STP MSPI FAQ – Mixed Status Systems

Question: the cooling water systems at STP are mixed status systems. By that 1/3 of the time the system is in standby and must start to satisfy the safety function. 2/3 of the time the system is running and does not need to start. When calculating the FV/U_R ratio what number do we use in the denominator? To complicate the matter more, failure of these systems are also plant level initiating events with mission times of one year. The $F\text{-}V/U_R$ ratios calculated for the active components in these systems are widely divergent because of the different operating modes and mission times. What method should we use to calculate these FV/U_R ratios?

Proposed Answer: The licensee should assess whether the appropriate weighting of FV/UR for FTS and FTR by the 1/3 and 2/3 factors could lead to an equivalent FV/UR for the components in question that is reasonable, if not conservative.

With regard to the initiator issue, one would like to include the contribution of the support system initiator to the FV of the component in question. In order for this to be calculated correctly, the same basic event name would have had to been used in BOTH the support system fault tree, and in the initiator fault tree. To address the differing mission times, several modeling approaches are possible. Below is an example of how one licensee modeled it, and the derivations of the FV appear to be correct. In the support system fault tree, assume a service water pump FTR basic event is called SW-PA-FTR. Assume that it had a 24-hour mission time. Now in the loss of service water initiator fault tree, it would be necessary to use an 8760 hour mission time to account for the per year frequency. One licensee addressed this by using the same basic event from the support system fault tree, SW-PA-FTR, and “ANDing” it with 365 (i.e. 8760/24). Because the PRA software calculated FV at the Basic Event level, it would have properly included the contribution from the support system fault tree and the initiator fault tree in the derivation of FV for SW-PA-FTR. Then, one simply divides by the basic event failure probability used in the 24-hour mission time.

The licensee should assess the feasibility of this or similar approaches. An alternate approach when no support system initiator fault trees are available has been discussed at the March 19, 2003, ROP and the April 7, 2003 shadow plant workshop.

STP MSPI FAQ – Estimates

Question: The current MSPI guidance (Appendix F, page F-3, line 10) defines demand as:

D is the total number of demands during the previous 12 quarters (actual ESF demands plus estimated test and estimated operational/alignment demands. An update to the estimated demands is required if a change to the basis for the estimated demands results in a >25% change in the estimate)

This guidance does not give direction on how to do the estimates. We have compiled computer history data that show start demands and run hours for the monitored equipment where available over a one to two year period. We have then averaged this data to obtain and average quarter for start and run data. In some cases this results in fractional numbers for a quarter (i.e. 3.5 starts per quarter). Is it an acceptable method for determining estimated demands and run hours?

Proposed Answer:

Yes, however an update to the estimated demands is required if a change to the operational or testing philosophy results in a >25% change in the estimate. The NRC staff concurs.

STP MSPI FAQ – RHR Unplanned Unavailability

The RHR function is supplied by the Low Head Safety Injection system at STP. The design of this system is not typical of other Westinghouse PWR designs. The Low Head Safety Injection system uses a common suction line with the High Head and Containment Spray systems and operates in parallel with them. These pumps are similar in design and have similar PM program requirements. The industry data for RHR systems (other than CE) is not representative for the STP design. Is it permissible to use the High Head Injection unplanned unavailability value for the Low Head Injection system RHR function in calculating our baseline valve?

Proposed Answer:

Yes. The design of the system and similarity of the components make this appropriate. Table 1 of Appendix F of NEI 99-02 indicates that the differences in unplanned unavailabilities between PWR HPSI and PWR (except CE) RHR are not significant. Recognizing the unique design for STP, the proposed approach is acceptable to the NRC staff.

STP MSPI FAQ – PMTs

The current MSPI guidance (Appendix F, page F-7, line 23 & 28) defines a demand as:

Start demand: Any demand for the component to successfully start to perform its risk-significant functions, actual or test. (Exclude post maintenance tests, unless the cause of failure was independent of the maintenance performed.)

Run demand: Any demand for the component, given that it has successfully started, to run/operate for its mission time to perform its risk-significant functions. (Exclude post maintenance tests, unless the cause of failure was independent of the maintenance performed.)

Excluding post maintenance tests (PMT) may not be the proper course of action. When performing a PMT there are three possible results:

The PMT fails due to failures in equipment worked on during the maintenance period.
The PMT passes with all equipment operating correctly
The PMT fails due to failures in equipment NOT worked on during the maintenance period.
In the case of example one, this is a proper exclusion since the maintenance period is still in progress, maintenance was not successful, and rework and retest will be required.

In the case of example 2, the demand should be counted since the equipment was exercised, started satisfactorily, and demonstrated functionality of the equipment.
The third case is currently counted as a demand and a failure per the current guidance.

Should the guidance be changed to count ALL demands except those that fail a PMT due solely to a failure of equipment that was worked on during the maintenance period?

Proposed Answer:

Change Appendix F, page F-7, line 23 *Start Demand:* to read:

Start demand: Any demand for the component to successfully start to perform its risk-significant functions, actual or test. (Exclude failures of post maintenance tests that fail solely due to the maintenance performed.)

Change Appendix F, page F-7, line 28 *Run Demand:* to read:

Run demand: Any demand for the component, given that it has successfully started, to run/operate for its mission time to perform its risk-significant functions. (Exclude failures of post maintenance tests that fail solely due to the maintenance performed.)

Including demands from successful post maintenance tests demonstrates the same exercise of the equipment as a normal start and run would. Current guidance requires counting a PMT if it fails, while not allowing credit for those that pass. The change will better characterize reliability of the equipment.

Excluding those post maintenance tests that fail solely due to the maintenance performed is proper since a failure of a PMT will require additional maintenance and retest. The maintenance period has not ended until then, but ONLY for the equipment worked on.

The NRC staff generally concurs with this approach. However, as discussed in previous public meetings (e.g. 12/11/02), there is concern with overcounting of demands from repetitive sequential testing following some maintenance activity. For example, four pump starts over a 24-hour period post-maintenance is not equivalent to four starts over a month, since certain standby failure modes would not be captured in the former situation. Therefore, the number of start demands that are counted following any given post-maintenance test should be limited to one.

Question:

Given that MSPI is taking advantage of the information provided by the site's PRAs in calculating F-V values for components, doesn't the definition of "Active Component" implicitly include only those components modeled in the PRA?

Answer:

Yes. Components not modeled in the PRA do not have information for calculating F-V and will not be included in data reporting. The definition of active components applies to those components modeled in the PRA. Current PRA's are assumed to be adequate to implement the indicator. Quality issues with the PRA will be dealt with outside the indicator. The NRC staff does not concur. The fundamental approach outlined in NEI 99-02 is to first include components based on deterministic criteria, such as active components that would fail a system train. The basis for this is to ensure that a sufficient number of components are included within each system to make the system MSPI calculation a meaningful one. In the future, as cutoff criteria based on FV/UR or Birnbaum are firmly established, it may be possible to exclude certain components that have low risk significance.

Therefore, it is more appropriate to begin with an all-inclusive list and pare it down, than to start with an incomplete list and question whether certain components should have been included. Components in question can be addressed on a case-by-case basis by submitting as much information as is available to the NRC staff via FAQ, including:

- Description of component <u>in question</u>
- Function of component
- Alternate means of providing same function, if any
- Simplified schematic of system
- FV (or approximation if available) and basic event probability
- Basis for excluding component.

An argument using sound PRA judgment for excluding an active component from the MSPI will be given serious consideration.

Question:

Shouldn't TI inspection criteria item 03.04.a be interpreted as identifying the list of components modeled in the PRA that will fail the train?

Answer:

Yes. No, the NRC staff does not necessarily concur. Item 03.04.a simply references the deterministic approach outlined in NEI 99-02 Appendix F.

Question:

What is the appropriate mechanism for arbitrating quality and technical differences in the PRA modeling techniques?

Answer:

One of the outcomes of the NRC program for validating their SPAR models are the identification of potential modeling and quality differences. This process should be used to gain agreement between the NRC and Licensee on modeling techniques and quality issues. The NRC staff concurs in part. The SPAR models are an independent means of verifying the accuracy and quality of the PRA model. But, the final disposition of differences of opinion between the licensee's PRA and inspection results would be to submit an FAQ.

Question:

Why are the second and third sentences included in the definition for Risk-Significant Mission Time? This seems to be establishing a PRA "standard" in a document that applies to an indicator.

Answer:

These sentences will be removed from the definition. Mission times used in the PRA are justified based on guidance provided for implementing PRA's. The NRC staff concurs. Very little value is added by sentences two and three, and they may lead to some confusion.

Question:

For components which are part of more than one monitored system, is reliability of these components included in both (multiple) systems?

Answer:

Yes. The NRC staff concurs. This situation is the exception and not the rule.

Progress Energy (not pilot plant)

1. Section 2.2, page 3, lines 26 - 28. Is there agreement on what "readily available for inspection" means?

   Proposed Answer: The NRC response to a previously submitted FAQ is provided below:

   Pilot licensees should have separately compiled and available for inspection: (1) simplified P&ID drawings of the monitored systems where the active components have been identified, (2) risk significant functions of those systems, (3) if the train/system success criteria differ from the plant's design/licensing basis, the PRA success criteria and related parameters should be listed, (4) for each active component a listing of the maximum F-V/UR value, the F-V and the UR value, and (5) for each train, the maximum F-V/UA value, the F-V and the UA value. In addition, a copy of this information should be sent to Donald Dube, RES.

   Additionally, licensees should also note where they have taken exception to the NEI 99-02 Appendix F guidance. For example, some active components that meet the MSPI definition of an active component may not be modeled in the PRA or included in the MSPI calculation. Licensee should explain in writing why this exception was taken and the reason for the exclusion or omission. By way of example, RES has found that the documentation compiled by Arizona Power for Palo Verde substantially meets the intent.

2. Section 2.2, page 5, lines 30 - 32 state that unavailability that lasts less than 15 minutes "... need not be counted as unavailable hours." At the last workshop, there was some discussion about plants that did not want to exclude them because it was more work for them. John Thompson said that all licensees would have to do it the same way i.e. either count it or not count it. I think it should be up to each plant to decide how they want to do it.

   Proposed Answer: For purposes of the pilot, licensees may count or not count the hours. Their choice. However, for full implementation, it is the expectation of the staff that the industry will be consistent and use one or the other method. Currently, the staff is indeterminate in its support of either method.

3. Appendix F, page F-3, lines 10 - 13 state that ESTIMATED demands plus actual ESF demands are to be reported. I know that some licensees have expressed a desire to report actual demands although that brings up the question of how to count PMTR demands. If the guidance remains as is, estimates are to be reported, not actuals. Is everyone on board with that?

   Proposed Answer: The NRC staff concurs that using ACTUAL demands is always an acceptable if not preferred alternative to ESTIMATES. The intent in Appendix F was to provide the licensees with the flexibility to use either actual or estimates for tests and operational alignments. The NRC staff response for post-maintenance testing is provided above.

Millstone MSPI FAQs:

1. Cooling Water Function:

This indicator has a separate monitored system for cooling water. At MP3 there is a separate cooling water system which cools the charging pump lube oil. The system is a closed cooling water system (CCE) which is cooled by service water. In PRA this is modeled as a separate system although unavailability is tied to charging (UAp is not based on actual CCE unavailability). When maintenance is performed on the CCE system that affects the ability to cool the charging pump lube oil the corresponding charging pump is put in pull-to-lock. Per the direction in maintenance rule this would require counting the unavailable hours against charging. How would unavailability be tracked for this? If unavailability is included with HPSI can we treat the charging pump as a supercomponent which includes the lube oil system and not count demands for the CCE pump?

Proposed Response:

Do not count the closed cooling water as a separate system. Since its unavailability results in charging being unavailable (and tagged out), the unavailability would already be included under the charging train. No additional unavailability needs to be counted for CCE as a separate cooling water system. This would be consistent with how other dedicated cooling water systems are counted (Example diesel jacket water cooling). Include the pumps of these systems as active components in the HPSI indicator. The NRC staff concurs. As a system dedicated to charging pump cooling, CCE may be considered an integral part of the charging system (and hence HPSI as defined in the MSPI program). Failure of CCE results in failure of the corresponding charging pump, and nothing else. Therefore, CCE may be considered part of a charging "supercomponent." If CCE unavailability is already counted against the corresponding charging train as is described above for the Maintenance Rule, then there is no need to "double count" the CCE unavailability. The CCE pump should be included as a separate component in the HPSI system on the NEI spreadsheet, not as part of the cooling water system. Demands and failures of the CCE pump should be tracked like any other HPSI component that could by itself fail a charging train.

2. Cooling Water Function:

This indicator has a separate monitored system for cooling water. At MP3 there is a separate cooling water system which cools intermediate head pumps (SIH). The system is a closed cooling water system (CCI) which is cooled by service water. In PRA removing a train of CCI is not modeled since the work always results in SIH being unavailable and there are no system crossties which would allow the opposite train of CCI to provide cooling. When maintenance is performed on the CCI system that affects the ability to cool the SIH pump lube oil the corresponding SIH pump is put in pull-to-lock. Per the direction in maintenance rule this would require counting the unavailable hours against SIH. How would unavailability be tracked for this? If unavailability is included with HPSI can we treat the SIH pump as a supercomponent which includes the lube oil system and not count demands for the CCI pump?

Proposed Response:

Do not count the closed cooling water as a separate system. Since its unavailability results in charging being unavailable (and tagged out), the unavailability would already be included under the SIH train. No additional unavailability needs to be counted for CCI as a separate cooling water system. This would be consistent with how other dedicated cooling water systems are counted (Example diesel jacket water cooling). Include the pumps of these systems as active components in the HPSI indicator. The NRC staff concurs. As a system dedicated to SIH pump cooling, CCI may be considered an integral part of the SIH system (and hence HPSI as defined in the MSPI program). Failure of CCI results in failure of the corresponding SIH pump, and nothing else. Therefore, CCI may be considered part of an SIH “supercomponent.” If CCI unavailability is already counted against the corresponding SIH train as is described above for the Maintenance Rule, then there is no need to “double count” the CCI unavailability. The CCI pump should be included as a separate component in the HPSI system on the NEI spreadsheet, not as part of the cooling water system. Demands and failures of the CCI pump should be tracked like any other HPSI component that could by itself fail an SIH train.

3. Service Water Function:

In the Additional Guidance section for Clarifying Notes for Specific Systems for Cooling Water Support it specifies that service water strainers are not considered active components. At both MP2 and MP3 there are backwash valves which clean the strainers of debris. At MP2 these valves are air operated and get an accident signal to open so the strainers will not get clogged during an accident. At MP3 these valves are MOVs which will continue to open and close on a high DP. Neither of these valves are modeled in PRA, although PRA assumes a probability associated with the strainer being clogged. Although the strainers are not considered active, should the backwash valves be active?

Proposed Response:

Do not include the backwash valves since the MSPI documentation specifically states that the strainers are not included. The original basis for excluding the service water strainers from the MSPI must be reviewed before fully responding to this issue.

4. Service Water and Closed Cooling Water Function:

PRA does not model removing either a train of service water or a train of RBCCW from service. They assume these trains are always available. There are testing evolutions which align the system such that flow balances are impacted such that accident flows can not be provided to the required components. The system engineer counts this as train unavailability. What should be used for the train unavailability Fussell-Vesely. Using the pump unavailability would not be accurate since an individual pump is less important than the train. Additionally, the individual pump unavailability is not determined by the system engineer.

Proposed Response:

Use the Fussell-Vesely of a failed train or a component that would be approximately the same as taking a train out. The pump numbers are not an adequate representation of the entire train being out. The NRC staff concurs that using service water or RBCCW pump unavailability for MP2 or MP3 is not equivalent to train unavailability, since this approach would significantly under predict the risk significance. The important parameter to preserve here is FV/UA for a train of cooling water, not necessarily FV. For low values of UA as is the usual case, FV/UA is approximately the Risk Achievement Worth minus 1 (RAW – 1) for the train of service water or RBCCW. Finding a component or basic event that would fail a train should give a FV/UR that is approximately equivalent to the FV/UA for the cooling water train in question. However, before closing this issue in full, a simplified diagram and the success criteria for the systems in question should be provided.

5. General Question:

Appendix F discusses what qualifies as an active component. It discusses redundant valves and which ones are considered active. It is our interpretation that within a train, two valves in series that are required to close or in parallel that are required to open do not need to be included as active components as long as the failure only impacts one train. The basis for this is the low likelihood in PRA of both valves failing. It is also our interpretation that within a system, two valves in series that are required to close or in parallel that are required to open need to be included as active components if the failure impacts both trains. The basis for this is the consequences of the valves not working is severe. Based on these interpretations there are several configurations on MP3 which we are unclear as to whether the valves should be considered active.

a) MP3 has three charging pumps. Each pump has one MOV on its recirculation line. There is an additional MOV on the common line (Figure 1). The three branch lines are power off one train and the common line is powered off the opposite train. Therefore for each pump either the common MOV or the branch line MOV must go closed. If the branch line MOVs and the common MOV do not close, all trains are lost. Would these valves be considered active?

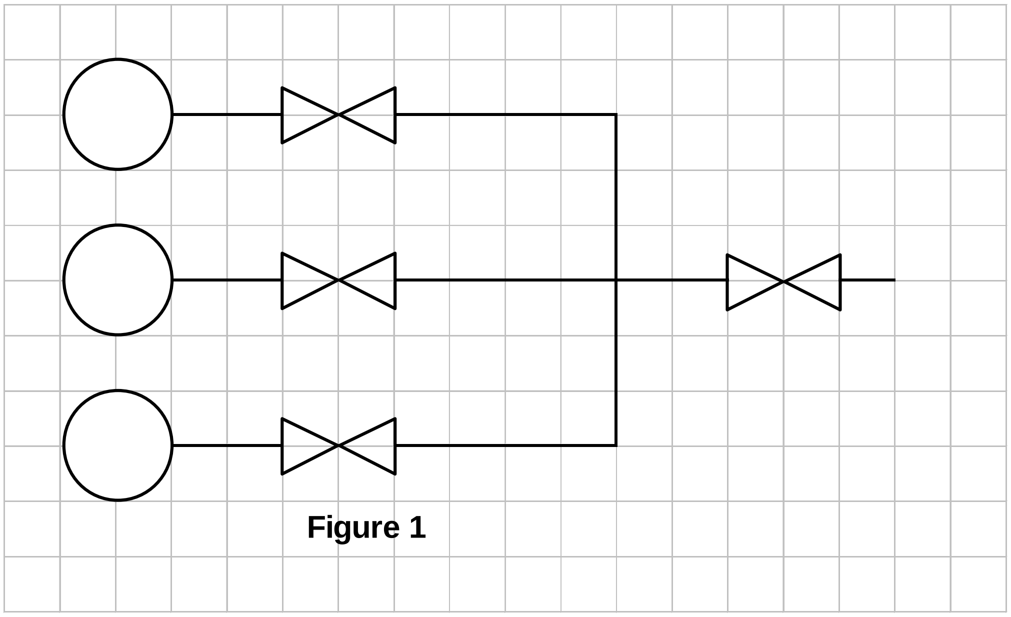
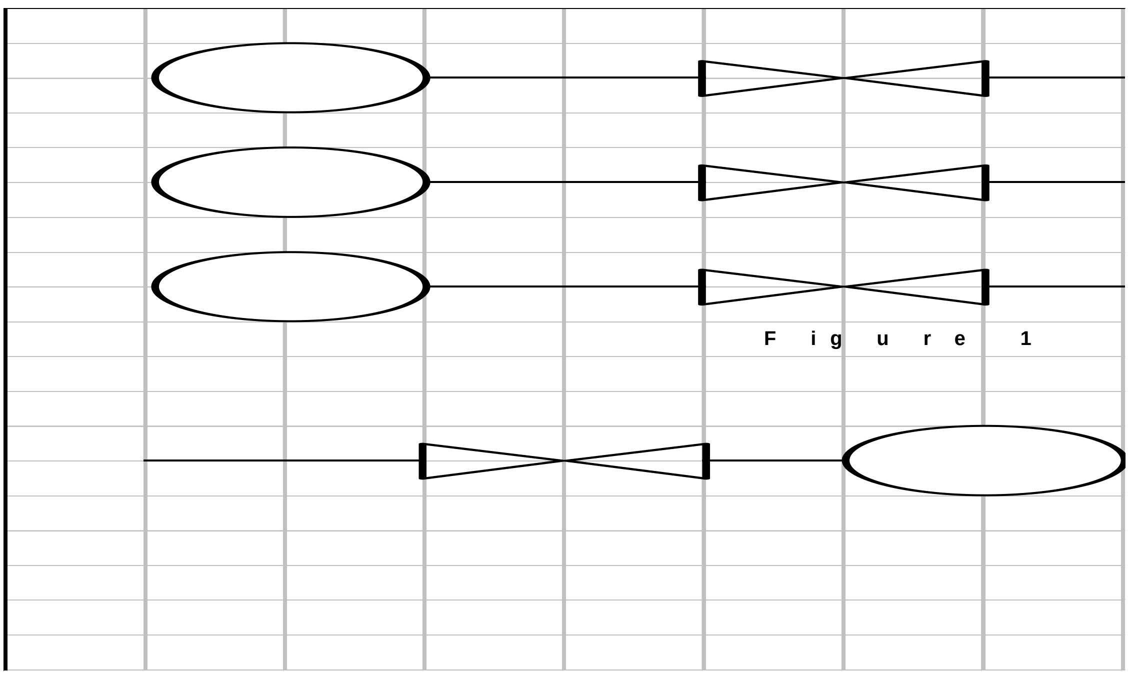


Figure 1

Proposed Response:

The charging minimum recirculation valves would be counted as active valves since they do not meet the redundancy criteria in that a failure of all valves impacts both trains. The NRC staff concurs that this configuration is not a clear case of the straightforward parallel/series configuration discussed in Appendix F. However, it would appear that per the guideline in NEI 99-02, page 9, the fourth bullet, these valves need NOT be included as active components since no two combination of valve failures would fail all pumps.

For recirculation MP3 has a two train system. Each train consists of two pump trains, of which one pumping train is required for recirculation (Figure 2). The pumping train consists of a suction MOV from the sump, a pump, and a discharge MOV to a common line which provides suction to either the intermediate head pumps or charging pumps. Each pumping train has its own discharge valves to the common header and can not be cross-connected. Since only one pumping train is required, are the suction and discharge valves considered active?



Proposed Response:

Yes since the pumping trains can not be cross tied. The success criteria and normal/accident valve positions must be better articulated. NEI 99-02, page F-9 should be reviewed to identify if any one valve in the train can fail the entire train. If not, then the valves need not be included as active valves.

At MP3 there are two trains for hot leg injection. Each train has a MOV in its discharge line to the cold legs and there is also a MOV in the common line to the cold legs. During switchover to hot leg injection, the discharge MOV to the cold legs is closed and the hot leg injection MOV is opened for one train and then the other train and then the common cold leg MOV is closed. To meet the hot leg injection requirements either the two discharge MOVs or the common cold leg MOV need to be closed. Would these valves be considered active?

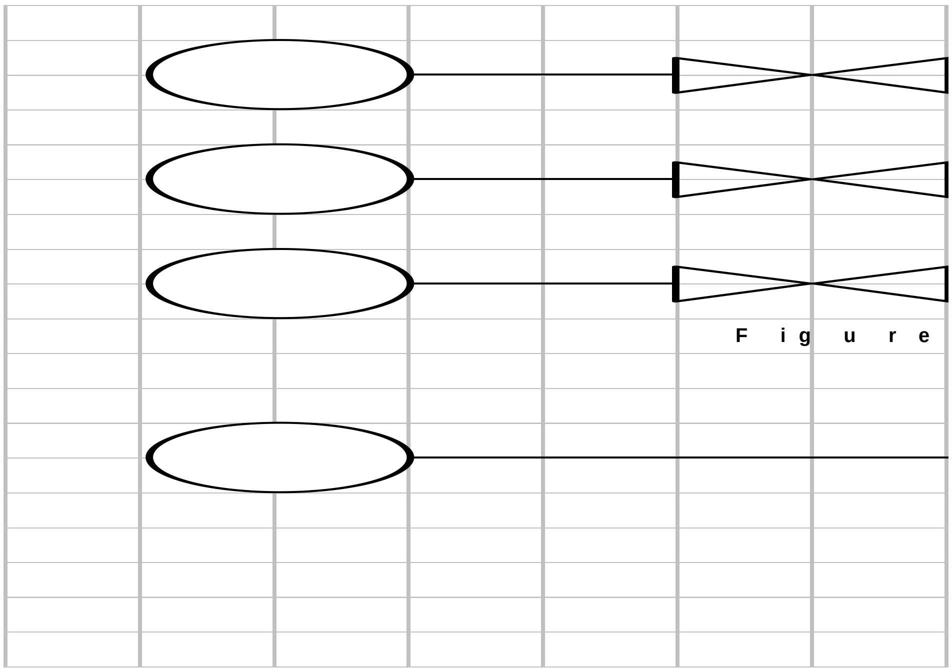


Figure 3

Proposed Response:

Yes since if both the discharge MOVs or the common line MOV did not close both trains of hot leg injection would be lost. The success criteria as well as normal/accident valve positions for both the cold leg injection and the hot leg injection functions must be better articulated. NEI 99-02, page F-9 should be reviewed to identify if any two valve failures can fail the entire system function. If not, then the valves need not be included as active valves.

HOPE CREEK MSPI FAQS

Q. Does a complete list of parameter-based success criteria for the monitored systems need to be provided?

A. No. Only if other than design basis values are being used. NRC response from an earlier FAQ is presented below:

All pilot participant licensees need to state in writing the systems' risk significant functions. If the licensee desires to use the design/licensing basis for success criteria, it must so state. A separate listing of design/licensing success criteria need not be included. If success criteria from the PRA are used, the specific success criteria must be stated in writing. Justification for the PRA success criteria will not be included in the MSPI documentation. (Note however, that justification should be available in the licensee's PRA documentation).

Q. Do detailed design basis parameters, values, and supporting calculations have to be readily available during the inspection? Examples include: Condensate storage tank (CST) and suppression pool level and temperature bands to support successful operation of HPCI; SACS pump flow rates; and HPCI, station service water (SSW), and safety auxiliary cooling system (SACS) valve actuation times.

A. No. Only if other than design basis values are being used. The NRC staff position is that conventional success criteria used in PRAs need to be readily available. Hence, "xx gallons per minute to 2 of 4 injection loops for yy hours" would be the level of detail necessary. To the extent that nominal tank levels are sufficient for the system mission time, detailed parameters need not be specified. Valve actuation times need not be specified.

Q. Does the HPCI minimum flow valve need to be included as an active component?

Inspection Report Comment: In the event that the valve does not close following an HPCI actuation, the HPCI system would not be able to fulfill its function. (The valve opens upon start of the pump and closes when pump discharge flow exceeds 560 gallons per minute.) Therefore, it should have been treated as an active component. In addition, PSEG's PRA did not model the HPCI minimum flow valve; consequently, PSEG did not have a Fussell-Vesely (F-V) importance measure for the valve to be used in the MSPI calculation.

PSEG Response: 1) If Min flow valve fails to close during full flow injection, the diversion of the min. flow path is not large enough to affect the HPCI performance; 2) In modeling HPCI injection, HPCI pump discharge flow rate is above the Min flow valve set point, therefore, Min. valve is not required to change from the normal position (close position). Based on the above discussion, Min. Flow valve is not modeled. The NRC staff's position is that there must be adequate justification and documentation as to whether the minimum flow valve should or should not be included in the PRA, and as an active component in the MSPI. Hence, if the consequence of the minimum flow recirculation valve not opening would be to potentially fail the HPCI pump owing to pump deadheading and overheating, during the time that RCS system pressure were above the shutoff of the pump in an accident, then the opening function of the valve is required to be modeled. Likewise, if best estimate accident analysis demonstrated the need for a minimum of (for example) 1500 gallons per minute to be injected into the core, and failure of the valve to reclose would result in so much flow diversion that only 1000 GPM could be demonstrated, then the reclose function of the valve would also have to be modeled. If there is any doubt, then the valve must be included. The FV/UR for the min flow valve would be approximately if not exactly the same as the HPCI pump itself, given the fault tree logic of “OR”ing the HPCI pump and the min flow valve fail-to-open and/or fail-to-close.

Q The MSPI F-V coefficients were not able to be verified against PSEG's PRA that was qualified for use by the NRC staff, because PSEG had not identified all of the F-V coefficients for the active components and the staff had not qualified the PRA. Do all F-V coefficients for the active components need to be provided, or is it satisfactory to provide the limiting ones, only? The NRC staff position is that the FV/UR for all active components to be monitored in the MSPI must be provided. However, if no FV/UR value for an active component is available because the component was not modeled in the PRA, then a reasonable estimate could be used. It is not necessary to completely revise the PRA for the purposes of the Pilot Program. For example, if a closed valve in series with a pump was omitted from the PRA model, the FV/UR for the pump fail-to-start or fail-to-run could be used for the valve fail-to-open.

Q. PSEG did not include all of the failure modes of the active components (e.g., HPCI turbine-driven pump) in the evaluation to determine the limiting F-V/UR ratio for an active component. For example, PSEG considered the HPCI turbine stop valve part of the HPCI turbine-driven pump. However, the valve was treated as an independent component that would fail the HPCI train within their PRA. In accordance with the MSPI guidance, the F-V/UR ratio that is used in the MSPI calculation should be the maximum ratio of the F-V/UR ratios for each of the basic events that fail the train. Consequently, the F-V/UR ratio for the HPCI pump used in the MSPI calculation may not have been correct. Does a PRA model change need to be made? The NRC staff position is that omitting some failure modes in the derivation of the maximum FV/UR does not necessarily require complete PRA model revision. Because of cutset truncation effects, some individual basic event FV could be in error. That is the reason why it is required to use the maximum FV/UR. Fortunately, as a general rule, high FV values that contribute most to risk are less susceptible to truncation effects. On the other hand, low FV values are most susceptible to truncation effects, but generally have low contribution to risk. If the dominant failure mode of the component or train were properly included (i.e. the failure mode with the highest failure probability), then the FV/UR is probably the maximum for that train. The licensee should review the various FV and FV/UR within a train, assess whether they may be subject to significant truncation effects, and respond accordingly.

Q. PSEG's PRA model assumed that the A and B SSW pumps and the A and B SACS pumps were normally operating. Consequently, the PRA model did not contain basic events for these pump trains being unavailable or for the failure of these pumps to start in the event that the C and D pumps were operating. Also, because the model assumed that the A and B pumps were operating, the model did not contain basic events for the failure of the pump discharge valves to open. In each of these cases, PSEG used the importance measures associated with the C train as a surrogate for the A and B trains.

PSEG Comments: The conclusion is incorrect. We have modeled all four trains for SSWS and SACS. However, we assume only two trains are normally running. Therefore, the FV ratios will be displayed for the running trains. For the MSPI calculation purpose, the FV ratios of the standby trains will use those values for the running trains. The model can simulate the actual plant conditions by choose the actual alignments. The NRC staff position is that it is conventional PRA practice to assume that certain pumps are normally running, while other pumps are normally in stand-by. For certain events such as loss-of-offsite power, the model should include pump restart as a failure mode for both stand-by and normally running pumps. Excluding such failure modes would lead to some small if not immeasurable impact on overall core damage frequency. Consideration should be given to a model revision consistent with the normal PRA update schedule. For the purposes of the MSPI, the important parameter to capture is the appropriate maximum FV/UR ratio. So long as there is no major asymmetry between one train and the next, using the maximum FV/UR ratios for one train should be a reasonable approximation for the redundant train.

Inspection Report Comments: The F-V/UA ratio for the D service water pump train unavailability should have been 4.46E-1 instead of 4.53E-1. The F-V/UA ratio for the D SACS pump train unavailability should have been 9.13E-2 instead of 9.84E-2. PRA re-calculated these numbers, and sticks with their original answer. The NRC staff position is that, given the general degree of accuracy in the calculation of the FVs from the PRA models, there is no statistically significant differences between the values discussed above.

PSEG used the F-V coefficients associated with the initiating event contribution for the cooling water support system pumps failing to run (e.g., SWS-MDP-FR-IA502/IB502/IC502/ID502 and SAC-MDP-FR-IA210/IB210/IC210/ID210). However, PSEG did not use the associated basic event failure probability when determining the F-V/UR ratio. Consequently, the F-V/UR ratio for these pumps used in the MSPI calculation may not have been correct. PSEG believes the number being used is conservative. The NRC staff requests additional clarification on this issue. It is not clear which FV was used, and which basic event failure probability was used.

The F-V importance value for several basic events associated with active components were below the truncation value of 1.0E-5. In these cases, PSEG used a default value of 1.0E-5. PSEG agrees that this is what we did, however, we believe it is a conservative approach that should be allowed. The NRC staff concurs with this approach. However, it is really a moot point. Sensitivity studies indicate that unless the truncation limit on the cutsets were at the 1E-15/yr level or lower, the inaccuracy in the derivation of the FV down to the 1E-5 level is so high as to make the value meaningless. Moreover, even assuming a UR as high as 1E-1, would equate to a FV/UR of only 1E-4, so low as to have no effect on the system MSPI. Based on discussion above, valves with FV/UR below 0.1 are candidates to be excluded from the MSPI.

MSPI Comment:

The 4160V breakers cross tie the Diesel Generators to their respective 4160V busses on the other unit. These cross tie breakers are modeled in the PRA and have a large effect on the CDF values. NEI 99-02 MSPI Rev 0 guidance on Unit Cross Tie Capability, states that "Components that cross tie monitored systems between units should be considered active components if they are modeled in the PRA and meet the active component criteria in Appendix F. Such active components are counted in each unit's performance indicators." Appendix F, Table 2, however, does not contain industry values for breakers, nor does the MSPI data spreadsheet contain a component type or industry values to allow including breakers as active components. Will breaker information be added to the guidance to allow breakers to be included as active components?

Response

Yes. As discussed at the January 21, 2003, Public Workshop on the MSPI, the values to use in Appendix F, Table 2 for electrical circuit breakers are: mean value = 3E-3 (open or close); a = 0.49, b = 160.

Surry MSPI FAQ - Scope of PRA Model

Question:

Should internal flooding initiating events be included in the scope of the PRA used for the MSPI calculations?

Background. The current MSPI guidance (Appendix F) defines the scope of the PRA model used for the MSPI calculations as "internal events." Internal flooding constitutes approximately 2/3rds of the total CDF at Surry. The Surry PRA model used for the MSPI calculations includes internal flooding initiating events. The NRC indicates in the TI report for Surry that internal flooding is an external event that should not be included in the MSPI scope per the NEI guidance. The Licensee believes based on GL 88-20 that internal flooding is an internal initiating event and should be included in the MSPI scope. The licensee notes that inclusion of internal flooding in the MSPI calculations does not mask the other internal initiating event delta CDF contributions since all the initiating event contributions are additive, as long as the accident sequence truncation limit is low enough to capture the contributions from all the significant initiating events. The accident sequence truncation limited used for the Surry MSPI calculation was 1E-12 per year.

Proposed Answer:

Internal flooding initiating events should be included in the scope of internal initiating events for the MSPI calculations. The NRC staff position is that the MSPI calculations were intended to address “at-power, internal events, Level-1 PRA.” While internal flooding was included in the GL 88-20 submittals, the vast majority of the licensees generally treat internal flooding, like all other “spatial events”, separate from the “internal events” model. As such, it was not the intent of the MSP to require all Pilot Plants to have to include “internal flooding.”

The MSPI formulation uses the Birnbaum importance measure (CDF * FV/UR) for the safety system components. The Birnbaum represents the sensitivity of the change in CDF owing to changes in component unreliability (or equivalently, unavailability). Including internal flooding in the derivation of the various component basic event Birnbaums would result in *higher* values of B than if internal flooding were not included. This is because of the additive nature of the constituents making up B. Hence, the delta CDF calculations, which get translated into URI, UAI, and ultimately MSPI, will be higher with internal flooding than without. This will result in conservatively higher calculations of MSPI given unreliabilities and/or unavailabilities above the baseline. As such, this could also result in a higher likelihood of “invalid indication.”

If the "internal flooding" portion of the Plant PRA model can be readily "turned off" via flags or the like, the staff would prefer that internal flooding NOT be included in the MSPI. This is because, among other reasons, the SPAR models which will form the basis for independent verification, do not include internal flooding at present.