started	12-Jun-09 23:24:21	Started
	13-Jun-09 07:24:21	Started	05-Apr-09 18:56:46	Started	12-May-10 22:58:18	Stopped	13-Jun-09 07:24:21	Started
	13-Jun-09 15:14:25	Started	05-Apr-09 19:03:37	Stopped	13-May-10 05:47:25	Started	13-Jun-09 15:14:25	Started
	13-Jun-09 23:04:33	Started	05-Apr-09 19:04:26	Started	13-May-10 06:44:14	Stopped	13-Jun-09 23:04:33	Started
	14-Jun-09 06:54:37	Started	05-Apr-09 22:00:05	Stopped	13-May-10 07:32:52	Started	14-Jun-09 06:54:37	Started

Formula View of Input and Output of Run-Hours Calculation Spreadsheet

Number of Pump StartsThrough 10-18-2011	**108**	
Minus Starts After 17-4PH SS Coupling Replacemnt		
Tag Name	YSP7C_D	
Tag Description	=PITagAtt(B3,"descriptor","plpapetsp008")	
Start Date	39976	
Number of Data Points to Retrieve	59000	
Date Tag Made Active	=PITagAtt(B3,"creationdate","plpapetsp008")	
Digitalset	=PITagAtt(B3,"digitalset","plpapetsp008")	
Current Status	=PICurrVal(B3, 0,"plpapetsp008")	
Change Position	Stopped	
Total Run Hours Through 10-18-2011	17520.8041666671	
Minus Hours After 17-4PH SS Coupling Replacemnt		
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")
	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")	=PINCompDat(B3,B5,B6, 1,"plpapetsp008","inside")

137	77		108	
=D1-5	**=F1-8**		**=H1**	
YSP7A_D	YSP7B_D		YSP7C_D	
Service Water Pump P-7A	Service Water Pump P-7B		Service Water Pump P-7C	
39907	40310		39976	
59000	59000		59000	
37004.4993865741	37004.4993865741		37004.4993865741	
STOPPEDSTARTED	STOPPEDSTARTED		STOPPEDSTARTED	
Started	Started		Stopped	
Stopped	Stopped		Stopped	
16184.4397222236	10000.1094444441		17520.8041666671	
=D11+((D7091-D7092)*24+(D7093-D7136)*24+(D7152-D7153)*24+(D7154-D7179)*24+(D7180-D7271)*24)	**=F11+((F3493-F3494)*24+(F3495-F3514)*24+(F3518-F3519)*24+(F3520-F3536)*24+(F3537-F3628)*24+(F3629-F3630)*24+(F3631-F3632)*24+(F3633-F3657)*24)**		**=H11**	
39907.0411226851	40310.2265972222	Stopped	39976.2118055556	Stopped
39907.3675462963	40310.5530324074	Stopped	39976.5158796296	Started
39907.7008796296	40310.7384490741	Started	39976.5160416667	Stopped
39908.034212963	40310.7385069444	Stopped	39976.6272800926	Started
39908.3606365741	40310.7428587963	Started	39976.648599537	Stopped
39908.5881944444	40310.7473958333	Stopped	39976.6488194444	Started
39908.5883217593	40310.9571296296	Started	39976.9752430556	Started
39908.7894212963	40310.9571527778	Stopped	39977.3085763889	Started
39908.7941782407	40311.2412615741	Started	39977.6350115741	Started
39908.7947453704	40311.2807175926	Stopped	39977.9614930556	Started
39908.916724537	40311.3144907407	Started	39978.2879282407	Started
39908.9169212963	40311.6409143519	Started	39978.6143402778	Started
39908.9629050926	40311.9673842593	Started	39978.9407523148	Started

Attachment 6: PRA Model Updates Since the Individual Plant Evaluation (IPE)

Palisades Model (date)	Truncation	CDF/yr	Reference	Hi Level Change Summary
IPE (1993)	1.0E-9	5.07E-05	Palisades IPE (R-0481)[c]	
PSAR1 (1999)	1.0E-9	5.95E-05[a]	EA-PSA-SAPH-99-18 (R-0843)	Switchyard modifications to reduce potential for plant centered loss of offsite power Moved the internal events CDF model from SETS to SAPHIRE.
PSAR1a (2000)	1.0E-9	5.47E-05[a]	EA-PSA-SAPH-00-0011 (R-0479)	The AFW alternate steam supply line to AFW pump P-8B was removed from the model as a result of a plant modification. Updated selected Main Steam Line Break initiating event data as well as the SGTR initiating event value. Selected human error probabilities (HEPs) were updated.

Attachment 6: PRA Model Updates Since the Individual Plant Evaluation (IPE)

Palisades Model (date)	Truncation	CDF/yr	Reference	Hi Level Change Summary
PSAR1b (2000)	1.0E-9	6.18E-05[a]	EA-PSA-PSAR1B-00-22 (R-0472)	Selected common cause failure logic for control and solenoid valves was updated. A plant modification that swapped High Pressure Air power supplies from MCC-7 to MCC-8 was incorporated. Open circuit bus faults were added to the DC system logic. The summertime EDG HVAC success criteria was set to True for all nominal baseline calculations. The independent ATWS event trees were eliminated. Transfers from all event trees to a single ATWS event tree was created, taking advantage of SAPHIRE's event tree linking options. DC power demand logic was added.
PSAR1b-Modified (2001)	1.0E-9	6.16E-05[a]	EA-PSA-PSAR1B-01-12 (R-0835)	Corrected a conservative Shutdown Cooling Heat Exchanger modeling assumption. Revision of ISLOCA model including realistic low pressure piping capacity.
PSAR1b-Modified w/HELB (2002)	1.0E-9	6.24E-05[b]	EA-PSA-CCW-HELB-02-17 (R-1452)	The model was updated to account for main steam line breaks into the CCW room(s). Steam/feedwater line breaks in the CCW rooms with door 167 or door 167B to CCW room 123 open were included. A new initiating event (IE-MSLB-D-CCW) was created to represent the steam lines downstream of the MSIVs but in the CCW room as separate from remaining lines in the turbine building.

Attachment 6: PRA Model Updates Since the Individual Plant Evaluation (IPE)

Palisades Model (date)	Truncation	CDF/yr	Reference	Hi Level Change Summary
PSAR1c (SAMA; 2004)	1.0E-9	4.05E-05[b]	EA-PSA-PSAR1C-01-003 (R-0703)	Diesel generator repair/recovery logic corrected. PCP seal LOCA model added. The Recirculation Actuation System plant modification was incorporated. HEP dependency modeling was explicitly included. Removed modeling conservatism in the critical SW header valve logic. FPS makeup to P-8C was updated to include tank T-2 failure. Traveling screen logic under FPS was updated. The auto MSIV close logic 'CHP' and 'low SG pressure' were correlated to the correct initiating event categories. Spurious bypass valve opening was added to both single and double steam generator blow down models. The gland seal condenser or air ejector after condenser rupture logic was updated. EQ logic was added to CCW pumps P-52A, P-52B and P-52C. DC bus D11-2 logic was corrected. Diversion path failure modes were added to selected air/N2 sources. Inadvertent PCS safety relief valve opening was added to the model. Failure of the AFW flow control valves to close was added to the system logic. The plant instrument air compressor modification was added to the model. The common cause data were updated.

Attachment 6: PRA Model Updates Since the Individual Plant Evaluation (IPE)

Palisades Model (date)	Truncation	CDF/yr	Reference	Hi Level Change Summary
PSAR2 (2004)	1.0E-9	4.65E-05[a]	EA-PSA-PSAR2-04-02 (R-1710)	Updated turbine driven AFW pump failure data. Addressed CST flow diversion. Updated Initiating Event data. Updated spurious actuation of MSIV model. Updated of RPS and MTC data. Re-assess the HEP stress evaluation in context of the accident sequences being recovered. Reassessed the Load Shed logic.
PSAR2a (2006)	1.0E-9	4.49E-05[a]	EA-PSA-PSAR2a-05-18 (R-1822)	Added SW containment isolation valves to the SW fault tree to support MSPI. Added additional logic for leg injection (HLI) to support MSPI. Added logic for various equipment recoveries during loss of offsite power events to remove over-conservatism. Modified EDG load/run failures to support MSPI. Added instrument air dryer bypass to remove conservatism in EOOS model. Improved fidelity for AFW model logic. Improved fidelity for diesel start model logic. Added control circuit contact pairs to support MSPI. Added human error modeling to support logic additions above. Added new failure rate and probability models to support the logic additions above.

Attachment 6: PRA Model Updates Since the Individual Plant Evaluation (IPE)

Palisades Model (date)	Truncation	CDF/yr	Reference	Hi Level Change Summary
PSAR2b (2006)	1.0E-9	4.36E-05[a]	EA-PSA-PSAR2b-06-07 (R-1823)	Added control room and C33 panel hand switches to support MSPI. Added CV-3001 and CV-3002 inline circuit scheme fuses for model improvement. Added new failure rate and probability models to support the logic additions above.
PSAR2c (2006)	1.0E-9	2.49E-05[a]	EA-PSA-PSAR2c-06-10 (R-1706)	Added logic for the non-safety related diesel logic. Addition of time phased offsite power recovery during SBO. Separated the load/run and run logic in the LOOP event tree to better characterize failures. Added operator action for diesel fuel oil recovery to address the proceduralized recovery of fuel oil to T-25A and B. Added bypass regulator model to address AFW low suction pressure trip failure given station battery discharge at 4 hours. Added plant modification automating switchover to RAS. Added credit for containment backpressure for providing HPSI NPSH to reduce conservatism. Added human error modeling to support logic additions above. Added new failure rate and probability models to support the logic additions above. Addition of sump strainer blockage.

Attachment 6: PRA Model Updates Since the Individual Plant Evaluation (IPE)

Palisades Model (date)	Truncation	CDF/yr	Reference	Hi Level Change Summary

a. subsumed cutset solution
b. non-subsumed cutset solution
c. "R-" is an internal reference label

Table of Contents

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
EC-01L	A38	AKVMA0522G	A-KVMA-SV-0522G	
	AHSMB0522B	AHSMB0522B	A-HSMB-HS-0522B	
	DFUMKW001A	DFUMKW001A	D-FUMK-W001-1	
	DFUMKW006D	DFUMKW006D	D-FUMK-W006-1	
	G113B	GCNMA386A8	-	This relay must energize to cause ADVs to open (the TBV solenoids must spuriously energize to open valve)
	G322B	GCNMA386A3	-	This relay must energize to cause ADVs to open
	G332B	GCNMA386A5	-	This relay must energize to cause ADVs to open
	GEPMT0511	GEPMT0511	B-EPMT-EP-0511	
	GHSMB0501A	GHSMB0501A	-	No credit for manual closure of MSIVs
	GKVMB0505A	GKVMB0505A	M-KVMB-SV-0505A	
	GKVMB0505B	GKVMB0505B	M-KVMB-SV-0505B	
	GPBMBE50A	GPBMBE50A	M-PBMB-HS-LPE50A	
	GPCMT0511	GPCMT0511	B-PCMT-PIC-0511	
	GREMBXE50A	GREMBXE50A	M-REMB-LPXE50A	
	GSCMT0511	GSCMT0511	B-CEPO-PM-0511	
	IST-11	FAVMC0729	-	CST makeup from hotwell not modeled
	IST-15	AAVMA0521	-	SGB no longer supplies steam to TDAFW
	IST-15	AAVMA0521	-	SGB no longer supplies steam to TDAFW
	IST-164	PC1MCY3001	P-C1MC-EY-30-01	
	IST-166	ZCEPO0751C	M-PCMT-PIC-0751C	
	IST-170	ZCEPO0752C	M-PCMT-PIC-0752C	
	IST-18	AKVMA0522B	A-KVMB-SV-0522B	
	IST-18	AKVMA0522B	A-KVMB-SV-0522B	
	IST-183	GMVMA0510	M-HSMB-0510C	
	IST-184	GHSMB0510C	M-HSMB-0510C	
	IST-19	ACNMC62-2A	A-REMD-62-2P8A	
	IST-198	GKVMA0507B	M-KVMB-SV-0507B	
	IST-199	GKVMA0507A	M-KVMB-SV-0507A	
	IST-20	AMLMACHA	A-CEPO-AFAS-MOD A	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-228	GAVMA0511	B-AVMA-CV-0511	
	IST-252	FCSMC105	M-CSMB-252-105CS	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
	IST-6	ACNMDSX741	A-REMD-PSX-0741	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	PFUMK3006	PFUMK3006	P-FUMK-Y3006-1	
EC-01R	DFUMKW002A	DFUMKW002A	D-FUMK-W002-1	
	GEPMT0511	GEPMT0511	B-EPMT-EP-0511	
	GHSMB0501A	GHSMB0501A	-	No credit for manual closure of MSIVs
	GKVMA0508	GKVMA0508	M-KVMB-SV-0508	
	GKVMA0514	GKVMA0514	M-KVMB-SV-0514	
	GKVMB0502	GKVMB0502	M-KVMB-SV-0502	
	GKVMB0513	GKVMB0513	M-KVMB-SV-0513	
	GPBMBE50B	GPBMBE50B	M-PBMB-HS-LPE50B	
	GPCMT0511	GPCMT0511	B-PCMT-PIC-0511	
	GREMBXE50B	GREMBXE50B	M-REMB-LPXE50B	
	GSCMT0511	GSCMT0511	B-CEPO-PM-0511	
	IST-1	ACNMD23P8C	A-REMD-62-3P8C	
	IST-11	FAVMC0729	-	CST makeup from hotwell not modeled
	IST-165	PC1MCY4001	P-C1MC-EY-40-01	
	IST-169	ZCEPO0751D	M-PCMT-PIC-0751D	
	IST-173	ZCEPO0752D	M-PCMT-PIC-0752D	
	IST-187	GMVMA0501	-	SGB no longer supplies steam to TDAFW
	IST-188	GHSMB0501C	-	SGB no longer supplies steam to TDAFW
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-228	GAVMA0511	B-AVMA-CV-0511	
	IST-253	FCSMB205	M-CBMB-252-205	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
EC-02L	IST-143	SREMBX161	G-REMB-42-161	
	IST-273	BMVMA2169	G-MVMA-MO-2169	
	IST-275	SCSMB127C1	G-CSMB-42-127CS1	
	IST-276	SCSMB187C1	G-CSMB-42-187CS1	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-279	BCVMA2139	G-PMME-P-56B	
	IST-281	BMVMA2170	G-MVMA-MO-2170	
	IST-301	DFUMKS17A	D-FUMK-S17-1	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-318	SHCMT3025A	L-HCMT-HIC-3025A	
	IST-376	DCBMC72109	D-CBMC-72-109	
	IST-376	DCBMC72109	D-CBMC-72-109	
	IST-396	SC2MCC-161	G-C2MC-52-161	
	IST-396	SC2MCC-161	G-C2MC-52-161	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-398	DFUMKB1105	D-FUMK-B1105-1	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-405	PCBMBC1105	G-C2MB-52-1105	
	S42161MAN	SCSMB161CS	G-CSMB-42-161CS1	
	S55C-I	SCSMB1105	G-CSMB-52-1105CS	
	SCBA19A	SCSMB42191	G-CSMB-42-191CS	
	SHSMB3025B	SHSMB3025B	L-HSMB-HS-3025B	
	SREMB127-O	SREMB127-O	G-REMB-42-127	
	SREMBR-191	SREMBR-191	-	auto start of P-56B no longer modeled in PSAR2
EC-02R	IST-274	BCVMA2138	G-PMME-P-56A	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-278	BMVMA2140	G-MVMA-MO-2140	
	IST-280	SCSMB227C1	G-CSMB-42-227CS1	
	IST-301	DFUMKS17A	D-FUMK-S17-1	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-377	PB2MKMCC26	P-B2MK-EB-26	
	IST-377	PB2MKMCC26	P-B2MK-EB-26	
	IST-391	DFUMKS55B	D-FUMK-S55-2	
	IST-395	PCBMCC1205	G-C2MC-52-1205	
	IST-397	SCNMA0101	G-C2MC-52-1206	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-400	DFUMK72205	D-FUMK-B1205-1	
	IST-401	PCBMB1206	G-C2MB-52-1206	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-404	SCNMBA0101	D-FUMK-B1206-1	
	PC2MA1206	PC2MA1206	-	Alternate power source for charging pumps no longer modeled in PSAR2
	S55A-H	SCSMB1205	G-CSMB-52-1205CS	
	S55B-I	SCSMB1206	G-CSMB-52-1206CS	
	SCSMB207C1	SCSMB207C1	G-CSMB-42-207CS1	
	SCSMB207C2	SCSMB207C2	G-CSMB-42-207CS1	
	SREMBR-287	SREMBR-287	-	auto start of P-56A no longer modeled in PSAR2
EC-03L	DFUMKS09	DFUMKS09	D-FUMK-S09-1	
	DFUMKS13A	DFUMKS13A	D-FUMK-S13-2	
	IST-296	PCBMCC-147	L-C2MC-52-147	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-300	DFUMK1111A	D-FUMK-A1111-1	
	IST-307	PCBMCB-111	L-C2MB-152-111	
	IST-308	HPVMD3030B	Q-PVMD-PCV-3030B	
	IST-310	SMVMA3190	L-MVMA-MO-3190	
	IST-311	SCNMBX147	L-REMB-42X-147	
	IST-328	PCBMCC-141	L-C2MC-52-141	
	IST-329	SCNMBX141	L-REMB-42X-141	
	IST-331	PBSMTMCC23	P-B2MK-EB-23	
	IST-337	DFUMK1114A	D-FUMK-A1114-1	
	IST-338	DFUMK1112A	D-FUMK-A1112-1	
	IST-340	PCNMC52112	S-REMB-144-112	
	IST-341	PCNMC52114	S-REMB-144-114	
	IST-345	PB2MKMCC23	P-B2MK-EB-23	
	IST-345	PB2MKMCC23	P-B2MK-EB-23	
	IST-346	DFUMK1113A	D-FUMK-A1113-1	
	IST-350	HFLMK3018	-	Flow path not modeled in PSAR2
	IST-351	PCBMCC-137	H-C2MC-52-137	
	IST-352	PCBMCC-197	H-C2MC-52-197	
	IST-353	PCBMCC-157	H-C2MC-52-157	
	IST-354	PCBMCC-151	H-C2MC-52-151	
	IST-363	HFLMK3070	I-FLMK-F-319	
	PCBMBB-111	PCBMBB-111	L-C2MB-152-111	
	SCNMA43111	SCNMA43111	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMA52111	SCSMA52111	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMB111	SCSMB111	L-HSMB-HS-111	
	SCSMB112	SCSMB112	S-CSMB-152-112CS	
	SCSMB114	SCSMB114	S-CSMB-152-114CS	
	SH117	SCSMB1571	H-CSMB-42-157CS1	
	SH157	SCSMB1511	H-CSMB-42-151CS1	
	SH207	SHSMB3018A	-	Flow path not modeled in PSAR2
	SH25	SCSMB1371	H-CSMB-42-137CS1	
	SH314A	SCSMB113	H-CSMB-152-113CS	
	SH77	SCSMB1971	H-CSMB-42-197CS1	
	SHSMB3018A	SHSMB3018A	-	Flow path not modeled in PSAR2
	SHSMB3018B	SHSMB3018B	-	Flow path not modeled in PSAR2
	SHSMB3059A	SHSMB3059A	-	Failure to close failure mode not modeled in PSAR2
	SHSMB3059B	SHSMB3059B	-	Failure to close failure mode not modeled in PSAR2
	SKVMA3018	SKVMA3018	-	Flow path not modeled in PSAR2

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SKVMB3030A	SKVMB3030A	Z-KVMB-SV-3030A	
	SKVMB3059	SKVMB3059	-	Failure to close failure mode not modeled in PSAR2
	SL54	SCSMB1411	L-HSMB-HS-141-1	
	SL64	SCSMB1471	L-HSMB-HS-147-1	
	SPMME67B	SPMME67B	L-PMME-P-67B	
	SSD40	SLMMB23395	L-REMB-42-2339	
	SSD41	SQSMB2339	L-REMB-42-2339	
	SU28	SHSMB3030A	-	Manual operation of CV-3030 not in PSAR2
EC-03R	DFUMK1206A	DFUMK1206A	D-FUMK-A1206-1	
	DFUMKS10	DFUMKS10	D-FUMK-S10-1	
	DFUMKS14A	DFUMKS14A	D-FUMK-S14-2	
	IST-1	ACNMD23P8C	A-REMD-62-3P8C	
	IST-295	PCBMCC-251	L-C2MC-52-251	
	IST-297	PCBMCC-247	L-C2MC-52-247	
	IST-305	PCBMCB-206	L-C2MB-152-206	
	IST-306	SAVMA3029	Z-AVMA-CV-3029	
	IST-309	SMVMA3199	L-MVMA-MO-3199	
	IST-312	SCNMBX247	L-REMB-42X-247	
	IST-313	SCNMBX251	L-REMB-42X-251	
	IST-330	PBSMTMCC24	P-B2MK-EB-24	
	IST-336	PCBMBB-210	S-CBMB-152-210	
	IST-339	GCNMB5P8	R-REMB-5P-8	
	IST-347	HFLMK3037	-	Flow path not modeled in PSAR2
	IST-348	PB2MKMCC22	P-B2MK-EB-22	
	IST-348	PB2MKMCC22	P-B2MK-EB-22	
	IST-349	DFUMK1207A	D-FUMK-A1207-2	
	IST-355	PCBMCC-261	H-C2MC-52-261	
	IST-356	PCBMCC-257	H-C2MC-52-257	
	IST-357	PCBMCC-237	H-C2MC-52-237	
	IST-358	PCBMCC-241	H-C2MC-52-241	
	IST-362	HFLMK3071	I-FLMK-F-321	
	IST-392	PCBMCC5221	H-REMT-3072IC	
	PCBMBB-206	PCBMBB-206	L-C2MB-152-206	
	SCNMA43206	SCNMA43206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMA52206	SCSMA52206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMB206	SCSMB206	L-HSMB-HS-206	
	SCSMB210	SCSMB210	S-CSMB-152-210CS	
	SH135	SCSMB2371	H-CSMB-42-237CS1	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SH175	SCSMB2411	H-CSMB-42-241CS1	
	SH194	SHSMB3037A	-	Flow path not modeled in PSAR2
	SH233A	SCSMB207	H-CSMB-152-207CS	
	SH49	SCSMB2611	H-CSMB-42-261CS1	
	SH95	SCSMB2571	H-CSMB-42-257CS1	
	SKVMB3029A	SKVMB3029A	Z-KVMB-SV-3029A	
	SL74	SCSMB2471	L-REMB-42-247	
	SL84	SCSMB2511	L-REMB-42-251	
	SPMME67A	SPMME67A	L-PMME-P-67A	
	SSD30	SLMMB24395	L-REMB-42-2439	
	SSD31	SQSMB2439	L-REMB-42-2439	
	SU11	SHSMB3029A	-	Manual operation of CV-3029 not in PSAR2
EC-04L	DC6	DCBMC72112	P-CBMA-152-106	
	DFUDK1105A	DFUDK1105A	D-FUMK-B1105-1	
	DFUDK1106A	DFUDK1106A	D-FUMK-B1106-1	
	DFUDK1302A	DFUDK1302A	-	backfeed power not modeled in PSAR2.
	DFUMKW001A	DFUMKW001A	D-FUMK-W001-1	
	G113B	GCNMA386A8	-	This relay must energize to cause ADVs to open (the TBV solenoids must spuriously energize to open valve)
	G322B	GCNMA386A3	-	This relay must energize to cause ADVs to open
	G332B	GCNMA386A5	-	This relay must energize to cause ADVs to open
	GHSMB0510A	GHSMB0510A	-	No credit for manual closure of MSIVs
	GKVMB0505A	GKVMB0505A	M-KVMB-SV-0505A	
	GKVMB0505B	GKVMB0505B	M-KVMB-SV-0505B	
	IST-140	PC1MCY3003	P-C1MC-EY-30-03	
	IST-141	SCNMBSISX1	R-REMB-SIS-X1	
	IST-142	SCNMBSISX3	R-REMB-SIS-X3	
	IST-146	SCNMASIS5	R-REMB-SIS-5	
	IST-15	AAVMA0521	-	SGB no longer supplies steam to TDAFW
	IST-158	PCNMB107AB	-	shutdown sequencer not modeled in PSAR2
	IST-158	PCNMB107AB	-	shutdown sequencer not modeled in PSAR2
	IST-159	DFUDK1107A	D-FUMK-A1107-1	
	IST-159	DFUDK1107A	D-FUMK-A1107-1	
	IST-159	DFUDK1107A	D-FUMK-A1107-1	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-19	ACNMC62-2A	A-REMD-62-2P8A	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-190	DCBDC72104	D-CBMC-72-104	
	IST-198	GKVMA0507B	M-KVMB-SV-0507B	
	IST-199	GKVMA0507A	M-KVMB-SV-0507A	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-257	DCBDC72101	D-CBMC-72-101	
	IST-257	DCBDC72101	D-CBMC-72-101	
	IST-257	DCBDC72101	D-CBMC-72-101	
	IST-471	DCBDC72111	D-CBMC-72-111	
	IST-483	EDGME11	E-DGME-K-6A	
	IST-486	PCBMBB-106	P-CBMB-152-106	
	IST-490	DCBDC72308	D-CBMC-72-308	
	IST-491	PREMB1275	P-CBMA-152-106	
	IST-500	DFUDK1303A	D-FUMK-A1303-1	
	IST-500	DFUDK1303A	D-FUMK-A1303-1	
	IST-501	PCBMBB-302	-	backfeed power not modeled in PSAR2.
	IST-502	PCBMAB-302	P-CBMA-152-302	
	IST-509	EKVMA1470	E-KVMB-SV-1470	
	P252B	PCNMB303CS	-	Manual trip of CB-152-302 not modeled in PSAR2
	PBS1F-08	PCNMB1FCS	-	No manual actuation of 252-302 modeled in PSAR2
	PCBMAB-105	PCBMAB-105	P-CBMA-152-105	
	PCBMAB-106	PCBMAB-106	P-CBMA-152-106	
	PCBMBC1103	PCBMBC1103	P-CBMB-52-1103	
	PCSMBA-301	PCSMBA-301	-	Closure of CB-252-302 not modeled
	PREMB1271	PREMB1271	P-REMA-127-1	
	PREMB271X1	PREMB271X1	P-REMB-127-1-X1	
	PREMB271X2	PREMB271X2	P-REMB-127-1-X2	
	PREMB38311	PREMB38311	P-REMB-383-11	
	PREMB8612	PREMB8612	-	Circuitry for 152-202 failing to trip not modeled in PSAR2
	PREMB8612X	PREMB8612X	-	Circuitry for 152-106 failing to trip not modeled in PSAR2
	SCNMBSISX5	SCNMBSISX5	R-REMB-SIS-X5	
	SPBMB1-1	SPBMB1-1	-	manual initiation of sis relays not modeled in PSAR2
	SREMBSIS1	SREMBSIS1	R-REMB-SIS-1	
	SREMBSIS5	SREMBSIS5	R-REMB-SIS-5	
	SREMBSISX5	SREMBSISX5	R-REMB-SIS-X5	
	SREMBSISX7	SREMBSISX7	R-REMB-SIS-X7	
	ZCNMB34510	ZCNMB34510	R-CEPO-MC-34L105	
	ZCNMB3453	ZCNMB3453	R-CEPO-MC-34L105	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	ZCNMB3455	ZCNMB3455	R-CEPO-MC-34L106	
	ZCNMB3459	ZCNMB3459	R-CEPO-MC-34L105	
	ZSEMT34-5	ZSEMT34-5	R-CEPO-MC-34L105	
EC-04R	DFUDK1203A	DFUDK1203A	P-CBMA-152-203	
	DFUDK1302A	DFUDK1302A	-	backfeed not modeled in PSAR2
	DFUMKW002A	DFUMKW002A	D-FUMK-W002-1	
	GHSMB0501A	GHSMB0501A	-	No credit for manual action to close MSIVs in PSAR2
	GKVMA0508	GKVMA0508	M-KVMB-SV-0508	
	GKVMA0514	GKVMA0514	M-KVMB-SV-0514	
	GKVMB0502	GKVMB0502	M-KVMB-SV-0502	
	GKVMB0513	GKVMB0513	M-KVMB-SV-0513	
	IST-137	PC1MCY2003	P-C1MC-EY-20-03	
	IST-138	SCNMBSISX2	R-REMB-SIS-X2	
	IST-139	SCNMBSISX4	R-REMB-SIS-X4	
	IST-149	SCNMASIS8	R-REMB-SIS-8	
	IST-161	PCNMB213AB	P-CBMB-152-213	
	IST-161	PCNMB213AB	P-CBMB-152-213	
	IST-162	DFUDK1213A	P-CBMB-152-213	
	IST-162	DFUDK1213A	P-CBMB-152-213	
	IST-162	DFUDK1213A	P-CBMB-152-213	
	IST-163	DCBDC72238	D-CBMC-72-236	
	IST-163	DCBDC72238	D-CBMC-72-236	
	IST-163	DCBDC72238	D-CBMC-72-236	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-259	DCBDC72201	D-CBMC-72-201	
	IST-259	DCBDC72201	D-CBMC-72-201	
	IST-259	DCBDC72201	D-CBMC-72-201	
	IST-259	DCBDC72201	D-CBMC-72-201	
	IST-492	EDGME12	E-DGME-K-6B	
	IST-494	PCBMBB-202	P-CBMB-152-202	
	IST-496	DFUDK1202A	D-FUMK-A1202-1	
	IST-497	DCBDC72403	D-CBMC-72-403	
	IST-498	PREMB1276	P-CBMA-152-202	
	IST-499	DCBDC72211	D-CBMC-72-211	
	IST-500	DFUDK1303A	D-FUMK-A1303-1	
	IST-501	PCBMBB-302	-	backfeed power not modeled in PSAR2.
	IST-502	PCBMAB-302	P-CBMA-152-302	
	IST-502	PCBMAB-302	P-CBMA-152-302	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-510	EKVMA1471	E-KVMB-SV-1471	
	P252B	PCNMB303CS	-	Manual trip of CB-152-302 not modeled in PSAR2
	PBS1G-08	PCNMB1GCS	-	No manual actuation of 252-302 modeled in PSAR2
	PCBMAB-203	PCBMAB-203	P-CBMA-152-203	
	PCBMBC1201	PCBMBC1201	P-C2MB-52-1201	
	PREMB1272	PREMB1272	P-REMA-127-1	
	PREMB272X1	PREMB272X1	P-REMB-127-2-X1	
	PREMB272X2	PREMB272X2	P-REMB-127-2-X2	
	PREMB38312	PREMB38312	P-REMB-383-12	
	PREMB38323	PREMB38323	P-REMB-383-23	
	SCNMBSISX6	SCNMBSISX6	R-REMB-SIS-X6	
	SPBMB1-2	SPBMB1-2	-	manual initiation of sis relays not modeled in PSAR2
	SREMBSIS2	SREMBSIS2	R-REMB-SIS-2	
	SREMBSIS6	SREMBSIS6	R-REMB-SIS-6	
	SREMBSIS8	SREMBSIS8	R-REMB-SIS-8	
	SREMBSISX6	SREMBSISX6	R-REMB-SIS-X6	
	SREMBSISX8	SREMBSISX8	R-REMB-SIS-X8	
	ZCNMB34610	ZCNMB34610	R-CEPO-MC-34R106	
	ZCNMB3463	ZCNMB3463	R-CEPO-MC-34R105	
	ZCNMB3468	ZCNMB3468	R-CEPO-MC-34R106	
	ZSEMT34-6	ZSEMT34-6	R-CEPO-MC-34R106	
EC-08L	CCSMB1094	CCSMB1094	-	manual start of CCW pumps not modeled in PSAR2
	CCSMB1164	CCSMB1164	-	manual start of CCW pumps not modeled in PSAR2
	IST-53	CCSMD1092	C-CSMD-152-109CS	
	IST-55	CCSMD1162	C-CSMD-152-116CS	
	IST-63	CCVMA0944	C-CVMA-CK-CC944	
	IST-75	DFUMKA1103	D-FUMK-A1103-1	
	IST-84	UCNMB44103	U-REMB-144-103	
	UCSMB103	UCSMB103	-	manual start of SWS pumps not modeled in PSAR2
	UPSMB1318	UPSMB1318	U-PSMB-PS-1318	
	UPSMB1325	UPSMB1325	U-PSMB-PS-1325	
EC-08R	C200	CANMT0917	-	Isolation of CCW leaks not modeled
	CCSMB2084	CCSMB2084	-	manual start of CCW pumps not modeled in PSAR2
	IST-54	CCSMD2082	C-CSMD-152-208CS	
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-65	CCVMA0943	C-CVMA-CK-CC943	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-74	PCBMCB-204	U-C2MC-152-204	
	IST-76	PCBMCB-205	P-CBMC-152-205	
	IST-77	DFUMKA1205	D-FUMK-A1205-1	
	IST-79	DFUMKA1204	D-FUMK-A1204-1	
	UCSMB204	UCSMB204	-	manual start of SWS pumps not modeled in PSAR2
	UCSMB205	UCSMB205	-	manual start of SWS pumps not modeled in PSAR2
EC-11L	C517	CPSMB0918	C-PSMB-PS-0918	
	CHP50	ZPSMT83A	R-PSMD-PS-1803A	
	CHSMB0910	CHSMB0910	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CHSMB0911	CHSMB0911	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	DFUMKW001A	DFUMKW001A	D-FUMK-W001-1	
	GHSMB0510A	GHSMB0510A	-	No credit for manual action to close MSIVs in PSAR2
	GKVMB0505A	GKVMB0505A	M-KVMB-SV-0505A	
	GKVMB0505B	GKVMB0505B	M-KVMB-SV-0505B	
	IST-15	AAVMA0521	-	SGB no longer supplies steam to TDAFW
	IST-156	ZPSMA811	R-PSMA-PS1801SW1	
	IST-157	ZPSMA831	R-PSMA-PS1803SW1	
	IST-18	AKVMA0522B	A-KVMB-SV-0522B	
	IST-19	ACNMC62-2A	A-REMD-62-2P8A	
	IST-198	GKVMA0507B	M-KVMB-SV-0507B	
	IST-199	GKVMA0507A	M-KVMB-SV-0507A	
	IST-20	AMLMACHA	A-CEPO-AFAS-MOD A	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-30	AFSMB0727A	A-FSMA-FS-0727A	
	IST-31	AFSMB0749A	A-FSMA-FS-0749A	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
	IST-60	CAVMB0910	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-66	CAVMB0911	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-68	DFUMKS027A	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	SCNMBX0327	SCNMBX0327	Z-REMA-LSX-0327	
	SCNMBX0329	SCNMBX0329	Z-REMA-LSX-0329	
	SCNMBY0327	SCNMBY0327	Z-REMA-LSY-0327	
	SCNMBY0329	SCNMBY0329	Z-REMA-LSY-0329	
	SLSMA0327	SLSMA0327	Z-LSMA-LS-0327	
	SLSMA0329	SLSMA0329	Z-LSMA-LS-0329	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SREMAX0327	SREMAX0327	Z-REMA-LSX-0327	
	SREMAX0329	SREMAX0329	Z-REMA-LSX-0329	
	SREMAY0327	SREMAY0327	Z-REMA-LSY-0327	
	SREMAY0329	SREMAY0329	Z-REMA-LSY-0329	
	ZPSMB83A1	ZPSMB83A1	R-PSMB-PS-1803A1	
	ZPSMB83A2	ZPSMB83A2	R-PSMB-PS-1803A2	
EC-11R	CHP46	ZPSMT81A	R-PSMT-PS-1801A	
	CHP49	ZPSMT84A	R-PSMT-PS-1804A	
	CREMBEX5P4	CREMBEX5P4	R-REMB-5P-4	
	DFUMKW002A	DFUMKW002A	D-FUMK-W002-1	
	GHSMB0501A	GHSMB0501A	-	No credit for manual action to close MSIVs in PSAR2
	GKVMA0508	GKVMA0508	M-KVMB-SV-0508	
	GKVMA0514	GKVMA0514	M-KVMB-SV-0514	
	GKVMB0502	GKVMB0502	M-KVMB-SV-0502	
	GKVMB0513	GKVMB0513	M-KVMB-SV-0513	
	GREMB5P8	GREMB5P8	R-REMB-5P-8	
	IST-152	ZPSMA821	R-PSMA-PS1802SW1	
	IST-153	ZPSMA841	R-PSMA-PS1804SW1	
	IST-180	MAEMTHOGGR	M-AEMT-C-4	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
	IST-335	GCNMA5P8	R-REMB-5P-8	
	IST-339	GCNMB5P8	R-REMB-5P-8	
	IST-46	AFSMB0737	A-FSMA-FS-0737	
	IST-47	AFSMB0736	A-FSMA-FS-0736	
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	PFUMKS04	PFUMKS04	P-FUMK-S04-1	
	PREMB5P8	PREMB5P8	R-REMB-5P-8	
	SCNMBX0328	SCNMBX0328	Z-REMA-LSX-0328	
	SCNMBX0330	SCNMBX0330	Z-REMA-LSX-0330	
	SCNMBY0328	SCNMBY0328	Z-REMA-LSY-0328	
	SCNMBY0330	SCNMBY0330	Z-REMA-LSY-0330	
	SLSMA0328	SLSMA0328	Z-LSMA-LS-0328	
	SLSMA0330	SLSMA0330	Z-LSMA-LS-0330	
	SREMAX0328	SREMAX0328	Z-REMA-LSX-0328	
	SREMAX0330	SREMAX0330	Z-REMA-LSX-0330	
	SREMAY0328	SREMAY0328	Z-REMA-LSY-0328	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SREMAY0330	SREMAY0330	Z-REMA-LSY-0330	
	ZPSMB81A1	ZPSMB81A1	R-PSMB-PS-1801A1	
	ZPSMB81A2	ZPSMB81A2	R-PSMB-PS-1801A2	
	ZPSMB84A1	ZPSMB84A1	R-PSMB-PS-1804A1	
	ZPSMB84A2	ZPSMB84A2	R-PSMB-PS-1804A2	
EC-12L	ABIOPASCA	ABIOPASCA	A-BIPO-LS-0751A	
	ABIOPASCC	ABIOPASCC	A-BIPO-LS-0751C	
	ABIOPBSCA	ABIOPBSCA	A-BIPO-LS-0752A	
	ABIOPBSCC	ABIOPBSCC	A-BIPO-LS-0752C	
	ATLMT0751A	ATLMT0751A	A-TLMT-LT-0751A	
	ATLMT0751C	ATLMT0751C	A-TLMT-LT-0751C	
	ATLMT0752A	ATLMT0752A	A-TLMT-LT-0752A	
	ATLMT0752C	ATLMT0752C	A-TLMT-LT-0752C	
	DFUMKW001A	DFUMKW001A	D-FUMK-W001-1	
	G113B	GCNMA386A8	-	This relay must energize to cause ADVs to open (the TBV solenoids must spuriously energize to open valve)
	G322B	GCNMA386A3	-	This relay must energize to cause ADVs to open
	G332B	GCNMA386A5	-	This relay must energize to cause ADVs to open
	GEPMT0511	GEPMT0511	B-EPMT-EP-0511	
	GHSMB0510A	GHSMB0510A	-	No credit for manual closure of MSIVs
	GKVMB0505A	GKVMB0505A	M-KVMB-SV-0505A	
	GKVMB0505B	GKVMB0505B	M-KVMB-SV-0505B	
	GPBMBE50A	GPBMBE50A	M-PBMB-HS-LPE50A	
	GPCMT0511	GPCMT0511	B-PCMT-PIC-0511	
	GREMBXE50A	GREMBXE50A	M-REMB-LPXE50A	
	GSCMT0511	GSCMT0511	B-CEPO-PM-0511	
	IST-143	SREMBX161	G-REMB-42-161	
	IST-15	AAVMA0521	-	SGB no longer supplies steam to TDAFW
	IST-164	PC1MCY3001	P-C1MC-EY-30-01	
	IST-166	ZCEPO0751C	M-PCMT-PIC-0751C	
	IST-166	ZCEPO0751C	M-PCMT-PIC-0751C	
	IST-168	ZCEPO0751A	M-PCMT-PIC-0751A	
	IST-168	ZCEPO0751A	M-PCMT-PIC-0751A	
	IST-170	ZCEPO0752C	M-PCMT-PIC-0752C	
	IST-170	ZCEPO0752C	M-PCMT-PIC-0752C	
	IST-172	ZCEPO0752A	M-PCMT-PIC-0752A	
	IST-172	ZCEPO0752A	M-PCMT-PIC-0752A	
	IST-198	GKVMA0507B	M-KVMB-SV-0507B	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-199	GKVMA0507A	M-KVMB-SV-0507A	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-228	GAVMA0511	B-AVMA-CV-0511	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-30	AFSMB0727A	A-FSMA-FS-0727A	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-376	DCBMC72109	D-CBMC-72-109	
	IST-396	SC2MCC-161	G-C2MC-52-161	
	IST-396	SC2MCC-161	G-C2MC-52-161	
	IST-398	DFUMKB1105	D-FUMK-B1105-1	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-405	PCBMBC1105	G-C2MB-52-1105	
	S42161MAN	SCSMB161CS	G-CSMB-42-161CS1	
	S55C-I	SCSMB1105	G-CSMB-52-1105CS	
	SPCMT102A	SPCMT102A	P-DCPO-PS-0102A	
	SPCMT102C	SPCMT102C	P-DCPO-PS-0102C	
	SREMAXPA1	SREMAXPA1	R-REMA-XPA1	
	SREMAXPA2	SREMAXPA2	R-REMA-XPA2	
	SREMAXPC1	SREMAXPC1	R-REMA-XPC1	
	SREMAXPC2	SREMAXPC2	R-REMA-XPC2	
EC-12R	ABIOPASCB	ABIOPASCB	A-BIPO-LS-0751B	
	ABIOPASCD	ABIOPASCD	A-BIPO-LS-0751D	
	ABIOPBSCB	ABIOPBSCB	A-BIPO-LS-0752B	
	ABIOPBSCD	ABIOPBSCD	A-BIPO-LS-0752D	
	ATLMT0751B	ATLMT0751B	A-TLMT-LT-0751B	
	ATLMT0751D	ATLMT0751D	A-TLMT-LT-0751D	
	ATLMT0752B	ATLMT0752B	A-TLMT-LT-0752B	
	ATLMT0752D	ATLMT0752D	A-TLMT-LT-0752D	
	C200	CANMT0917	-	Isolation of CCW leakage not modeled
	DFUMKW002A	DFUMKW002A	D-FUMK-W002-1	
	GEPMT0511	GEPMT0511	B-EPMT-EP-0511	
	GHSMB0501A	GHSMB0501A	-	No credit for manual action to close MSIVs in PSAR2
	GKVMA0508	GKVMA0508	M-KVMB-SV-0508	
	GKVMA0514	GKVMA0514	M-KVMB-SV-0514	
	GKVMB0502	GKVMB0502	M-KVMB-SV-0502	
	GKVMB0513	GKVMB0513	M-KVMB-SV-0513	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	GPBMBE50B	GPBMBE50B	M-PBMB-HS-LPE50B	
	GPCMT0511	GPCMT0511	B-PCMT-PIC-0511	
	GREMBXE50B	GREMBXE50B	M-REMB-LPXE50B	
	GSCMT0511	GSCMT0511	B-CEPO-PM-0511	
	IST-165	PC1MCY4001	P-C1MC-EY-40-01	
	IST-167	ZCEPO0751B	M-PCMT-PIC-0751B	
	IST-167	ZCEPO0751B	M-PCMT-PIC-0751B	
	IST-169	ZCEPO0751D	M-PCMT-PIC-0751D	
	IST-169	ZCEPO0751D	M-PCMT-PIC-0751D	
	IST-171	ZCEPO0752B	M-PCMT-PIC-0752B	
	IST-171	ZCEPO0752B	M-PCMT-PIC-0752B	
	IST-173	ZCEPO0752D	M-PCMT-PIC-0752D	
	IST-173	ZCEPO0752D	M-PCMT-PIC-0752D	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-228	GAVMA0511	B-AVMA-CV-0511	
	IST-274	BCVMA2138	G-PMME-P-56A	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-301	DFUMKS17A	D-FUMK-S17-1	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
	IST-377	PB2MKMCC26	P-B2MK-EB-26	
	IST-391	DFUMKS55B	D-FUMK-S55-2	
	IST-395	PCBMCC1205	G-C2MC-52-1205	
	IST-397	SCNMA0101	G-C2MC-52-1206	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-400	DFUMK72205	D-FUMK-B1205-1	
	IST-401	PCBMB1206	G-C2MB-52-1206	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-404	SCNMBA0101	-	Auto start of P55B not modeled
	IST-46	AFSMB0737	A-FSMA-FS-0737	
	PC2MA1206	PC2MA1206	-	Alternate power source for charging pumps no longer modeled in PSAR2
	S55A-H	SCSMB1205	G-CSMB-52-1205CS	
	S55B-I	SCSMB1206	G-CSMB-52-1206CS	
	SCSMB207C1	SCSMB207C1	G-CSMB-42-207CS1	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SCSMB207C2	SCSMB207C2	G-CSMB-42-207CS1	
	SPCMT102B	SPCMT102B	P-DCPO-PS-0102B	
	SPCMT102D	SPCMT102D	P-DCPO-PS-0102D	
	SREMAXPB1	SREMAXPB1	R-REMA-XPB1	
	SREMAXPB2	SREMAXPB2	R-REMA-XPB2	
	SREMAXPD1	SREMAXPD1	R-REMA-XPD1	
	SREMAXPD2	SREMAXPD2	R-REMA-XPD2	
	SREMBR-287	SREMBR-287	-	auto start of P-56A no longer modeled in PSAR2
EC-13L	C517	CPSMB0918	C-PSMB-PS-0918	
	CCSMB1094	CCSMB1094	-	manual start of CCW pumps not modeled in PSAR2
	CCSMB1164	CCSMB1164	-	manual start of CCW pumps not modeled in PSAR2
	CHP50	ZPSMT83A	R-PSMT-PS-1803A	
	CHSMB0910	CHSMB0910	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CHSMB0911	CHSMB0911	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	DFUDK1302A	DFUDK1302A	-	Backfeed power to Bus 1C,D&E not modeled in PSAR2
	DFUMKS13A	DFUMKS13A	D-FUMK-S13-2	
	DFUMKS13B	DFUMKS13B	D-FUMK-S13-1	
	GCNMBHPX1L	GCNMBHPX1L	S-AVMA-CV-3002	
	IST-100	ICMME2C	I-CMME-C-2C	
	IST-100	ICMME2C	I-CMME-C-2C	
	IST-101	ICMMTC2C	I-CMME-C-2C	
	IST-101	ICMMTC2C	I-CMME-C-2C	
	IST-102	ICMME2A	I-CMME-C-2A	
	IST-102	ICMME2A	I-CMME-C-2A	
	IST-104	ICSMB1207	I-C2MB-52-1207	
	IST-105	ICNMBCR4	I-REMB-CR-4	
	IST-109	ICMMTC2A	I-CMME-C-2A	
	IST-109	ICMMTC2A	I-CMME-C-2A	
	IST-140	PC1MCY3003	P-C1MC-EY-30-03	
	IST-141	SCNMBSISX1	R-REMB-SIS-X1	
	IST-142	SCNMBSISX3	R-REMB-SIS-X3	
	IST-143	SREMBX161	G-REMB-42-161	
	IST-146	SCNMASIS5	R-REMB-SIS-5	
	IST-156	ZPSMA811	R-PSMA-PS1801SW1	
	IST-157	ZPSMA831	R-PSMA-PS1803SW1	
	IST-158	PCNMB107AB	-	shutdown sequencer not modeled in PSAR2

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-158	PCNMB107AB	-	shutdown sequencer not modeled in PSAR2
	IST-159	DFUDK1107A	D-FUMK-A1107-1	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-174	XAVMA2008	-	T81 makeup to CST no longer modeled
	IST-176	XAVMA2010	A-AVMA-CV-2010	
	IST-19	ACNMC62-2A	A-REMD-62-2P8A	
	IST-19	ACNMC62-2A	A-REMD-62-2P8A	
	IST-192	DCBMC72119	D-CBMC-72-119	
	IST-20	AMLMACHA	A-CEPO-AFAS-MOD A	
	IST-273	BMVMA2169	G-MVMA-MO-2169	
	IST-275	SCSMB127C1	G-CSMB-42-127CS1	
	IST-276	SCSMB187C1	G-CSMB-42-187CS1	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-279	BCVMA2139	G-PMME-P-56B	
	IST-281	BMVMA2170	G-MVMA-MO-2170	
	IST-283	PCBMCC-131	-	ESF room cooling no longer modeled
	IST-285	VTSFC1850	-	ESF room cooling no longer modeled
	IST-288	PCBMCC-133	-	ESF room cooling no longer modeled
	IST-290	VTSFC1857	-	ESF room cooling no longer modeled
	IST-296	PCBMCC-147	L-C2MC-52-147	
	IST-300	DFUMK1111A	D-FUMK-A1111-1	
	IST-307	PCBMCB-111	L-C2MB-152-111	
	IST-308	HPVMD3030B	Q-PVMD-PCV-3030B	
	IST-311	SCNMBX147	L-REMB-42X-147	
	IST-328	PCBMCC-141	L-C2MC-52-141	
	IST-329	SCNMBX141	L-REMB-42X-141	
	IST-337	DFUMK1114A	D-FUMK-A1114-1	
	IST-338	DFUMK1112A	D-FUMK-A1112-1	
	IST-340	PCNMC52112	S-REMB-144-112	
	IST-341	PCNMC52114	S-REMB-144-114	
	IST-346	DFUMK1113A	D-FUMK-A1113-1	
	IST-351	PCBMCC-137	H-C2MC-52-137	
	IST-352	PCBMCC-197	H-C2MC-52-197	
	IST-353	PCBMCC-157	H-C2MC-52-157	
	IST-354	PCBMCC-151	H-C2MC-52-151	
	IST-366	PCBMBC1305	F-C2MC-52-1305	
	IST-369	QCXMTC1305	F-C2MC-P-9ALOCAL	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-371	QCNMBPS2	F-PSMB-PS-1310	
	IST-378	IST-378	Z-REMB-4L1	
	IST-380	IST-380	Z-REMB-4L3	
	IST-396	SC2MCC-161	G-C2MC-52-161	
	IST-396	SC2MCC-161	G-C2MC-52-161	
	IST-398	DFUMKB1105	D-FUMK-B1105-1	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-405	PCBMBC1105	G-C2MB-52-1105	
	IST-501	PCBMBB-302	-	backfeed power not modeled in PSAR2.
	IST-502	PCBMAB-302	P-CBMA-152-302	
	IST-53	CCSMD1092	C-CSMD-152-109CS	
	IST-55	CCSMD1162	C-CSMD-152-116CS	
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-60	CAVMB0910	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-63	CCVMA0944	C-CVMA-CK-CC944	
	IST-66	CAVMB0911	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-68	DFUMKS027A	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-69	UKVMA0801	-	Compressors no longer require SW cooling
	IST-70	UKVMA0803	-	Compressors no longer require SW cooling
	IST-75	DFUMKA1103	D-FUMK-A1103-1	
	IST-82	SCNMA16-3	-	CV-1359 sis test contacts not modeled in PSAR2
	IST-84	UCNMB44103	U-REMB-144-103	
	IST-98	DFUMKB1207	D-FUMK-B1207-1	
	IST-99	DFUMKB1106	D-FUMK-B1106-1	
	IST-99	DFUMKB1106	D-FUMK-B1106-1	
	IST-99	DFUMKB1106	D-FUMK-B1106-1	
	PCBMBB-111	PCBMBB-111	L-C2MB-152-111	
	QCNMB5TR1C	QCNMB5TR1C	F-PSMB-PS-1310	
	S42161MAN	SCSMB161CS	G-CSMB-42-161CS1	
	S55C-I	SCSMB1105	G-CSMB-52-1105CS	
	SCBA19A	SCSMB42191	G-CSMB-42-191CS	
	SCNMA43111	SCNMA43111	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCNMA4L1	SCNMA4L1	Z-REMB-4L1	
	SCNMBSISX5	SCNMBSISX5	R-REMB-SIS-X5	
	SCNMBX0327	SCNMBX0327	Z-REMA-LSX-0327	
	SCNMBX0329	SCNMBX0329	Z-REMA-LSX-0329	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SCNMBY0327	SCNMBY0327	Z-REMA-LSY-0327	
	SCNMBY0329	SCNMBY0329	Z-REMA-LSY-0329	
	SCSMA52111	SCSMA52111	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMB111	SCSMB111	L-HSMB-HS-111	
	SCSMB112	SCSMB112	S-CSMB-152-112CS	
	SCSMB114	SCSMB114	S-CSMB-152-114CS	
	SH117	SCSMB1571	H-CSMB-42-157CS1	
	SH157	SCSMB1511	H-CSMB-42-151CS1	
	SH25	SCSMB1371	H-CSMB-42-137CS1	
	SH314A	SCSMB113	H-CSMB-152-113CS	
	SH77	SCSMB1971	H-CSMB-42-197CS1	
	SKVMB3030A	SKVMB3030A	Z-KVMB-SV-3030A	
	SL54	SCSMB1411	L-HSMB-HS-141-1	
	SL64	SCSMB1471	L-HSMB-HS-147-1	
	SLSMA0327	SLSMA0327	Z-LSMA-LS-0327	
	SLSMA0329	SLSMA0329	Z-LSMA-LS-0329	
	SPBMB1-1	SPBMB1-1	-	manual initiation of sis relays not modeled in PSAR2
	SPMME67B	SPMME67B	L-PMME-P-67B	
	SREMAX0327	SREMAX0327	Z-REMA-LSX-0327	
	SREMAX0329	SREMAX0329	Z-REMA-LSX-0329	
	SREMAY0327	SREMAY0327	Z-REMA-LSY-0327	
	SREMAY0329	SREMAY0329	Z-REMA-LSY-0329	
	SREMB127-O	SREMB127-O	G-REMB-42-127	
	SREMB4L1	SREMB4L1	Z-REMB-4L1	
	SREMBR-191	SREMBR-191	-	auto start of P-56B no longer modeled in PSAR2
	SREMBSIS1	SREMBSIS1	R-REMB-SIS-1	
	SREMBSIS5	SREMBSIS5	R-REMB-SIS-5	
	SREMBSISX5	SREMBSISX5	R-REMB-SIS-X5	
	SREMBSISX7	SREMBSISX7	R-REMB-SIS-X7	
	SU28	SHSMB3030A	-	Manual operation of CV-3030 not in PSAR2
	UCSMB103	UCSMB103	-	manual start of SWS pumps not modeled in PSAR2
	UPSMB1318	UPSMB1318	U-PSMB-PS-1318	
	UPSMB1325	UPSMB1325	U-PSMB-PS-1325	
	V22	VCSMB131	-	ESF room cooling no longer modeled
	V48	VCSMB133	-	ESF room cooling no longer modeled
	ZCNMB34510	ZCNMB34510	R-CEPO-MC-34L105	
	ZCNMB3453	ZCNMB3453	R-CEPO-MC-34L105	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	ZCNMB3455	ZCNMB3455	R-CEPO-MC-34L106	
	ZCNMB3459	ZCNMB3459	R-CEPO-MC-34L105	
	ZPSMB83A1	ZPSMB83A1	R-PSMB-PS-1803A1	
	ZPSMB83A2	ZPSMB83A2	R-PSMB-PS-1803A2	
	ZSEMT34-5	ZSEMT34-5	R-CEPO-MC-34L105	
EC-13R	CCSMB2084	CCSMB2084	-	manual start of CCW pumps not modeled in PSAR2
	CHP46	ZPSMT81A	R-PSMT-PS-1801A	
	CHP49	ZPSMT84A	R-PSMT-PS-1804A	
	CHSMB0940	CHSMB0940	-	Isolation of CCW to containment not modeled in PSAR2
	CREMBEX5P4	CREMBEX5P4	R-REMB-5P-4	
	DFUDK1302A	DFUDK1302A	-	Backfeed power to Bus 1C,D&E not modeled in PSAR2
	DFUMK1206A	DFUMK1206A	D-FUMK-A1206-1	
	DFUMKS14A	DFUMKS14A	D-FUMK-S14-2	
	DFUMKS14B	#N/A	D-FUMK-S14-1	
	GREMB5P8	GREMB5P8	R-REMB-5P-8	
	ICNMAK24	ICNMAK24	I-CMME-C-2B	
	ICNMBK21	ICNMBK21	I-CMME-C-2B	
	ICNMBK22	ICNMBK22	I-CMME-C-2B	
	IFUMKF3	IFUMKF3	I-CMME-C-2B	
	IREMBK22	IREMBK22	I-CMME-C-2B	
	IREMBK24	IREMBK24	I-CMME-C-2B	
	IST-103	ICNMAK22	I-CMME-C-2C	
	IST-104	ICSMB1207	I-C2MB-52-1207	
	IST-105	ICNMBCR4	I-REMB-CR-4	
	IST-106	ICNMCK23	I-CMME-C-2B	
	IST-107	ICNMBK23	I-CMME-C-2B	
	IST-137	PC1MCY2003	P-C1MC-EY-20-03	
	IST-138	SCNMBSISX2	R-REMB-SIS-X2	
	IST-139	SCNMBSISX4	R-REMB-SIS-X4	
	IST-149	SCNMASIS8	R-REMB-SIS-8	
	IST-152	ZPSMA821	R-PSMA-PS1802SW1	
	IST-153	ZPSMA841	R-PSMA-PS1804SW1	
	IST-161	PCNMB213AB	P-CBMB-152-213	
	IST-161	PCNMB213AB	P-CBMB-152-213	
	IST-162	DFUDK1213A	P-CBMB-152-213	
	IST-163	DCBDC72238	D-CBMC-72-236	
	IST-163	DCBDC72238	D-CBMC-72-236	
	IST-174	XAVMA2008	-	T81 makeup to CST no longer modeled

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-175	PB2MKBUS91	P-B2MK-EB-91	
	IST-176	XAVMA2010	A-AVMA-CV-2010	
	IST-180	MAEMTHOGGR	M-AEMT-C-4	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-274	BCVMA2138	G-PMME-P-56A	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-278	BMVMA2140	G-MVMA-MO-2140	
	IST-280	SCSMB227C1	G-CSMB-42-227CS1	
	IST-284	PCBMCC-211	-	ESF room cooling no longer modeled
	IST-286	VTSFC1851	-	ESF room cooling no longer modeled
	IST-289	PCBMCC-221	-	ESF room cooling no longer modeled
	IST-291	VTSFC1858	-	ESF room cooling no longer modeled
	IST-295	PCBMCC-251	L-C2MC-52-251	
	IST-297	PCBMCC-247	L-C2MC-52-247	
	IST-305	PCBMCB-206	L-C2MB-152-206	
	IST-306	SAVMA3029	Z-AVMA-CV-3029	
	IST-312	SCNMBX247	L-REMB-42X-247	
	IST-313	SCNMBX251	L-REMB-42X-251	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
	IST-335	GCNMA5P8	R-REMB-5P-8	
	IST-336	PCBMBB-210	S-CBMB-152-210	
	IST-339	GCNMB5P8	R-REMB-5P-8	
	IST-339	GCNMB5P8	R-REMB-5P-8	
	IST-349	DFUMK1207A	D-FUMK-A1207-2	
	IST-355	PCBMCC-261	H-C2MC-52-261	
	IST-356	PCBMCC-257	H-C2MC-52-257	
	IST-357	PCBMCC-237	H-C2MC-52-237	
	IST-358	PCBMCC-241	H-C2MC-52-241	
	IST-371	QCNMBPS2	F-PSMB-PS-1310	
	IST-381	IST-381	Z-REMB-4L2	
	IST-383	IST-383	Z-REMB-4L4	
	IST-395	PCBMCC1205	G-C2MC-52-1205	
	IST-397	SCNMA0101	G-C2MC-52-1206	
	IST-400	DFUMK72205	D-FUMK-B1205-1	
	IST-401	PCBMB1206	G-C2MB-52-1206	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-501	PCBMBB-302	-	backfeed power not modeled in PSAR2.
	IST-502	PCBMAB-302	P-CBMA-152-302	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-54	CCSMD2082	C-CSMD-152-208CS	
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-65	CCVMA0943	C-CVMA-CK-CC943	
	IST-67	CAVMB0940	-	containment CCW isolation not modeled in PSAR2
	IST-74	PCBMCB-204	U-C2MC-152-204	
	IST-76	PCBMCB-205	P-CBMC-152-205	
	IST-77	DFUMKA1205	D-FUMK-A1205-1	
	IST-79	DFUMKA1204	D-FUMK-A1204-1	
	IST-82	SCNMA16-3	-	CV-1359 sis test contacts not modeled in PSAR2
	IST-98	DFUMKB1207	D-FUMK-B1207-1	
	ISWFCS3	ISWFCS3	-	Failure of logic to unload compressor and prevent RV actuation not modeled in PSAR2
	PC2MA1206	PC2MA1206	-	Alternate power source for charging pumps no longer modeled in PSAR2
	PCBMBB-206	PCBMBB-206	L-C2MB-152-206	
	PFUMKS04	PFUMKS04	P-FUMK-S04-1	
	PREMB5P8	PREMB5P8	R-REMB-5P-8	
	QCNMB5TR1C	QCNMB5TR1C	F-PSMB-PS-1310	
	S55A-H	SCSMB1205	G-CSMB-52-1205CS	
	S55B-I	SCSMB1206	G-CSMB-52-1206CS	
	SCNMA43206	SCNMA43206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCNMA4L2	SCNMA4L2	Z-REMB-4L2	
	SCNMBSISX6	SCNMBSISX6	R-REMB-SIS-X6	
	SCNMBX0328	SCNMBX0328	Z-REMA-LSX-0328	
	SCNMBX0330	SCNMBX0330	Z-REMA-LSX-0330	
	SCNMBY0328	SCNMBY0328	Z-REMA-LSY-0328	
	SCNMBY0330	SCNMBY0330	Z-REMA-LSY-0330	
	SCSMA52206	SCSMA52206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMB206	SCSMB206	L-HSMB-HS-206	
	SCSMB210	SCSMB210	S-CSMB-152-210CS	
	SH135	SCSMB2371	H-CSMB-42-237CS1	
	SH175	SCSMB2411	H-CSMB-42-241CS1	
	SH233A	SCSMB207	H-CSMB-152-207CS	
	SH49	SCSMB2611	H-CSMB-42-261CS1	
	SH95	SCSMB2571	H-CSMB-42-257CS1	
	SKVMB3029A	SKVMB3029A	Z-KVMB-SV-3029A	
	SL74	SCSMB2471	L-REMB-42-247	

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SL84	SCSMB2511	L-REMB-42-251	
	SLSMA0328	SLSMA0328	Z-LSMA-LS-0328	
	SLSMA0330	SLSMA0330	Z-LSMA-LS-0330	
	SPBMB1-2	SPBMB1-2	-	manual initiation of sis relays not modeled in PSAR2
	SPMME67A	SPMME67A	L-PMME-P-67A	
	SREMAX0328	SREMAX0328	Z-REMA-LSX-0328	
	SREMAX0330	SREMAX0330	Z-REMA-LSX-0330	
	SREMAY0328	SREMAY0328	Z-REMA-LSY-0328	
	SREMAY0330	SREMAY0330	Z-REMA-LSY-0330	
	SREMB4L2	SREMB4L2	Z-REMB-4L2	
	SREMBR-287	SREMBR-287	-	auto start of P-56A no longer modeled in PSAR2
	SREMBSIS2	SREMBSIS2	R-REMB-SIS-2	
	SREMBSIS6	SREMBSIS6	R-REMB-SIS-6	
	SREMBSIS8	SREMBSIS8	R-REMB-SIS-8	
	SREMBSISX6	SREMBSISX6	R-REMB-SIS-X6	
	SREMBSISX8	SREMBSISX8	R-REMB-SIS-X8	
	SU11	SHSMB3029A	-	Manual operation of CV-3029 not in PSAR2
	UCSMB204	UCSMB204	-	manual start of SWS pumps not modeled in PSAR2
	UCSMB205	UCSMB205	-	manual start of SWS pumps not modeled in PSAR2
	V25	VCSMB211	-	ESF room cooling no longer modeled
	V51	VCSMB221	-	ESF room cooling no longer modeled
	X32	XCNMB9631A	A-PBMC-PB-P936	
	X33	XHSMB8950A	A-HSMC-HS-8950A	
	ZCNMB34610	ZCNMB34610	R-CEPO-MC-34R106	
	ZCNMB3463	ZCNMB3463	R-CEPO-MC-34R105	
	ZCNMB3468	ZCNMB3468	R-CEPO-MC-34R106	
	ZPSMB81A1	ZPSMB81A1	R-PSMB-PS-1801A1	
	ZPSMB81A2	ZPSMB81A2	R-PSMB-PS-1801A2	
	ZPSMB84A1	ZPSMB84A1	R-PSMB-PS-1804A1	
	ZPSMB84A2	ZPSMB84A2	R-PSMB-PS-1804A2	
	ZSEMT34-6	ZSEMT34-6	R-CEPO-MC-34R106	
EC-106	IST-190	DCBDC72104	D-CBMC-72-104	
	IST-259	DCBDC72201	D-CBMC-72-201	
	IST-519	PCNMD52402	P-CBMA-252-401	
	PBS1F-08	PCNMB1FCS	-	No manual actuation of 252-302 modeled in PSAR2
	PBS1G-08	PCNMB1GCS	-	No manual actuation of 252-402 modeled in PSAR2
	PCSMBA-301	PCSMBA-301	-	No manual actuation of 252-301 modeled

Fire Area 1 - Control Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment in PSAR2
EC-126	IST-190	DCBDC72104	D-CBMC-72-104	
	IST-191	DCBDC72207	D-CBMC-72-207	
	IST-191	DCBDC72207	D-CBMC-72-207	
	IST-374	QCNMBP41PS	F-PSMB-PS-5350	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
Exposure fire	A197	APSMD0762A	A-TPMT-PT-0762A	
	A199	APSMD0762B	A-TPMT-PT-0762B	
	A201	APSMD0762C	A-TPMT-PT-0762C	
	A38	AKVMA0522G	A-KVMA-SV-0522G	
	ABIOPASCA	ABIOPASCA	A-BIPO-LS-0751A	
	ABIOPASCB	ABIOPASCB	A-BIPO-LS-0751B	
	ABIOPASCC	ABIOPASCC	A-BIPO-LS-0751C	
	ABIOPASCD	ABIOPASCD	A-BIPO-LS-0751D	
	ABIOPBSCA	ABIOPBSCA	A-BIPO-LS-0752A	
	ABIOPBSCB	ABIOPBSCB	A-BIPO-LS-0752B	
	ABIOPBSCC	ABIOPBSCC	A-BIPO-LS-0752C	
	ABIOPBSCD	ABIOPBSCD	A-BIPO-LS-0752D	
	AHSMB0522B	AHSMB0522B	A-HSMB-HS-0522B	
	ATLMT0751A	ATLMT0751A	A-TLMT-LT-0751A	
	ATLMT0751B	ATLMT0751B	A-TLMT-LT-0751B	
	ATLMT0751C	ATLMT0751C	A-TLMT-LT-0751C	
	ATLMT0751D	ATLMT0751D	A-TLMT-LT-0751D	
	ATLMT0752A	ATLMT0752A	A-TLMT-LT-0752A	
	ATLMT0752B	ATLMT0752B	A-TLMT-LT-0752B	
	ATLMT0752C	ATLMT0752C	A-TLMT-LT-0752C	
	ATLMT0752D	ATLMT0752D	A-TLMT-LT-0752D	
	C200	CANMT0917	-	Isolation of CCW leaks not modeled
	C517	CPSMB0918	C-PSMB-PS-0918	
	CCSMB1094	CCSMB1094	-	Manual start of CCW pumps not modeled
	CCSMB1164	CCSMB1164	-	Manual start of CCW pumps not modeled
	CCSMB2084	CCSMB2084	-	Manual start of CCW pumps not modeled
	CHP46	ZPSMT81A	R-PSMT-PS-1801A	
	CHP49	ZPSMT84A	R-PSMT-PS-1804A	
	CHP50	ZPSMT83A	R-PSMT-PS-1803A	
	CREMBEX5P4	CREMBEX5P4	R-REMB-5P-4	
	DC6	DCBMC72112	P-CBMA-152-106	
	DFUDK1105A	DFUDK1105A	D-FUMK-B1105-1	
	DFUDK1106A	DFUDK1106A	D-FUMK-B1106-1	
	DFUDK1203A	DFUDK1203A	P-CBMA-152-203	
	DFUMK1206A	DFUMK1206A	D-FUMK-A1206-1	
	DFUMKS09	DFUMKS09	D-FUMK-S09-1	
	DFUMKS10	DFUMKS10	D-FUMK-S10-1	
	DFUMKS13A	DFUMKS13A	D-FUMK-S13-2	
	DFUMKS14A	DFUMKS14A	D-FUMK-S14-2	
	DFUMKW001A	DFUMKW001A	D-FUMK-W001-1	
	DFUMKW002A	DFUMKW002A	D-FUMK-W002-1	
	DFUMKW006D	DFUMKW006D	D-FUMK-W006-1	
	G113B	GCNMA386A8	-	This relay must energize to cause ADVs to

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
				open (the TBV solenoids must spuriously energize to open valve)
	G322B	GCNMA386A3	-	This relay must energize to cause ADVs to open
	G332B	GCNMA386A5	-	This relay must energize to cause ADVs to open
	GCNMBHPX1L	GCNMBHPX1L	S-AVMA-CV-3002	
	GEPMT0511	GEPMT0511	B-EPMT-EP-0511	
	GHSMB0501A	GHSMB0501A	-	No credit for manual closure of MSIVs
	GHSMB0510A	GHSMB0510A	-	No credit for manual closure of MSIVs
	GKVMA0508	GKVMA0508	M-KVMB-SV-0508	
	GKVMA0514	GKVMA0514	M-KVMB-SV-0514	
	GKVMB0502	GKVMB0502	M-KVMB-SV-0502	
	GKVMB0505A	GKVMB0505A	M-KVMB-SV-0505A	
	GKVMB0505B	GKVMB0505B	M-KVMB-SV-0505B	
	GKVMB0513	GKVMB0513	M-KVMB-SV-0513	
	GPBMBE50A	GPBMBE50A	M-PBMB-HS-LPE50A	
	GPBMBE50B	GPBMBE50B	M-PBMB-HS-LPE50B	
	GPCMT0511	GPCMT0511	B-PCMT-PIC-0511	
	GREMB5P8	GREMB5P8	R-REMB-5P-8	
	GREMBXE50A	GREMBXE50A	M-REMB-LPXE50A	
	GREMBXE50B	GREMBXE50B	M-REMB-LPXE50B	
	GSCMT0511	GSCMT0511	B-CEPO-PM-0511	
	IST-1	ACNMD23P8C	A-REMD-62-3P8C	
	IST-11	FAVMC0729	-	CST makeup from hotwell not modeled
	IST-15	AAVMA0521	-	SGB no longer supplies steam to TDAFW
	IST-152	ZPSMA821	R-PSMA-PS1802SW1	
	IST-153	ZPSMA841	R-PSMA-PS1804SW1	
	IST-156	ZPSMA811	R-PSMA-PS1801SW1	
	IST-157	ZPSMA831	R-PSMA-PS1803SW1	
	IST-158	PCNMB107AB	-	shutdown sequencer not modeled in PSAR2
	IST-159	DFUDK1107A	D-FUMK-A1107-1	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-161	PCNMB213AB	P-CBMB-152-213	
	IST-162	DFUDK1213A	P-CBMB-152-213	
	IST-163	DCBDC72238	D-CBMC-72-236	
	IST-164	PC1MCY3001	P-C1MC-EY-30-01	
	IST-165	PC1MCY4001	P-C1MC-EY-40-01	
	IST-166	ZCEPO0751C	M-PCMT-PIC-0751C	
	IST-167	ZCEPO0751B	M-PCMT-PIC-0751B	
	IST-168	ZCEPO0751A	M-PCMT-PIC-0751A	
	IST-169	ZCEPO0751D	M-PCMT-PIC-0751D	
	IST-170	ZCEPO0752C	M-PCMT-PIC-0752C	
	IST-171	ZCEPO0752B	M-PCMT-PIC-0752B	
	IST-172	ZCEPO0752A	M-PCMT-PIC-0752A	
	IST-173	ZCEPO0752D	M-PCMT-PIC-0752D	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-174	XAVMA2008	-	T81 makeup to CST no longer modeled
	IST-175	PB2MKBUS91	P-B2MK-EB-91	
	IST-176	XAVMA2010	A-AVMA-CV-2010	
	IST-18	AKVMA0522B	A-KVMB-SV-0522B	
	IST-180	MAEMTHOGGR	M-AEMT-C-4	
	IST-183	GMVMA0510	M-HSMB-0510C	
	IST-184	GHSMB0510C	M-HSMB-0510C	
	IST-187	GMVMA0501	-	SGB no longer supplies steam to TDAFW
	IST-188	GHSMB0501C	-	SGB no longer supplies steam to TDAFW
	IST-19	ACNMC62-2A	A-REMD-62-2P8A	
	IST-190	DCBDC72104	D-CBMC-72-104	
	IST-191	DCBDC72207	D-CBMC-72-207	
	IST-198	GKVMA0507B	M-KVMB-SV-0507B	
	IST-199	GKVMA0507A	M-KVMB-SV-0507A	
	IST-20	AMLMACHA	A-CEPO-AFAS-MODA	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-228	GAVMA0511	B-AVMA-CV-0511	
	IST-252	FCSMC105	M-CSMB-252-105CS	
	IST-253	FCSMB205	M-CBMB-252-205	
	IST-257	DCBDC72101	D-CBMC-72-101	
	IST-259	DCBDC72201	D-CBMC-72-201	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-30	AFSMB0727A	A-FSMA-FS-0727A	
	IST-300	DFUMK1111A	D-FUMK-A1111-1	
	IST-301	DFUMKS17A	D-FUMK-S17-1	
	IST-305	PCBMCB-206	L-C2MB-152-206	
	IST-306	SAVMA3029	Z-AVMA-CV-3029	
	IST-307	PCBMCB-111	L-C2MB-152-111	
	IST-308	HPVMD3030B	Q-PVMD-PCV-3030B	
	IST-31	AFSMB0749A	A-FSMA-FS-0749A	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
	IST-335	GCNMA5P8	R-REMB-5P-8	
	IST-336	PCBMBB-210	S-CBMB-152-210	
	IST-337	DFUMK1114A	D-FUMK-A1114-1	
	IST-338	DFUMK1112A	D-FUMK-A1112-1	
	IST-339	GCNMB5P8	R-REMB-5P-8	
	IST-340	PCNMC52112	S-REMB-144-112	
	IST-341	PCNMC52114	S-REMB-144-114	
	IST-346	DFUMK1113A	D-FUMK-A1113-1	
	IST-347	HFLMK3037	-	Flow path not modeled in PSAR2
	IST-348	PB2MKMCC22	P-B2MK-EB-22	
	IST-349	DFUMK1207A	D-FUMK-A1207-2	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-350	HFLMK3018	-	Flow path not modeled in PSAR2
	IST-362	HFLMK3071	I-FLMK-F-321	
	IST-363	HFLMK3070	I-FLMK-F-319	
	IST-366	PCBMBC1305	F-C2MC-52-1305	
	IST-369	QCXMTC1305	F-C2MC-P-9ALOCAL	
	IST-371	QCNMBPS2	F-PSMB-PS-1310	
	IST-374	QCNMBP41PS	F-PSMB-PS-5350	
	IST-376	DCBMC72109	D-CBMC-72-109	
	IST-377	PB2MKMCC26	P-B2MK-EB-26	
	IST-391	DFUMKS55B	D-FUMK-S55-2	
	IST-396	SC2MCC-161	G-C2MC-52-161	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-40	APSMD0741A	A-PSMD-PS-0741A	
	IST-404	SCNMBA0101	D-FUMK-B1206-1	
	IST-41	APSMD0741B	A-PSMD-PS-0741B	
	IST-42	APSMD741DD	A-PSMD-PS-0741DD	
	IST-43	PC1MCY1014	P-C1MC-EY-10-14	
	IST-46	AFSMB0737	A-FSMA-FS-0737	
	IST-47	AFSMB0736	A-FSMA-FS-0736	
	IST-471	DCBDC72111	D-CBMC-72-111	
	IST-486	PCBMBB-106	P-CBMB-152-106	
	IST-491	PREMB1275	P-CBMA-152-106	
	IST-494	PCBMBB-202	P-CBMB-152-202	
	IST-496	DFUDK1202A	D-FUMK-A1202-1	
	IST-498	PREMB1276	P-CBMA-152-202	
	IST-499	DCBDC72211	D-CBMC-72-211	
	IST-500	DFUDK1303A	D-FUMK-A1303-1	
	IST-502	PCBMAB-302	P-CBMA-152-302	
	IST-519	PCNMD52402	P-CBMA-252-401	
	IST-53	CCSMD1092	C-CSMD-152-109CS	
	IST-54	CCSMD2082	C-CSMD-152-208CS	
	IST-55	CCSMD1162	C-CSMD-152-116CS	
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-6	ACNMDSX741	A-REMD-PSX-0741	
	IST-63	CCVMA0944	C-CVMA-CK-CC944	
	IST-65	CCVMA0943	C-CVMA-CK-CC943	
	IST-75	DFUMKA1103	D-FUMK-A1103-1	
	IST-82	SCNMA16-3	-	CV-1359 sis test contacts not modeled in PSAR2
	IST-84	UCNMB44103	U-REMB-144-103	
	PBS1F-08	PCNMB1FCS	-	No manual actuation of 252-302 modeled in PSAR2
	PBS1G-08	PCNMB1GCS	-	No manual actuation of 252-402 modeled in PSAR2
	PCBMAB-105	PCBMAB-105	P-CBMA-152-105	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	PCBMAB-106	PCBMAB-106	P-CBMA-152-106	
	PCBMAB-203	PCBMAB-203	P-CBMA-152-203	
	PCBMBB-111	PCBMBB-111	L-C2MB-152-111	
	PCBMBB-206	PCBMBB-206	L-C2MB-152-206	
	PCSMBA-301	PCSMBA-301	-	Closure of CB-252-302 not modeled
	PFUMKS04	PFUMKS04	P-FUMK-S04-1	
	PREMB38311	PREMB38311	P-REMB-383-11	
	PREMB38312	PREMB38312	P-REMB-383-12	
	PREMB38323	PREMB38323	P-REMB-383-23	
	PREMB5P8	PREMB5P8	R-REMB-5P-8	
	PREMB8612	PREMB8612	-	Circuitry for 152-202 failing to trip not modeled in PSAR2
	PREMB8612X	PREMB8612X	-	Circuitry for 152-202 failing to trip not modeled in PSAR2
	QCNMB5TR1C	QCNMB5TR1C	F-PSMB-PS-1310	
	SCNMA43111	SCNMA43111	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCNMA43206	SCNMA43206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCNMBX0327	SCNMBX0327	Z-REMA-LSX-0327	
	SCNMBX0328	SCNMBX0328	Z-REMA-LSX-0328	
	SCNMBX0329	SCNMBX0329	Z-REMA-LSX-0329	
	SCNMBX0330	SCNMBX0330	Z-REMA-LSX-0330	
	SCNMBY0327	SCNMBY0327	Z-REMA-LSY-0327	
	SCNMBY0328	SCNMBY0328	Z-REMA-LSY-0328	
	SCNMBY0329	SCNMBY0329	Z-REMA-LSY-0329	
	SCNMBY0330	SCNMBY0330	Z-REMA-LSY-0330	
	SCSMA52111	SCSMA52111	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMA52206	SCSMA52206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMB111	SCSMB111	L-HSMB-HS-111	
	SCSMB112	SCSMB112	S-CSMB-152-112CS	
	SCSMB114	SCSMB114	S-CSMB-152-114CS	
	SCSMB206	SCSMB206	L-HSMB-HS-206	
	SCSMB210	SCSMB210	S-CSMB-152-210CS	
	SH194	SHSMB3037A	-	Flow path not modeled in PSAR2
	SH207	SHSMB3018A	-	Flow path not modeled in PSAR2
	SH233A	SCSMB207	H-CSMB-152-207CS	
	SH314A	SCSMB113	H-CSMB-152-113CS	
	SHSMB3018A	SHSMB3018A	-	Flow path not modeled in PSAR2
	SHSMB3018B	SHSMB3018B	-	Flow path not modeled in PSAR2
	SHSMB3059A	SHSMB3059A	-	Failure to close failure mode not modeled in PSAR2
	SHSMB3059B	SHSMB3059B	-	Failure to close failure mode not modeled in PSAR2
	SKVMA3018	SKVMA3018	-	Flow path not modeled in PSAR2
	SKVMB3029A	SKVMB3029A	Z-KVMB-SV-3029A	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SKVMB3030A	SKVMB3030A	Z-KVMB-SV-3030A	
	SKVMB3059	SKVMB3059	-	Failure to close failure mode not modeled in PSAR2
	SLSMA0327	SLSMA0327	Z-LSMA-LS-0327	
	SLSMA0328	SLSMA0328	Z-LSMA-LS-0328	
	SLSMA0329	SLSMA0329	Z-LSMA-LS-0329	
	SLSMA0330	SLSMA0330	Z-LSMA-LS-0330	
	SPCMT102A	SPCMT102A	P-DCPO-PS-0102A	
	SPCMT102B	SPCMT102B	P-DCPO-PS-0102B	
	SPCMT102C	SPCMT102C	P-DCPO-PS-0102C	
	SPCMT102D	SPCMT102D	P-DCPO-PS-0102D	
	SPMME67A	SPMME67A	L-PMME-P-67A	
	SPMME67B	SPMME67B	L-PMME-P-67B	
	SREMAX0327	SREMAX0327	Z-REMA-LSX-0327	
	SREMAX0328	SREMAX0328	Z-REMA-LSX-0328	
	SREMAX0329	SREMAX0329	Z-REMA-LSX-0329	
	SREMAX0330	SREMAX0330	Z-REMA-LSX-0330	
	SREMAY0327	SREMAY0327	Z-REMA-LSY-0327	
	SREMAY0328	SREMAY0328	Z-REMA-LSY-0328	
	SREMAY0329	SREMAY0329	Z-REMA-LSY-0329	
	SREMAY0330	SREMAY0330	Z-REMA-LSY-0330	
	SU11	SHSMB3029A	-	Manual operation of CV-3029 not in PSAR2
	SU28	SHSMB3030A	-	Manual operation of CV-3030 not in PSAR2
	UCSMB103	UCSMB103	-	manual start of SWS pumps not modeled in PSAR2
	UPSMB1318	UPSMB1318	U-PSMB-PS-1318	
	UPSMB1325	UPSMB1325	U-PSMB-PS-1325	
	X32	XCNMB9631A	A-PBMC-PB-P936	
	X33	XHSMB8950A	A-HSMC-HS-8950A	
	ZPSMB81A1	ZPSMB81A1	R-PSMB-PS-1801A1	
	ZPSMB81A2	ZPSMB81A2	R-PSMB-PS-1801A2	
	ZPSMB83A1	ZPSMB83A1	R-PSMB-PS-1803A1	
	ZPSMB83A2	ZPSMB83A2	R-PSMB-PS-1803A2	
	ZPSMB84A1	ZPSMB84A1	R-PSMB-PS-1804A1	
	ZPSMB84A2	ZPSMB84A2	R-PSMB-PS-1804A2	
EB-01	IST-143	SREMBX161	G-REMB-42-161	
	IST-273	BMVMA2169	G-MVMA-MO-2169	
	IST-275	SCSMB127C1	G-CSMB-42-127CS1	
	IST-276	SCSMB187C1	G-CSMB-42-187CS1	
	IST-279	BCVMA2139	G-PMME-P-56B	
	IST-281	BMVMA2170	G-MVMA-MO-2170	
	IST-283	PCBMCC-131	ESF room cooling no longer modeled	
	IST-285	VTSFC1850	ESF room cooling no longer modeled	
	IST-288	PCBMCC-133	ESF room cooling no	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
			longer modeled	
	IST-290	VTSFC1857	ESF room cooling no longer modeled	
	IST-296	PCBMCC-147	L-C2MC-52-147	
	IST-311	SCNMBX147	L-REMB-42X-147	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-328	PCBMCC-141	L-C2MC-52-141	
	IST-329	SCNMBX141	L-REMB-42X-141	
	IST-351	PCBMCC-137	H-C2MC-52-137	
	IST-352	PCBMCC-197	H-C2MC-52-197	
	IST-353	PCBMCC-157	H-C2MC-52-157	
	IST-354	PCBMCC-151	H-C2MC-52-151	
	IST-376	DCBMC72109	D-CBMC-72-109	
	IST-396	SC2MCC-161	G-C2MC-52-161	
	IST-470	DBCMTCHG4	D-BCMT-ED-18	
	IST-477	PCBMCC-145	P-C1MC-52-145	
	IST-483	EDGME11	E-DGME-K-6A	
	IST-509	EKVMA1470	E-KVMB-SV-1470	
	PB2MKMCC1	PB2MKMCC1	P-B2MK-EB-01	
	S42161MAN	SCSMB161CS	G-CSMB-42-161CS1	
	SCBA19A	SCSMB42191	G-CSMB-42-191CS	
	SH117	SCSMB1571	H-CSMB-42-157CS1	
	SH157	SCSMB1511	H-CSMB-42-151CS1	
	SH25	SCSMB1371	H-CSMB-42-137CS1	
	SH77	SCSMB1971	H-CSMB-42-197CS1	
	SL54	SCSMB1411	L-HSMB-HS-141-1	
	SL64	SCSMB1471	L-HSMB-HS-147-1	
	SREMB127-O	SREMB127-O	G-REMB-42-127	
	SREMBR-191	SREMBR-191	-	auto start of P-56B no longer modeled in PSAR2
	V22	VCSMB131	-	ESF room cooling no longer modeled
	V48	VCSMB133	-	ESF room cooling no longer modeled
EY-01	IST-190	DCBDC72104	D-CBMC-72-104	
	IST-191	DCBDC72207	D-CBMC-72-207	
	IST-301	DFUMKS17A	D-FUMK-S17-1	
	IST-318	SHCMT3025A	L-HCMT-HIC-3025A	
	IST-476	PC1MBY0141	-	Bypass regulator not modeled in PSAR2
	IST-477	PCBMCC-145	P-C1MC-52-145	
	IST-478	PCBMCC-236	P-C1MC-52-236	
	PB3MKY01	PB3MKY01	P-PAMK-EY-01	
	PREFAC-LCO	PREFAC-LCO	-	normal alignment of power from bypass regulator not modeled in PSAR2
	SHSMB3025B	SHSMB3025B	L-HSMB-HS-3025B	
EY-10	IST-474	DCBMC72016	P-C1MC-72-16	
	IST-475	PC1MBIV1	P-C1MC-CB-INV1	
	PPAMKY10	PPAMKY10	P-PAMK-EY-10	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	PREFAC-LCO	PREFAC-LCO	-	normal alignment of power from bypass regulator not modeled in PSAR2
EY-20	IST-44	DCBMC72026	P-C1MC-72-26	
	PREFAC-LCO	PREFAC-LCO	-	normal alignment of power from bypass regulator not modeled in PSAR2
EY-30	IST-144	DCBMC72011	P-C1MC-72-11	
	PFUMK3006	PFUMK3006	P-FUMK-Y3006-1	
	PREFAC-LCO	PREFAC-LCO	-	normal alignment of power from bypass regulator not modeled in PSAR2
EY-40	DFUDKD21	DFUDKD21	D-FUMK-D21-1	
	DFUMKD21	DFUMKD21	D-FUMK-D21-2	
	IST-135	DCBMC72021	P-C1MC-72-21	
	PREFAC-LCO	PREFAC-LCO	-	normal alignment of power from bypass regulator not modeled in PSAR2
EY-50	IST-476	PC1MBY0141	-	Bypass regulator not modeled in PSAR2
	IST-478	PCBMCC-236	P-C1MC-52-236	
EB-02	IST-274	BCVMA2138	G-PMME-P-56A	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-278	BMVMA2140	G-MVMA-MO-2140	
	IST-280	SCSMB227C1	G-CSMB-42-227CS1	
	IST-284	PCBMCC-211	-	ESF room cooling no longer modeled
	IST-286	VTSFC1851	-	ESF room cooling no longer modeled
	IST-289	PCBMCC-221	-	ESF room cooling no longer modeled
	IST-291	VTSFC1858	-	ESF room cooling no longer modeled
	IST-295	PCBMCC-251	L-C2MC-52-251	
	IST-297	PCBMCC-247	L-C2MC-52-247	
	IST-312	SCNMBX247	L-REMB-42X-247	
	IST-313	SCNMBX251	L-REMB-42X-251	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-355	PCBMCC-261	H-C2MC-52-261	
	IST-356	PCBMCC-257	H-C2MC-52-257	
	IST-357	PCBMCC-237	H-C2MC-52-237	
	IST-358	PCBMCC-241	H-C2MC-52-241	
	IST-392	PCBMCC5221	H-REMT-3072IC	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-469	DBCMTCHG2	D-BCMT-ED-16	
	IST-478	PCBMCC-236	P-C1MC-52-236	
	IST-492	EDGME12	E-DGME-K-6B	
	IST-510	EKVMA1471	E-KVMB-SV-1471	
	PB2MKMCC2	PB2MKMCC2	P-B2MK-EB-02	
	SCSMB207C1	SCSMB207C1	G-CSMB-42-207CS1	
	SCSMB207C2	SCSMB207C2	G-CSMB-42-207CS1	
	SH135	SCSMB2371	H-CSMB-42-237CS1	
	SH175	SCSMB2411	H-CSMB-42-241CS1	
	SH49	SCSMB2611	H-CSMB-42-261CS1	
	SH95	SCSMB2571	H-CSMB-42-257CS1	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SL74	SCSMB2471	L-REMB-42-247	
	SL84	SCSMB2511	L-REMB-42-251	
	SREMBR-287	SREMBR-287	-	auto start of P-56A no longer modeled in PSAR2
	V25	VCSMB211	-	ESF room cooling no longer modeled
	V51	VCSMB221	-	ESF room cooling no longer modeled
EB-11	IST-100	ICMME2C	I-CMME-C-2C	
	IST-101	ICMMTC2C	I-CMME-C-2C	
	IST-102	ICMME2A	I-CMME-C-2A	
	IST-104	ICSMB1207	I-C2MB-52-1207	
	IST-105	ICNMBCR4	I-REMB-CR-4	
	IST-109	ICMMTC2A	I-CMME-C-2A	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-192	DCBMC72119	D-CBMC-72-119	
	IST-398	DFUMKB1105	D-FUMK-B1105-1	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-405	PCBMBC1105	G-C2MB-52-1105	
	IST-490	DCBDC72308	D-CBMC-72-308	
	IST-69	UKVMA0801	-	Compressors no longer require SW cooling
	IST-70	UKVMA0803	-	Compressors no longer require SW cooling
	IST-98	DFUMKB1207	D-FUMK-B1207-1	
	IST-99	DFUMKB1106	D-FUMK-B1106-1	
	PB2MKBUS11	PB2MKBUS11	P-B2MK-EB-11	
	PCBMBC1103	PCBMBC1103	P-CBMB-52-1103	
	PREMB1271	PREMB1271	P-REMA-127-1	
	PREMB271X1	PREMB271X1	P-REMB-127-1-X1	
	PREMB271X2	PREMB271X2	P-REMB-127-1-X2	
	PT2MT11	PT2MT11	P-T2MT-EX-11	
	S55C-I	SCSMB1105	G-CSMB-52-1105CS	
EB-12	ICNMAK24	ICNMAK24	I-CMME-C-2B	
	ICNMBK21	ICNMBK21	I-CMME-C-2B	
	ICNMBK22	ICNMBK22	I-CMME-C-2B	
	IFUMKF3	IFUMKF3	I-CMME-C-2B	
	IREMBK22	IREMBK22	I-CMME-C-2B	
	IREMBK24	IREMBK24	I-CMME-C-2B	
	IST-100	ICMME2C	I-CMME-C-2C	
	IST-101	ICMMTC2C	I-CMME-C-2C	
	IST-102	ICMME2A	I-CMME-C-2A	
	IST-103	ICNMAK22	I-CMME-C-2C	
	IST-104	ICSMB1207	I-C2MB-52-1207	
	IST-105	ICNMBCR4	I-REMB-CR-4	
	IST-106	ICNMCK23	I-CMME-C-2B	
	IST-107	ICNMBK23	I-CMME-C-2B	
	IST-109	ICMMTC2A	I-CMME-C-2A	
	IST-163	DCBDC72238	D-CBMC-72-236	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-192	DCBMC72119	D-CBMC-72-119	
	IST-395	PCBMCC1205	G-C2MC-52-1205	
	IST-397	SCNMA0101	G-C2MC-52-1206	
	IST-400	DFUMK72205	D-FUMK-B1205-1	
	IST-401	PCBMB1206	G-C2MB-52-1206	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-497	DCBDC72403	D-CBMC-72-403	
	IST-69	UKVMA0801	-	Compressors no longer require SW cooling
	IST-70	UKVMA0803	-	Compressors no longer require SW cooling
	IST-98	DFUMKB1207	D-FUMK-B1207-1	
	IST-99	DFUMKB1106	D-FUMK-B1106-1	
	ISWFCS3	ISWFCS3	-	Failure of logic to unload compressor and prevent RV actuation not modeled in PSAR2
	PB2MKBUS12	PB2MKBUS12	P-B2MK-EB-12	
	PC2MA1206	PC2MA1206	-	Alternate power source for charging pumps no longer modeled in PSAR2
	PCBMBC1201	PCBMBC1201	P-C2MB-52-1201	
	PREMB1272	PREMB1272	P-REMA-127-1	
	PREMB272X1	PREMB272X1	P-REMB-127-2-X1	
	PREMB272X2	PREMB272X2	P-REMB-127-2-X2	
	PT2MT12	PT2MT12	P-T2MT-EX-12	
	S55A-H	SCSMB1205	G-CSMB-52-1205CS	
	S55B-I	SCSMB1206	G-CSMB-52-1206CS	
EB-21	IST-345	PB2MKMCC23	P-B2MK-EB-23	
	IST-503	PCBMCC2111	-	Battery room ventillation not needed in PSAR2
	PB2MKMCC21	PB2MKMCC21	P-B2MK-EB-21	
EB-23	IST-310	SMVMA3190	L-MVMA-MO-3190	
	IST-331	PBSMTMCC23	P-B2MK-EB-23	
	IST-345	PB2MKMCC23	P-B2MK-EB-23	
	SSD40	SLMMB23395	L-REMB-42-2339	
	SSD41	SQSMB2339	L-REMB-42-2339	
EB-24	293AUTO	VTSFC1822	E-TSFC-TS-1822	
	861AUTO	VTSFC1820	E-TSFC-TS-1820	
	IST-309	SMVMA3199	L-MVMA-MO-3199	
	IST-330	PBSMTMCC24	P-B2MK-EB-24	
	IST-348	PB2MKMCC22	P-B2MK-EB-22	
	IST-492	EDGME12	E-DGME-K-6B	
	IST-504	PCBMCC2411	-	Battery room ventillation not needed in PSAR2
	IST-507	VCNMB2931	-	Manual start of EDG fans not modeled in PSAR2
	IST-508	VCNMB8611	-	Manual start of EDG fans not modeled in PSAR2
	PB2MKMCC24	PB2MKMCC24	P-B2MK-EB-24	
	SSD30	SLMMB24395	L-REMB-42-2439	
	SSD31	SQSMB2439	L-REMB-42-2439	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
ED-06	IST-474	DCBMC72016	P-C1MC-72-16	
	IST-475	PC1MBIV1	P-C1MC-CB-INV1	
ED-07	IST-44	DCBMC72026	P-C1MC-72-26	
ED-08	IST-144	DCBMC72011	P-C1MC-72-11	
ED-09	IST-135	DCBMC72021	P-C1MC-72-21	
ED-10	DCB7218MOD	DCBMC72018	D-CBMC-72-18	
	DFUDKD11	DFUDKD11	D-FUMK-D11-1	
	DFUDKD11A	DFUDKD11A	D-FUMK-D018-1	
	DFUMKD11	DFUMKD11	D-FUMK-D11-1	
	DFUMKD11A	DFUMKD11A	D-FUMK-D018-1	
	IST-144	DCBMC72011	P-C1MC-72-11	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-472	DBCMTCHG1	D-BCMT-ED-15	
	IST-473	DBCMTCHG3	D-BCMT-ED-17	
	IST-474	DCBMC72016	P-C1MC-72-16	
	IST-475	PC1MBIV1	P-C1MC-CB-INV1	
ED-15	IST-472	DBCMTCHG1	D-BCMT-ED-15	
ED-16	IST-469	DBCMTCHG2	D-BCMT-ED-16	
ED-17	IST-473	DBCMTCHG3	D-BCMT-ED-17	
ED-18	IST-470	DBCMTCHG4	D-BCMT-ED-18	
ED-20	DCB7228MOD	DCBMC72028	D-CBMC-72-28	
	DFUDKD21	DFUDKD21	D-FUMK-D21-1	
	DFUMKD21	DFUMKD21	D-FUMK-D21-2	
	IST-135	DCBMC72021	P-C1MC-72-21	
	IST-163	DCBDC72238	D-CBMC-72-236	
	IST-44	DCBMC72026	P-C1MC-72-26	
	IST-470	DBCMTCHG4	D-BCMT-ED-18	
EJ-14A	IST-74	PCBMCB-204	U-C2MC-152-204	
	IST-76	PCBMCB-205	P-CBMC-152-205	
	IST-77	DFUMKA1205	D-FUMK-A1205-1	
	IST-79	DFUMKA1204	D-FUMK-A1204-1	
	UCSMB204	UCSMB204	-	manual start of SWS pumps not modeled in PSAR2
	UCSMB205	UCSMB205	-	manual start of SWS pumps not modeled in PSAR2
EJ-542	CHSMB0940	CHSMB0940	-	Isolation of CCW to containment not modeled in PSAR2
	DFUDK1302A	DFUDK1302A	-	backfeed power not modeled in PSAR2.
	IST-137	PC1MCY2003	P-C1MC-EY-20-03	
	IST-138	SCNMBSISX2	R-REMB-SIS-X2	
	IST-139	SCNMBSISX4	R-REMB-SIS-X4	
	IST-149	SCNMASIS8	R-REMB-SIS-8	
	IST-161	PCNMB213AB	P-CBMB-152-213	
	IST-163	DCBDC72238	D-CBMC-72-236	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-500	DFUDK1303A	D-FUMK-A1303-1	
	IST-501	PCBMBB-302	-	backfeed power not modeled in PSAR2.
	IST-502	PCBMAB-302	P-CBMA-152-302	
	IST-67	CAVMB0940	-	containment CCW isolation not modeled in PSAR2
	P252B	PCNMB303CS	-	Manual trip of CB-152-302 not modeled in PSAR2
	SCNMBSISX6	SCNMBSISX6	R-REMB-SIS-X6	
	SPBMB1-2	SPBMB1-2	-	manual initiation of sis relays not modeled in PSAR2
	SREMBSIS2	SREMBSIS2	R-REMB-SIS-2	
	SREMBSIS6	SREMBSIS6	R-REMB-SIS-6	
	SREMBSIS8	SREMBSIS8	R-REMB-SIS-8	
	SREMBSISX6	SREMBSISX6	R-REMB-SIS-X6	
	SREMBSISX8	SREMBSISX8	R-REMB-SIS-X8	
	ZCNMB34610	ZCNMB34610	R-CEPO-MC-34R106	
	ZCNMB3463	ZCNMB3463	R-CEPO-MC-34R105	
	ZCNMB3468	ZCNMB3468	R-CEPO-MC-34R106	
	ZSEMT34-6	ZSEMT34-6	R-CEPO-MC-34R106	
EJ-543	CHSMB0910	CHSMB0910	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CHSMB0911	CHSMB0911	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	DFUDK1302A	DFUDK1302A	-	backfeed power not modeled in PSAR2.
	IST-140	PC1MCY3003	P-C1MC-EY-30-03	
	IST-141	SCNMBSISX1	R-REMB-SIS-X1	
	IST-142	SCNMBSISX3	R-REMB-SIS-X3	
	IST-146	SCNMASIS5	R-REMB-SIS-5	
	IST-158	PCNMB107AB	-	shutdown sequencer not modeled in PSAR2
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-19	ACNMC62-2A	A-REMD-62-2P8A	
	IST-500	DFUDK1303A	D-FUMK-A1303-1	
	IST-501	PCBMBB-302	-	backfeed power not modeled in PSAR2.
	IST-502	PCBMAB-302	P-CBMA-152-302	
	IST-60	CAVMB0910	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-66	CAVMB0911	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-68	DFUMKS027A	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	P252B	PCNMB303CS	-	Manual trip of CB-152-302 not modeled in PSAR2
	SCNMBSISX5	SCNMBSISX5	R-REMB-SIS-X5	
	SPBMB1-1	SPBMB1-1	-	manual initiation of sis relays not modeled in PSAR2
	SREMBSIS1	SREMBSIS1	R-REMB-SIS-1	
	SREMBSIS5	SREMBSIS5	R-REMB-SIS-5	
	SREMBSISX5	SREMBSISX5	R-REMB-SIS-X5	
	SREMBSISX7	SREMBSISX7	R-REMB-SIS-X7	
	ZCNMB34510	ZCNMB34510	R-CEPO-MC-34L105	

Fire Area 2 - Cable Spreading Room

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	ZCNMB3453	ZCNMB3453	R-CEPO-MC-34L105	
	ZCNMB3455	ZCNMB3455	R-CEPO-MC-34L106	
	ZCNMB3459	ZCNMB3459	R-CEPO-MC-34L105	
	ZSEMT34-5	ZSEMT34-5	R-CEPO-MC-34L105	
EJ-575	DCB7218MOD	DCBMC72018	D-CBMC-72-18	
	DFUDKD11A	DFUDKD11A	D-FUMK-D018-1	
	DFUMKD11A	DFUMKD11A	D-FUMK-D018-1	
EJ-576	DCB7228MOD	DCBMC72028	D-CBMC-72-28	

Fire Area 3 - Bus 1D Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
Exposure fire	C200	CANMT0917	-	Isolation of CCW leaks not modeled
	C517	CPSMB0918	C-PSMB-PS-0918	
	CHP49	ZPSMT84A	R-PSMT-PS-1804A	
	CHP50	ZPSMT83A	R-PSMT-PS-1803A	
	CHSMB0910	CHSMB0910	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CHSMB0911	CHSMB0911	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CHSMB0940	CHSMB0940	-	Isolation of CCW to containment not modeled in PSAR2
	IST-152	ZPSMA821	R-PSMA-PS1802SW1	
	IST-153	ZPSMA841	R-PSMA-PS1804SW1	
	IST-156	ZPSMA811	R-PSMA-PS1801SW1	
	IST-157	ZPSMA831	R-PSMA-PS1803SW1	
	IST-180	MAEMTHOGGR	M-AEMT-C-4	
	IST-295	PCBMCC-251	L-C2MC-52-251	
	IST-297	PCBMCC-247	L-C2MC-52-247	
	IST-301	DFUMKS17A	D-FUMK-S17-1	
	IST-312	SCNMBX247	L-REMB-42X-247	
	IST-313	SCNMBX251	L-REMB-42X-251	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-348	PB2MKMCC22	P-B2MK-EB-22	
	IST-355	PCBMCC-261	H-C2MC-52-261	
	IST-356	PCBMCC-257	H-C2MC-52-257	
	IST-357	PCBMCC-237	H-C2MC-52-237	
	IST-358	PCBMCC-241	H-C2MC-52-241	
	IST-376	DCBMC72109	D-CBMC-72-109	
	IST-377	PB2MKMCC26	P-B2MK-EB-26	
	IST-391	DFUMKS55B	D-FUMK-S55-2	
	IST-397	SCNMA0101	G-C2MC-52-1206	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-401	PCBMB1206	G-C2MB-52-1206	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-60	CAVMB0910	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-66	CAVMB0911	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-67	CAVMB0940	-	Isolation of CCW to containment not modeled in PSAR2
	IST-68	DFUMKS027A	-	Isolation of CCW to containment not modeled in PSAR2
	PC2MA1206	PC2MA1206	-	Alternate power source for charging pumps no longer modeled in PSAR2
	S55B-I	SCSMB1206	G-CSMB-52-1206CS	

Fire Area 3 - Bus 1D Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SCNMBX0327	SCNMBX0327	Z-REMA-LSX-0327	
	SCNMBX0328	SCNMBX0328	Z-REMA-LSX-0328	
	SCNMBX0329	SCNMBX0329	Z-REMA-LSX-0329	
	SCNMBX0330	SCNMBX0330	Z-REMA-LSX-0330	
	SCNMBY0327	SCNMBY0327	Z-REMA-LSY-0327	
	SCNMBY0328	SCNMBY0328	Z-REMA-LSY-0328	
	SCNMBY0329	SCNMBY0329	Z-REMA-LSY-0329	
	SCNMBY0330	SCNMBY0330	Z-REMA-LSY-0330	
	SH135	SCSMB2371	H-CSMB-42-237CS1	
	SH175	SCSMB2411	H-CSMB-42-241CS1	
	SH49	SCSMB2611	H-CSMB-42-261CS1	
	SH95	SCSMB2571	H-CSMB-42-257CS1	
	SL74	SCSMB2471	L-REMB-42-247	
	SL84	SCSMB2511	L-REMB-42-251	
	SLSMA0327	SLSMA0327	Z-LSMA-LS-0327	
	SLSMA0328	SLSMA0328	Z-LSMA-LS-0328	
	SLSMA0329	SLSMA0329	Z-LSMA-LS-0329	
	SLSMA0330	SLSMA0330	Z-LSMA-LS-0330	
	SPCMT102B	SPCMT102B	P-DCPO-PS-0102B	
	SPCMT102D	SPCMT102D	P-DCPO-PS-0102D	
	SREMAX0327	SREMAX0327	Z-REMA-LSX-0327	
	SREMAX0328	SREMAX0328	Z-REMA-LSX-0328	
	SREMAX0329	SREMAX0329	Z-REMA-LSX-0329	
	SREMAX0330	SREMAX0330	Z-REMA-LSX-0330	
	SREMAY0327	SREMAY0327	Z-REMA-LSY-0327	
	SREMAY0328	SREMAY0328	Z-REMA-LSY-0328	
	SREMAY0329	SREMAY0329	Z-REMA-LSY-0329	
	SREMAY0330	SREMAY0330	Z-REMA-LSY-0330	
	ZPSMB83A1	ZPSMB83A1	R-PSMB-PS-1803A1	
	ZPSMB83A2	ZPSMB83A2	R-PSMB-PS-1803A2	
	ZPSMB84A1	ZPSMB84A1	R-PSMB-PS-1804A1	
	ZPSMB84A2	ZPSMB84A2	R-PSMB-PS-1804A2	
EA-12	CCSMB2084	CCSMB2084	-	manual start of CCW pumps not modeled in PSAR2
	DFUDK1203A	DFUDK1203A	P-CBMA-152-203	
	DFUMK1206A	DFUMK1206A	D-FUMK-A1206-1	
	IST-1	ACNMD23P8C	A-REMD-62-3P8C	
	IST-137	PC1MCY2003	P-C1MC-EY-20-03	
	IST-138	SCNMBSISX2	R-REMB-SIS-X2	
	IST-139	SCNMBSISX4	R-REMB-SIS-X4	
	IST-149	SCNMASIS8	R-REMB-SIS-8	
	IST-161	PCNMB213AB	P-CBMB-152-213	
	IST-162	DFUDK1213A	P-CBMB-152-213	
	IST-163	DCBDC72238	D-CBMC-72-236	

Fire Area 3 - Bus 1D Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-259	DCBDC72201	D-CBMC-72-201	
	IST-305	PCBMCB-206	L-C2MB-152-206	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
	IST-336	PCBMBB-210	S-CBMB-152-210	
	IST-339	GCNMB5P8	R-REMB-5P-8	
	IST-349	DFUMK1207A	D-FUMK-A1207-2	
	IST-492	EDGME12	E-DGME-K-6B	
	IST-494	PCBMBB-202	P-CBMB-152-202	
	IST-496	DFUDK1202A	D-FUMK-A1202-1	
	IST-497	DCBDC72403	D-CBMC-72-403	
	IST-498	PREMB1276	P-CBMA-152-202	
	IST-499	DCBDC72211	D-CBMC-72-211	
	IST-502	PCBMAB-302	P-CBMA-152-302	
	IST-510	EKVMA1471	E-KVMB-SV-1471	
	IST-54	CCSMD2082	C-CSMD-152-208CS	
	IST-65	CCVMA0943	C-CVMA-CK-CC943	
	IST-74	PCBMCB-204	U-C2MC-152-204	
	IST-76	PCBMCB-205	P-CBMC-152-205	
	IST-77	DFUMKA1205	D-FUMK-A1205-1	
	IST-79	DFUMKA1204	D-FUMK-A1204-1	
	PB1MKBUS1D	PB1MKBUS1D	P-B1MK-EA-12	
	PCBMAB-203	PCBMAB-203	P-CBMA-152-203	
	PCBMBB-206	PCBMBB-206	L-C2MB-152-206	
	PREMB1272	PREMB1272	P-REMA-127-1	
	PREMB272X1	PREMB272X1	P-REMB-127-2-X1	
	PREMB272X2	PREMB272X2	P-REMB-127-2-X2	
	PREMB38312	PREMB38312	P-REMB-383-12	
	PREMB38323	PREMB38323	P-REMB-383-23	
	SCNMA43206	SCNMA43206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCNMBSISX6	SCNMBSISX6	R-REMB-SIS-X6	
	SCSMA52206	SCSMA52206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMB206	SCSMB206	L-HSMB-HS-206	
	SCSMB210	SCSMB210	S-CSMB-152-210CS	
	SH233A	SCSMB207	H-CSMB-152-207CS	
	SPBMB1-2	SPBMB1-2	-	manual initiation of sis relays not modeled in PSAR2
	SPMME67A	SPMME67A	L-PMME-P-67A	
	SREMBSIS2	SREMBSIS2	R-REMB-SIS-2	
	SREMBSIS6	SREMBSIS6	R-REMB-SIS-6	
	SREMBSIS8	SREMBSIS8	R-REMB-SIS-8	
	SREMBSISX6	SREMBSISX6	R-REMB-SIS-X6	
	SREMBSISX8	SREMBSISX8	R-REMB-SIS-X8	

Fire Area 3 - Bus 1D Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	UCSMB204	UCSMB204	-	manual start of SWS pumps not modeled in PSAR2
	UCSMB205	UCSMB205	-	manual start of SWS pumps not modeled in PSAR2
	ZCNMB34610	ZCNMB34610	R-CEPO-MC-34R106	
	ZCNMB3463	ZCNMB3463	R-CEPO-MC-34R105	
	ZCNMB3468	ZCNMB3468	R-CEPO-MC-34R10	
	ZSEMT34-6	ZSEMT34-6	R-CEPO-MC-34R106	
EB-22	IST-348	PB2MKMCC22	P-B2MK-EB-22	
EC-181	DFUMKW002A	DFUMKW002A	D-FUMK-W002-1	
	GHSMB0501A	GHSMB0501A	-	No credit for manual closure of MSIVs
	GKVMA0508	GKVMA0508	M-KVMB-SV-0508	
	GKVMA0514	GKVMA0514	M-KVMB-SV-0514	
	GKVMB0502	GKVMB0502	M-KVMB-SV-0502	
	GKVMB0513	GKVMB0513	M-KVMB-SV-0513	
EC-187	ABIOPASCA	ABIOPASCA	A-BIPO-LS-0751A	
	ABIOPASCB	ABIOPASCB	A-BIPO-LS-0751B	
	ABIOPASCC	ABIOPASCC	A-BIPO-LS-0751C	
	ABIOPASCD	ABIOPASCD	A-BIPO-LS-0751D	
	ABIOPBSCA	ABIOPBSCA	A-BIPO-LS-0752A	
	ABIOPBSCB	ABIOPBSCB	A-BIPO-LS-0752B	
	ABIOPBSCC	ABIOPBSCC	A-BIPO-LS-0752C	
	ABIOPBSCD	ABIOPBSCD	A-BIPO-LS-0752D	
	ATLMT0751A	ATLMT0751A	A-TLMT-LT-0751A	
	ATLMT0751B	ATLMT0751B	A-TLMT-LT-0751B	
	ATLMT0751C	ATLMT0751C	A-TLMT-LT-0751C	
	ATLMT0751D	ATLMT0751D	A-TLMT-LT-0751D	
	ATLMT0752A	ATLMT0752A	A-TLMT-LT-0752A	
	ATLMT0752B	ATLMT0752B	A-TLMT-LT-0752B	
	ATLMT0752C	ATLMT0752C	A-TLMT-LT-0752C	
	ATLMT0752D	ATLMT0752D	A-TLMT-LT-0752D	
	IST-166	ZCEPO0751C	M-PCMT-PIC-0751C	
	IST-167	ZCEPO0751B	M-PCMT-PIC-0751B	
	IST-168	ZCEPO0751A	M-PCMT-PIC-0751A	
	IST-169	ZCEPO0751D	M-PCMT-PIC-0751D	
	IST-170	ZCEPO0752C	M-PCMT-PIC-0752C	
	IST-171	ZCEPO0752B	M-PCMT-PIC-0752B	
	IST-172	ZCEPO0752A	M-PCMT-PIC-0752A	
	IST-173	ZCEPO0752D	M-PCMT-PIC-0752D	
	IST-18	AKVMA0522B	A-KVMB-SV-0522B	
	IST-19	ACNMC62-2A	A-REMD-62-2P8A	
	IST-20	AMLMACHA	A-CEPO-AFAS-MODA	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
EJ-1005	A38	AKVMA0522G	A-KVMA-SV-0522G	

Fire Area 3 - Bus 1D Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	AHSMB0522B	AHSMB0522B	A-HSMB-HS-0522B	
	DFUMKW001A	DFUMKW001A	D-FUMK-W001-1	
	DFUMKW006D	DFUMKW006D	D-FUMK-W006-1	
	GHSMB0510A	GHSMB0510A	-	No credit for manual closure of MSIVs
	GKVMB0505A	GKVMB0505A	M-KVMB-SV-0505A	
	GKVMB0505B	GKVMB0505B	M-KVMB-SV-0505B	
	IST-15	AAVMA0521	-	SGB no longer supplies steam to TDAFW
	IST-18	AKVMA0522B	A-KVMB-SV-0522B	
	IST-19	ACNMC62-2A	A-REMD-62-2P8A	
	IST-198	GKVMA0507B	M-KVMB-SV-0507B	
	IST-199	GKVMA0507A	M-KVMB-SV-0507A	
	IST-20	AMLMACHA	A-CEPO-AFAS-MODA	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
	IST-6	ACNMDSX741	A-REMD-PSX-0741	
EJ-1006	IST-1	ACNMD23P8C	A-REMD-62-3P8C	
	IST-18	AKVMA0522B	A-KVMB-SV-0522B	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
EJ-1051	IST-19	ACNMC62-2A	A-REMD-62-2P8A	
	IST-20	AMLMACHA	A-CEPO-AFAS-MODA	
	IST-30	AFSMB0727A	A-FSMA-FS-0727A	
	IST-31	AFSMB0749A	A-FSMA-FS-0749A	
	IST-40	APSMD0741A	A-PSMD-PS-0741A	
	IST-41	APSMD0741B	A-PSMD-PS-0741B	
	IST-42	APSMD741DD	A-PSMD-PS-0741DD	
	IST-43	PC1MCY1014	P-C1MC-EY-10-14	
EJ-1052	A197	APSMD0762A	A-TPMT-PT-0762A	
	A199	APSMD0762B	A-TPMT-PT-0762B	
	A201	APSMD0762C	A-TPMT-PT-0762C	
	IST-1	ACNMD23P8C	A-REMD-62-3P8C	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
	IST-46	AFSMB0737	A-FSMA-FS-0737	
	IST-47	AFSMB0736	A-FSMA-FS-0736	
EJ-9401	DFUDK1203A	DFUDK1203A	P-CBMA-152-203	
	IST-137	PC1MCY2003	P-C1MC-EY-20-03	
	IST-138	SCNMBSISX2	R-REMB-SIS-X2	
	IST-139	SCNMBSISX4	R-REMB-SIS-X4	
	IST-149	SCNMASIS8	R-REMB-SIS-8	
	IST-161	PCNMB213AB	P-CBMB-152-213	
	IST-162	DFUDK1213A	P-CBMB-152-213	
	IST-163	DCBDC72238	D-CBMC-72-236	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	

Fire Area 3 - Bus 1D Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-494	PCBMBB-202	P-CBMB-152-202	
	IST-496	DFUDK1202A	D-FUMK-A1202-1	
	IST-497	DCBDC72403	D-CBMC-72-403	
	PCBMAB-203	PCBMAB-203	P-CBMA-152-203	
	PREMB1272	PREMB1272	P-REMA-127-1	
	PREMB272X1	PREMB272X1	P-REMB-127-2-X1	
	PREMB272X2	PREMB272X2	P-REMB-127-2-X2	
	SCNMBSISX6	SCNMBSISX6	R-REMB-SIS-X6	
	SPBMB1-2	SPBMB1-2	-	manual initiation of sis relays not modeled in PSAR2
	SREMBSIS2	SREMBSIS2	R-REMB-SIS-2	
	SREMBSIS6	SREMBSIS6	R-REMB-SIS-6	
	SREMBSIS8	SREMBSIS8	R-REMB-SIS-8	
	SREMBSISX6	SREMBSISX6	R-REMB-SIS-X6	
	SREMBSISX8	SREMBSISX8	R-REMB-SIS-X8	
	ZCNMB34610	ZCNMB34610	R-CEPO-MC-34R106	
	ZCNMB3463	ZCNMB3463	R-CEPO-MC-34R105	
	ZCNMB3468	ZCNMB3468	R-CEPO-MC-34R106	
	ZSEMT34-6	ZSEMT34-6	R-CEPO-MC-34R106	

Fire Area 4 - Bus 1C Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
Exposure fire	A197	APSMD0762A	A-TPMT-PT-0762A	
	A199	APSMD0762B	A-TPMT-PT-0762B	
	A201	APSMD0762C	A-TPMT-PT-0762C	
	A38	AKVMA0522G	A-KVMA-SV-0522G	
	ABIOPASCA	ABIOPASCA	A-BIPO-LS-0751A	
	ABIOPASCB	ABIOPASCB	A-BIPO-LS-0751B	
	ABIOPASCC	ABIOPASCC	A-BIPO-LS-0751C	
	ABIOPBSCA	ABIOPBSCA	A-BIPO-LS-0752A	
	ABIOPBSCB	ABIOPBSCB	A-BIPO-LS-0752B	
	ABIOPBSCC	ABIOPBSCC	A-BIPO-LS-0752C	
	AHSMB0522B	AHSMB0522B	A-HSMB-HS-0522B	
	ATLMT0751A	ATLMT0751A	A-TLMT-LT-0751A	
	ATLMT0751B	ATLMT0751B	A-TLMT-LT-0751B	
	ATLMT0751C	ATLMT0751C	A-TLMT-LT-0751C	
	ATLMT0752A	ATLMT0752A	A-TLMT-LT-0752A	
	ATLMT0752B	ATLMT0752B	A-TLMT-LT-0752B	
	ATLMT0752C	ATLMT0752C	A-TLMT-LT-0752C	
	C200	CANMT0917	-	Isolation of CCW leaks not modeled
	C517	CPSMB0918	C-PSMB-PS-0918	
	CCSMB2084	CCSMB2084	-	manual start of CCW pumps not modeled in PSAR2
	CHP46	ZPSMT81A	R-PSMT-PS-1801A	
	CHP49	ZPSMT84A	R-PSMT-PS-1804A	
	CHP50	ZPSMT83A	R-PSMT-PS-1803A	
	CHSMB0910	CHSMB0910	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CHSMB0911	CHSMB0911	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CHSMB0940	CHSMB0940	-	Isolation of CCW to containment not modeled in PSAR2
	CREMBEX5P4	CREMBEX5P4	R-REMB-5P-4	
	DC6	DCBMC72112	P-CBMA-152-106	
	DFUDK1302A	DFUDK1302A	-	backfeed power not modeled in PSAR2.
	DFUMK1206A	DFUMK1206A	D-FUMK-A1206-1	
	DFUMKS09	DFUMKS09	D-FUMK-S09-1	
	DFUMKS10	DFUMKS10	D-FUMK-S10-1	
	DFUMKS13A	DFUMKS13A	D-FUMK-S13-2	
	DFUMKS14A	DFUMKS14A	D-FUMK-S14-2	
	DFUMKW001A	DFUMKW001A	D-FUMK-W001-1	
	DFUMKW002A	DFUMKW002A	D-FUMK-W002-1	
	DFUMKW006D	DFUMKW006D	D-FUMK-W006-1	
	G113B	GCNMA386A8	-	This relay must energize to cause ADVs to open (the TBV solenoids must spuriously energize to open valve)
	G322B	GCNMA386A3	-	This relay must energize to cause ADVs to

Fire Area 4 - Bus 1C Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
				open
	G332B	GCNMA386A5	-	This relay must energize to cause ADVs to open
	GCNMBHPX1L	GCNMBHPX1L	S-AVMA-CV-3002	
	GEPMT0511	GEPMT0511	B-EPMT-EP-0511	
	GHSMB0501A	GHSMB0501A	-	No credit for manual closure of MSIVs
	GHSMB0510A	GHSMB0510A	-	No credit for manual closure of MSIVs
	GKVMA0508	GKVMA0508	M-KVMB-SV-0508	
	GKVMA0514	GKVMA0514	M-KVMB-SV-0514	
	GKVMB0502	GKVMB0502	M-KVMB-SV-0502	
	GKVMB0505A	GKVMB0505A	M-KVMB-SV-0505A	
	GKVMB0505B	GKVMB0505B	M-KVMB-SV-0505B	
	GKVMB0513	GKVMB0513	M-KVMB-SV-0513	
	GPCMT0511	GPCMT0511	B-PCMT-PIC-0511	
	GREMB5P8	GREMB5P8	R-REMB-5P-8	
	GSCMT0511	GSCMT0511	B-CEPO-PM-0511	
	ICNMAK24	ICNMAK24	I-CMME-C-2B	
	ICNMBK21	ICNMBK21	I-CMME-C-2B	
	ICNMBK22	ICNMBK22	I-CMME-C-2B	
	IFUMKF3	IFUMKF3	I-CMME-C-2B	
	IREMBK22	IREMBK22	I-CMME-C-2B	
	IREMBK24	IREMBK24	I-CMME-C-2B	
	IST-1	ACNMD23P8C	A-REMD-62-3P8C	
	IST-100	ICMME2C	I-CMME-C-2C	
	IST-100	ICMME2C	I-CMME-C-2C	
	IST-101	ICMMTC2C	I-CMME-C-2C	
	IST-101	ICMMTC2C	I-CMME-C-2C	
	IST-102	ICMME2A	I-CMME-C-2A	
	IST-102	ICMME2A	I-CMME-C-2A	
	IST-103	ICNMAK22	I-CMME-C-2C	
	IST-104	ICSMB1207	I-C2MB-52-1207	
	IST-104	ICSMB1207	I-C2MB-52-1207	
	IST-105	ICNMBCR4	I-REMB-CR-4	
	IST-105	ICNMBCR4	I-REMB-CR-4	
	IST-106	ICNMCK23	I-CMME-C-2B	
	IST-107	ICNMBK23	I-CMME-C-2B	
	IST-109	ICMMTC2A	I-CMME-C-2A	
	IST-109	ICMMTC2A	I-CMME-C-2A	
	IST-11	FAVMC0729	-	Hotwell reject to CST not credited in PSAR2
	IST-137	PC1MCY2003	P-C1MC-EY-20-03	
	IST-138	SCNMBSISX2	R-REMB-SIS-X2	
	IST-139	SCNMBSISX4	R-REMB-SIS-X4	
	IST-143	SREMBX161	G-REMB-42-161	
	IST-149	SCNMASIS8	R-REMB-SIS-8	
	IST-15	AAVMA0521	-	SGB no longer supplies steam to TDAFW

Fire Area 4 - Bus 1C Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-15	AAVMA0521	-	SGB no longer supplies steam to TDAFW
	IST-152	ZPSMA821	R-PSMA-PS1802SW1	
	IST-153	ZPSMA841	R-PSMA-PS1804SW1	
	IST-156	ZPSMA811	R-PSMA-PS1801SW1	
	IST-157	ZPSMA831	R-PSMA-PS1803SW1	
	IST-161	PCNMB213AB	P-CBMB-152-213	
	IST-163	DCBDC72238	D-CBMC-72-236	
	IST-166	ZCEPO0751C	M-PCMT-PIC-0751C	
	IST-167	ZCEPO0751B	M-PCMT-PIC-0751B	
	IST-168	ZCEPO0751A	M-PCMT-PIC-0751A	
	IST-170	ZCEPO0752C	M-PCMT-PIC-0752C	
	IST-171	ZCEPO0752B	M-PCMT-PIC-0752B	
	IST-172	ZCEPO0752A	M-PCMT-PIC-0752A	
	IST-174	XAVMA2008	-	T81 makeup to CST no longer modeled
	IST-176	XAVMA2010	A-AVMA-CV-2010	
	IST-18	AKVMA0522B	A-KVMB-SV-0522B	
	IST-18	AKVMA0522B	A-KVMB-SV-0522B	
	IST-180	MAEMTHOGGR	M-AEMT-C-4	
	IST-183	GMVMA0510	M-HSMB-0510C	
	IST-184	GHSMB0510C	M-HSMB-0510C	
	IST-187	GMVMA0501	-	SGB no longer supplies steam to TDAFW
	IST-188	GHSMB0501C	-	SGB no longer supplies steam to TDAFW
	IST-190	DCBDC72104	D-CBMC-72-104	
	IST-191	DCBDC72207	D-CBMC-72-207	
	IST-191	DCBDC72207	D-CBMC-72-207	
	IST-191	DCBDC72207	D-CBMC-72-207	
	IST-192	DCBMC72119	D-CBMC-72-119	
	IST-198	GKVMA0507B	M-KVMB-SV-0507B	
	IST-199	GKVMA0507A	M-KVMB-SV-0507A	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-21	ACNMD1C2-6	A-REMB-62-1P8C	
	IST-228	GAVMA0511	B-AVMA-CV-0511	
	IST-252	FCSMC105	M-CSMB-252-105CS	
	IST-253	FCSMB205	M-CBMB-252-205	
	IST-257	DCBDC72101	D-CBMC-72-101	
	IST-257	DCBDC72101	D-CBMC-72-101	
	IST-259	DCBDC72201	D-CBMC-72-201	
	IST-259	DCBDC72201	D-CBMC-72-201	
	IST-259	DCBDC72201	D-CBMC-72-201	
	IST-273	BMVMA2169	G-MVMA-MO-2169	
	IST-274	BCVMA2138	G-PMME-P-56A	
	IST-275	SCSMB127C1	G-CSMB-42-127CS1	
	IST-276	SCSMB187C1	G-CSMB-42-187CS1	

Fire Area 4 - Bus 1C Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-278	BMVMA2140	G-MVMA-MO-2140	
	IST-279	BCVMA2139	G-PMME-P-56B	
	IST-280	SCSMB227C1	G-CSMB-42-227CS1	
	IST-281	BMVMA2170	G-MVMA-MO-2170	
	IST-283	PCBMCC-131	-	ESF room cooling no longer modeled
	IST-284	PCBMCC-211	-	ESF room cooling no longer modeled
	IST-285	VTSFC1850	-	ESF room cooling no longer modeled
	IST-286	VTSFC1851	-	ESF room cooling no longer modeled
	IST-288	PCBMCC-133	-	ESF room cooling no longer modeled
	IST-289	PCBMCC-221	-	ESF room cooling no longer modeled
	IST-290	VTSFC1857	-	ESF room cooling no longer modeled
	IST-291	VTSFC1858	-	ESF room cooling no longer modeled
	IST-295	PCBMCC-251	L-C2MC-52-251	
	IST-296	PCBMCC-147	L-C2MC-52-147	
	IST-297	PCBMCC-247	L-C2MC-52-247	
	IST-30	AFSMB0727A	A-FSMA-FS-0727A	
	IST-301	DFUMKS17A	D-FUMK-S17-1	
	IST-301	DFUMKS17A	D-FUMK-S17-1	
	IST-305	PCBMCB-206	L-C2MB-152-206	
	IST-306	SAVMA3029	Z-AVMA-CV-3029	
	IST-308	HPVMD3030B	Q-PVMD-PCV-3030B	
	IST-309	SMVMA3199	L-MVMA-MO-3199	
	IST-31	AFSMB0749A	A-FSMA-FS-0749A	
	IST-310	SMVMA3190	L-MVMA-MO-3190	
	IST-311	SCNMBX147	L-REMB-42X-147	
	IST-312	SCNMBX247	L-REMB-42X-247	
	IST-313	SCNMBX251	L-REMB-42X-251	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-318	SHCMT3025A	L-HCMT-HIC-3025A	
	IST-32	AREMB22P8B	A-REMB-62-2P8B	
	IST-328	PCBMCC-141	L-C2MC-52-141	
	IST-329	SCNMBX141	L-REMB-42X-141	
	IST-330	PBSMTMCC24	P-B2MK-EB-24	
	IST-331	PBSMTMCC23	P-B2MK-EB-23	
	IST-335	GCNMA5P8	R-REMB-5P-8	
	IST-339	GCNMB5P8	R-REMB-5P-8	
	IST-345	PB2MKMCC23	P-B2MK-EB-23	
	IST-345	PB2MKMCC23	P-B2MK-EB-23	
	IST-347	HFLMK3037	-	Flow path not modeled in PSAR2

Fire Area 4 - Bus 1C Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-348	PB2MKMCC22	P-B2MK-EB-22	
	IST-348	PB2MKMCC22	P-B2MK-EB-22	
	IST-350	HFLMK3018	-	Flow path not modeled in PSAR2
	IST-351	PCBMCC-137	H-C2MC-52-137	
	IST-352	PCBMCC-197	H-C2MC-52-197	
	IST-353	PCBMCC-157	H-C2MC-52-157	
	IST-354	PCBMCC-151	H-C2MC-52-151	
	IST-355	PCBMCC-261	H-C2MC-52-261	
	IST-356	PCBMCC-257	H-C2MC-52-257	
	IST-357	PCBMCC-237	H-C2MC-52-237	
	IST-358	PCBMCC-241	H-C2MC-52-241	
	IST-362	HFLMK3071	I-FLMK-F-321	
	IST-363	HFLMK3070	I-FLMK-F-319	
	IST-366	PCBMBC1305	F-C2MC-52-1305	
	IST-369	QCXMTC1305	F-C2MC-P-9ALOCAL	
	IST-371	QCNMBPS2	F-PSMB-PS-1310	
	IST-374	QCNMBP41PS	F-PSMB-PS-5350	
	IST-376	DCBMC72109	D-CBMC-72-109	
	IST-376	DCBMC72109	D-CBMC-72-109	
	IST-391	DFUMKS55B	D-FUMK-S55-2	
	IST-392	PCBMCC5221	H-REMT-3072IC	
	IST-395	PCBMCC1205	G-C2MC-52-1205	
	IST-396	SC2MCC-161	G-C2MC-52-161	
	IST-396	SC2MCC-161	G-C2MC-52-161	
	IST-397	SCNMA0101	G-C2MC-52-1206	
	IST-398	DFUMKB1105	D-FUMK-B1105-1	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-400	DFUMK72205	D-FUMK-B1205-1	
	IST-401	PCBMB1206	G-C2MB-52-1206	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-404	SCNMBA0101	D-FUMK-B1206-1	
	IST-405	PCBMBC1105	G-C2MB-52-1105	
	IST-46	AFSMB0737	A-FSMA-FS-0737	
	IST-47	AFSMB0736	A-FSMA-FS-0736	
	IST-500	DFUDK1303A	D-FUMK-A1303-1	
	IST-501	PCBMBB-302	-	backfeed power not modeled in PSAR2.
	IST-502	PCBMAB-302	P-CBMA-152-302	
	IST-519	PCNMD52402	P-CBMA-252-401	
	IST-54	CCSMD2082	C-CSMD-152-208CS	
	IST-57	CAVMA0918	-	Makeup to CCW not modeled

Fire Area 4 - Bus 1C Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-60	CAVMB0910	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-65	CCVMA0943	C-CVMA-CK-CC943	
	IST-66	CAVMB0911	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-67	CAVMB0940	-	containment CCW isolation not modeled in PSAR2
	IST-68	DFUMKS027A	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-69	UKVMA0801	-	Compressors no longer require SW cooling
	IST-70	UKVMA0803	-	Compressors no longer require SW cooling
	IST-76	PCBMCB-205	P-CBMC-152-205	
	IST-77	DFUMKA1205	D-FUMK-A1205-1	
	IST-82	SCNMA16-3	-	CV-1359 sis test contacts not modeled in PSAR2
	IST-82	SCNMA16-3	-	CV-1359 sis test contacts not modeled in PSAR2
	IST-98	DFUMKB1207	D-FUMK-B1207-1	
	IST-98	DFUMKB1207	D-FUMK-B1207-1	
	IST-99	DFUMKB1106	D-FUMK-B1106-1	
	IST-99	DFUMKB1106	D-FUMK-B1106-1	
	IST-99	DFUMKB1106	D-FUMK-B1106-1	
	ISWFCS3	ISWFCS3	-	Failure of logic to unload compressor and prevent RV actuation not modeled in PSAR2
	P252B	PCNMB303CS	-	Manual trip of CB-152-302 not modeled in PSAR2
	PBS1G-08	PCNMB1GCS	-	No manual actuation of 252-302 modeled in PSAR2
	PC2MA1206	PC2MA1206	-	Alternate power source for charging pumps no longer modeled in PSAR2
	PCBMBB-206	PCBMBB-206	L-C2MB-152-206	
	PCBMBC1103	PCBMBC1103	P-CBMB-52-1103	
	PCBMBC1201	PCBMBC1201	P-C2MB-52-1201	
	PFUMKS04	PFUMKS04	P-FUMK-S04-1	
	PREMB5P8	PREMB5P8	R-REMB-5P-8	
	PREMB8612	PREMB8612	-	Circuitry for 152-202 failing to trip not modeled in PSAR2
	PREMB8612X	PREMB8612X	-	Circuitry for 152-106 failing to trip not modeled in PSAR2
	QCNMB5TR1C	QCNMB5TR1C	F-PSMB-PS-1310	
	S42161MAN	SCSMB161CS	G-CSMB-42-161CS1	
	S55A-H	SCSMB1205	G-CSMB-52-1205CS	
	S55B-I	SCSMB1206	G-CSMB-52-1206CS	
	S55C-I	SCSMB1105	G-CSMB-52-1105CS	
	SCBA19A	SCSMB42191	G-CSMB-42-191CS	
	SCNMA43206	SCNMA43206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCNMBSISX6	SCNMBSISX6	R-REMB-SIS-X6	

Fire Area 4 - Bus 1C Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SCNMBX0327	SCNMBX0327	Z-REMA-LSX-0327	
	SCNMBX0328	SCNMBX0328	Z-REMA-LSX-0328	
	SCNMBX0329	SCNMBX0329	Z-REMA-LSX-0329	
	SCNMBX0330	SCNMBX0330	Z-REMA-LSX-0330	
	SCNMBY0327	SCNMBY0327	Z-REMA-LSY-0327	
	SCNMBY0328	SCNMBY0328	Z-REMA-LSY-0328	
	SCNMBY0329	SCNMBY0329	Z-REMA-LSY-0329	
	SCNMBY0330	SCNMBY0330	Z-REMA-LSY-0330	
	SCSMA52206	SCSMA52206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMB206	SCSMB206	L-HSMB-HS-206	
	SCSMB207C1	SCSMB207C1	G-CSMB-42-207CS1	
	SCSMB207C2	SCSMB207C2	G-CSMB-42-207CS1	
	SH117	SCSMB1571	H-CSMB-42-157CS1	
	SH135	SCSMB2371	H-CSMB-42-237CS1	
	SH157	SCSMB1511	H-CSMB-42-151CS1	
	SH175	SCSMB2411	H-CSMB-42-241CS1	
	SH194	SHSMB3037A	-	Flow path not modeled in PSAR2
	SH207	SHSMB3018A	-	Flow path not modeled in PSAR2
	SH25	SCSMB1371	H-CSMB-42-137CS1	
	SH49	SCSMB2611	H-CSMB-42-261CS1	
	SH77	SCSMB1971	H-CSMB-42-197CS1	
	SH95	SCSMB2571	H-CSMB-42-257CS1	
	SHSMB3018A	SHSMB3018A	-	Flow path not modeled in PSAR2
	SHSMB3018B	SHSMB3018B	-	Flow path not modeled in PSAR2
	SHSMB3025B	SHSMB3025B	L-HSMB-HS-3025B	
	SHSMB3059A	SHSMB3059A	-	Failure to close failure mode not modeled in PSAR2
	SHSMB3059B	SHSMB3059B	-	Failure to close failure mode not modeled in PSAR2
	SKVMA3018	SKVMA3018	-	Flow path not modeled in PSAR2
	SKVMB3029A	SKVMB3029A	Z-KVMB-SV-3029A	
	SKVMB3030A	SKVMB3030A	Z-KVMB-SV-3030A	
	SKVMB3059	SKVMB3059	-	Failure to close failure mode not modeled in PSAR2
	SL54	SCSMB1411	L-HSMB-HS-141-1	
	SL64	SCSMB1471	L-HSMB-HS-147-1	
	SL74	SCSMB2471	L-REMB-42-247	
	SL84	SCSMB2511	L-REMB-42-251	
	SLSMA0327	SLSMA0327	Z-LSMA-LS-0327	
	SLSMA0328	SLSMA0328	Z-LSMA-LS-0328	
	SLSMA0329	SLSMA0329	Z-LSMA-LS-0329	
	SLSMA0330	SLSMA0330	Z-LSMA-LS-0330	
	SPBMB1-2	SPBMB1-2	-	manual initiation of sis relays not modeled in PSAR2
	SPCMT102A	SPCMT102A	P-DCPO-PS-0102A	

Fire Area 4 - Bus 1C Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SPCMT102C	SPCMT102C	P-DCPO-PS-0102C	
	SPMME67A	SPMME67A	L-PMME-P-67A	
	SREMAX0327	SREMAX0327	Z-REMA-LSX-0327	
	SREMAX0328	SREMAX0328	Z-REMA-LSX-0328	
	SREMAX0329	SREMAX0329	Z-REMA-LSX-0329	
	SREMAX0330	SREMAX0330	Z-REMA-LSX-0330	
	SREMAY0327	SREMAY0327	Z-REMA-LSY-0327	
	SREMAY0328	SREMAY0328	Z-REMA-LSY-0328	
	SREMAY0329	SREMAY0329	Z-REMA-LSY-0329	
	SREMAY0330	SREMAY0330	Z-REMA-LSY-0330	
	SREMB127-O	SREMB127-O	G-REMB-42-127	
	SREMBR-191	SREMBR-191	-	auto start of P-56B no longer modeled in PSAR2
	SREMBR-287	SREMBR-287	-	auto start of P-56A no longer modeled in PSAR2
	SREMBSIS2	SREMBSIS2	R-REMB-SIS-2	
	SREMBSIS6	SREMBSIS6	R-REMB-SIS-6	
	SREMBSIS8	SREMBSIS8	R-REMB-SIS-8	
	SREMBSISX6	SREMBSISX6	R-REMB-SIS-X6	
	SREMBSISX8	SREMBSISX8	R-REMB-SIS-X8	
	SSD30	SLMMB24395	L-REMB-42-2439	
	SSD31	SQSMB2439	L-REMB-42-2439	
	SSD40	SLMMB23395	L-REMB-42-2339	
	SSD41	SQSMB2339	L-REMB-42-2339	
	SU11	SHSMB3029A	-	Manual operation of CV-3029 not in PSAR2
	SU28	SHSMB3030A	-	Manual operation of CV-3029 not in PSAR2
	UCSMB205	UCSMB205	-	manual start of SWS pumps not modeled in PSAR2
	V22	VCSMB131	-	ESF room cooling no longer modeled
	V25	VCSMB211	-	ESF room cooling no longer modeled
	V48	VCSMB133	-	ESF room cooling no longer modeled
	V51	VCSMB221	-	ESF room cooling no longer modeled
	ZCNMB34610	ZCNMB34610	R-CEPO-MC-34R106	
	ZCNMB3463	ZCNMB3463	R-CEPO-MC-34R105	
	ZCNMB3468	ZCNMB3468	R-CEPO-MC-34R106	
	ZPSMB81A1	ZPSMB81A1	R-PSMB-PS-1801A1	
	ZPSMB81A2	ZPSMB81A2	R-PSMB-PS-1801A2	
	ZPSMB83A1	ZPSMB83A1	R-PSMB-PS-1803A1	
	ZPSMB83A2	ZPSMB83A2	R-PSMB-PS-1803A2	
	ZPSMB84A1	ZPSMB84A1	R-PSMB-PS-1804A1	
	ZPSMB84A2	ZPSMB84A2	R-PSMB-PS-1804A2	
	ZSEMT34-6	ZSEMT34-6	R-CEPO-MC-34R106	
EA-11	CCSMB1094	CCSMB1094	-	manual start of CCW pumps not modeled in PSAR2
	CCSMB1164	CCSMB1164	-	manual start of CCW pumps not modeled in PSAR2

Fire Area 4 - Bus 1C Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	DFUDK1105A	DFUDK1105A	D-FUMK-B1105-1	
	DFUDK1106A	DFUDK1106A	D-FUMK-B1106-1	
	IST-140	PC1MCY3003	P-C1MC-EY-30-03	
	IST-141	SCNMBSISX1	R-REMB-SIS-X1	
	IST-142	SCNMBSISX3	R-REMB-SIS-X3	
	IST-146	SCNMASIS5	R-REMB-SIS-5	
	IST-158	PCNMB107AB	-	shutdown sequencer not modeled in PSAR2
	IST-158	PCNMB107AB	-	shutdown sequencer not modeled in PSAR2
	IST-159	DFUDK1107A	D-FUMK-A1107-1	
	IST-159	DFUDK1107A	D-FUMK-A1107-1	
	IST-159	DFUDK1107A	D-FUMK-A1107-1	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-19	ACNMC62-2A	A-REMD-62-2P8A	
	IST-19	ACNMC62-2A	A-REMD-62-2P8A	
	IST-20	AMLMACHA	A-CEPO-AFAS-MODA	
	IST-257	DCBDC72101	D-CBMC-72-101	
	IST-300	DFUMK1111A	D-FUMK-A1111-1	
	IST-307	PCBMCB-111	L-C2MB-152-111	
	IST-337	DFUMK1114A	D-FUMK-A1114-1	
	IST-338	DFUMK1112A	D-FUMK-A1112-1	
	IST-340	PCNMC52112	S-REMB-144-112	
	IST-341	PCNMC52114	S-REMB-144-114	
	IST-346	DFUMK1113A	D-FUMK-A1113-1	
	IST-471	DCBDC72111	D-CBMC-72-111	
	IST-483	EDGME11	E-DGME-K-6A	
	IST-486	PCBMBB-106	P-CBMB-152-106	
	IST-490	DCBDC72308	D-CBMC-72-308	
	IST-490	DCBDC72308	D-CBMC-72-308	
	IST-491	PREMB1275	P-CBMB-152-106	
	IST-500	DFUDK1303A	D-FUMK-A1303-1	
	IST-509	EKVMA1470	E-KVMB-SV-1470	
	IST-53	CCSMD1092	C-CSMD-152-109CS	
	IST-55	CCSMD1162	C-CSMD-152-116CS	
	IST-6	ACNMDSX741	A-REMD-PSX-0741	
	IST-63	CCVMA0944	C-CVMA-CK-CC944	
	IST-75	DFUMKA1103	D-FUMK-A1103-1	
	IST-84	UCNMB44103	U-REMB-144-103	
	PB1MKBUS1C	PB1MKBUS1C	P-B1MK-EA-11	
	PCBMAB-105	PCBMAB-105	P-CBMA-152-105	
	PCBMAB-106	PCBMAB-106	P-CBMA-152-106	
	PCBMBB-111	PCBMBB-111	L-C2MB-152-111	
	PREMB1271	PREMB1271	P-REMA-127-1	

Fire Area 4 - Bus 1C Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	PREMB271X1	PREMB271X1	P-REMB-127-1-X1	
	PREMB271X2	PREMB271X2	P-REMB-127-1-X2	
	PREMB38311	PREMB38311	P-REMB-383-11	
	SCNMA43111	SCNMA43111	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCNMBSISX5	SCNMBSISX5	R-REMB-SIS-X5	
	SCSMA52111	SCSMA52111	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMB111	SCSMB111	L-HSMB-HS-111	
	SCSMB112	SCSMB112	S-CSMB-152-112CS	
	SCSMB114	SCSMB114	S-CSMB-152-114CS	
	SH314A	SCSMB113	H-CSMB-152-113CS	
	SPBMB1-1	SPBMB1-1	-	manual initiation of sis relays not modeled in PSAR2
	SPMME67B	SPMME67B	L-PMME-P-67B	
	SREMBSIS1	SREMBSIS1	R-REMB-SIS-1	
	SREMBSIS5	SREMBSIS5	R-REMB-SIS-5	
	SREMBSISX5	SREMBSISX5	R-REMB-SIS-X5	
	SREMBSISX7	SREMBSISX7	R-REMB-SIS-X7	
	UCSMB103	UCSMB103	-	manual start of SWS pumps not modeled in PSAR2
	UPSMB1318	UPSMB1318	U-PSMB-PS-1318	
	UPSMB1325	UPSMB1325	U-PSMB-PS-1325	
	ZCNMB34510	ZCNMB34510	R-CEPO-MC-34L105	
	ZCNMB3453	ZCNMB3453	R-CEPO-MC-34L105	
	ZCNMB3455	ZCNMB3455	R-CEPO-MC-34L106	
	ZCNMB3459	ZCNMB3459	R-CEPO-MC-34L105	
	ZSEMT34-5	ZSEMT34-5	R-CEPO-MC-34L105	
ED-11A	DCB7218MOD	DCBMC72018	D-CBMC-72-18	
	DFUDKD11A	DFUDKD11A	D-FUMK-D018-1	
	DFUMKD11A	DFUMKD11A	D-FUMK-D018-1	
	IST-490	DCBDC72308	D-CBMC-72-308	
EJ-9400	DFUDK1105A	DFUDK1105A	D-FUMK-B1105-1	
	DFUDK1106A	DFUDK1106A	D-FUMK-B1106-1	
	IST-159	DFUDK1107A	D-FUMK-A1107-1	
	IST-159	DFUDK1107A	D-FUMK-A1107-1	
	IST-160	DCBDC72136	D-CBMC-72-136	
	IST-257	DCBDC72101	D-CBMC-72-101	
	IST-471	DCBDC72111	D-CBMC-72-111	
	IST-486	PCBMBB-106	P-CBMB-152-106	
	IST-490	DCBDC72308	D-CBMC-72-308	
	IST-491	PREMB1275	P-CBMB-152-106	
	IST-500	DFUDK1303A	D-FUMK-A1303-1	
	PCBMAB-105	PCBMAB-105	P-CBMA-152-105	
	PCBMAB-106	PCBMAB-106	P-CBMA-152-106	

Fire Area 4 - Bus 1C Switchgear

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	PREMB1271	PREMB1271	P-REMA-127-1	
	PREMB271X1	PREMB271X1	P-REMB-127-1-X1	
	PREMB271X2	PREMB271X2	P-REMB-127-1-X2	
	PREMB38311	PREMB38311	P-REMB-383-11	

Fire Area 13A1 - Aux Building Corridor

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
Exposure Fire	C517	CPSMB0918	C-PSMB-PS-0918	
	CCSMB1164	CCSMB1164	-	manual start of P52c not modeled in PSAR2
	CCSMB2084	CCSMB2084	-	manual start of P52c not modeled in PSAR2
	CHP46	ZPSMT81A	R-PSMT-PS-1801A	
	CHP50	ZPSMT83A	R-PSMT-PS-1803A	
	CHSMB0910	CHSMB0910	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CHSMB0911	CHSMB0911	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CHSMB0940	CHSMB0940	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CREMBEX5P4	CREMBEX5P4	R-REMB-5P-4	
	DFUMK1206A	DFUMK1206A	D-FUMK-A1206-1	
	DFUMKS09	DFUMKS09	D-FUMK-S09-1	
	DFUMKS10	DFUMKS10	D-FUMK-S10-1	
	DFUMKS13A	DFUMKS13A	D-FUMK-S13-2	
	DFUMKS14A	DFUMKS14A	D-FUMK-S14-2	
	GCNMBHPX1L	GCNMBHPX1L	S-AVMA-CV-3002	
	GREMB5P8	GREMB5P8	R-REMB-5P-8	
	HC6A-MST	HHSMB771	-	manual start of compressors not modeled in PSAR2
	HC6B-MST	HHSMB811	-	manual start of compressors not modeled in PSAR2
	IST-1	ACNMD23P8C	A-REMD-62-3P8C	
	IST-100	ICMME2C	I-CMME-C-2C	
	IST-101	ICMMTC2C	I-CMME-C-2C	
	IST-102	ICMME2A	I-CMME-C-2A	
	IST-104	ICSMB1207	I-C2MB-52-1207	
	IST-105	ICNMBCR4	I-REMB-CR-4	
	IST-109	ICMMTC2A	I-CMME-C-2A	
	IST-114	HADMTM9B	Q-ADMK-M-9B	
	IST-121	HADMTM9A	Q-ADMK-M-9A	
	IST-131	HPSMB0440	Q-PSMB-PS-0440	
	IST-133	HPSMB0442	Q-PSMB-PS-0442	
	IST-143	SREMBX161	G-REMB-42-161	
	IST-152	ZPSMA821	R-PSMA-PS1802SW1	
	IST-156	ZPSMA811	R-PSMA-PS1801SW1	
	IST-157	ZPSMA831	R-PSMA-PS1803SW1	
	IST-161	PCNMB213AB	P-CBMB-152-213	
	IST-163	DCBDC72238	D-CBMC-72-236	
	IST-180	MAEMTHOGGR	M-AEMT-C-4	
	IST-192	DCBMC72119	D-CBMC-72-119	
	IST-273	BMVMA2169	G-MVMA-MO-2169	
	IST-275	SCSMB127C1	G-CSMB-42-127CS1	
	IST-276	SCSMB187C1	G-CSMB-42-187CS1	

Fire Area 13A1 - Aux Building Corridor

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-278	BMVMA2140	G-MVMA-MO-2140	
	IST-280	SCSMB227C1	G-CSMB-42-227CS1	
	IST-281	BMVMA2170	G-MVMA-MO-2170	
	IST-283	PCBMCC-131	-	ESF room cooling no longer modeled
	IST-284	PCBMCC-211	-	ESF room cooling no longer modeled
	IST-285	VTSFC1850	-	ESF room cooling no longer modeled
	IST-286	VTSFC1851	-	ESF room cooling no longer modeled
	IST-288	PCBMCC-133	-	ESF room cooling no longer modeled
	IST-289	PCBMCC-221	-	ESF room cooling no longer modeled
	IST-290	VTSFC1857	-	ESF room cooling no longer modeled
	IST-291	VTSFC1858	-	ESF room cooling no longer modeled
	IST-295	PCBMCC-251	L-C2MC-52-251	
	IST-296	PCBMCC-147	L-C2MC-52-147	
	IST-297	PCBMCC-247	L-C2MC-52-247	
	IST-300	DFUMK1111A	D-FUMK-A1111-1	
	IST-301	DFUMKS17A	D-FUMK-S17-1	
	IST-305	PCBMCB-206	L-C2MB-152-206	
	IST-306	SAVMA3029	Z-AVMA-CV-3029	
	IST-307	PCBMCB-111	L-C2MB-152-111	
	IST-308	HPVMD3030B	Q-PVMD-PCV-3030B	
	IST-309	SMVMA3199	L-MVMA-MO-3199	
	IST-310	SMVMA3190	L-MVMA-MO-3190	
	IST-311	SCNMBX147	L-REMB-42X-147	
	IST-312	SCNMBX247	L-REMB-42X-247	
	IST-313	SCNMBX251	L-REMB-42X-251	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-318	SHCMT3025A	L-HCMT-HIC-3025A	
	IST-328	PCBMCC-141	L-C2MC-52-141	
	IST-329	SCNMBX141	L-REMB-42X-141	
	IST-330	PBSMTMCC24	P-B2MK-EB-24	
	IST-331	PBSMTMCC23	P-B2MK-EB-23	
	IST-335	GCNMA5P8	R-REMB-5P-8	
	IST-339	GCNMB5P8	R-REMB-5P-8	
	IST-345	PB2MKMCC23	P-B2MK-EB-23	
	IST-347	HFLMK3037	-	Flow path not modeled in PSAR2
	IST-348	PB2MKMCC22	P-B2MK-EB-22	
	IST-350	HFLMK3018	-	Flow path not modeled in PSAR2
	IST-351	PCBMCC-137	H-C2MC-52-137	
	IST-352	PCBMCC-197	H-C2MC-52-197	
	IST-353	PCBMCC-157	H-C2MC-52-157	
	IST-354	PCBMCC-151	H-C2MC-52-151	
	IST-355	PCBMCC-261	H-C2MC-52-261	

Fire Area 13A1 - Aux Building Corridor

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-356	PCBMCC-257	H-C2MC-52-257	
	IST-357	PCBMCC-237	H-C2MC-52-237	
	IST-358	PCBMCC-241	H-C2MC-52-241	
	IST-362	HFLMK3071	I-FLMK-F-321	
	IST-363	HFLMK3070	I-FLMK-F-319	
	IST-391	DFUMKS55B	D-FUMK-S55-2	
	IST-392	PCBMCC5221	H-REMT-3072IC	
	IST-395	PCBMCC1205	G-C2MC-52-1205	
	IST-396	SC2MCC-161	G-C2MC-52-161	
	IST-397	SCNMA0101	G-C2MC-52-1206	
	IST-398	DFUMKB1105	D-FUMK-B1105-1	
	IST-399	PCBMC52207	G-C2MC-52-207	
	IST-400	DFUMK72205	D-FUMK-B1205-1	
	IST-401	PCBMB1206	G-C2MB-52-1206	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-404	SCNMBA0101	-	Auto start of P55B not modeled
	IST-405	PCBMBC1105	G-C2MB-52-1105	
	IST-46	AFSMB0737	A-FSMA-FS-0737	
	IST-54	CCSMD2082	C-CSMD-152-208CS	
	IST-55	CCSMD1162	C-CSMD-152-116CS	
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-60	CAVMB0910	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-63	CCVMA0944	C-CVMA-CK-CC944	
	IST-65	CCVMA0943	C-CVMA-CK-CC943	
	IST-66	CAVMB0911	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-67	CAVMB0940	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-68	DFUMKS027A	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-69	UKVMA0801	-	Compressors no longer require SW cooling
	IST-70	UKVMA0803	-	Compressors no longer require SW cooling
	IST-74	PCBMCB-204	U-C2MC-152-204	
	IST-76	PCBMCB-205	P-CBMC-152-205	
	IST-77	DFUMKA1205	D-FUMK-A1205-1	
	IST-79	DFUMKA1204	D-FUMK-A1204-1	
	IST-82	SCNMA16-3	-	CV-1359 sis test contacts not modeled in PSAR2
	IST-98	DFUMKB1207	D-FUMK-B1207-1	
	IST-99	DFUMKB1106	D-FUMK-B1106-1	
	PC2MA1206	PC2MA1206	-	Alternate power source for charging pumps no longer modeled in PSAR2
	PCBMBB-111	PCBMBB-111	L-C2MB-152-111	
	PCBMBB-206	PCBMBB-206	L-C2MB-152-206	
	PCBMBC1103	PCBMBC1103	PCBMBC1103	

Fire Area 13A1 - Aux Building Corridor

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	PCBMBC1201	PCBMBC1201	P-C2MB-52-1201	
	PFUMKS04	PFUMKS04	P-FUMK-S04-1	
	PREMB5P8	PREMB5P8	R-REMB-5P-8	
	S42161MAN	SCSMB161CS	G-CSMB-42-161CS1	
	S55A-H	SCSMB1205	G-CSMB-52-1205CS	
	S55B-I	SCSMB1206	G-CSMB-52-1206CS	
	S55C-I	SCSMB1105	G-CSMB-52-1105CS	
	SCNMA43111	SCNMA43111	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCNMA43206	SCNMA43206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCNMBX0327	SCNMBX0327	Z-REMA-LSX-0327	
	SCNMBX0328	SCNMBX0328	Z-REMA-LSX-0328	
	SCNMBX0329	SCNMBX0329	Z-REMA-LSX-0329	
	SCNMBY0327	SCNMBY0327	Z-REMA-LSY-0327	
	SCNMBY0328	SCNMBY0328	Z-REMA-LSY-0328	
	SCNMBY0329	SCNMBY0329	Z-REMA-LSY-0329	
	SCSMA52111	SCSMA52111	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMA52206	SCSMA52206	-	blocking LPSI trip on RAS not modeled in PSAR2
	SCSMB111	SCSMB111	L-HSMB-HS-111	
	SCSMB206	SCSMB206	L-HSMB-HS-206	
	SCSMB207C1	SCSMB207C1	G-CSMB-42-207CS1	
	SCSMB207C2	SCSMB207C2	G-CSMB-42-207CS1	
	SH117	SCSMB1571	H-CSMB-42-157CS1	
	SH135	SCSMB2371	H-CSMB-42-237CS1	
	SH157	SCSMB1511	H-CSMB-42-151CS1	
	SH175	SCSMB2411	H-CSMB-42-241CS1	
	SH194	SHSMB3037A	-	Flow path not modeled in PSAR2
	SH207	SHSMB3018A	-	Flow path not modeled in PSAR2
	SH25	SCSMB1371	H-CSMB-42-137CS1	
	SH49	SCSMB2611	H-CSMB-42-261CS1	
	SH77	SCSMB1971	H-CSMB-42-197CS1	
	SH95	SCSMB2571	H-CSMB-42-257CS1	
	SHSMB3018A	SHSMB3018A	-	Flow path not modeled in PSAR2
	SHSMB3018B	SHSMB3018B	-	Flow path not modeled in PSAR2
	SHSMB3025B	SHSMB3025B	L-HSMB-HS-3025B	
	SHSMB3059A	SHSMB3059A	-	Failure to close failure mode not modeled in PSAR2
	SHSMB3059B	SHSMB3059B	-	Failure to close failure mode not modeled in PSAR2
	SKVMA3018	SKVMA3018	-	Flow path not modeled in PSAR2
	SKVMB3029A	SKVMB3029A	Z-KVMB-SV-3029A	
	SKVMB3030A	SKVMB3030A	Z-KVMB-SV-3030A	
	SKVMB3059	SKVMB3059	-	Failure to close failure mode not modeled in PSAR2

Fire Area 13A1 - Aux Building Corridor

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	SL54	SCSMB1411	L-HSMB-HS-141-1	
	SL64	SCSMB1471	L-HSMB-HS-147-1	
	SL74	SCSMB2471	L-REMB-42-247	
	SL84	SCSMB2511	L-REMB-42-251	
	SLSMA0327	SLSMA0327	Z-LSMA-LS-0327	
	SLSMA0328	SLSMA0328	Z-LSMA-LS-0328	
	SLSMA0329	SLSMA0329	Z-LSMA-LS-0329	
	SPMME67A	SPMME67A	L-PMME-P-67A	
	SPMME67B	SPMME67B	L-PMME-P-67B	
	SREMAX0327	SREMAX0327	Z-REMA-LSX-0327	
	SREMAX0328	SREMAX0328	Z-REMA-LSX-0328	
	SREMAX0329	SREMAX0329	Z-REMA-LSX-0329	
	SREMAY0327	SREMAY0327	Z-REMA-LSY-0327	
	SREMAY0328	SREMAY0328	Z-REMA-LSY-0328	
	SREMAY0329	SREMAY0329	Z-REMA-LSY-0329	
	SREMB127-O	SREMB127-O	G-REMB-42-127	
	SSD30	SLMMB24395	L-REMB-42-2439	
	SSD31	SQSMB2439	L-REMB-42-2439	
	SSD40	SLMMB23395	L-REMB-42-2339	
	SSD41	SQSMB2339	L-REMB-42-2339	
	SU11	SHSMB3029A	-	Manual operation of CV-3029 not in PSAR2
	SU28	SHSMB3030A	-	Manual operation of CV-3030 not in PSAR2
	UCSMB204	UCSMB204	-	manual start of SWS pumps not modeled in PSAR2
	UCSMB205	UCSMB205	-	manual start of SWS pumps not modeled in PSAR2
	V22	VCSMB131	-	ESF room cooling no longer modeled
	V25	VCSMB211	-	ESF room cooling no longer modeled
	V48	VCSMB133	-	ESF room cooling no longer modeled
	V51	VCSMB221	-	ESF room cooling no longer modeled
	ZPSMB81A1	ZPSMB81A1	R-PSMB-PS-1801A1	
	ZPSMB81A2	ZPSMB81A2	R-PSMB-PS-1801A2	
	ZPSMB83A1	ZPSMB83A1	R-PSMB-PS-1803A1	

Fire Area 13A2 - Aux Building Corridor

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
Exposure Fire	CHSMB0910	CHSMB0910	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CHSMB091ire1	CHSMB0911	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	GCNMBHPX1L	GCNMBHPX1L	S-AVMA-CV-3002	
	IST-273	BMVMA2169	G-MVMA-MO-2169	
	IST-274	BCVMA2138	G-PMME-P-56A	
	IST-275	SCSMB127C1	G-CSMB-42-127CS1	
	IST-276	SCSMB187C1	G-CSMB-42-187CS1	
	IST-277	42-2425/CS	G-CSMB-42-287CS	
	IST-279	BCVMA2139	G-PMME-P-56Bure	
	IST-281	BMVMA2170	G-MVMA-MO-2170	
	IST-301	DFUMKS17A	D-FUMK-S17-1	
	IST-318	SHCMT3025A	L-HCMT-HIC-3025A	
	IST-397	SCNMA0101	G-C2MC-52-1206	
	IST-398	DFUMKB1105	D-FUMK-B1105-1	
	IST-401	PCBMB1206	G-C2MB-52-1206	
	IST-402	PC2MA1105C	G-C2MC-52-1105C	
	IST-405	PCBMBC1105	G-C2MB-52-1105	
	IST-60	CAVMB0910	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	IST-66	CAVMB0911	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	IST-68	DFUMKS027A	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	IST-82	SCNMA16-3	-	CV-1359 sis test contacts not modeled in PSAR2
	PC2MA1206	PC2MA1206	-	Bus 11 is not an alternate power source for Bus 12 in PSAR2
	S55B-I	SCSMB1206	G-CSMB-52-1206CS	
	S55C-I	SCSMB1105	G-CSMB-52-1105CS	
	SCBA19A	SCSMB42191	G-CSMB-42-191CS	
	SHSMB3025B	SHSMB3025B	L-HSMB-HS-3025B	
	SREMB127-O	SREMB127-O	G-REMB-42-127	
	SREMBR-191	SREMBR-191	-	auto start of P-56B no longer modeled in PSAR2
	SREMBR-287	SREMBR-287	-	auto start of P-56A no longer modeled in PSAR2

Fire Area 23B - East Turbine Building

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
Exposure Fire	A38	AKVMA0522G	A-KVMA-SV-0522G	
	AHSMB0522B	AHSMB0522B	A-HSMB-HS-0522B	
	CHSMB0910	CHSMB0910	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	CHSMB0911	CHSMB0911	-	Isolation of loss of CCW inside containment not modeled in PSAR2
	DC6	DCBMC72112	P-CBMA-152-106	
	DFUDK1302A	DFUDK1302A	-	Backfeed power to Bus 1C,D&E not modeled in PSAR2
	DFUMKW001A	DFUMKW001A	D-FUMK-W001-1	
	DFUMKW002A	DFUMKW002A	D-FUMK-W002-1	
	DFUMKW006D	DFUMKW006D	D-FUMK-W006-1	
	G113B	GCNMA386A8	-	This relay must energize to cause ADVs to open (the TBV solenoids must spuriously energize to open valve)
	G322B	GCNMA386A3	-	This relay must energize to cause ADVs to open
	G332B	GCNMA386A5	-	This relay must energize to cause ADVs to open
	GEPMT0511	GEPMT0511	B-EPMT-EP-0511	
	GHSMB0501A	GHSMB0501A	-	No credit for manual closure of MSIVs
	GHSMB0510A	GHSMB0510A	-	No credit for manual closure of MSIVs
	GKVMA0508	GKVMA0508	M-KVMB-SV-0508	
	GKVMA0514	GKVMA0514	M-KVMB-SV-0514	
	GKVMB0502	GKVMB0502	M-KVMB-SV-0502	
	GKVMB0505A	GKVMB0505A	M-KVMB-SV-0505A	
	GKVMB0505B	GKVMB0505B	M-KVMB-SV-0505B	
	GKVMB0513	GKVMB0513	M-KVMB-SV-0513	
	GPCMT0511	GPCMT0511	B-PCMT-PIC-0511	
	GSCMT0511	GSCMT0511	B-CEPO-PM-0511	
	I15A	IRVMB1200	I-RVMC-RV-1200	
	I15B	IRVMB1204	I-RVMC-RV-1204	
	I15C	IRVMB1202	I-RVMC-RV-1202	
	ICNMAK24	ICNMAK24	I-CMME-C-2B	
	ICNMBK21	ICNMBK21	I-CMME-C-2B	
	ICNMBK22	ICNMBK22	I-CMME-C-2B	
	IFUMKF3	IFUMKF3	I-CMME-C-2B	
	IREMBK22	IREMBK22	I-CMME-C-2B	
	IREMBK24	IREMBK24	I-CMME-C-2B	
	IST-100	ICMME2C	I-CMME-C-2C	
	IST-101	ICMMTC2C	I-CMME-C-2C	
	IST-102	ICMME2A	I-CMME-C-2A	
	IST-103	ICNMAK22	I-CMME-C-2C	
	IST-104	ICSMB1207	I-C2MB-52-1207	
	IST-105	ICNMBCR4	I-REMB-CR-4	

Fire Area 23B - East Turbine Building

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-106	ICNMCK23	I-CMME-C-2B	
	IST-107	ICNMBK23	I-CMME-C-2B	
	IST-109	ICMMTC2A	I-CMME-C-2A	
	IST-11	FAVMC0729	-	CST makeup from hotwell not modeled
	IST-117	HADMTM9C	Q-ADMK-M-9C	
	IST-134	PB2MKMCC4	P-B2MK-EB-04	
	IST-15	AAVMA0521	-	TDAFW pump no longer gets steam from SGB
	IST-17	AHSMB0102A	A-HSMB-HS-0102A	
	IST-174	XAVMA2008	-	T-81 no longer modeled as redundant to other CST makeup sources
	IST-175	PB2MKBUS91	P-B2MK-EB-91	
	IST-176	XAVMA2010	A-AVMA-CV-2010	
	IST-177	PBSMTL03	P-BSMK-EL-22	
	IST-179	MCNMB42615	M-REMB-52-615	
	IST-18	AKVMA0522B	A-KVMB-SV-0522B	
	IST-180	MAEMTHOGGR	M-AEMT-C-4	
	IST-183	GMVMA0510	M-HSMB-0510C	
	IST-184	GHSMB0510C	M-HSMB-0510C	
	IST-185	PB2MKMCC3	P-B2MK-EB-03	
	IST-187	GMVMA0501	-	SGB no longer supplies steam to TDAFW
	IST-188	GHSMB0501C	-	SGB no longer supplies steam to TDAFW
	IST-190	DCBDC72104	D-CBMC-72-104	
	IST-191	DCBDC72207	D-CBMC-72-207	
	IST-192	DCBMC72119	D-CBMC-72-119	
	IST-198	GKVMA0507B	M-KVMB-SV-0507B	
	IST-199	GKVMA0507A	M-KVMB-SV-0507A	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-228	GAVMA0511	B-AVMA-CV-0511	
	IST-252	FCSMC105	M-CSMB-252-105CS	
	IST-253	FCSMB205	M-CBMB-252-205	
	IST-257	DCBDC72101	D-CBMC-72-101	
	IST-259	DCBDC72201	D-CBMC-72-201	
	IST-296	PCBMCC-147	L-C2MC-52-147	
	IST-30	AFSMB0727A	A-FSMA-FS-0727A	
	IST-31	AFSMB0749A	A-FSMA-FS-0749A	
	IST-311	SCNMBX147	L-REMB-42X-147	
	IST-314	PCBMCC-167	L-C2MC-52-167	
	IST-328	PCBMCC-141	L-C2MC-52-141	
	IST-329	SCNMBX141	L-REMB-42X-141	
	IST-345	PB2MKMCC23	P-B2MK-EB-23	
	IST-351	PCBMCC-137	H-C2MC-52-137	
	IST-352	PCBMCC-197	H-C2MC-52-197	
	IST-353	PCBMCC-157	H-C2MC-52-157	

Fire Area 23B - East Turbine Building

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-354	PCBMCC-151	H-C2MC-52-151	
	IST-366	PCBMBC1305	F-C2MC-52-1305	
	IST-369	QCXMTC1305	F-C2MC-P-9ALOCAL	
	IST-371	QCNMBPS2	F-PSMB-PS-1310	
	IST-374	QCNMBP41PS	F-PSMB-PS-5350	
	IST-40	APSMD0741A	A-PSMD-PS-0741A	
	IST-403	PCBMB1206B	D-FUMK-B1206-1	
	IST-406	PCBMBC105B	D-FUMK-B1105-1	
	IST-41	APSMD0741B	A-PSMD-PS-0741B	
	IST-42	APSMD741DD	A-PSMD-PS-0741DD	
	IST-43	PC1MCY1014	P-C1MC-EY-10-14	
	IST-491	PREMB1275	P-CBMD-152-106	
	IST-498	PREMB1276	P-CBMA-152-202	
	IST-500	DFUDK1303A	D-FUMK-A1303-1	
	IST-501	PCBMBB-302	-	backfeed power not modeled in PSAR2.
	IST-502	PCBMAB-302	P-CBMA-152-302	
	IST-503	PCBMCC2111	-	Battery room ventilation not needed in PSAR2
	IST-504	PCBMCC2411	-	Battery room ventilation not needed in PSAR2
	IST-516	PGNMTMAIN	-	Main xfrmr not modeled in PSAR2
	IST-519	PCNMD52402	P-CBMA-252-401	
	IST-57	CAVMA0918	-	Makeup to CCW not modeled
	IST-60	CAVMB0910	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-66	CAVMB0911	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-68	DFUMKS027A	-	Isolation of CCW leaks inside containment not modeled in PSAR2
	IST-69	UKVMA0801	-	Compressors no longer require SWS
	IST-70	UKVMA0803	-	Compressors no longer require SWS
	IST-98	DFUMKB1207	D-FUMK-B1207-1	
	IST-99	DFUMKB1106	D-FUMK-B1106-1	
	ISWFCS3	ISWFCS3	-	Failure of logic to unload compressor and prevent RV actuation not modeled in PSAR2
	P252B	PCNMB303CS	-	Manual trip of CB-152-302 not modeled in PSAR2
	PBS1F-08	PCNMB1FCS	-	No manual actuation of 252-302 modeled in PSAR2
	PBS1G-08	PCNMB1GCS	-	No manual actuation of 252-402 modeled in PSAR2
	PCSMBA-301	PCSMBA-301	P-CBMA-252-301	
	PREMB38311	PREMB38311	P-REMB-383-11	
	PREMB38312	PREMB38312	P-REMB-383-12	
	PREMB38323	PREMB38323	P-REMB-383-23	
	PREMB8612	PREMB8612	-	Circuitry for 152-202 failing to trip not modeled in PSAR2
	PREMB8612X	PREMB8612X	-	Circuitry for 152-106 failing to trip not modeled in PSAR2

Fire Area 23B - East Turbine Building

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	QCNMB5TR1C	QCNMB5TR1C	F-PSMB-PS-1310	
	SH117	SCSMB1571	H-CSMB-42-157CS1	
	SH157	SCSMB1511	H-CSMB-42-151CS1	
	SH25	SCSMB1371	H-CSMB-42-137CS1	
	SH77	SCSMB1971	H-CSMB-42-197CS1	
	SL54	SCSMB1411	L-HSMB-HS-141-1	
	SL64	SCSMB1471	L-HSMB-HS-147-1	
	X32	XCNMB9631A	A-PBMC-PB-P936	
	X33	XHSMB8950A	A-HSMC-HS-8950A	

Fire Area 23D - West Turbine Building

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
Exposure Fire	A38	AKVMA0522G	A-KVMA-SV-0522G	
	AHSMB0522B	AHSMB0522B	A-HSMB-HS-0522B	
	DFUMKW001A	DFUMKW001A	D-FUMK-W001-1	
	DFUMKW006D	DFUMKW006D	D-FUMK-W006-1	
	G113B	GCNMA386A8	-	This relay must energize to cause ADVs to open (the TBV solenoids must spuriously energize to open valve)
	G322B	GCNMA386A3	-	This relay must energize to cause ADVs to open
	G332B	GCNMA386A5	-	This relay must energize to cause ADVs to open
	GEPMT0511	GEPMT0511	B-EPMT-EP-0511	
	GHSMB0510A	GHSMB0510A	-	No credit for manual closure of MSIVs
	GKVMB0505A	GKVMB0505A	M-KVMB-SV-0505A	
	GKVMB0505B	GKVMB0505B	M-KVMB-SV-0505B	
	GPCMT0511	GPCMT0511	B-PCMT-PIC-0511	
	GSCMT0511	GSCMT0511	B-CEPO-PM-0511	
	IST-11	FAVMC0729	-	No longer considered a condensate flow diversion path
	IST-117	HADMTM9C	Q-ADMK-M-9C	
	IST-14	AAVMA0522B	A-AVMA-CV-0522B	
	IST-15	AAVMA0521	-	TDAFW pump no longer gets steam from SGB
	IST-17	AHSMB0102A	A-HSMB-HS-0102A	
	IST-174	XAVMA2008	-	T-81 no longer modeled as redundant to other CST makeup sources
	IST-175	PB2MKBUS91	P-B2MK-EB-91	
	IST-176	XAVMA2010	A-AVMA-CV-2010	
	IST-179	MCNMB42615	M-REMB-52-615	
	IST-18	AKVMA0522B	A-KVMB-SV-0522B	
	IST-180	MAEMTHOGGR	M-AEMT-C-4	
	IST-189	IXVMD180CA	I-XVMD-MV-CA180	
	IST-190	DCBDC72104	D-CBMC-72-104	
	IST-191	DCBDC72207	D-CBMC-72-207	
	IST-196	FAVMA0730	M-AVMA-CV-0730	
	IST-198	GKVMA0507B	M-KVMB-SV-0507B	
	IST-199	GKVMA0507A	M-KVMB-SV-0507A	
	IST-203	GTPMT0510	B-TPMT-PT-0510	
	IST-228	GAVMA0511	B-AVMA-CV-0511	
	IST-252	FCSMC105	M-CSMB-252-105CS	
	IST-253	FCSMB205	M-CBMB-252-205	
	IST-364	PCBMB1306	U-PMME-P5	
	IST-366	PCBMBC1305	F-C2MC-52-1305	
	IST-369	QCXMTC1305	F-C2MC-P-9ALOCAL	
	IST-371	QCNMBPS2	F-PSMB-PS-1310	
	IST-374	QCNMBP41PS	F-PSMB-PS-5350	
	IST-40	APSMD0741A	A-PSMD-PS-0741A	

Fire Area 23D - West Turbine Building

Area/ Cabinet	BE/IST (Fire IPEEE)	Orig BE	New BE (PSAR2)	Comment
	IST-41	APSMD0741B	A-PSMD-PS-0741B	
	IST-42	APSMD741DD	A-PSMD-PS-0741DD	
	IST-43	PC1MCY1014	P-C1MC-EY-10-14	
	IST-516	PGNMTMAIN	-	Main xfrmr not modeled in PSAR2
	PCBMB1306	PCBMB1306	U-PMME-P5	
	QCNMB5TR1C	QCNMB5TR1C	F-PSMB-PS-1310	
	X32	XCNMB9631A	A-PBMC-PB-P936	
	X33	XHSMB8950A	A-HSMC-HS-8950A	

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Table A5.1, Modifications Made to Reflect Fire IPEEE Logic	
Gate	Description
A24-Fire	Local closure of P8C breaker
A47-Fire	Local closure of P8A breaker
A69A-Fire	Local opening of CV-0749
A89-Fire	Local opening of CV-0727
F39-Fire	Manual action to start fire pump 9A
F40-Fire	Manual action to start fire pump 9B
F52-Fire	Manual action to start fire pump P41
P106B4A-Fire	Local closure of fast transfer breaker 152-106
P202B4-Fire	Local closure of fast transfer breaker 152-202
U973-DGA-Fire	Local closure of breaker to P7B
UGT020-Fire	Alignment of warm water recirc pump (parallel to traveling screens)
H334A-Fire	Local operation of MO-3070

Table A5.2, Modifications Made to Logic to Assure Correct Modeling of Plant Response to Fire Initiators	
Gate	Description
The following logic adds a house event to reflect that fire initiating events do not cause conditions that would generate an automatic SIS	
NONSISINT-Fire	Add HSE-FA-INIT as a flag to indicate that a non-SIS fire initiating event has occurred
The following four changes are directed at preventing a dual SG blowdown from disabling all flow paths to the SGs even though AFW is still available	
AHDR1-1-Fire	Disable ESDE failing flow path through CV-0749
AHDR2-1-Fire	Disable ESDE failing flow path through CV-0727
AHDR3-1-Fire	Disable ESDE failing flow path through CV-0736A
AHDR4-1-Fire	Disable ESDE failing flow path through CV-0737A
The following change disables logic that assumes HPSI flow diversion will occur on hot short of MO-3072 (it appears the flow diversion will be back to the PCS)	
H079-Fire	Disable HPSI flow diversion through MO-3072

Table A5.3, Modifications to Logic to Allow Evaluation of MOV Functions not Currently in the Models (not used in this analysis)	
Gate	Description
GS02-Fire	Add charging to PCS flow path through MO-3072
LSDC45-Fire	Add CK-3240 as means of preventing flow downstream of MO-3198 to SIRWT
LSDC57-Fire	Add CK-3239 as means of preventing flow downstream of MO-3189 to SIRWT
XADVA-FTO-Fire	Alignment of hogger as means of preventing demands on SGA SRVs
XESDE-DA1-Fire	Addition of TBV & ADVs on SGB as means of blowing down SGA
XESDE-DA2-Fire	Isolation of SGA including MO-0510 FTRC
X1001-FIRE	Operator action to trip closed CV-0510 locally (without credit for this action, MO-0510 would not be important as SGA MSIV would be failed open for many Fire Areas - see Ref 2.1.8).

Table A5.4, Modifications to credit local operation of MOVs (not used in this analysis)	
Gate	Description
G068-HSFire	Local operation of MO-2160
GCBA10-HSFire	Local operation of MO-2140
GS02-HSFire	Local operation of MO-3072
LLSDC-HSFire	Local operation of MO-3012
LLSDC56-HSFire	Local operation of MO-3010
LLSDC76-HSFire	Local operation of MO-3014
LLSDC86-HSFire	Local operation of MO-3008
LLSDC44-HSFire	Local operation of MO-3199
LLSDC46-HSFire	Local operation of MO-3198
LLSDC56-HSFire	Local operation of MO-3190
LLSDC57-HSFire	Local operation of MO-3189
XADVA-FTO7A-HSFire	Local operation of MO-0510
H111A1-Fire	Local operation of MO-3011
H151A1-Fire	Local operation of MO-3013
H19A1-Fire	Local operation of MO-3007
H801A1-Fire	Local operation of MO-3009
HH129A1-Fire	Local operation of MO-3064
HH169A1-Fire	Local operation of MO-3062
HH43A1-Fire	Local operation of MO-3068
HH89A1-Fire	Local operation of MO-3066

Table A5.5, Modifications Adding MOV Hot Short Failure Modes (not used in this analysis)	
Gate	Description
G068B-HSFire	Hot short of MO-2160
GCBA10B-HSFire	Hot short of MO-2140
GS02B-HSFire	Hot short of MO-3072
LLSDC66B-HSFire	Hot short of MO-3012
LLSDC56B-HSFire	Hot short of MO-3010
LLSDC76B-HSFire	Hot short of MO-3014
LLSDC86B-HSFire	Hot short of MO-3008
LSDC46-HSFire	Hot short of MO-3199
LSDC50-HSFire	Hot short of MO-3198
LSDC58-HSFire	Hot short of MO-3190
LSDC62-HSFire	Hot short of MO-3189
XADVA-FT08-HSFire	Hot short of MO-0510
H110-HSFire	Hot short of MO-3011
H150-HSFire	Hot short of MO-3013
H18-HSFire	Hot short of MO-3007
H800-HSFire	Hot short of MO-3009
HH128-HSFire	Hot short of MO-3064
HH168-HSFire	Hot short of MO-3062
HH42-HSFire	Hot short of MO-3068
HH88-HSFire	Hot short of MO-3066
CNT-22-LOOP1A-HPSI-HSFIRE	Hot short of MO-3068 leading to ISLOCA
CNT-22-LOOP1B-HPSI-HSFIRE	Hot short of MO-3066 leading to ISLOCA
CNT-22-LOOP2A-HPSI-HSFIRE	Hot short of MO-3064 leading to ISLOCA
CNT-22-LOOP2B-HPSI-HSFIRE	Hot short of MO-3062 leading to ISLOCA
CNT-23-LOOP1A-HPSI-HSFIRE	Hot short of MO-3007 leading to ISLOCA
CNT-23-LOOP1B-HPSI-HSFIRE	Hot short of MO-3009 leading to ISLOCA
CNT-23-LOOP2A-HPSI-HSFIRE	Hot short of MO-3011 leading to ISLOCA
CNT-23-LOOP2B-HPSI-HSFIRE	Hot short of MO-3013 leading to ISLOCA
CNT-32-LOOP1A-LPSI-HSFIRE	Hot short of MO-3008 leading to ISLOCA
CNT-32-LOOP1B-LPSI-HSFIRE	Hot short of MO-3010 leading to ISLOCA
CNT-32-LOOP2A-LPSI-HSFIRE	Hot short of MO-3012 leading to ISLOCA
CNT-32-LOOP2B-LPSI-HSFIRE	Hot short of MO-3014 leading to ISLOCA

Table A5.6, Modifications identifying Unsuppressed Fires Requiring Control From the Hot Shutdown Panel

Gate	Description
FA1SUP	Fire Area 1 exposure fires anded with SUP
FA2SUP	Fire Area 2 exposure fires anded with SUP-AUTO
FA3SUP	Fire Area 3 exposure fires anded with SUP-AUTO
FA4SUP	Fire Area 4 exposure fires anded with SUP-AUTO

Note: These gates are used to distinguish logic differences when unsuppressed fires require manning of the hot shutdown panel.

Table A5.7, House Events Added to Fault Tree Models

House Event	Description
HS-MO-0510	Logic enabling MOV hot short failure mode (T)
HS-MO-2140	"
HS-MO-2160	"
HS-MO-3007	"
HS-MO-3008	"
HS-MO-3009	"
HS-MO-3010	"
HS-MO-3011	"
HS-MO-3012	"
HS-MO-3013	"
HS-MO-3014	"
HS-MO-3062	"
HS-MO-3064	"
HS-MO-3066	"
HS-MO-3068	"
HS-MO-3072	"
HS-MO-3189	"
HS-MO-3190	"
HS-MO-3198	"
HS-MO-3199	"
HSE-3072-FLOWDIV	Disables HPSI flow diversion thru MO-3072 (F)
HSE-AFW-FLOWDIV	Disables AFW flow diversion on SG blowdown (F)
HSE-FA-INIT	Indicates that a non-SIS fire initiator occurred (T)
HSE-ANYFIRE	Enables Fire IPEEE logic changes fall fire areas (T)
HSE-NOTANY	Enables Fire IPEEE logic changes all fire areas (F)
HSE-NOTFA1	Enables logic changes for FA1 (not used)
HSE-NOTFA13A	Enables logic changes for FA13A (not used)
HSE-NOTFA2	Enables logic changes for FA2 (not used)
HSE-NOTFA2-ED-10	Enables logic changes for FA2-ED-10 (not used)
HSE-NOTFA2-ED-20	Enables logic changes for FA2-ED-20 (not used)
HSE-NOTFA23	Enables logic changes for FA23E, S & W (not used)
HSE-NOTFA23ES	Enables logic changes for FA23E & S (not used)
HSE-NOTFA3	Enables logic changes for FA3 (not used)
HSE-NOTFA4	Enables logic changes for FA4 (not used)
HSE-NOTFACR	Enables logic changes for FA1 (not used)
IE-FA-1	Disables components for FA1 exposure fire (T)s
IE-FA-1-EC-01L	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-01R	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-02L	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-02R	Disables components for FA1 cabinet fire (T)

Table A5.7, House Events Added to Fault Tree Models	
House Event	Description
IE-FA-1-EC-03L	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-03R	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-04L	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-04R	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-08L	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-08R	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-106	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-11L	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-11R	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-126	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-12L	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-12R	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-13L	Disables components for FA1 cabinet fire (T)
IE-FA-1-EC-13R	Disables components for FA1 cabinet fire (T)
IE-FA-2	Disables components for FA1 exposure fire (T)
IE-FA-2-EB-01	Disables components for FA2 cabinet fire (T)
IE-FA-2-EB-02	Disables components for FA2 cabinet fire (T)
IE-FA-2-EB-11	Disables components for FA2 cabinet fire (T)
IE-FA-2-EB-12	Disables components for FA2 cabinet fire (T)
IE-FA-2-EB-21	Disables components for FA2 cabinet fire (T)
IE-FA-2-EB-23	Disables components for FA2 cabinet fire (T)
IE-FA-2-EB-24	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-06	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-07	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-08	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-09	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-10	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-11	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-15	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-16	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-17	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-18	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-20	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-21	Disables components for FA2 cabinet fire (T)
IE-FA-2-ED-576	Disables components for FA2 cabinet fire (T)
IE-FA-2-EJ-14A	Disables components for FA2 cabinet fire (T)
IE-FA-2-EJ-542	Disables components for FA2 cabinet fire (T)
IE-FA-2-EJ-543	Disables components for FA2 cabinet fire (T)
IE-FA-2-EJ-575	Disables components for FA2 cabinet fire (T)
IE-FA-2-EJ-576	Disables components for FA2 cabinet fire (T)
IE-FA-2-EY-01	Disables components for FA2 cabinet fire (T)
IE-FA-2-EY-10	Disables components for FA2 cabinet fire (T)

Table A5.7, House Events Added to Fault Tree Models	
House Event	Description
IE-FA-2-EY-20	Disables components for FA2 cabinet fire (T)
IE-FA-2-EY-30	Disables components for FA2 cabinet fire (T)
IE-FA-2-EY-40	Disables components for FA2 cabinet fire (T)
IE-FA-2-EY-50	Disables components for FA2 cabinet fire (T)
IE-FA-2-FZ2	Disables components for FA2 cabinet fire (T)
IE-FA-3	Disables components for FA3 exposure fire (T)
IE-FA-3-EA-12	Disables components for FA3 cabinet fire (T)
IE-FA-3-EB-22	Disables components for FA3 cabinet fire (T)
IE-FA-3-EC-181	Disables components for FA3 cabinet fire (T)
IE-FA-3-EC-187	Disables components for FA3 cabinet fire (T)
IE-FA-3-EJ-1005	Disables components for FA3 cabinet fire (T)
IE-FA-3-EJ-1006	Disables components for FA3 cabinet fire (T)
IE-FA-3-EJ-1051	Disables components for FA3 cabinet fire (T)
IE-FA-3-EJ-1052	Disables components for FA3 cabinet fire (T)
IE-FA-3-EJ-9401	Disables components for FA3 cabinet fire (T)
IE-FA-4	Disables components for FA4 exposure fire (T)
IE-FA-4-EA-11	Disables components for FA4 cabinet fire (T)
IE-FA-4-ED-11A	Disables components for FA4 cabinet fire (T)
IE-FA-4-EJ-9400	Disables components for FA4 cabinet fire (T)
IE-FA-13-13A1	Disables components for FA13A1 exposure fire (T)
IE-FA-13-13A2	Disables components for FA13A2 exposure fire (T)
IE-FA-23-23E	Disables components for FA23E exposure fire (T)
IE-FA-23-23S	Disables components for FA23S exposure fire (T)
IE-FA-23-23W	Disables components for FA23W exposure fire (T)

Table A5.8, Fire Initiating Events Added to Event Tree Logic		
Initiating Event	Frequency	Reference
FA-1	2.43E-03	Fire IPEEE (Ref 2.1.3)
FA-1-EC-01L	9.50E-03	"
FA-1-EC-01R	9.50E-03	"
FA-1-EC-02L	9.50E-03	"
FA-1-EC-02R	9.50E-03	"
FA-1-EC-03L	9.50E-03	"
FA-1-EC-03R	9.50E-03	"
FA-1-EC-04L	9.50E-03	"
FA-1-EC-04R	9.50E-03	"
FA-1-EC-08L	9.50E-03	"
FA-1-EC-08R	9.50E-03	"
FA-1-EC-106	9.50E-03	"
FA-1-EC-11L	9.50E-03	"
FA-1-EC-11R	9.50E-03	"
FA-1-EC-126	9.50E-03	"
FA-1-EC-12L	9.50E-03	"
FA-1-EC-12R	9.50E-03	"
FA-1-EC-13L	9.50E-03	"
FA-1-EC-13R	9.50E-03	"
FA-2	3.10E-03	"
FA-2-EB-01	3.20E-03	"
FA-2-EB-02	3.20E-03	"
FA-2-EB-11	3.20E-03	"
FA-2-EB-12	3.20E-03	"
FA-2-EB-21	3.20E-03	"
FA-2-EB-23	3.20E-03	"
FA-2-EB-24	3.20E-03	"
FA-2-ED-06	3.20E-03	"
FA-2-ED-07	3.20E-03	"
FA-2-ED-08	3.20E-03	"
FA-2-ED-09	3.20E-03	"
FA-2-ED-10	3.20E-03	"
FA-2-ED-11	3.20E-03	"
FA-2-ED-15	3.20E-03	"
FA-2-ED-16	3.20E-03	"
FA-2-ED-17	3.20E-03	"
FA-2-ED-18	3.20E-03	"
FA-2-ED-20	3.20E-03	"
FA-2-ED-21	3.20E-03	"
FA-2-EJ-14A	3.20E-03	"

Table A5.8, Fire Initiating Events Added to Event Tree Logic		
Initiating Event	Frequency	Reference
FA-2-EJ-542	3.20E-03	"
FA-2-EJ-543	3.20E-03	"
FA-2-EJ-575	3.20E-03	"
FA-2-EJ-576	3.20E-03	"
FA-2-EY-01	3.20E-03	"
FA-2-EY-10	3.20E-03	"
FA-2-EY-20	3.20E-03	"
FA-2-EY-30	3.20E-03	"
FA-2-EY-40	3.20E-03	"
FA-2-EY-50	3.20E-03	"
FA-3	9.81E-04	"
FA-3-EA-12	3.75E-03	"
FA-3-EB-22	3.75E-03	"
FA-3-EC-181	3.75E-03	"
FA-3-EC-187	3.75E-03	"
FA-3-EJ-1005	3.75E-03	"
FA-3-EJ-1006	3.75E-03	"
FA-3-EJ-1051	3.75E-03	"
FA-3-EJ-1052	3.75E-03	"
FA-3-EJ-9401	3.75E-03	"
FA-4	4.15E-04	"
FA-4-EA-11	3.75E-03	"
FA-4-ED-11A	3.75E-03	"
FA-4-EJ-9400	3.75E-03	"
FA-13-13A1	1.99E-03	"
FA-13-13A2	5.37E-03	"
FA-23-23E	2.94E-02	"
FA-23-23S	6.42E-02	"
FA-23-23W	1.55E-03	"

Table A5.9: Random Failures Added to Fault Trees			
Event	Prob	Reference	Description
B-AVMB-CV-0511	3.64E-03	PSAR2.BE ADV FTRC	Spurious operation of turbine bypass valve
H-CVMC-CK-ES3101HS	5.85E-04	PSAR2.BE Ck Valve FTRC	HPSI injection line check valve FTRC (ISLOCA model)
H-CVMC-CK-ES3103HS	5.85E-04	PSAR2.BE Ck Valve FTRC	HPSI injection line check valve FTRC (ISLOCA model)
H-CVMC-CK-ES3116HS	5.85E-04	PSAR2.BE Ck Valve FTRC	HPSI injection line check valve FTRC (ISLOCA model)
H-CVMC-CK-ES3131HS	5.85E-04	PSAR2.BE Ck Valve FTRC	HPSI injection line check valve FTRC (ISLOCA model)
H-CVMC-CK-ES3146HS	5.85E-04	PSAR2.BE Ck Valve FTRC	HPSI injection line check valve FTRC (ISLOCA model)
H-MVMA-MO-3072	4.18E-03	PSAR2.BE CVCS MOV FTO	CVCS injection to primary system
H-MVMD-MO-3072	2.96E-05	PSAR2.BE CVCS MOV FTRO	CVCS injection to primary system
H-REMT-3072IC	0	NA (used to assign fire areas that will fail the MOV I&C)	I&C failure mode for MO-3072 inj to primary system
L-CVMC-CK-ES3101HS	5.85E-04	PSAR2.BE Ck Valve FTRC	LPSI injection line check valve FTRC (ISLOCA model)
L-CVMC-CK-ES3116HS	5.85E-04	PSAR2.BE Ck Valve FTRC	LPSI injection line check valve FTRC (ISLOCA model)
L-CVMC-CK-ES3131HS	5.85E-04	PSAR2.BE Ck Valve FTRC	LPSI injection line check valve FTRC (ISLOCA model)
L-CVMC-CK-ES3146HS	5.85E-04	PSAR2.BE Ck Valve FTRC	LPSI injection line check valve FTRC (ISLOCA model)
M-FUMK-B389	2.21E-05	PSAR2.BE Fuse failure	MO-0510 control failure
M-HSMB-0510C	6.71E-05	PSAR2.BE Hand switch FTC	MO-0510 remote hand switch failure
M-LMMC-0510A	2.33E-05	PSAR2.BE Limit switch FTRC	MO-0510 control failure
M-MVMA-MO-0510	4.18E-03	PSAR2.BE MOV FTO	MO-0510 FTO to supply steam to hogger
M-MVMC-MO-0510	8.12E-04	PSAR2.BE MOV FTRC	MO-0510 FTRC preventing SGA from depressurizing
M-MVMD-MO-0510	2.96E-05	PSAR2.BE MOV FTRO	MO-0510 FTRO to supply steam to hogger
M-QSMC-0510	2.33E-05	PSAR2.BE Torque sw FTRC	MO-0510 control failure
M-REMB-389O	2.41E-04	PSAR2.BE Relay fail to energize	MO-0510 control failure
M-REMC-389O	2.40E-05	PSAR2.BE Relay FTRE	MO-0510 control failure
M-REMD-389C	2.40E-05	PSAR2.BE Relay FTRDE	MO-0510 control failure
M-REMD-4938	2.40E-05	PSAR2.BE Relay FTRDE	MO-0510 control failure
M-TRMT-B389	3.72E-05	PSAR2.BE Trans fails to function	MO-0510 control failure
P-B2MK-EB-03	1.20E-05	PSAR2.BE Bus fails to function	MCC3 fails to function (power to MO-0510)
P-CBMC-152-110	1.0	NA (conservatively assigned value of 1)	Breaker to Bus 13
P-CBMC-52-389	1.49E-05	PSAR2.BE Breaker FTRC	MO-0510 control failure
U-PMME-P5	1.0	NA (conservatively assigned value of 1)	Warm water recirc pump FTR (bypasses plugged traveling screens)

Table A5.10, Random Failures Changed for the Purpose of Fire PSA Quantification		
Event	Prob	Description
M-PMCC-P-2AB-MG	T	Used as a house event to disable Feedwater, condensate and main condenser

Table A5.11, Operator Actions Added to Fault Tree Logic

Operator Action	Prob	Reference	Description
A-AVOE-AVMAN	3.38E-2	Fire IPEEE	Operator action to open AFW flow control valves on auto signal failure
F-PMOE-FPS	3.40E-2	Fire IPEEE	Operator action to start fire pumps on auto signal failure
G-MVOA-CBALOCAL	1.0	NA (conservatively set to value of 1)	Operator action to open locally MO-2140 or MO-2160
H-AVOA-SUB-LOCAL	1.0	NA (conservatively set to value of 1)	Operator action to open locally CV-3070
H-MVOA-3072LOCAL	1.0	NA (conservatively set to value of 1)	Operator action to bypass MO-3072 I&C failure
H-MVOA-CHG2HPSI	3.40E-2		Operator action to align charging to primary system
H-MVOA-HPSI-LOCAL	1.0E-2	Fire IPEEE	Operator action to align HPSI injection valves locally
M-MVOA-0510LOCAL	1.0	NA (conservatively set to value of 1)	Operator action to open MO-0510 locally
M-CVOA-MSIVLOCAL	0.1	Screening value	Operator action to trip closed MSIVs locally
P-CBOT-TFXFR	1E-2	Fire IPEEE	Operator action to manually align fast transfer
U-PMOE-P5	1.0	NA (conservatively set to value of 1)	Operator action to align warm water recirc pump
U-PMOE-PUMP	1.0	NA (conservatively set to value of 1)	Operator action to start P7B on auto start failure

Table A5.12: Hot Short Failure Modes Added to Fault Trees (not used in this analysis)

Hot Short	Prob	Description
G-MVMD-MO-2140HS	1.0	Hot short of MO-2140 FTRO
G-MVMD-MO-2160HS	1.0	Hot short of MO-2160 FTRO
H-MVMC-MO-3007HS	1.0	Hot short of MO-3007 FTRC (ISLOCA)
H-MVMD-MO-3007HS	1.0	Hot short of MO-3007 FTRO
H-MVMC-MO-3009HS	1.0	Hot short of MO-3009 FTRC (ISLOCA)
H-MVMD-MO-3009HS	1.0	Hot short of MO-3009 FTRO
H-MVMC-MO-3011HS	1.0	Hot short of MO-3011 FTRC (ISLOCA)
H-MVMD-MO-3011HS	1.0	Hot short of MO-3011 FTRO
H-MVMC-MO-3013HS	1.0	Hot short of MO-3013 FTRC (ISLOCA)
H-MVMD-MO-3013HS	1.0	Hot short of MO-3013 FTRO
H-MVMC-MO-3062HS	1.0	Hot short of MO-3062 FTRC (ISLOCA)
H-MVMD-MO-3062HS	1.0	Hot short of MO-3062 FTRO
H-MVMC-MO-3064HS	1.0	Hot short of MO-3064 FTRC (ISLOCA)
H-MVMD-MO-3064HS	1.0	Hot short of MO-3064 FTRO
H-MVMC-MO-3066HS	1.0	Hot short of MO-3066 FTRC (ISLOCA)
H-MVMD-MO-3066HS	1.0	Hot short of MO-3066 FTRO
H-MVMC-MO-3068HS	1.0	Hot short of MO-3068 FTRC (ISLOCA)
H-MVMD-MO-3068HS	1.0	Hot short of MO-3068 FTRO
H-MVMD-MO-3072HS	1.0	Hot short of MO-3072 FTRO
L-MVMC-MO-3008HS	1.0	Hot short of MO-3008 FTRC (ISLOCA)
L-MVMD-MO-3008HS	1.0	Hot short of MO-3008 FTRO
L-MVMC-MO-3010HS	1.0	Hot short of MO-3010 FTRC (ISLOCA)
L-MVMD-MO-3010HS	1.0	Hot short of MO-3010 FTRO
L-MVMC-MO-3012HS	1.0	Hot short of MO-3012 FTRC (ISLOCA)
L-MVMD-MO-3012HS	1.0	Hot short of MO-3012 FTRO
L-MVMC-MO-3014HS	1.0	Hot short of MO-3014 FTRC (ISLOCA)
L-MVMD-MO-3014HS	1.0	Hot short of MO-3014 FTRO
L-MVMC-MO-3189HS	1.0	Hot short of MO-3189 FTRC
L-MVMC-MO-3198HS	1.0	Hot short of MO-3198 FTRC
L-MVMD-MO-3190HS	1.0	Hot short of MO-3190 FTRO
L-MVMD-MO-3199HS	1.0	Hot short of MO-3199 FTRO

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Table A6.1: IPEEE Table 4.7-3 Palisades Ignition Source Frequencies and Combustible Loading			
FIRE AREA	DESCRIPTION	COMBUSTIBLE LOADING	IGNITION SOURCE FREQUENCY (yr)
1	Control Room Exposure Fire Cabinet Fire	Moderate	2.43E-3 9.50E-3
2	Cable Spreading Room Exposure Fire Cabinet Fire	Moderate	3.19E-3 3.20E-3
3	1D Switchgear Room Exposure Fire Cabinet Fire	Moderate	9.81E-4 3.75E-3
4	1C Switchgear Room Exposure Fire Cabinet Fire	Moderate	4.15E-4 3.75E-3
5	Diesel Generator 1-1	Light	1.69E-2
6	Diesel Generator 1-2	Light	1.72E-2
7 & 8	Diesel Day Tanks	Heavy	N/A - Screened
9A	Intake Structure - East Side (SWS)	Light	7.20E-3
9B	Intake Structure - West Side (FPS)	Light	7.20E-3
10	East Engineered Safeguards	Minimal	2.36E-3
11	Battery Room #2	Moderate	1.60E-3
12	Battery Room #1	Moderate	1.60E-3
13A1	Auxiliary Building 590' Corridor (CCW to Charging)	Minimal	1.99E-3
13A2	Auxiliary Building 590' Corridor (Except Zone 13A1)	Moderate	5.37E-3
13B	Charging Pump Room	Minimal	2.06E-3
13C	All Other Areas on the 590' Auxiliary Building	Minimal - Moderate	1.15E-2
14	Containment Building	Light	N/A
15	Engineered Safeguards Panel Room	Moderate	1.50E-4
16	Component Cooling Water Pump Room	Minimal	2.36E-3
17	Refueling and Spent Fuel Pool Room	Minimal	N/A - Screened
18	Demineralizer Room	Minimal	N/A - Screened
19	Compactor Area - Track Alley	Minimal - Moderate	N/A - Screened
20	Spent Fuel Pool Equipment Room	Minimal	6.02E-4
21A	Electric Equipment Room - East Side (Bus 19)	Light	3.80E-3
21B	Electric Equipment Room - West Side (Bus 20)	Light	3.80E-3
22	Turbine Lube Oil Room	Heavy	N/A - Screened
23E	Turbine Building East Side	Moderate	2.94E-2
23S	Turbine Building South Side	Heavy	6.42E-2
23W	Turbine Building West Side	Moderate	1.55E-3
24	Auxiliary Feedwater Pump Room	Minimal	2.27E-4
25	Heating Boiler Rooms	Moderate	N/A - Screened

Table A6.1: IPEEE Table 4.7-3 Palisades Ignition Source Frequencies and Combustible Loading			
FIRE AREA	DESCRIPTION	COMBUSTIBLE LOADING	IGNITION SOURCE FREQUENCY (yr)
26	Southwest Cable Penetration Room	Moderate	6.89E-5
27	Radwaste Addition - VRS	Moderate	N/A - Screened
28	West Engineered Safeguards	Minimal	2.74E-3
29	Center Mechanical Equipment Rooms	Minimal	N/A - Screened
30	East Mechanical Equipment Rooms	Moderate	N/A - Screened
31	West Mechanical Equipment Rooms	Moderate	N/A - Screened
32	SIRW Tank/CCW Roof Area	Minimal	4.85E-5
33	Technical Support Center	Moderate	N/A - Screened
34	Man Hole #1, #2, #3	Light	3.97E-5

Table A6.2, Fault Tree/Fire Area Frequencies		
Fault Tree	Frequency/yr	Description
FA-1	2.43E-03	GENERAL AREA FIRE
FA-1-EC-01L	9.50E-03	LEFT CH PANEL EC-01/CONTROL ROOM CAB FIRE
FA-1-EC-01R	9.50E-03	RIGHT CH PANEL EC-01/CONTROL ROOM CAB FIRE
FA-1-EC-02L	9.50E-03	LEFT CH PANEL EC-02/CONTROL ROOM CAB FIRE
FA-1-EC-02R	9.50E-03	RIGHT CH PANEL EC-02/CONTROL ROOM CAB FIRE
FA-1-EC-03L	9.50E-03	LEFT CH PANEL EC-03/CONTROL ROOM CAB FIRE
FA-1-EC-03R	9.50E-03	RIGHT CH PANEL EC-03/CONTROL ROOM CAB FIRE
FA-1-EC-04L	9.50E-03	LEFT CH PANEL EC-04/CONTROL ROOM CAB FIRE
FA-1-EC-04R	9.50E-03	RIGHT CH PANEL EC-04/CONTROL ROOM CAB FIRE
FA-1-EC-08L	9.50E-03	LEFT CH PANEL EC-08/CONTROL ROOM CAB FIRE
FA-1-EC-08R	9.50E-03	RIGHT CH PANEL EC-08/CONTROL ROOM CAB FIRE
FA-1-EC-106	9.50E-03	CLG TWR MASTER SUPRVISORY & CONT CABINET CAB FIRE
FA-1-EC-11L	9.50E-03	LEFT CH RAD/TURBINE AUX MONITOR PANEL CAB FIRE
FA-1-EC-11R	9.50E-03	RIGHT CH RAD/TURBINE AUX MONITOR PANEL CAB FIRE
FA-1-EC-126	9.50E-03	CIRCULATION WATER & IODINE REMOVAL PANEL CAB FIRE
FA-1-EC-12L	9.50E-03	LEFT CH PRIMARY SYSTEM CONTROL PANEL CAB FIRE
FA-1-EC-12R	9.50E-03	RIGHT CH PRIMARY SYSTEM CONTROL PANEL CAB FIRE
FA-1-EC-13L	9.50E-03	L CH DBA/SHTDWN & MISC LOADS CNTRL PNL CAB FIRE
FA-1-EC-13R	9.50E-03	R CH DBA/SHTDWN & MISC LOADS CNTRL PNL CAB FIRE
FA-10	2.36E-03	EAST ENGINEERED SAFEGUARDS EXP FIRE
FA-11	1.60E-03	BATTERY ROOM 2 EXP FIRE
FA-12	1.60E-03	BATTERY ROOM 1 EXP FIRE
FA-13-13A1	1.99E-03	AUX BLDNG 590' CORRIDR (CCW - CHARGING) EXP FIRE
FA-13-13A2	5.37E-03	AUX BLDNG 590' CORRIDR (EXCEPT ZNE 13A1) EXP FIRE
FA-13-13B	2.06E-03	CHARGING PUMP ROOM EXP FIRE
FA-13-13C	1.15E-02	ALL OTHR AREAS AT 590' AUXI BUILDNG EXP FIRE
FA-14	1.00E+00	CONTAINMENT BUILDING
FA-15	1.50E-04	ENGINEERED SAFEGUARDS PANEL ROOM EXP FIRE
FA-16	2.36E-03	COMPONENT COOLING WATER ROOM EXP FIRE
FA-18	1.00E+00	DEMINERALIZER ROOM EXP FIRE
FA-2	3.10E-03	CSR EXP FIRE
FA-2-EB-01	3.20E-03	CSR 480 V MCC NO.1 CAB FIRE
FA-2-EB-02	3.20E-03	CSR 480 V MCC NO.2 CAB FIRE
FA-2-EB-11	3.20E-03	CSR 480 V BUS NO. 11 CAB FIRE
FA-2-EB-12	3.20E-03	CSR 480 V BUS NO. 12 CAB FIRE
FA-2-EB-21	3.20E-03	CSR 480 V MCC #21 CAB FIRE
FA-2-EB-23	3.20E-03	CSR 480 V MCC #23 CAB FIRE
FA-2-EB-24	3.20E-03	CSR 480 V MCC #24 CAB FIRE
FA-2-ED-06	3.20E-03	CSR INVERTER NO. 1 CAB FIRE
FA-2-ED-07	3.20E-03	CSR INVERTER NO. 2 CAB FIRE
FA-2-ED-08	3.20E-03	CSR INVERTER NO. 3 CAB FIRE

Table A6.2, Fault Tree/Fire Area Frequencies

Fault Tree	Frequency/yr	Description
FA-2-ED-09	3.20E-03	CSR INVERTER NO. 4 CAB FIRE
FA-2-ED-10	3.20E-03	CSR 125 V BUS NO. 1- LEFT SIDE - TIE BKR CAB FIRE
FA-2-ED-11	3.20E-03	CSR 125 V BUS CAB FIRE
FA-2-ED-15	3.20E-03	CSR BATTERY CHARGER NO. 1 CAB FIRE
FA-2-ED-16	3.20E-03	CSR BATTERY CHARGER NO. 2 CAB FIRE
FA-2-ED-17	3.20E-03	CSR BATTERY CHARGER NO. 3 CAB FIRE
FA-2-ED-18	3.20E-03	CSR BATTERY CHARGER NO. 4 CAB FIRE
FA-2-ED-20	3.20E-03	CSR CSR 125 VDC BUS NO. 2 CAB FIRE
FA-2-ED-21	3.20E-03	CSR CSR 125 VOLTS DC DISTRIBUTION PANEL CAB FIRE
FA-2-EJ-14A	3.20E-03	CSR J BOX EJ-14A CAB FIRE
FA-2-EJ-542	3.20E-03	CSR J BOX EJ-542 CAB FIRE
FA-2-EJ-543	3.20E-03	CSR J BOX EJ-543 CAB FIRE
FA-2-EJ-575	3.20E-03	CSR J BOX EJ-575 CAB FIRE
FA-2-EJ-576	3.20E-03	CSR J BOX EJ-576 CAB FIRE
FA-2-EY-01	3.20E-03	CSR INSTRUMENT AC PANEL CAB FIRE
FA-2-EY-10	3.20E-03	CSR PREFERRED AC BUS NO. 1 INVERTER CAB FIRE
FA-2-EY-20	3.20E-03	CSR PREFERRED AC BUS NO. 2 INVERTER CAB FIRE
FA-2-EY-30	3.20E-03	CSR PREFERRED AC BUS NO. 3 INVERTER CAB FIRE
FA-2-EY-40	3.20E-03	CSR PREFERRED AC BUS NO. 4 INVERTER CAB FIRE
FA-2-EY-50	3.20E-03	CSR EY-01 PANEL TRANSFER SWITCH CAB FIRE
FA-20	6.02E-04	SPENT FUEL POOL EQUIPMENT ROOM EXP FIRE
FA-21-21A	3.80E-03	EEQUIP ROOM - EAST SIDE (BUS 19) EXP FIRE
FA-21-21B	3.80E-03	EEQUIP ROOM - WEST SIDE (BUS 20) EXP FIRE
FA-23-23E	2.94E-02	TURBINE BUILDING EAST SIDE EXP FIRE
FA-23-23S	6.42E-02	TURBINE BUILDING SOUTH SIDE EXP FIRE
FA-23-23W	1.55E-03	TURBINE BUILDING WEST SIDE EXP FIRE
FA-24	2.27E-04	AUXILIARY FEEDWATER PUMP ROOM EXP FIRE
FA-25	1.00E+00	HEATING BOILER ROOMS EXP FIRE
FA-26	6.89E-05	SOUTHWEST CABLE PENETRATION ROOM EXP FIRE
FA-28	2.74E-03	WEST ENGINEERED SAFEGUARDS EXP FIRE
FA-3	9.81E-04	1D SWITCHGR LOGICAL PLACEHOLDER
FA-3-EA-12	3.75E-03	1D SWITCHGR 2400 V BUS 1D CAB FIRE
FA-3-EB-22	3.75E-03	1D SWITCHGR 4160 V BUS 1B CAB FIRE
FA-3-EC-181	3.75E-03	1D SWITCHGR MSIV SOLENOID VALVE PANEL CAB FIRE
FA-3-EC-187	3.75E-03	1D SWITCHGR AFW ACTUATION CABINET CAB FIRE
FA-3-EJ-1005	3.75E-03	1D SWITCHGR J BOX J-1005 CAB FIRE
FA-3-EJ-1006	3.75E-03	1D SWITCHGR J BOX J-1006 CAB FIRE
FA-3-EJ-1051	3.75E-03	1D SWITCHGR J BOX J-1051 CAB FIRE
FA-3-EJ-1052	3.75E-03	1D SWITCHGR J BOX J-1052 CAB FIRE
FA-3-EJ-9401	3.75E-03	1D SWITCHGR J BOX J-9401 CAB FIRE
FA-32	4.85E-05	SIRW TANK/CCW ROOF AREA EXP FIRE
FA-34	3.97E-05	MAN HOLE #1, #2, #3 EXP FIRE

Table A6.2, Fault Tree/Fire Area Frequencies		
Fault Tree	Frequency/yr	Description
FA-4	4.15E-04	1C SWITCHGR LOGICAL PLACEHOLDER
FA-4-EA-11	3.75E-03	1C SWITCHGR 2400 V BUS 1C CAB FIRE
FA-4-ED-11A	3.75E-03	1C SWITCHGR ED-11A 125 VOLTS DC DIST PANEL CAB FIRE
FA-4-EJ-9400	3.75E-03	1C SWITCHGR J BOX J-9400 CAB FIRE
FA-5	1.69E-02	DIESEL GENERATOR 1-1 (LOGICAL PLACEHOLDER)
FA-6	1.72E-02	DIESEL GENERATOR 1-2 (LOGICAL PLACEHOLDER)
FA-7	1.00E+00	DIESEL GENERATOR 1-1 (LOGICAL PLACEHOLDER)
FA-8	1.00E+00	DIESEL GENERATOR 1-2 (LOGICAL PLACEHOLDER)
FA-9-9A	7.20E-03	INTAKE STRUCTURE - EAST SIDE (SWS) EXP FIRE
FA-9-9B	7.20E-03	INTAKE STRUCTURE - WEST SIDE (FPS) EXP FIRE

Table A6.3, Fire Area Assigned Logical Event and Frequency		
Fire Area Assigned Logical Event	Frequency/yr	Description
IE-FA-1	1.00E+00	LOGICAL PLACEHOLDER
IE-FA-1-EC-01L	9.50E-03	LEFT CH PANEL EC-01/CONTROL ROOM CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-01R	9.50E-03	RIGHT CH PANEL EC-01/CONTROL ROOM CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-02L	9.50E-03	LEFT CH PANEL EC-02/CONTROL ROOM CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-02R	9.50E-03	RIGHT CH PANEL EC-02/CONTROL ROOM CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-03L	9.50E-03	LEFT CH PANEL EC-03/CONTROL ROOM CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-03R	9.50E-03	RIGHT CH PANEL EC-03/CONTROL ROOM CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-04L	9.50E-03	LEFT CH PANEL EC-04/CONTROL ROOM CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-04R	9.50E-03	RIGHT CH PANEL EC-04/CONTROL ROOM CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-08L	9.50E-03	LEFT CH PANEL EC-08/CONTROL ROOM CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-08R	9.50E-03	RIGHT CH PANEL EC-08/CONTROL ROOM CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-106	9.50E-03	CLG TWR MASTER SUPRVISORY & CONT CABINET CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-11L	9.50E-03	LEFT CH RAD/TURBINE AUX MONITOR PANEL CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-11R	9.50E-03	RIGHT CH RAD/TURBINE AUX MONITOR PANEL CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-126	9.50E-03	CIRCULATION WATER & IODINE REMOVAL PANEL CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-12L	9.50E-03	LEFT CH PRIMARY SYSTEM CONTROL PANEL CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-12R	9.50E-03	RIGHT CH PRIMARY SYSTEM CONTROL PANEL CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-13L	9.50E-03	L CH DBA/SHTDWN & MISC LOADS CNTRL PNL CAB FIRE (MOD)(IE Freq)
IE-FA-1-EC-13R	9.50E-03	R CH DBA/SHTDWN & MISC LOADS CNTRL PNL CAB FIRE (MOD)(IE Freq)
IE-FA-10	2.36E-03	EAST ENGINEERED SAFEGUARDS EXP FIRE (MINIMAL)(IE Freq)
IE-FA-11	1.60E-03	BATTERY ROOM 2 EXP FIRE (MODERATE)(IE Freq)
IE-FA-12	1.60E-03	BATTERY ROOM 1 EXP FIRE (MODERATE)(IE Freq)
IE-FA-13-13A1	1.99E-03	AUX BLDNG 590' CORRIDR (CCW - CHARGING) EXP FIRE (MIN)(IE Freq)
IE-FA-13-13A2	5.37E-03	AUX BLDNG 590' CORRIDR (EXCEPT ZNE 13A1) EXP FIRE (MOD)(IE Freq)
IE-FA-13-13B	2.06E-03	CHARGING PUMP ROOM EXP FIRE (MIN)(IE Freq)
IE-FA-13-13C	1.15E-02	ALL OTHR AREAS AT 590' AUXI BUILDNG EXP FIRE (MIN-MOD)(IE Freq)
IE-FA-14	1.00E+00	CONTAINMENT BUILDING (IE-Freq - N/A)
IE-FA-15	1.50E-04	ENGINEERED SAFEGUARDS PANEL ROOM EXP FIRE (MOD)(IE Freq)
IE-FA-16	2.36E-03	COMPONENT COOLING WATER ROOM EXP FIRE (MIN)(IE Freq)
IE-FA-18	1.00E+00	DEMINERALIZER ROOM EXP FIRE (MIN)(IE-Freq - N/A)
IE-FA-2	3.10E-03	CSR EXP FIRE (MOD)(IE Freq)
IE-FA-2-EB-01	3.20E-03	CSR 480 V MCC NO.1 CAB FIRE (MOD)(IE Freq)
IE-FA-2-EB-02	3.20E-03	CSR 480 V MCC NO.2 CAB FIRE (MOD)(IE Freq)
IE-FA-2-EB-11	3.20E-03	CSR 480 V BUS NO. 11 CAB FIRE (MOD)(IE Freq)
IE-FA-2-EB-12	3.20E-03	CSR 480 V BUS NO. 12 CAB FIRE (MOD)(IE Freq)
IE-FA-2-EB-21	3.20E-03	CSR 480 V MCC #21 CAB FIRE (MOD)(IE Freq)
IE-FA-2-EB-23	3.20E-03	CSR 480 V MCC #23 CAB FIRE (MOD)(IE Freq)
IE-FA-2-EB-24	3.20E-03	CSR 480 V MCC #24 CAB FIRE (MOD)(IE Freq)
IE-FA-2-ED-06	3.20E-03	CSR INVERTER NO. 1 CAB FIRE (MOD)(IE Freq)
IE-FA-2-ED-07	3.20E-03	CSR INVERTER NO. 2 CAB FIRE (MOD)(IE Freq)
IE-FA-2-ED-08	3.20E-03	CSR INVERTER NO. 3 CAB FIRE (MOD)(IE Freq)

Table A6.3, Fire Area Assigned Logical Event and Frequency

Fire Area Assigned Logical Event	Frequency/yr	Description
IE-FA-2-ED-09	3.20E-03	CSR INVERTER NO. 4 CAB FIRE (MOD)(IE Freq)
IE-FA-2-ED-10	3.20E-03	CSR 125 V BUS NO. 1- LEFT SIDE - TIE BKR CAB FIRE (MOD)(IE Freq)
IE-FA-2-ED-11	3.20E-03	CSR 125 V BUS CAB FIRE (MOD)(IE Freq)
IE-FA-2-ED-15	3.20E-03	CSR BATTERY CHARGER NO. 1 CAB FIRE (MOD)(IE Freq)
IE-FA-2-ED-16	3.20E-03	CSR BATTERY CHARGER NO. 2 CAB FIRE (MOD)(IE Freq)
IE-FA-2-ED-17	3.20E-03	CSR BATTERY CHARGER NO. 3 CAB FIRE (MOD)(IE Freq)
IE-FA-2-ED-18	3.20E-03	CSR BATTERY CHARGER NO. 4 CAB FIRE (MOD)(IE Freq)
IE-FA-2-ED-20	3.20E-03	CSR CSR 125 VDC BUS NO. 2 CAB FIRE (MOD)(IE Freq)
IE-FA-2-ED-21	3.20E-03	CSR CSR 125 VOLTS DC DISTRIBUTION PANEL CAB FIRE (MOD)(IE Freq)
IE-FA-2-EJ-14A	3.20E-03	CSR J BOX EJ-14A CAB FIRE (MOD)(IE Freq)
IE-FA-2-EJ-542	3.20E-03	CSR J BOX EJ-542 CAB FIRE (MOD)(IE Freq)
IE-FA-2-EJ-543	3.20E-03	CSR J BOX EJ-543 CAB FIRE (MOD)(IE Freq)
IE-FA-2-EJ-575	3.20E-03	CSR J BOX EJ-575 CAB FIRE (MOD)(IE Freq)
IE-FA-2-EJ-576	3.20E-03	CSR J BOX EJ-576 CAB FIRE (MOD)(IE Freq)
IE-FA-2-EY-01	3.20E-03	CSR INSTRUMENT AC PANEL CAB FIRE (MOD)(IE Freq)
IE-FA-2-EY-10	3.20E-03	CSR PREFERRED AC BUS NO. 1 INVERTER CAB FIRE (MOD)(IE Freq)
IE-FA-2-EY-20	3.20E-03	CSR PREFERRED AC BUS NO. 2 INVERTER CAB FIRE (MOD)(IE Freq)
IE-FA-2-EY-30	3.20E-03	CSR PREFERRED AC BUS NO. 3 INVERTER CAB FIRE (MOD)(IE Freq)
IE-FA-2-EY-40	3.20E-03	CSR PREFERRED AC BUS NO. 4 INVERTER CAB FIRE (MOD)(IE Freq)
IE-FA-2-EY-50	3.20E-03	CSR EY-01 PANEL TRANSFER SWITCH CAB FIRE (MOD)(IE Freq)
IE-FA-20	6.02E-04	SPENT FUEL POOL EQUIPMENT ROOM EXP FIRE (MIN)(IE Freq)
IE-FA-21-21A	3.80E-03	EEQUIP ROOM - EAST SIDE (BUS 19) EXP FIRE (LIGHT)(IE Freq)
IE-FA-21-21B	3.80E-03	EEQUIP ROOM - WEST SIDE (BUS 20) EXP FIRE (LIGHT)(IE Freq)
IE-FA-23-23E	2.94E-02	TURBINE BUILDING EAST SIDE EXP FIRE (MOD)(IE Freq)
IE-FA-23-23S	6.42E-02	TURBINE BUILDING SOUTH SIDE EXP FIRE (HEAVY)(IE Freq)
IE-FA-23-23W	1.55E-03	TURBINE BUILDING WEST SIDE EXP FIRE (MOD)(IE Freq)
IE-FA-24	2.27E-04	AUXILIARY FEEDWATER PUMP ROOM EXP FIRE (MIN)(IE Freq)
IE-FA-25	1.00E+00	HEATING BOILER ROOMS EXP FIRE (MOD)(IE-Freq - N/A)
IE-FA-26	6.89E-05	SOUTHWEST CABLE PENETRATION ROOM EXP FIRE (MOD)(IE Freq)
IE-FA-28	2.74E-03	WEST ENGINEERED SAFEGUARDS EXP FIRE (MIN)(IE Freq)
IE-FA-3	1.00E+00	1D SWITCHGR LOGICAL PLACEHOLDER
IE-FA-3-EA-12	3.75E-03	1D SWITCHGR 2400 V BUS 1D CAB FIRE (MOD)(IE Freq)
IE-FA-3-EB-22	3.75E-03	1D SWITCHGR 4160 V BUS 1B CAB FIRE (MOD)(IE Freq)
IE-FA-3-EC-181	3.75E-03	1D SWITCHGR MSIV SOLENOID VALVE PANEL CAB FIRE (MOD)(IE Freq)
IE-FA-3-EC-187	3.75E-03	1D SWITCHGR AFW ACTUATION CABINET CAB FIRE (MOD)(IE Freq)
IE-FA-3-EJ-1005	3.75E-03	1D SWITCHGR J BOX J-1005 CAB FIRE (MOD)(IE Freq)
IE-FA-3-EJ-1006	3.75E-03	1D SWITCHGR J BOX J-1006 CAB FIRE (MOD)(IE Freq)
IE-FA-3-EJ-1051	3.75E-03	1D SWITCHGR J BOX J-1051 CAB FIRE (MOD)(IE Freq)
IE-FA-3-EJ-1052	3.75E-03	1D SWITCHGR J BOX J-1052 CAB FIRE (MOD)(IE Freq)
IE-FA-3-EJ-9401	3.75E-03	1D SWITCHGR J BOX J-9401 CAB FIRE (MOD)(IE Freq)
IE-FA-32	4.85E-05	SIRW TANK/CCW ROOF AREA EXP FIRE (MIN)(IE Freq)
IE-FA-34	3.97E-05	MAN HOLE #1, #2, #3 EXP FIRE (LIGHT)(IE Freq)

Table A6.3, Fire Area Assigned Logical Event and Frequency		
Fire Area Assigned Logical Event	Frequency/yr	Description
IE-FA-4	1.00E+00	1C SWITCHGR LOGICAL PLACEHOLDER
IE-FA-4-EA-11	3.75E-03	1C SWITCHGR 2400 V BUS 1C CAB FIRE (IE Freq)
IE-FA-4-ED-11A	3.75E-03	1C SWITCHGR ED-11A 125 VOLTS DC DIST PANEL CAB FIRE (IE Freq)
IE-FA-4-EJ-9400	3.75E-03	1C SWITCHGR J BOX J-9400 CAB FIRE (MOD)(IE Freq)
IE-FA-5	1.69E-02	DIESEL GENERATOR 1-1 (LOGICAL PLACEHOLDER)
IE-FA-6	1.72E-02	DIESEL GENERATOR 1-2 (LOGICAL PLACEHOLDER)
IE-FA-7	1.00E+00	DIESEL GENERATOR 1-1 (LOGICAL PLACEHOLDER)
IE-FA-8	1.00E+00	DIESEL GENERATOR 1-2 (LOGICAL PLACEHOLDER)
IE-FA-9-9A	7.20E-03	INTAKE STRUCTURE - EAST SIDE (SWS) EXP FIRE (LIGHT)(IE Freq)
IE-FA-9-9B	7.20E-03	INTAKE STRUCTURE - WEST SIDE (FPS) EXP FIRE (LIGHT)(IE Freq)
IE-FA-9A	1.00E+00	LOGICAL PLACEHOLDER
IE-FA-9B	1.00E+00	LOGICAL PLACEHOLDER

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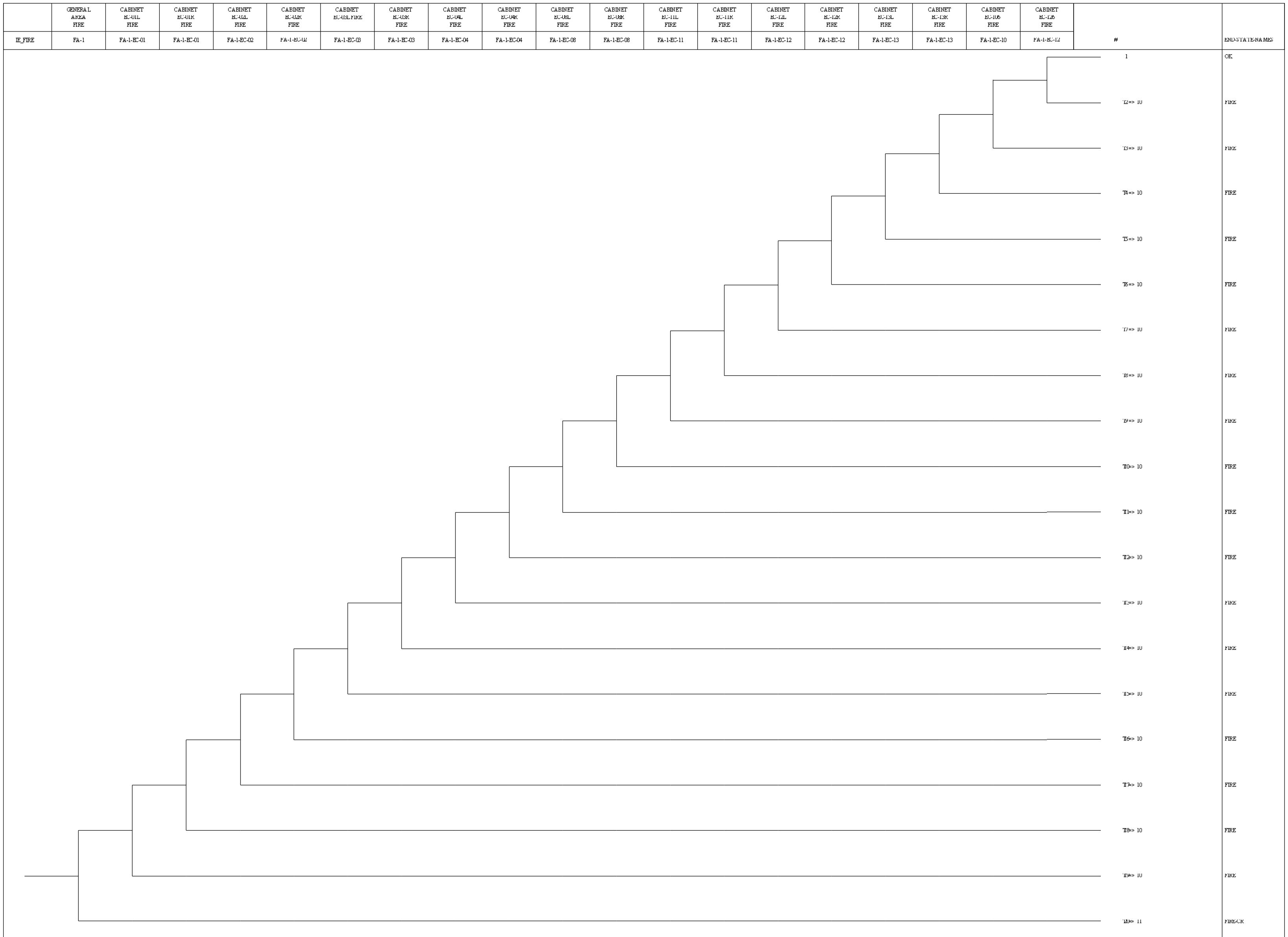

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Figure A7.1 - FA1 Control Room Fires

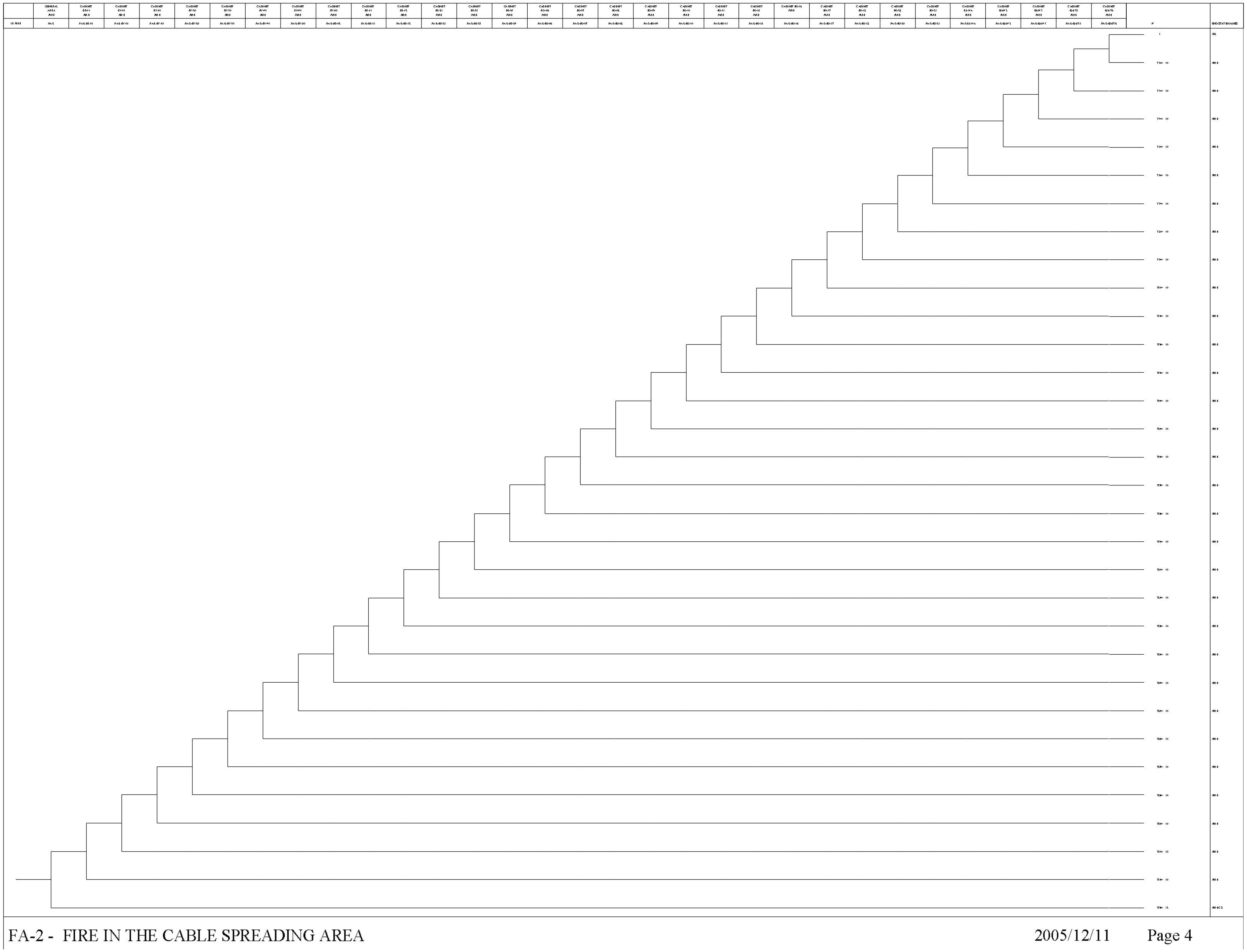

Figure A7.2 - Cable Spreading Room Fires

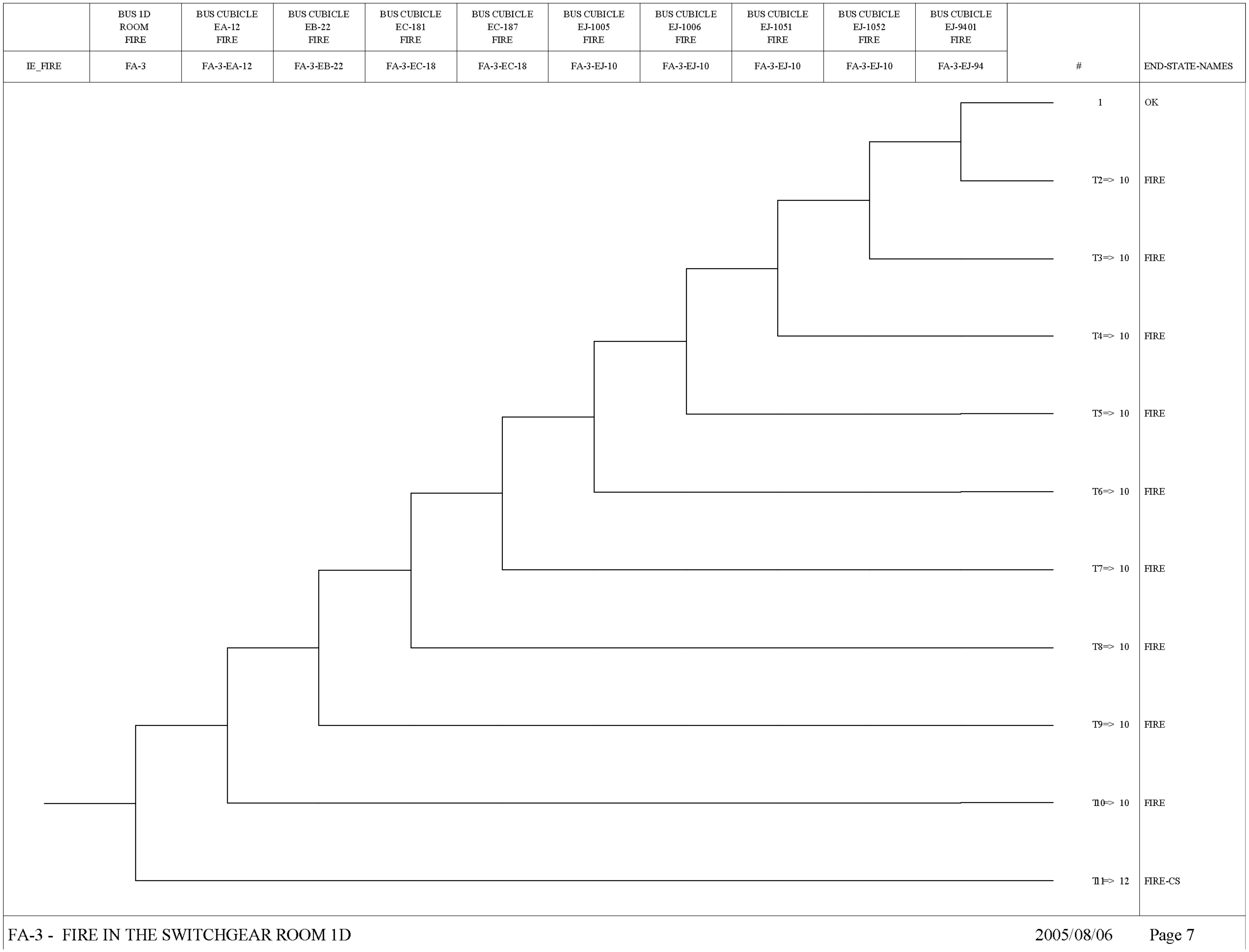

Figure A7.3 - Bus 1D Switchgear Room Fires

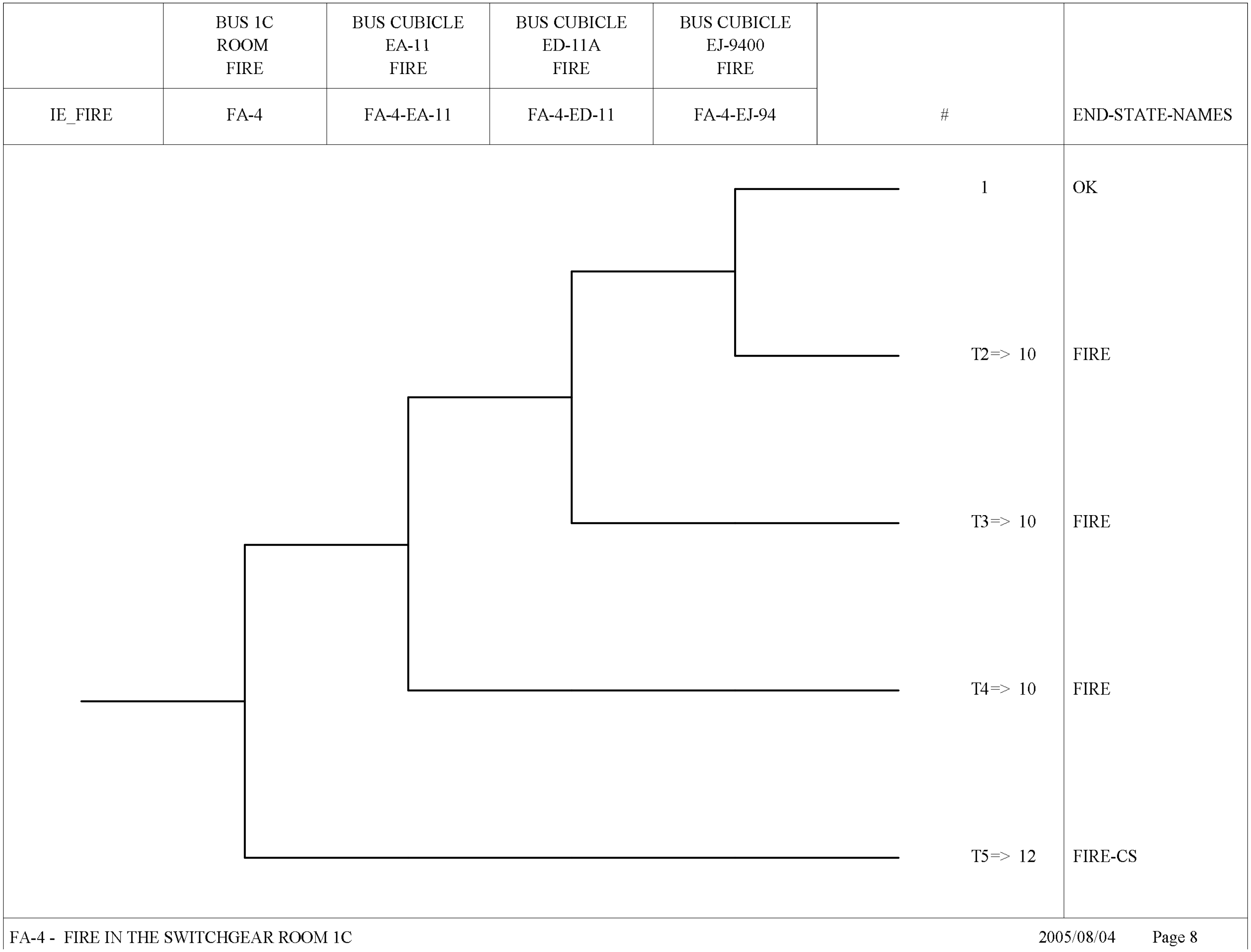

Figure A7.4 - Bus 1C Switchgear Room Fires

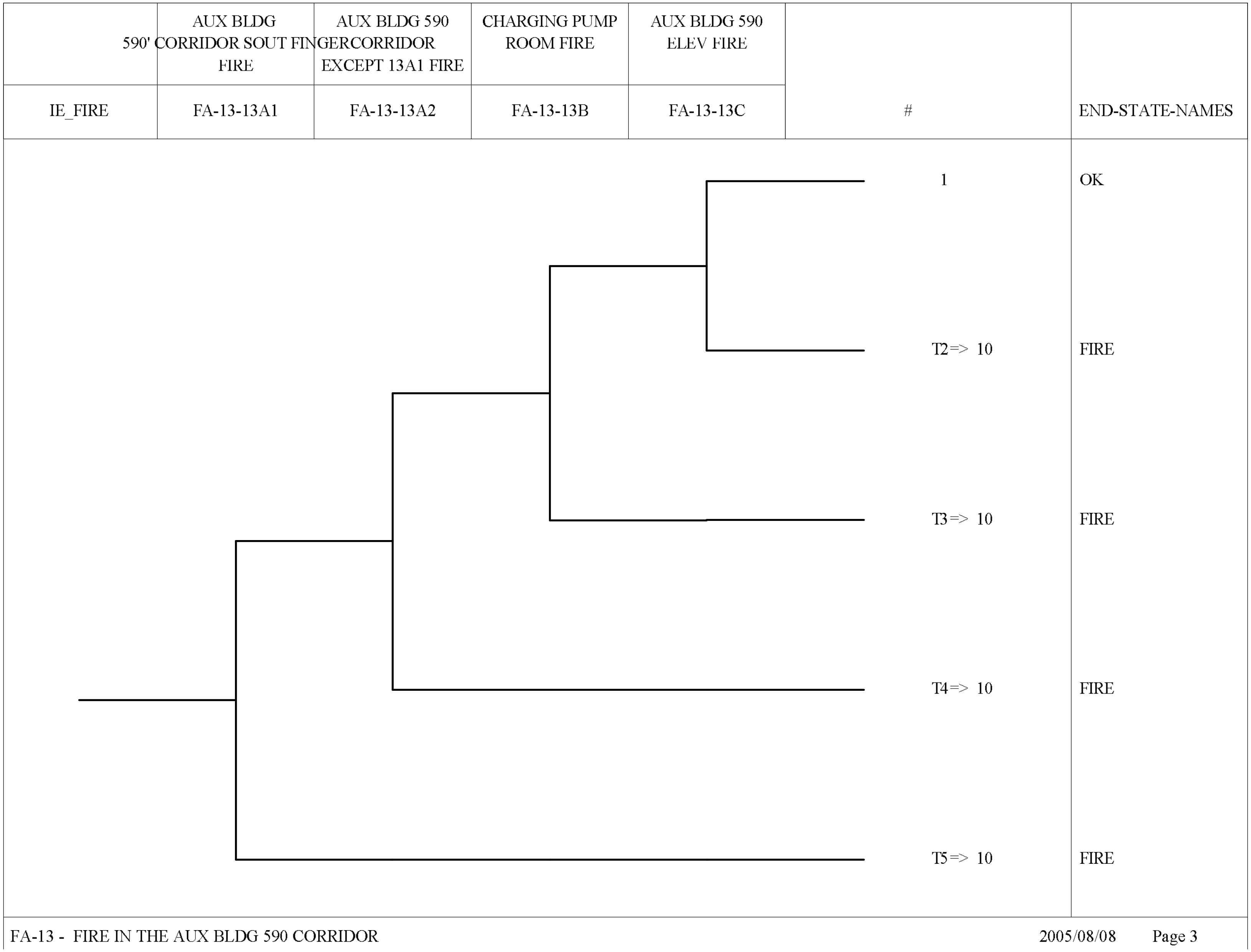

Figure A7.5 - Aux Building Corridor Fires

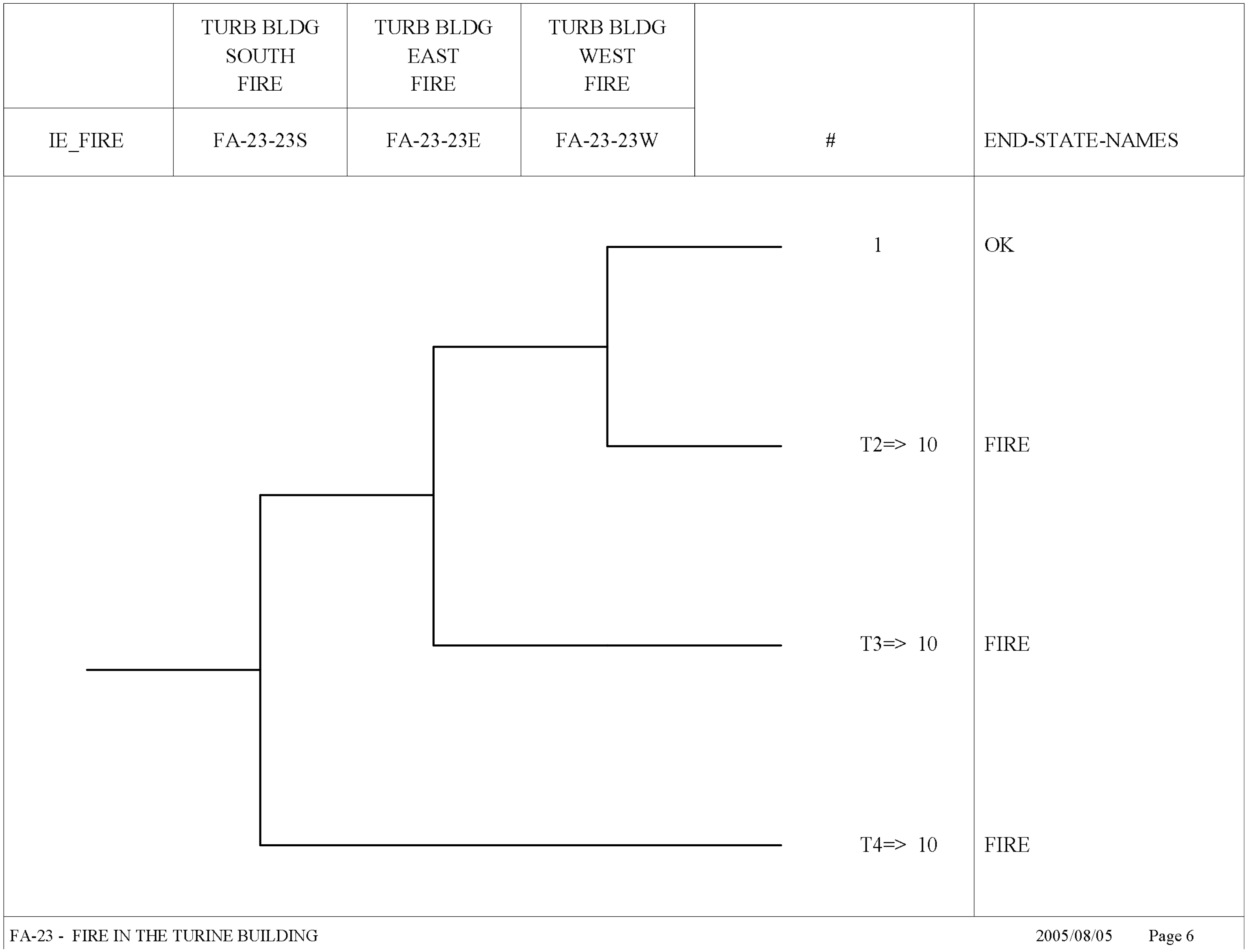

Figure A7.6 - Turbine Building Fires

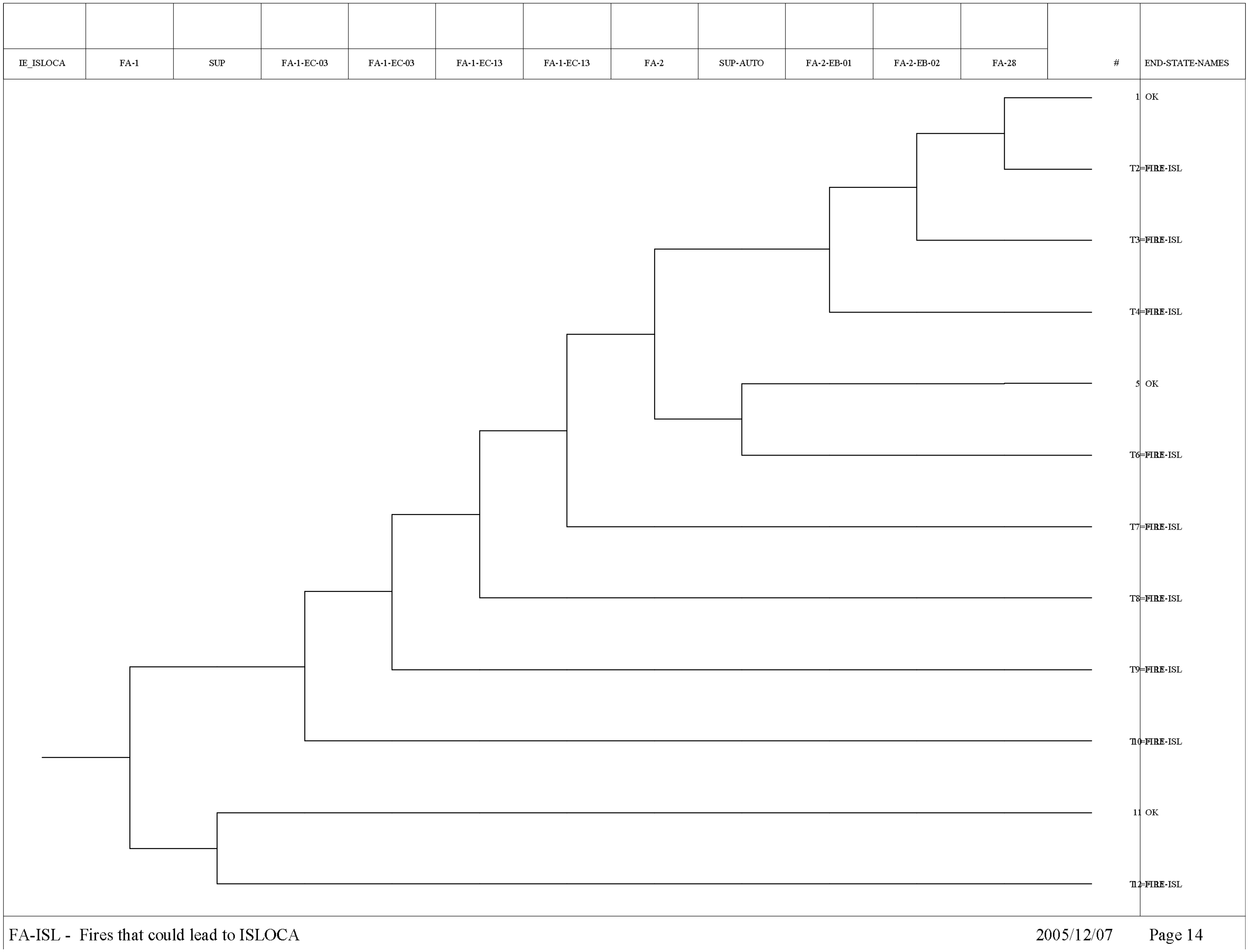

Figure A7.7 - Fires Leading to ISLOCA

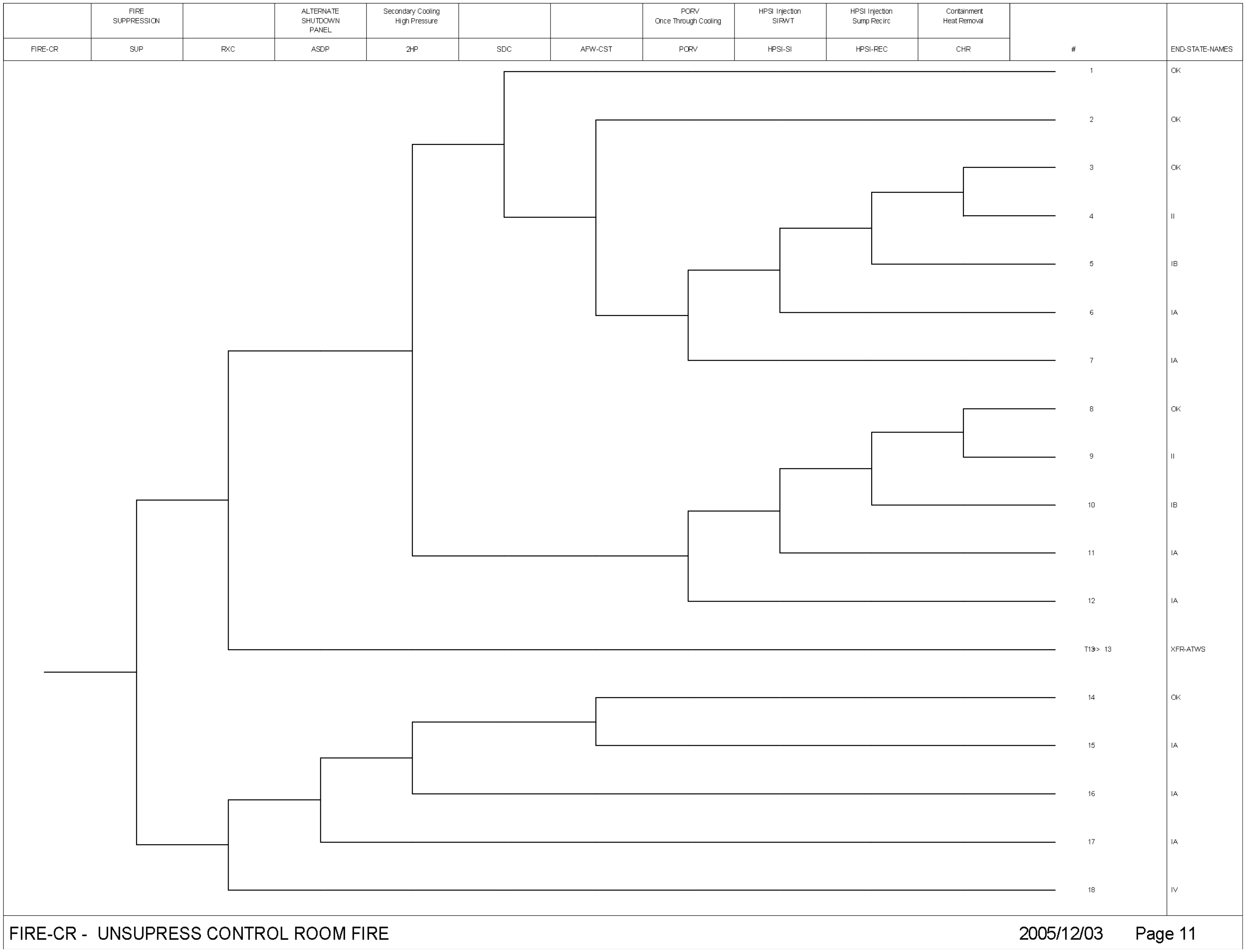

Figure A7.8 - Control Room Fire Accident Sequences

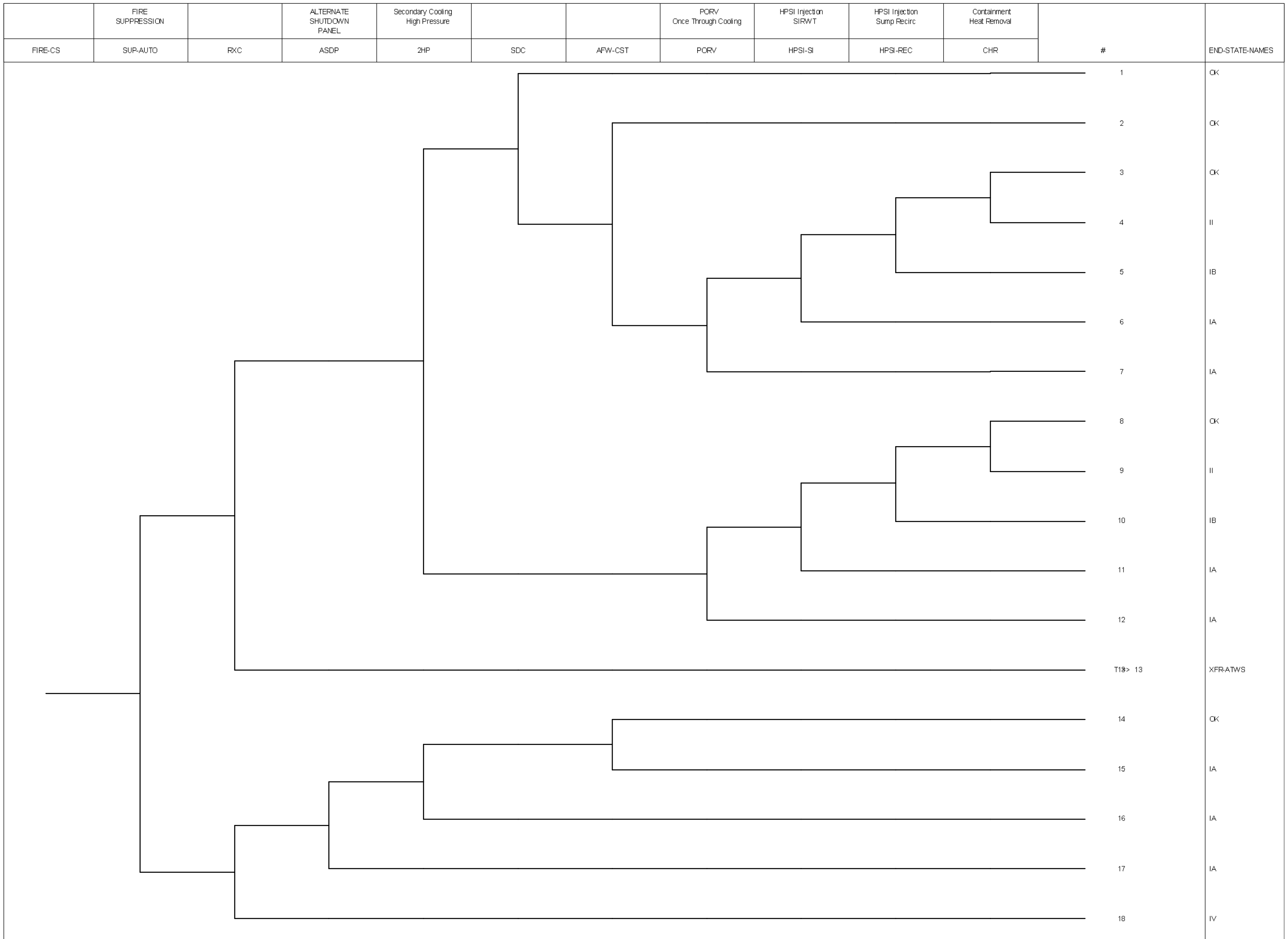

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Figure A7.9 - Cable Spreading Room and Emergency Switchgear Room Accident Sequences