DRAFT

REQUEST FOR ADDITIONAL INFORMATION NEEDED TO COMPLETE THE TECHNICAL REVIEW OF TSTF-424, REVISION 0, "RISK-INFORMED HPSI AOT/CT EXTENSION"

Question 1(a)

1. The staff requested clarification of the proposed implementation approach with respect to guidance provided in Maintenance Rule (a)(4) and RGs 1.174 and 1.177 (Question 2 of "acceptance review" comments). The industry's response did not fully clarify all of the staff's questions. Please answer the following questions, including examples when judged to be helpful.

(a) Briefly describe the process, including criteria, that will be used to determine the extended (or "flexible") AOT/CT (i.e., the amount by which the front stop AOT/CT will be extended) for a given plant configuration. Example(s) could be used to illustrate the process and distinguish among potential cases (e.g., planned maintenance vs. emergent condition during the extended AOT/CT).

<u>Response: 1(a)</u>

The process to be used will be consistent with the Risk Management Technical Specification (RMTS) Guidance document. The key features of the process are envisioned to be as follows:

A. <u>Contemporaneous Risk Assessments</u>

1. The RMTS guidance document is applicable to all Technical Specifications that include a flexible Allow Outage Time/Completion Time (AOT/CT) (frontstop and backstop). The general process is illustrated in Figure 1.

2. In accordance with the Maintenance Rule (MR) (a)(4) and associated regulatory guidance a risk assessment is performed. This risk assessment will establish a Risk-Informed Completion Time (RICT). The status of components within the scope of the maintenance rule will be considered in the assessment.

3. Risk levels are referenced to a zero maintenance Core Damage Frequencies (CDF). The RICT will be measured from the time of initial entry into the TS.

    a. For <u>planned maintenance</u> activities the RICT will be established to have an ICDP < 1.0E-6 and an ILERP < 1.0E-7.

    b. For <u>emergent</u> conditions larger risks may develop. As the RMTS is consistent with the maintenance rule, ICDP associated with the maximum RICT is < 1.0E-5 and a corresponding ILERP < 1.0E-6, as measured from the initial entry into the TS.

4. Screening will be available to ensure an emergent configuration does not have an unacceptably high risk. High risk configurations have a CDF > 1.0E-3 per year and projected ICDP > 1.0E-5. Most high risk configurations are precluded by TS. Maintenance projected to exceed the RICT (i.e., has an ICDP above 1.0E-5) or maintenance that will extend beyond the backstop AOT/CT will be considered to have the TS REQUIRED ACTION NOT MET and proceed in accordance with the TS.

Question 1(a) continued

5. Compensatory measures/contingency actions will be taken commensurate with the level of risk. CDF credit for these actions may be considered in the RICT evaluation, in accordance with Section 3.6 of the risk management guidance.

B. Tracking of Accumulated Risk

To demonstrate conformance with RG 1.174 the plant will track all entries into the HPSI TS that exceeds the frontstop time. The recorded ICDP will be that associated with the contemporaneous plant configuration as measured from the time the frontstop is exceeded to the time the HPSI TS is exited.

C. Shutdown

No new shutdown processes are introduced by the flexible AOT/CT concept. Once it is determined that either of the following conditions exists:

a. The cumulative ICDP (as tracked from initial entry into the TS) exceeds 1.0E-5

b. Or the instantaneous risk exceeds 1.0E-3/year

c. The time within the TS exceeds the backstop time

The plant must exit that TS and take the required Action for the condition that the LCO is not met.

The operators will proceed with an orderly shutdown in accordance with station procedures in the same manner they would for any other TS required shutdown. As provided by the TS, the shutdown does not have to be completed if the affected component is restored to operable status in the interim.

D. Consideration of External Events

The risk significance of the HPSI system is not significantly changed by consideration of external events. Therefore, treatment of external events within the context of the HPSI TS changes is considered small. Regardless, external events will be explicitly considered. The specific process will vary among utilities, consistent with the RM guidance treatment, via use of one of the following options:

a. Full scope external events PRAs,

or

b. Bounding Calculations

or

c. Demonstrating of negligble impact

Question 1(a) continued

The current pilot will utilize option b. Bounding calculations will build upon plant specific insights applied in a manner as to reasonably estimate the risk of bounding analyses will not necessarily bound all aspects of the event. Examples of bounding approaches for appropriate external event evaluations are presented in Responses to RAIs 35 and 36.

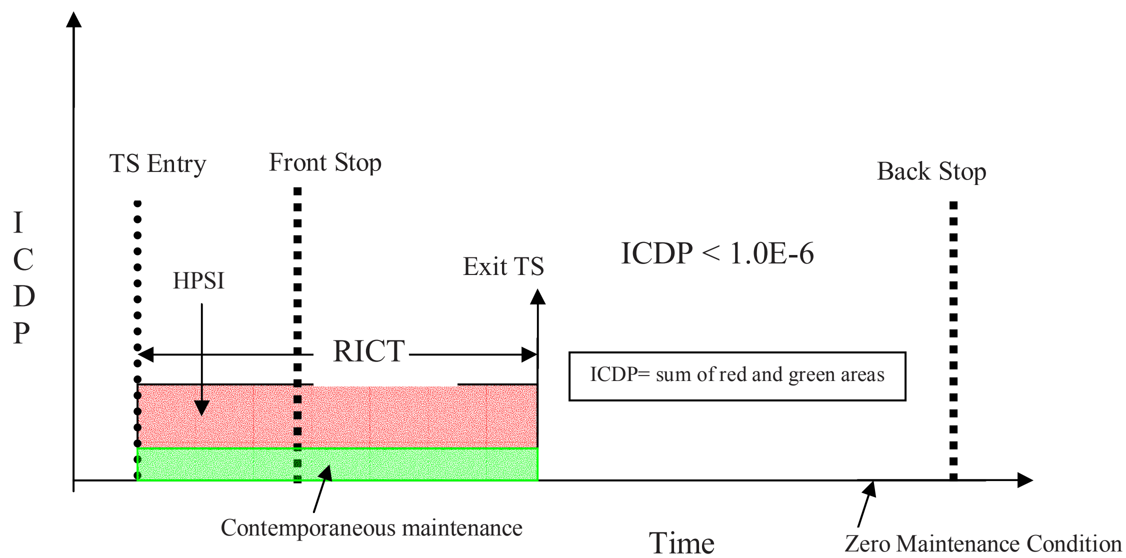
E. Common Cause

An explicit common cause consideration is to be considered for emergent equipment failures. Common cause impacts on risk are treated in accordance with RMTS Guide contained in Section 3.5.2.3.

F. Documentation

A summary of the key elements to be included in this subject documentation is contained in Response to RAI 47. For the pilot plant, the information will be recorded within the plants' (a)(3) report.

Figure 1
Illustration of RICT Calculation for Planned Maintenance Activity



Notes:

1. For planned/scheduled activities where component is removed for preventive maintenance RICT based on ICDP < 1.0E-6
2. Initial RICT calculated or reconfirmed in planning stage prior to TS entry
3. RICT recalculated prior to exceeding frontstop
4. RICT continually re-evaluated as plant configuration changes
5. All plant changes that occur simultaneously with the HPSI outage are tracked and included in risk assessment
6. When emergent conditions occur during extended AOT then:
   a. A risk assessment is performed expediously (see RMTS Guidance) with high risk conditions screened
   b. When ICDP exceeds 10^{-6} plant implements Risk Management Actions (RMA)

Question 1(b).1

(b) In the industry's response it is stated that flexible AOTs should in aggregate conform to the general guidance of RG 1.174. Although the staff agrees with this statement, there may be a difference in the understanding of this statement between the staff and the industry:

- **The industry states that an increase in CDF of up to 1E-5/yr is small and, therefore, acceptable. However, the guidance provided in RG 1.174 states that this is acceptable only when the plant's baseline risk from all sources (i.e., both internal and external events at power as well as during shutdown) has been reasonably assessed (i.e., uncertainties were also addressed) and is lower than 1E-4/yr. Please discuss.**

<u>Response: 1(b).1</u>

We agree that the 1E-5/year risk increase due to the usage of a flexible AOT should be associated with a full scope PRA. Furthermore, the goal should apply to all TSs covered under the flexible AOT/CT process.

Of the CE PWRs several plants have full scope PRAs, and many have internal event PRAs enhanced with dominant external event sequences. Current CEOG member CDFs (see RAI 7) indicates that there is no expectation that the baseline total CDF would exceed 1.0E-4 per year for the most limiting unit.

Question 1(b).2

- **If the flexible AOTs should <u>in aggregate</u> conform to the general guidance of RG 1.174 for allowed risk increases, then why it is proposed to be able to accumulate all the allowed risk increase in a single AOT/CT extension? Please discuss.**

<u>Response: 1(b).2</u>

It is not proposed that the plant aggregate the total annual expected incremental risk at one time. RG 1.182 (which endorses the industry MR guidance) denotes 1E-5 as the ICDP above which entry is not voluntary. As a general rule, planned maintenance evolutions would be less than 1E-6, so the aggregated risk for multiple events would be less than 1E-5 annually. For example, at FCS for planned maintenance to be in the green region (normal maintenance) the risk level (ICDP) must be < 1E-8. As maintenance risk increases, the level of management scrutiny and attention to risk management actions increase. A high risk (> 1E-5 ICDP) entry could arise as a result of an emergent condition.

Question 1(b).3

- **Please clarify how the aggregate increase in risk associated with the proposed flexible HPSI AOT/CT extensions will be calculated (e.g., the time the risk accumulation begins, credit for compensatory measures, risk increases measured from the "zero maintenance" baseline or the "average maintenance" baseline).**

<u>Response: 1.b.3</u>

As discussed in Response to 1(a) the calculation of risk will be based on the plant PRA.

Question 1(b) continued

Two accumulations are being tracked: (1) maintenance configuration risk and (2) aggregate or accumulated risk beyond the front stop. These are discussed below.

1. <u>Maintenance Configuration Risk:</u> Maintenance configuration risk is the risk associated with the particular TS maintenance configuration as measured from the initial entry into a Risk-Informed Technical Specification (RI TS) to the exit from that same TS. Associated ICDP and ICLERP are therefore based on initial entry into the TS, using a zero maintenance PRA.

2. <u>Aggregate Flexible AOT:</u> The aggregate flexible AOT risk is a metric for use in tracking the use the flexible AOT. The aggregate flexible AOT risk is to be tracked for those TSs that have a flexible AOT/CT. Tracking of the aggregate risk in the CEOG process begins when the evolution passes the frontstop and ends when the TS'd item is returned to service. Tracking is referenced to the configuration that would have existed had the RITS component not been out of service. This metric is associated with that component's contribution to risk while in extended maintenance beyond the front stop. A bounding way of performing the analysis can include consideration of the total configuration risk beyond the frontstop.

Question 1(b).4

< **If contingency actions and compensatory measures are credited in assessing risk increases, risk-informed regulation requires procedures and administrative controls as well as appropriate PRA modeling for such actions and measures. Please discuss how this requirement will be implemented.**

<u>Response: 1(b).4</u>

RMTS Sections 3.5.3 and 3.6 discuss implementation of risk management actions and guidance for considering those actions within the risk assessment. Contingency actions (including the staging of hardware) are for the purpose of risk management and will be treated qualitatively for low risk conditions. When quantitative treatment is desired for significant yet unrecovered cutsets, actions will be credited when: (1) procedures exist, (2) operators have a high probability of completing the task when required (e.g., manual actions to close valves, actuate systems) and (3) probability of success can be quantified. PRA evaluations, if utilized, will estimate HRA factors following standard PRA practices. For planned conditions, any credited compensatory measures will be established and evaluated as part of the maintenance planning.

Question 1(b).5

< **Please explain how the risk increases to be used in RG 1.174 criteria will be calculated (e.g., from the zero maintenance baseline or the average maintenance baseline). Include a brief discussion of the proposed approach (e.g., risk increases are in accordance with RG 1.174 guidelines or they are calculated conservatively).**

<u>Response: 1(b).5</u>

Risk increased will be measured from a zero maintenance baseline to TS exit time and begins at entry to TS. Risk increases will be calculated realistically or conservatively as appropriate for the condition at hand.

Question 1(c)

(c) Describe the process, including criteria, for initiating a plant shutdown. How will this process address the proposed removal of current constraints to plant operation at power imposed by the fixed AOTs/CTs? The staff believes that the guidance provided in maintenance rule (a)(4) regarding the initiation of plant shutdown needs improvement to compensate for the proposed removal of current constraints to plant operation at power imposed by the TS fixed AOTs/CTs.

<u>Response: 1.c</u>

See response to Item 1(a).

Question 1(d)

(d) Please clarify the risk metrics used for: (1) the configuration from the beginning of the outage to completion and return to service and (2) the configuration beyond the front-stop (i.e., associated with the AOT/CT extension), respectively. Use of different designators for risks associated with these two cases would help eliminate confusion throughout the report.

<u>Response: 1(d)</u>

See response to 1(b).3 above. Additional discussion will be provided in a revised topical report.

Question 2.1

The staff needs further clarification of the following statements included in the industry's response to Question 4 of "acceptance review" comments (regarding the criterion for limiting the allowed instantaneous increase of risk):

< **It is stated: *"...entries into configurations with incremental risks (ICDPs) greater than 1E-5 should not be voluntary."* Does this statement imply that during an AOT/CT extension, which is voluntary, no ICDPs greater than 1E-5 will be allowed? If this is correct, shouldn't an ICDP greater than 1E-5 require the initiation of plant shutdown? Furthermore, the industry's RMTS guide states that preventive maintenance involving an AOT/CT extension will be planned so that it is completed before the ICDP reaches the value of 1E-6. Please discuss.**

<u>Response: 2.1</u>

Yes, consistent with NUMARC 93-01 and RG 1.182 the utility will not plan a preventive maintenance activity that has an ICDP > 1E-6. The revised guidance in the RMTS indicates that the TS is considered to not be met when: (1) the ICDP as measured from the time of TS entry will exceed 1.0E-5, (2) the instantaneous risk exceeds > 1.0E-3/year or (3) the time exceeds that in the TS allowed by the backstop.

Question 2.2

< **It is stated: *"...instantaneous risks greater than 1E-3/yr ...should be performed only when supported by a plant assessment to determine the efficacy of a plant shutdown assessment."* Please clarify this statement. Also, explain how is this statement in agreement with maintenance rule (a)(4) Section 11 which states that a configuration with instantaneous CDF risk greater than 1E-3/yr should not be entered voluntarily? Please discuss.**

<u>Response: 2.2</u>

The text will be modified to reflect that planned maintenance will be performed in accordance with NUMARC-93-01, Rev. 3 which states that configurations with risks > 1.0E-3 per year would not be entered voluntarily.

Question 3

The staff needs clarification of statements included in the industry's response to Question 5 of "acceptance review" comments regarding the need for more detailed discussion of the plant specific risk assessments discussed in the report. It is stated: *".... the intent of this effort is to establish a process for risk evaluation that is consistent with the MR. Therefore, detailed a priori information assessments for each action need not be required on an individual basis. The information provided in the base report and associated RAIs include examples of potential configurations for the purpose of illustrating the use of the process."* These statements do not seem consistent with the proposed TS changes in TSTF-424. The industry has requested generic staff approval for the proposed HPSI AOT/CT extensions for <u>all</u> CEOG plants. If this is correct, then the risk assessment information provided to the staff should be detailed enough to demonstrate that <u>all</u> CEOG plants have the capability to use the proposed process to extend HPSI-related AOTs/CTs safely. Such capability cannot be demonstrated by just illustrating the use of a process. Additional information regarding important assumptions made in the PRA (e.g., in modeling the various HPSI inoperabilities and degradations) is needed. Please discuss.

<u>Response: 3</u>

TSTF-424 will be modified to reflect that the CEOG effort will follow a pilot process. Members will provide additional information to support exportability of the process, but simultaneous plant approvals for the CEOG fleet are not requested. However, detailed information will be provided for the pilot plant with supplementary information provided for other CE participants in order to improve exportability of the TS change to the other CE PWRs.

Prior to implementing the TS extension, plants participating in this task will have completed a PRA peer review and have resolved the A and B (high level) findings. Documentation of those activities will be provided. Plant specific LOCA modeling assumptions available at the time the Topical was prepared were included in Tables 6.3.2.1-1 through 3 of the topical report. These tables provided LOCA Initiating Event Frequencies (IEFs), high level assumptions regarding HPSI room cooling and mini-flow operability, and LOCA success criteria associated with the HPSI. Example analyses were provided for most plants in the CE fleet except Millstone Unit 2 and Calvert Cliffs Units 1 and 2.

To improve exportability of this change, other member plants will provide related information to illustrate the impact of the change on plants other than the pilot.

The HPSI modeling information provided in the Topical Report is intended to illustrate the types of inoperabilities that might occur and the associated results of potential risk assessments. The associated RICT will be based on contemporaneous risk assessments considering the current plant configuration. These assessments will be affected by plant designs and to some extent, modeling assumptions used in the base models. The assumptions for modeling the degradations evaluated are presented in Tables 6.3-1, 6.3-2, 6.3-3 and Table 5.1-1 of the submitted report. Some specific responses are also included in later RAIs (see for example RAIs 8, 15, 16, 17, 19, 20, 21, 23 and 25). Some variation occurred as members implemented the process. Differences in results among plants reflect assumptions associated with selection of success criteria, LOCA IEF, as well as plant designs. Information regarding these factors is captured in the topical report. Plant specific information for the pilot will be provided under separate cover. Information such as representative PRA cutsets and sensitivity studies will be provided.

Plant maintenance during the HPSI system extended AOT will involve reliance on the HPSI PRA model. Prior to implementation of the flexible AOT, the utility will self assess those portions of the PRA important to HPSI system modeling with regard to RG 1.200. Issues that significantly impact risk informed decision making, if any, will be identified and resolved. (See also response to RAI 5.1.)

Question 4.1

The industry's response to Question 6 of "acceptance review" comments lists four elements that should be included in the RMTS guidelines. The staff agrees that these elements should be an important part of the RMTS guidelines and should be in place before the proposed HPSI AOT/CT extensions are approved. Also, the staff requests the following information related to the proposed guidelines:

< **The first element is the *"identification of high risk configurations in a timely manner."* It is stated that *"[The] timely consideration of high risk configurations imply either availability of pre-assessed "high risk" configurations, or a process and ability to perform and respond to contemporaneous online assessments of high risk....."* How do the various CEOG plants intend to incorporate this element for the proposed HPSI AOT/CT extensions? Is this an issue that would be addressed generically (i.e., at the topical report SE stage) or on a plant-specific basis at a later stage? The identification of high risk configurations issue needs to be discussed in the revised topical report.**

<u>Response: 4.1</u>

High risk plant configurations can only occur as a result of emergent plant conditions. Such configurations may arise as a result of complete loss of a key safety function (e.g. inventory control, RCS heat removal, etc.) or significant cross train outages. Most high risk configurations are explicitly addressed in the existing TS and are subject to required operator actions and restricted times. These exigent conditions are not impacted by the existing single train AOT extension. Following the occurrence of an emergent outage that may result in a high risk configuration the plant operators will continue to take the same immediate actions to ensure that the plant is in a safe condition. When the condition is concurrent with a RMTS LCO Action that places the plant beyond the frontstop AOT the RMTS guidance is also to be followed. In this process, the operator will also be required to perform a risk screening evaluation of the configuration within a 12 hour period. Procedures for meeting this screening assessment may include either: (1) on-line assessments of contemporaneous configurations or (2) pre-evaluation of "high risk" component combinations that define risk significant equipment outages associated with the HPSI AOT.

Question 4.2

< **The second element is the *"prompt consideration and resolution of common cause issues (if any)."* Will there be generic and/or plant-specific guidance on how to look for potential common-cause issues and on strategies and actions to resolve any such issues? The common-cause issue needs to be discussed in the revised topical report.**

<u>Response: 4.2</u>

Agree. The resolution to this issue will be discussed in the topical report.

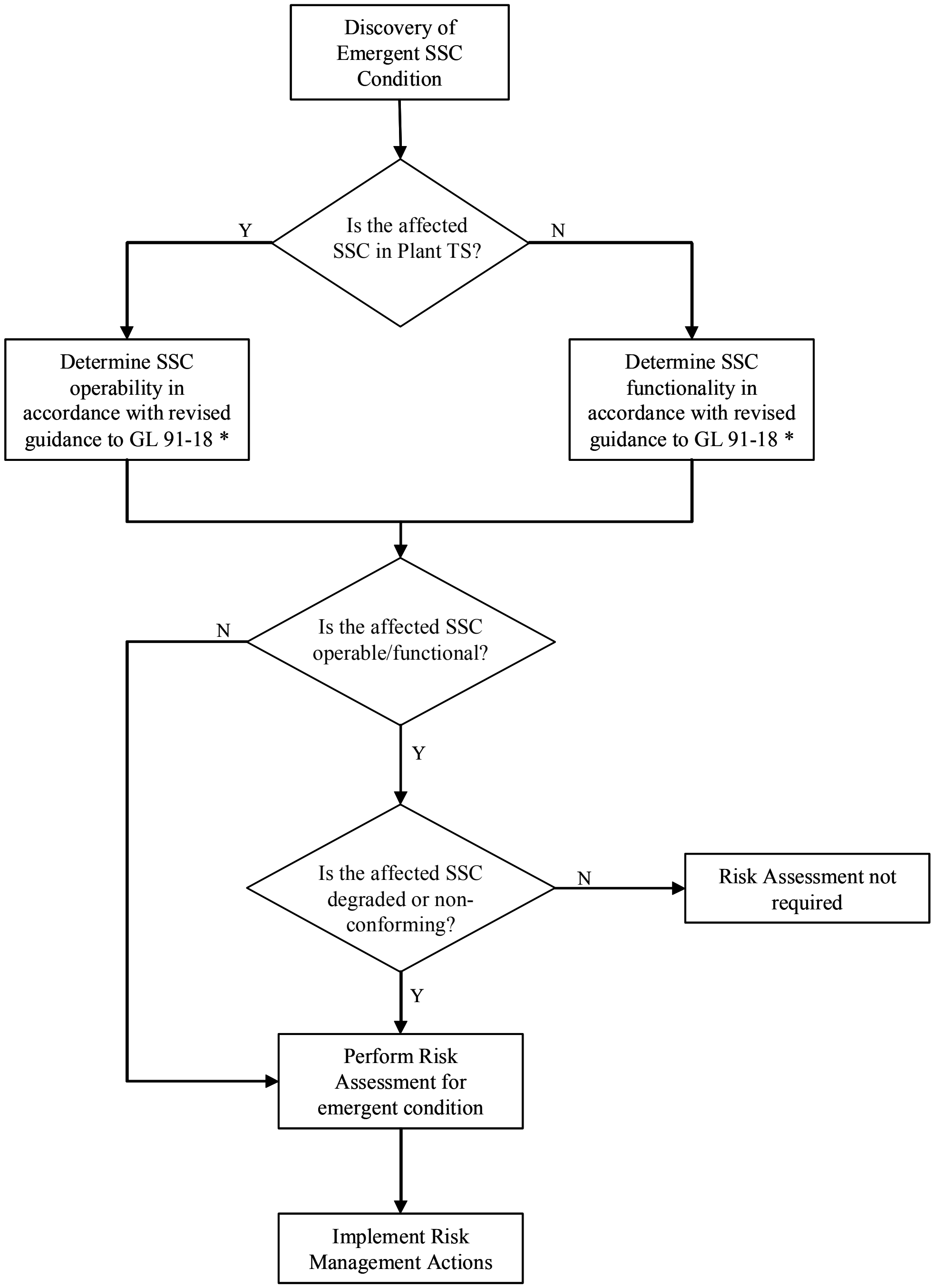
For the purpose of TS entry, component operability will be assessed by the operator in accordance with GL 91-18. Risk assessments will reflect the emergent nature of the failure and the state of knowledge with regard to redundant components. The risk assessment will be performed in accordance with the guidance in the RMTS Section 3.5.2.3. An overview of this process is presented in Figure 4-1.

GL 91-18 provides guidance to the operator for ensuring the functional capability of component/system in assigning Operability and for resolution of degraded and non-conforming conditions. Risk evaluations will <u>not</u> change in any way the existing GL 91-18 guidance. Once an Inoperability determination is made PRA assessments will be used to establish the plant risks.

Question 4 continued

Example of the impact of common cause failure potential on the calculation of the RICT is discussed in RAI 24.

Figure 4-1
CCF Assessment Process



* Revised guidance to NRC Inspection Manual – Part 9900: Technical Guidance, "Operability Determinations and Resolution of Nonconformances of Structures, Systems, and Components"

Question 4.3

< **The third element is *"a process for considering unmodeled external challenges (e.g., challenges beyond the scope of PRA evaluation."* The industry lists options for addressing external events, especially when only qualitative and semi-qualitative risk assessments are available. However, the industry needs to develop generic and plant-specific guidance for treating external challenges. For the proposed HPSI AOT/CT extensions, this guidance can be based on insights such as those discussed in Section 6.3.2.6 of the topical report. This issue needs to be further discussed in the revised topical report.**

<u>Response: 4.3</u>

The RMTS Guidelines provides high level guidance on the consideration of external events in Section 3.5.2.2. External events are important in understanding the total risk of the configuration. Experience shows that many external events and fire scenarios progress to core damage in a similar manner to internal events. For the most part, from a plant perspective the risk significant seismic and fire events have characteristics similar to a station blackout. Selected sequences may also resemble small LOCAs with mitigating systems available.

External events should be considered in determining the appropriate RICT for the HPSI flexible AOT extension. External events: (1) may be directly considered in the PRA and hence directly impact CDF or LERF, (2) may be assessed via reasonable bounding assessments or (3) may be dispositioned by demonstrating that the external events pose a insignificant contribution to the configuration risk.

These issues are quantitatively discussed with respect to the HPSI AOT extension in response to RAIs 35 and 36.

Question 4.4

< **The fourth element is *"a risk-informed shutdown process."* However, no such a process is discussed in the industry's report. In the industry's response it is also stated that *"Prior to implementation of the "flexible AOT" plant specific implementation guidelines will be prepared."* The staff believes that a risk-informed shutdown process based on generic principles and criteria, and not on plant-specific implementation guidelines as the industry's response implies, is needed. Please discuss.**

<u>Response: 4.4</u>

We agree. General principles are discussed in response to Question 2 and are provided in the RMTS guidelines. In summary, when operating beyond the front stop, the plant TS will be considered not met when:

(a) The RICT based on an ICDP of 1.0E-5 (as measured from TS entry) is exceeded.
(b) The instantaneous risk of the associated with the plant configuration exceeds 1.0E-3/year, or
(c) The backstop AOT is exceeded

See also response to RAI 1.

Question 5.1

Question 8 of "acceptance review" comments discusses the need to address the issue of PRA quality for the proposed risk-informed application (i.e., HPSI flexible AOT/CT extension at all CEOG plants). The ASME PRA Standard (endorsed by RG 1.200) requires that the parts of the plant-specific PRA, which are impacted by the proposed change, be identified and evaluated to determine whether the PRA scope and level of detail are sufficient for the application in order to provide confidence that the results can be used in the decision-making process. To meet this requirement, the staff requested the following information:

< **Documentation that the parts of the PRA required to produce the results used in the decision are performed consistently with the standard or peer review process as endorsed by the staff, <u>or</u> a discussion showing that the impact on the results of not meeting the standard or the criteria of the peer review process is not significant.**

<u>Response: 5.1</u>

It is the intent of the AOT extension that the calculation of RICTs be supported by capable plant PRAs. Prior to implementation of the current TS, members will provide to the NRC results of the member's peer review, including a summary of high level (A&B) findings and resolution of those findings. Issues related to modeling of HPSI system and associated scenarios where HPSI is a primary means of inventory control will be identified. This information will be provided under separate cover.

Plant submitting the request for the HPSI AOT extension after RG 1.200 is finalized will provide a RG 1.200 comparison of the PRA elements important to risk-informed maintenance decisions associated with a HPSI outage.

Question 5.2

< **A characterization of the assumptions and approximations that have a significant impact on the results used in the decision-making process of the specific application, including a discussion of the resolution of the peer review comments.**

<u>Response: 5.2</u>

A discussion of the assumptions associated with HPSI system models that have significant impact on the risk-informed decision process will be provided as part of the plant specific submittal. This information will be provided by member utilities under separate cover. See also response to RAI 10.

Question 5.3

The industry responded by stating that *"Prior to implementation of the flexible AOT utilities will review the PRA high level [peer review] findings and other known modeling deficiencies that may significantly impact configuration risk assessment of the target component (HPSI) and remove the limitation, or provide appropriate guidance for addressing the limitation in risk assessments."* This statement does not seem consistent with the proposed TS change in TSTF-424. The industry has requested staff approval for the proposed HPSI AOT/CT extensions for <u>all</u> CEOG plants (i.e., a license amendment). If this is correct, then it should be demonstrated that <u>all</u> CEOG plants have PRA quality which provide confidence that the results can be used in the decision-making process to extend HPSI-related AOTs/CTs without compromising safety. The staff understands that there may be considerable overlapping between the information requested in this RAI and RAI #3 (above). In the industry's response to Question 8 of the staff's acceptance review comments, it is also stated that *"The submittal will be modified to reflect that the PRA internal events review will be consistent with the intent of RG 1.200......."* The staff needs clarification of this statement regarding the timing and content of the proposed modification of the TSTF-424 submittal.

<u>Response: 5.3</u>

The effort should be continued as a pilot activity. Fort Calhoun Station is the pilot plant. Several other utilities have provided information to illustrate the breadth of impact of the requested change across the fleet. Pilot approval should include a roadmap of information required to secure the extended AOT for other CEOG members.

In the industry response to Question 8 of the Staff's acceptance review, the industry indicated that the PRA will be "consistent with the intent of RG 1.200". The intent of the statement is to indicate that exercise of the flexible AOT/CT will be tied to a PRA of adequate capability to make appropriate risk-informed decisions. FCS is not an RG 1.200 pilot. Resolution of the RG 1.200 pilots is not considered necessary prior to implementation. (See Response to RAI 5.1.)

Question 6

The industry's responses to Question 9 of "acceptance review" comments provides an outline of some general ideas of how to use qualitative and blended evaluations in the risk-informed decisionmaking process for flexible HPSI AOT/CT extensions. The staff views this information only as the first step in the development of a structured process that will be capable to allow, reliably and safely, AOT/CT extensions based on actual plant configurations. The staff expects this process to become an element of the generic RMTS guidance currently being developed. However, for the HPSI-specific application it could be possible to proceed without the benefit of the final generic structured process for incorporating qualitative and blended evaluations. This will be the case if it can be shown that all CEOG plants have PRA models (for internal events) which are of "adequate quality" for the application (as discussed in RAIs # 3 and 5 above) and at the same time perform bounding type analyses, such as those reported in Section 6.3.2.6 of the TSTF-424 submittal, to "capture" the impact of external events for which no detailed PRA models are available. Please discuss how the industry proposes to address the issue of using qualitative and blended evaluations in the risk-informed decisionmaking process for flexible HPSI AOT/CT extensions.

Response: 6

The report discusses overlaps between HPSI AOT/CTs and fire and external events. So long as the ability to effect a safe shutdown remains, the impact of fire events should be minimal. The process for the assessment of external events is discussed in responses to RAIs 35 and 36.

Note that plants implementing the present AOT will vary in model scope. CEOG agrees that for limited scope, such as the present HPSI AOT extension beyond the frontstop RICT assessments will be adjusted to accommodate external event risks, as appropriate. Associated incremental external event risks can be established based on PRA or IPEEE insights

For many plants, External Events (EE) are explicitly modeled in the PRA. These plants may utilize external events and fire models, as appropriate, to directly estimate RICT associated with the maintenance configuration.

Question 7.1

In Question 10 of "acceptance review" comments the staff states that the acceptability of incremental plant risks in Region II (per RG 1.174 guidelines) depends on several factors, such as the plant baseline risk from all sources (internal and external events at power and shutdown operation). This, according to the staff means that an annual increase in risk that falls in Region II is not acceptable for plants with high baseline risk (CDF of about 1E-4/yr or higher or LERF of about 1E-5/yr or higher). The industry did not address this issue in its response to Question 10 of the staff "acceptance review" comments. Please discuss.

Response: 7.1

Table 7-1a summarizes the CDFs/LERFs for member PWRs. Note that, the table includes CDFs associated with internal events and flooding and those CDFs associated with fire, flood and other hazards. These results indicate that CEOG member's plants are expected to have total core damage frequencies below 1.0E-04/year. Thus, the RG 1.174 guidance is expected to remain applicable to all CEOG members. Note that for the 14 plants covered by this application, only 2 have internal events CDFs > 3.5E-05/year. Only one plant has a total CDF (internals plus external events) that approaches 1.0E-04/year. Updated evaluations from that plant suggest the potential for a reduced CDF. Table 7-1b provides a summary status of the plant PRA internal events industry PRA peer review and scope.

Question 7.2.1

Also, with reference to statements made in the industry's response, please clarify the following:

1. **Please discuss in more detail the statement provided in response to Question 10A: *"Acceptability of the flexible AOT will be tracked via recording entries (number, duration, configuration, estimated risk (or bounding color), reason for entry) into the extended AOT."* How each of these factors will be taken into consideration and what are the acceptance criteria? How these factors and acceptance criteria provide adequate assurance that the plant risk will not creep up as a result of the proposed flexible AOTs/CTs? How will the concept of "bounding color" be integrated in the quantitative assessments? Also, please clarify the information provided in the long (third) insert in the response to Question 10A.**

Response: 7.2.1

Several options for tracking risk were identified. These options track accumulated risk and use of RITS that vary in precision of the risk assessment. The process for tracking the use of the extended AOT includes the following elements:

- Number of entries. This is accomplished by tracking/recording each entry beyond the frontstop.
- Duration defines the time used beyond the frontstop. Duration is measured from the entry beyond frontstop to time TS is exited.
- Risk may be tracked explicitly via bounding estimates of the region the risk was assigned.
- The reason for entry into each extended AOT will be summarized for future review.

Additional information to be collected during the use of RMTS beyond the frontstop is summarized in RAI 47.

The bounding color designation is a surrogate for a bounding numerical assessment. Risk assessments are performed to establish the overall risk of an evolution. This risk will place the configuration in one of several risk related bands. These bands may be identified with a color ranging from green to red, with green being lowest risk and red being highest risk. Once located in a band the risk may be associated with the upper limit of each band. Regardless, the plant implementing the HPSI flexible AOT will utilize quantitative risk estimates to plan and track the risks associated with plant maintenance.

Question 7.2.2

2. **Please explain the statement provided in response to Question 10B: "Where qualitative risks are large contributors to the risk, a bounding assessment will be required. Typically this can be considered by the expert panel by increasing the risk color ...." How would the risk color concept work? An example may be needed to clarify this concept.**

<u>Response: 7.2.2</u>

The color concept was used as a surrogate for a quantitative process. The wording in the final report will be adjusted to reflect that the risk will be tracked via a quantitative process

Question 7.2.3

3. **Please clarify the statement provided in response to Question 10C:** ***"The tracking of ICDPs (above zero maintenance) when the risk is less than 1E-6 for the entry configuration is not recommended. This is consistent with the maintenance rule designation for a normal configuration and special treatment is not needed. If the extended AOT has a total ICDP in excess of the maintenance rule normal condition, tracking should be performed. Process tracking of the number of entries and durations spent beyond the frontstop will be tracked for all entries and reviewed to ensure appropriate use of the flexible AOT."***

   Why are the ICDPs above zero maintenance more conservative than ICDPs above average maintenance?

   Please explain how the ICDPs are calculated (list the assumptions about component unavailability due to maintenance at the beginning and the end of the outage).

   How is the ***term "ICDP*** **for the entry configuration" defined? How is the term "total ICDP of the extended AOT" defined? What are the criteria for reviewing the number of entries and durations spent beyond the frontstop?**

<u>Response: 7.2.3</u>

It was an initial recommendation that tracking of risks at levels which were less than what is considered "normal" maintenance per the NUMARC-93-01 was not necessary. Currently, the RMTS guidance requires tracking of the risks to the RMTS that are accumulated during maintenance or related operation beyond the front stop. All entries into the extended AOT include quantified assessments. This process will be used for the HPSI AOT pilot as well. Appropriate changes will be made to the text of the topical report.

The deltas between the ICDPs calculated by zero and average maintenance PRA models is not expected to be significant. The intent of the statement in the Topical was to reflect that by assuming a zero maintenance baseline, no consideration is made for the fact that the actual component unavailability is non-zero. This maximizes the change in risk associated with component unavailability. However, it is possible that random concurrent unavailabilities can offset this effect. The topical report wording will be changed to reflect that tracking from a zero maintenance condition provides a realistic means of estimating the risk impact of plant maintenance.

ICDPs are calculated using a zero maintenance plant baseline considering <u>all</u> components that are modeled in the PRA, currently in-service. It also includes consideration of risk significant components important to the fire and seismic response. The initial time for ICDP calculation is the time of entry into the RITS, and the end time is the time the plant exits the TS. At the time of entry the configuration is projected based on maintenance staff input. Emergent conditions are added to the calculation of the ICDP as the condition develops and stops accumulating incremental risk when the issue/inoperability is resolved.

The following information is provided to clarify the terms "ICDP for the entry configuration" and "total ICDP of the extended AOT". The definitions are as follows:

- ***"ICDP*** **for the entry configuration":** This is the incremental core damage probability as measured from the zero maintenance baseline and includes the inoperability of the TS equipment in question along with existing components that are out of service and those that are planned to be out of service during the repair period for the TS SSC in question.

- ***The total ICDP of the extended configuration*:** This is the integral core damage risk (as measured from time beyond the front stop) associated with the repair of the TS SSC and includes consideration of all unavailable components that are included in the PRA.

All entries made beyond the frontstop will be recorded. This information will be reviewed to trend the use of the extended AOT. This information will be reviewed periodically.

Table 7-1a
Comparison of PRA Predictions

Plant	CDF (per year)				LERF (per year)	
	Internal	**Fire**	**Seismic**	**Other**	**Internal**	**Other**
St. Lucie Unit 1	2.28 E-5	FIVE	NA	NA	6 E-6	
St. Lucie Unit 2	2.02 E-5	FIVE	NA	NA		
Waterford Unit 3	6.75 E-6	7.0 E-6**	NA		2.4 E-7	
Palisades	6.24 E-5	3.4 E-5			6.18 E-8	
Palo Verde Units 1, 2, 3+	1.27E-5	4.15E-6	---	---	1.576-E-6	1.906E-7
San Onofre Units 2 and 3	1.9 E-5	4.1 E-6	8.9 E-6		4.3 E-7	9.6 E-8 (Fire) 4.7 E-7 (Seismic)
CCNPP Unit 1, 2	1.34 E-05	Included	Included			
AN0-2 (ZM)	4.50E-06					
ANO-2 (AM)	4.71E-06					
Fort Calhoun Station (ZM)	1.62E-05		Dominant risks Included in Level1	External flood* High winds and Tornado	2.45E-06	
Fort Calhoun Station (AM)	1.81E-05	Five**	Dominant risks Included in Level1		2.61E-06	
Millstone Unit 2	3.5 E-05	6.3 E-6++				

* Not relevant to maintenance planning
** IPEEE
\+ Average Maintenance ++ Total

Table 7-1b
Status of Member Utility PRA and Peer Review Status

Plant	Peer Reviewed Internal Events PRA	Resolution of A and B Peer Review Findings	Fire PRA	Seismic PRA	Other
St. Lucie Units 1 and 2	May 2002	Resolved	No. Scoping FIVE	Simplified SMA	All other risks screened out
Waterford Unit 3	January 2000	In Progress	Fire PRA for areas unscreened by FIVE	EPRI SMA	Toxic Chemical Risk Assessment
Palisades	September 2000	Resolved all A. B resolution in progress	Fire PRA based on FIVE	Yes	Screening approach to other risks
Palo Verde Units 1,2,3	December 1999	Resolved all but one	Yes	EPRI SMA	Limited tornado assessments
San Onofre Units 2 and 3	June 2003	In Progress	Yes	Yes	All other events screen out
CCNPP Units 1 and 2	November 2001	No "A" findings. Resolution of B in progress	Yes	Yes	Explicitly models high winds, tornadoes and hurricanes.
AN0-2	February, 2002	Resolution effort in progress	FIVE	EPRI SMA	IPE level assessment
Fort Calhoun Station	April 1999 (pilot); follow-up October, 2003	Resolved all A. B resolution in progress	FIVE with conservative risk assessments	Simple Seismic PRA for initiators > 0.1 g	External flood (Dam break). High winds and tornado ----

Question 8

In Question 13 of "acceptance review" comments the staff requested clarification of the process and criteria that will be used to determine whether the completion time extension is acceptable given the plant configuration following an emergent condition. The staff needs clarification of the following statements made in the industry's response:

1. **The statement *"Note that the CEOG submittal involves a single train outage with no loss of function"* implies that no high risk configurations are likely. The staff notes that high risk configurations are possible when trains of systems other than HPSI (e.g. AFW and EDG) are also unavailable.**

2. **The statement *"operators are well trained to quickly identify high risk significant plant conditions"* appear to weaken the statement made elsewhere in the response that *".... potential high risk configurations will be determined a priori."* Please confirm that the identification of potential high risk configurations will be a licensee commitment for the proposed flexible AOT/CT extension. As mentioned also in RAI #4, the identification of high risk configurations issue needs to be discussed in the revised topical report (e.g., will it be addressed generically at the topical report SE stage or on a plant-specific basis at a later stage?). Please discuss.**

3. **The statement *"....the flexible AOT is expected to work in conjunction with the exigent AOT extensions (CENPSD-1208)"* needs clarification. The staff notes that "exigent AOTs" have been based on average maintenance unavailability and not on actual plant configurations. Please discuss.**

Response: 8

It is recognized that concurrent failures can be risk significant. This may be true regardless of the state of the HPSI system. The impact of concurrent equipment outages in the presence of a low risk HPSI outage due to a closed injection valve in one injection path is illustrated in Figures 6.3-8 to 6.3-14 in the topical report. These evaluations indicate the impact of unavailability of Turbine-driven AFW Pump (TD AFW), Motor-driven AFW Pump (MD AFW) and an opposite train EDG. Note that in the ISTS, inoperability of an opposite train EDG has a specified TS action which requires the plant to enter 3.0.3. The impact of the component unavailability depends on the level of redundancy available in the plant design. Note that for a concurrent failure of a TD AFW pump or an opposite train EDG risk assessments indicate that the EDG and AFW pump dominate the risk. For the cases analyzed, the most significant impacts are noted for FCS, Waterford, Palisades and ANO-2. The impact is less at San Onofre Units 2 and 3 and St Lucie Units 1 and 2 since those sites include proceduralized methods to cross tie emergency diesel generators among the two units.

Actions to assess and manage the risk of multiple outages is already considered within the maintenance planning process. Plants will be able to estimate Level 1 risks rapidly using on-line tools. Operator training will also enable the plant staff to recognize potentially high risk conditions. Practical examples of potentially high risk conditions concurrent with maintenance on a HPSI include concurrent outages of:

- EDG (in particular the cross train on EDG)
- Turbine-driven AFW pump
- CCW
- Cross train in HPSI
- Any loss of function

Question 8 continued

Many of these configurations reflect loss of redundancy and will be covered by their respective TS. Plant operators are expected to be well aware of high risk conditions in the plant even without the aid of computerized risk models. Operators will take action to resolve high risk configurations. In accordance with the RMTS guidance, a formal risk screening of high risk configurations will be completed within 12 hours of entry.

It was also stated that the flexible HPSI AOT will work in conjunction with the exigent AOT. Both of these initiatives are supported by the CEOG. In the CEOG application, the exigent AOT limits the operation of safety related equipment with a loss of function. A recent CEOG WCAP identifies several TS which have the exigent plant responses adjusted based on risk-informed arguments. Several other TSs also have short AOTs. These TS conditions and those exigent AOT limitations defined in WCAP-16125-NP are fixed. These AOTs cannot be modified by the current HPSI application of the flexible AOT. As a result of the short duration for implementation, exigent AOTs are not subject to change. Specifically, this AOT results in small extensions to several AOTs with multiple train failures. HPSI system unavailability, for example, was increased to 4 hours. Thus, while for the CEOG pilots the flexible AOT considers conditions where one HPSI train is OOS, it is the exigent AOT that provides operational limits for two trains unavailable. Once the HPSI train is declared OPERABLE, the HPSI RMTS is exited.

Question 9

In Question 14 of "acceptance review" comments the staff requested clarification regarding contingency actions and compensatory measures that may be credited in risk assessments. Specifically, the staff requested clarification of the process for identifying "contingency actions and compensatory measures" and determining their acceptability for both planned and emergent conditions.

The staff needs clarification of the following two statements included in the response: *"...the impact may be assessed using reasonable approximations and reviewed via a panel of experts"* and *"In finalizing the process, the process will include considerations for both planned and emergent work"*

Will there be any guidance to be used by the "panel of experts" in assessing the risk impact of contingency actions and compensatory measures credited in risk assessments?

Will there be procedures and administrative controls for contingency actions and compensatory measures credited in risk assessments?

Please discuss how the industry proposes to address this issue in the risk-informed decisionmaking process for flexible HPSI AOT/CT extensions.

<u>Response: 9</u>

A general discussion of the treatment of contingency actions and compensatory measures is presented in Section 3.6 of the RMTS Guidelines. Contingency actions that can be credited in RICT calculations will be declared in written policies and procedures at each plant. For planned maintenance, contingency actions and compensatory measures are established at the planning stage (as appropriate). Additional information is contained in RAI Response 1(b).1.

The credible contingency actions will be reviewed and approved in accordance with the quality assurance program associated with the policy or procedure chosen to implement this feature of the flexible AOT process. When PRA credit is given for the compensatory measure, the credit is to be established based on interviews with operations personnel, availability of procedures and human factor considerations.

Sections 3.5.3 and 3.6 of the RMTS guidelines discuss crediting contingency actions and compensatory measures in PRA risk assessments. Contingencies always exist, but they are not always necessarily part of a risk calculation. Generally, a credible contingency action will be one that is captured in a procedure and performed by a person at the plant adequately trained to carry out the action with a high probability of success within the acceptable time, e.g., manually closing a valve before a tank completely drains. For planned maintenance activities, credited contingency actions and compensatory measures will be documented prior to entry into the TS. Emergent conditions provide fewer opportunities to have a ready procedure with able personnel to successfully perform the procedure.

For plants desiring to credit exigent compensatory measures and contingency actions in RICT risk assessments, training will be provide for the panel of experts on a plant specific basis. The intent of the training is to ensure the experts understand the types of inputs needed for quantification of contingency actions and compensatory measures. For example, they will be taught how the existence of procedures and training significantly improves the probability of success. Procedures and administrative controls for contingency actions and compensatory measures credited in risk assessments will be available.

Question 9 continued

As discussed above, the CEOG will utilize the same methodology as proposed in the RMTS. As this focus is less global than a full implementation of the flexible AOT across many TS, the PRA capability will be expected to be commensurate with the application. No contingency measures are expected to be required to address seismic risks. Furthermore, actions to mitigate seismic levels are not readily defined. Plant's response to compensatory measures to address fire issues for HPSI outage will likely vary based on plant design and vintage. Risk insights will be used to identify vulnerable areas, which should a fire occur, would potentially create an inventory loss event. Particular attention will be paid to those challenges that also can affect functionality of the remaining HPSI pumps. Compensatory actions to be taken include posting of fire watches, restrictions on transient combustibles, and ensure availability of fire suppression. Other external events (high winds, etc.) will be considered in accordance with standard practice. These procedures will be site dependent. Typically such compensatory measures may vary from restrictions placed on placement of cranes to plant shutdown.

The rules for considering the potential for crediting compensatory measures in the PRA are given in RAI 1.

Question 10

Statements made in the cover letter and on page 1 of TSTF-424 Rev. 0 appear to conflict each other. In the cover letter from NEI it is stated: *"This report is intended to demonstrate typical risk results in order to facilitate discussion leading to risk assessment and management guidance. The purpose is to provide an example ...."* However, on page 1 of TSTF-424, Rev. 0 it is stated: *"This traveler is a request to amend NUREG 1432, Revision 2, revised Standard Technical Specifications for Combustion Engineering Plants. The proposed change provides a risk-informed alternative to the existing restoration period for the High Pressure Safety Injection (HPSI) System, allowing this period to be extended from 72 hours up to 30 days."* Please clarify these two statements. Is the industry requesting generic staff approval for the proposed HPSI AOT/CT extensions for <u>all</u> CEOG plants?

<u>Response: 10</u>

The HPSI flexible AOT is being pursued as a pilot program. The pilot plant for this application is Fort Calhoun Station. It is the desire to have the TS ultimately apply to all CEOG member utilities. To expedite this process, background information has been provided on all utilities to varying degrees. It is anticipated that as condition of approval the following information will be provided by participants:

PRA Model
- Results of PRA peer review
- Resolution of A&B comments related to modeling of HPSI system and LOCA/scenarios (if any)
- List of LOCA success criteria and modeling assumptions

Application
- Results of example maintenance configuration analyses (see Section 6.3 of topical report)
- Commitment to use RMTS guidance for performance of maintenance within an extended AOT (beyond front-stop)

Tracking / Documentation
- Commitment for documentation of conditions/risks following operation within an extended AOT (beyond front stop)
- Tracking of risks accumulated during beyond front stop applications

Question 11

On page 3-1, second paragraph, it is stated that "Initiative 4B, focuses on the change to selected TSs ...." This statement is confusing because Initiative 4B proposes AOT/CT extensions for all systems? Please discuss.

Response: 11

Initiative 4B is conceptually directed towards any maintainable system within the TS and is therefore indirectly tied to the maintenance rule. The Initiative 4B process is also considered applicable to limited TS extensions such as the HPSI, as well as more global applications. However, the current application for CEOG focuses only on the single train HPSI OOS TS. This will be clarified in the Topical. The intent is for the general process, with appropriate fine tuning, to be applicable to both types of applications.

Question 12

On page 3-1, bottom of third paragraph, it is stated: *"Non-risk significant degradations at ....have lead to a forced shutdown (Reference 7) at one CE designed PWR and potential shutdowns at others."* What are potential shutdowns? If only one forced shutdown has occurred which is associated with non-risk significant degradations of HPSI, one would argue that the proposed TS change may not be of much benefit. Please discuss.

Response: 12

Plants have practices in place to minimize the risk of inadvertent shutdowns. At many plants the time allocated for SSC repair is administratively limited to less than the TS AOT/CT. However, there have been instances where this margin has eroded due to unexpected maintenance issues and a "potential" shutdown situation exists. In those situations plants prepare NOEDs and/or emergency TS changes. To ensure that the information is available prior to the actual need, many NOEDs are generated unnecessarily. Another situation exists where a repaired component fails its acceptance test. This usually occurs unexpectedly and a race may begin between the time to fix/retest and the time to generate the NOED. While few shutdowns have actually occurred, the level of effort to prepare an NOED to avert shutdown (even though one didn't materialize) is significant.

Another aspect of the HPSI flexible AOT is to note that many subcomponent non-functionalities within the HPSI system that would require a system INOPERABILITY designation may result in system that has a significant capability. Currently, when a component is tagged out for maintenance there is an incentive to complete additional parallel maintenance items of the affected train in the same time window to minimize the overall train outage. The net impact may be to have shorter but more comprehensive maintenance activities. By recognizing the HPSI low risk non-functionalities, the flexible AOT will provide a rational for serializing the maintenance and allowing a longer but overall lower risk maintenance evolution within the same TS Action.

While this application asks only for the flexible AOT concept to be applied to the HPSI system, this effort is intended to be a focused pilot application for a process to extend flexible AOTs to many TS systems. It is the intent of this example TS to demonstrate that risk-informed processes may be used to manage and extend outages of risk significant components. By including a class of plants the opportunity is provided to ensure the exportability of the process by exploring the impact of plant to plant differences on alternate implementation strategies and variations in PRA capability. It is the intent that as a single system pilot for the flexible AOT, the HPSI flexible AOT, will provide the basis for additional system extensions for plants not desiring to be full system pilots.

Question 13

On page 3-1, fourth paragraph, it is stated: *"The intent of the Backstop TS change is ...."* This terminology is confusing and non-consistent with terminology used throughout the report. Please clarify.

Response: 13

Text should read "The intent of the flexible AOT is….". The wording will be clarified to make the report consistent with the RMTS guidelines.

Question 14

On page 3-1, fifth paragraph, it is stated: *"all CE plants are participating in this CEOG activity."* However, no plant-specific risk assessments are reported for some plants (e.g., Calvert Cliffs). Please discuss and clarify.

Response: 14

All utilities are participating in the activity however, two utilities did not provide analytical input to the base document: Constellation Nuclear and CCNPP Units 1 and 2 and Dominion (Millstone Unit 2). Any analyses necessary to support the AOT extension for these utilities will be supplied at the time of plant specific submittal. At this time, it is not expected that this extension be subject to CLIIP.

Question 15

The first two paragraphs on page 5-5 need clarification. In the first paragraph it is stated that the use of the installed spare as a replacement for one of the other two HPSI pumps allows extended pump maintenance to be performed without entering an LCO Action Statement. However, in the second paragraph it is stated that *"the spare HPSI pump cannot be used to replace the inoperable HPSI pump."* Please clarify. Also, in the footnote on page 5-5 it is stated: *"Plants that must voluntarily enter the LCO Action Statement..."* How can an action be voluntary and required at the same time? Please explain.

Response: 15

HPSI system alignments vary among the CE fleet. These alignments are summarized in Table 5.1-1 and footnote 1 on page 5-5 of the Topical Report. Plants with 2 HPSI pumps must enter the TS Action Statement when one HPSI is OOS. Plants with 3 HPSI pumps often can power a spare HPSI from a bus in the same train as the inoperable HPSI. In this instance the TS for HPSI train inoperability is not entered. However, some plants (e.g., Fort Calhoun Station) have alignment configurations where the spare HPSI pump is credited for alignment to a single power supply bus. Thus, a HPSI pump inoperability in one train cannot necessarily be replaced by a spare operable pump if the spare pump cannot be aligned to the same power source for the inoperable HPSI pump. Thus, operability of 2 HPSI pumps assigned to Train A will not serve to satisfy the HPSI pump delivery requirement for Train B.

On page 5-5 of the topical report footnote the word combination "must voluntarily" was used. The word "voluntarily" will be deleted.

Question 16

On page 5-7, under Operability vs. Functionality, it is stated: *"For the HPSI system partial system inoperabilities include (but are not limited to) the following ....."* What other inoperabilities are there? Have they been analyzed, understood and modeled in the PRA? To ensure that HPSI inoperabilities are adequately modeled in the PRA, it is necessary to identify the complete set of inoperabilities for which flexible AOTs/CTs will be allowed. Please discuss.

Response: 16

The HPSI system may be represented by a relatively simple PRA model. Component boundaries for the HPSI system are well defined to reflect the failure modes included in the HPSI PRA model. In general, a HPSI component includes several sub-components/parts, which by themselves are not explicitly identified in the HPSI PRA model. For example, the inclusion of a HPSI pump failure in the PRA model reflects all sub-components or parts within the pump boundary, that if failed would render the affected pump inoperable. A relay failure in the pump control logic is typically modeled as failure if the affected HPSI pump to start or run. Therefore, it is not necessary to identify a set of sub-component/part inoperabilities (i.e., relay failure). The effects of such inoperabilities are reflected in the HPSI model as failure of the pump to start or run, or other appropriate failure mode. The various sub-component/part inoperabilities are reflected in the data used to quantify HPSI failure probability.

For cases where the specific failures are not modeled, it is possible to map the partial system failures onto a more global HPSI system failure (up to and including the failure of HPSI pump delivery). Therefore, it is not necessary to identify a complete set of "sub-component inoperabilities". The ability to credit partial inoperabilities will be dependent on the level of detail included within the plant PRA, degree of conservatism used in defining success criteria and the definition selected for component boundaries. It is likely that plants with more complete system modeling treatment will provide more realistic estimated risks and potentially justify longer RICTs.

Question 17

On page 6-4 it is stated: ***"For smaller LOCAs, PRA analyses using the realistic evaluation model (Reference 22) indicate that during the injection-mode core damage conditions may be avoided with HPSI flow rates less than minimum design basis requirements."*** **What are the important results of Reference 22? Have the staff reviewed the "realistic evaluation model" of Reference 22? How the statement** ***"core damage conditions may be avoided..."*** **is modeled in the PRA?**

Response: 17

CE small break LOCA Realistic Evaluation Model (CEFLASH-4AS REM, Reference 22 of Topical Report) was used for PRA success criteria assessment for the CEOG fleet. The tool has been used for design basis assessments for the System 80+ design certification. In performing the success criteria assessments, the model uses the decay heat ANS standard with a 2 sigma upperbound. Input values reflected realistic power profiles. Success criteria were established by running a spectrum of LOCA scenarios and reducing the amount and capability of mitigating equipment. Safety Injection (SI) line unavailability was modeled as a reduction in the HPSI injection flowrate resulting from the increase in hydraulic resistance of the remaining delivery lines in the ECCS system. Core heatup calculations are compared to a core damage criterion associated with a peak clad temperature of 2200 ^{o}F. Many success criteria combinations resulted in PCTs well below the limit. Assessments were performed for breaks spanning the spectrum from small to the lower end of large (approximately 1ft^2).

Results of Reference 22 indicate that using "best estimate" models detailed LOCA success criteria indicates that for CEOG PWRs, adequate inventory control can be maintained with degradations in the HPSI injection flow. This can be reflected in the HPSI injection criteria by noting that for small LOCAs, only one HPSI with two of four SI injection paths open is required to successfully mitigate the event. Additional guidance was also provided regarding the importance of SITs and LPSIs. Depending on plant design unavailability of two SI injection lines results in a 10% to 30% reduction in RCS delivered flow (plant specific).

Question 18

On page 6-7 (last paragraph) it is stated: *"In order to go beyond the frontstop AOT, the allowable incremental risks will be associated with maintenance of the component beyond the frontstop AOT. Incremental CDPs beyond the frontstop AOT will be "targeted" in the range of 1.0E-06 and will be accompanied by compensatory actions, as appropriate."* Please clarify the definition of "allowable incremental risks" and "incremental CDPs" appearing in the two sentences of the statement. Also, please discuss how RG 1.174 guidance will be met when CDPs beyond the frontstop AOT are "targeted" in the range of 1.0E-06 and whether compensatory actions will be credited to meet guidance criteria.

Response: 18

It is the intent of the TS to be transparent with respect to maintenance planning. The goal of "targeting" risks of planned maintenance is to maintain the ICDP in the normal range for the duration of the activity. Currently, configuration risks that incur ICDPs of 1E-06 or below are considered part of normal operation (NUMARC-93-01, Rev. 3). The statement will more clearly indicate that risks are planned to have an ICDP below 1.0E-6. For the pilot plant "normal" maintenance conditions, that is, conditions where no additional contingency measures are considered are managed to an ICDP of < 1.0E-7. Thus, planned risks of continued operation beyond the frontstop will be controlled consistent with the maintenance rule with configuration risks in the "normal" range.

The allowable incremental risk is an outgrowth of the "targeting". The allowable incremental risk is a fraction of the yearly risk limit criterion. It is not the intent to utilize the maximum allowable AOT/CT on a yearly basis. Targeting is intended to ensure that maintenance activities beyond the frontstop are carefully managed. As risks of operation in the TS exceed 1.0E-6 (as measured from initial entry) risk management actions to reduce risks will be considered, and if appropriate, put in place.

As discussed in Response to RAI 1, planned maintenance activities will be planned and managed to maintain ICDP's < 1.0E-6. Emergent conditions cannot always be controlled. For emergent conditions, the "targeting" process emphasizes the importance of managing risk to a low level. As noted, the low risk management action thresholds of the pilot plant will ensure significant risks will not accumulate as a result of institutional issues. Even the higher 1.0E-6 recommended target limits provide sufficient margin for planning resolution of emergent conditions and early management attention such that RG 1.174 guidelines will not be violated.

Question 19

Key PRA modeling assumptions of mini-flow operability requirements for the HPSI system at the various CEOG plants are listed in the third column of Table 6.3-1 (page 6-10). A brief discussion of these assumptions would help characterize their robustness and clarify their basis. For example, a brief discussion would help clarify the following assumptions:

1. **For Fort Calhoun it is stated: *"Failure of mini-flow will impact a break less than 5% of small LOCA spectrum."* Which part of the spectrum? What does it mean in terms of accident sequence modeling? What is the basis for this statement?**

2. **For ANO Unit-2 it is stated: *"Not modeled, impact neglected (Reference 16e)."* Is this assumption justified?**

3. **For WSES Unit 3 it is stated: "Unavailability of mini-flow assumes HPSI fails for LOCAs and SGTRs." Does this assumption include transient-induced LOCAs? What is the basis for this statement?**

Response: 19

The mini-flow recirculation line provides a flow path from the discharge of the HPSI to the refueling tank. Functionality of this line ensures that whenever the HPSI system is activated it can pump to high pressure "sink" and not become deadheaded. During injection it is required that the mini-flow line be open. Following generation of a Recirculation Actuation Signal (RAS), the mini-flow line is isolated. Failure of the mini-flow line to isolate results in depletion of inventory from the emergency sump with consequence of potential radiation releases to the public.

Question 19.1

Question: For Fort Calhoun it is stated: *"Failure of mini-flow will impact a break less than 5% of small LOCA spectrum."* Which part of the spectrum? What does it mean in terms of accident sequence modeling? What is the basis for this statement?

Response: 19.1

Fort Calhoun station performed a thermal-hydraulic evaluation to determine the RCS pressure transient during several small LOCAs. The intent of this evaluation was to determine the size of a small break LOCA that is sufficiently large to depressurize the RCS below the HPSI shutoff head. The FCS HPSI shutoff head is about 1380 psig. The intent of this effort was to establish the impact of loss of HPSI mini-flow recirculation. Should mini-flow capability fail or (be otherwise unavailable) the HPSI pump could operate dead-headed for a considerable time. Pump operation in a dead-headed condition (without mini-flow) for a period greater than 30 minutes was judged by the manufacturer to potentially cause HPSI pump failure. The limiting break area for which continued HPSI pump operation would result in failure should the pump be exposed to prolonged dead-headed operation, was relatively small and spanned 5% of the small break range. This condition was modeled in the PRA as a 5% probability of HPSI failure given mini-flow unavailability concurrent with a small break LOCA .

Question 19.2

For ANO Unit-2 it is stated: *"Not modeled, impact neglected (Reference 16e)."* Is this assumption justified?

Response: 19.2

Referring to Table 5.1-1 of the topical report it can be seen that the shutoff head of the HPSI pump is 1450 psig. The PRA model does not explicitly consider the failure mode which results in a closed mini-flow value. Such closure may be due to valve stem failure or maintenance error, etc. Neglecting the impact of damaging HPSI pumps during dead-headed operation provides a potentially small under-estimate of risk. A model change request has been prepared to extend the capability of the model in this area. This issue will be resolved prior to requesting the HPSI AOT extension for ANO Unit 2.

Question 19.3

For WSES Unit 3 it is stated: "Unavailability of mini-flow assumes HPSI fails for LOCAs and SGTRs." Does this assumption include transient-induced LOCAs? What is the basis for this statement?

Response: 19.3

WSES assumption is a conservative position. The PRA model assumes that whenever the HPSI system is required for accident mitigation, including transient-induced LOCAs, unavailability of mini-flow results in HPSI failure.

Question 20

Table 6.3-2 (page 6-11) lists the assumed LOCA initiating event frequencies at the various CEOG plants. It appears that there is a large variability in the assumed LOCA frequencies among plants (over two orders of magnitude in some cases). This variability can drive the risk assessment results. It is important to understand the uncertainty associated with initiating event frequencies, and other parameters, that impact the results of the risk assessments. Please address the issue of uncertainties in assumptions that drive the risk assessment results.

Response: 20

The HPSI system provides mitigative capability for inventory loss events. Among the most challenging of the inventory loss events is the LOCA. The specification of the Initiating Event Frequency (IEF) for LOCA has changed over time. Values selected tend to represent an amalgam of vintage data, new data and conservative approaches. This variability in approach has lead to a large distribution in LOCA IEFs. From the perspective of HPSI maintenance, the most significant LOCA is the small LOCA. Plants typically use values for the small LOCA IEF between 2.9E-03 to 6.9E-03 per year. These values are typically consistent with values used in WASH-1400. Overall, this variation is quite small. However, in 1999, INEL re-investigated the LOCA frequency. A new small LOCA frequency was established by pooling small break PWR and BWR experience from 1969 to 1997. In that time frame there were zero failures observed in 2102 calendar years of operation. The approximate failure rate was 2.4E-04 per calendar year (Section J-4 of Reference 1) or 5 E-04 per reactor critical year (see Table 3-5 of Reference 1). Thus, the smaller values used for SBLOCA frequencies represent more realistic LOCA estimates, the larger values typically include consideration of pipe leaks as well. While the results are variable, the tendency is to conservatively model the risk impact by including larger frequencies. Of the utilities participating in the study only one utility used the Reference 1 revised industry estimate for SBLOCA. The remaining utilities used conservative values to approximate the LOCA.

Other uncertainties also are relevant to HPSI maintenance activity. As discussed previously, the HPSI provides makeup to the RCS in the event of an inventory loss event. Thus, modeling assumptions that impact LOCA and induced inventory loss events (stuck open PORV, total loss of feedwater and RCP seal LOCAs) can impact RICT assessments. An evaluation of modeling uncertainty is summarized in the attached table. Parametric uncertainty focuses on the uncertainty of selected parameters. Parametric uncertainty arises from variability in injection flow rates, inventory resources, component failure rates, etc. The impact of parameter uncertainty is more readily identified, analyzed and dispositioned than modeling uncertainties.

Reference

1. NUREG/CR-5750, "Rates of Initiating Events at U.S. Nuclear Power Plants: 1987-1995," Poloski, J.P., Marksberry, D.G., Atwood, C.L., Galyean,W.J., INEL, February, 1999.

	PRA Sources of Model Uncertainty in Small LOCA events	
Key Model Feature/Assumption	**Sources of Uncertainty**	**Impact of Uncertainty**
Selection of Break Location	PRAs traditionally consider LOCAs to be initiated by breaks in primary system piping located at the bottom of the cold leg piping. This selection of location: (1) minimizes the head of water available to drive water into the core, (2) increases discharge by increasing the time the break is covered with a liquid or two-phase mixture and (3) affects the extent of RCS refill.	Assumption tends to bias risks of LOCA events upward. Uncertainty in break location (e.g., top versus bottom of piping, RCS pipe location (hot leg, discharge leg, suction) will affect the scenario risk significance. Common practice is to model the worst LOCA break based on location and orientation. This normally results in the selection of "worst Case" LOCA in the cold leg with a break at the bottom of the pipe. This selection results in conservatisms as : (1) Breaks in the upper portion of piping may allow long term RCS recirculation; this reduces the reliance on the emergency sump and hot/side cold side injection for LTC. This is particular significant for smaller breaker sizes. (2) Hot leg breaks cannot be affected by spillage of injection water thus, all injection paths are available. Fracture mechanic analyses indicate that for CE designed PWRs the likelihood of a hot die LOCA contributes to < 10% of the LOCA frequency.
Definition of Success Criteria	Event success criteria are a function of several parameters including: • Selection of core damage definition • Selection of the core decay heat model • Deterministic break and two-phase modeling assumptions • Assumptions associated with selection of the thermo-hydraulic model including the power profile • Consideration of backup inventory control strategies	The impact of these assumptions vary among PSAs and can impact the calculation of RICT. Conservative models (that is, those using core uncovery as a surrogate for core damage, and design basis equipment lineup requirements) tend to over credit the need for the HPSI and associated sub-components. Best estimate models provide more realism in the LOCA calculation and can reduce equipment/ system required for success. Reductions are typically seen as reduced requirements on SIT availability, number of SI injection paths and HPSI pump delivery requirements. RCP operation may have a small impact by shifting the boundaries between medium and small LOCA.
RCP Operation	Analyses tend to emphasize LOCAs concurrent with an induced LOOP. This results in analyses being performed without RCP operation.	The impact of using induced power loss LOCA analyses is considered small. In practice best estimate analyses indicates that for CE designed PWRs there is a small shift in the boundaries between small and medium LOCAs. However, this has little practical importance as LOCAs with power are characterized by no need for EDGs, and availability of multiple SI trains. Thus the contribution to LOCA risk is low.

	PRA Sources of Model Uncertainty in Small LOCA events	
Key Model Feature/Assumption	**Sources of Uncertainty**	**Impact of Uncertainty**
Operator Actions	As a result of the rapidity of the LOCA event, operator actions are few; operators are well trained in their implementation. In some instances, actions that are implemented are not required.	Operator actions are not a significant contributor to uncertainty in LOCA events
Equipment Characterization and Repair Likelihood	• HVAC models typically neglect to credit the timing of the core-damage sequence and the transient nature of some of the room heat loads. • LOCAs result in rapid inventory losses. Therefore, repair of equipment is not normally considered. However, analyses suggest that double-sequencing of EDG loads can be successfully completed.	Lack of room heat-up models often results in upwardly biased prediction of component failure. Neglect of equipment repair and HPSI restart biases RICT downward.

	PRA Sources of Model Uncertainty Induced LOCA events	
Key Model Feature/Assumption	**Sources of Uncertainty**	**Impact of Uncertainty**
RCP Seal LOCA Model	RCP seal leakage is an uncertain process. No RCP seal LOCA events have been observed at CE PWRs and the design of the CE seal is robust to seal failure events. RCP seals have demonstrated the capability to operate many hours following an SBO event prior to developing a leak. A report describing the probabilistic modeling of the CE PWR RCP seal LOCA event is being completed by NRC. Several CE PWRs utilize variations of this model in their PRAs. CE plants will transition to a consensus CEOG RCP seal model following approval of the model.	As a result of the low probability of the event the impact of modeling uncertainty is small. Regardless, CE plants model this failure mode and will fully incorporate the approved consensus model into the plant specific PRA, as appropriate.
PORV/PSV Challenge	Challenges to the plant PORVs/PSVs may arise as a consequence of: (1) Transient overpressure challenges with a stuck open PSV (2) Spurious opening of a PORV (3) Total Loss of Feedwater events (4) Station blackouts	The impact of the frequency of the PORV/PSV challenges varies among the CE plants. CE plants fall into three categories: (1) plants with standard size PORVs, (2) plants with large PORVs or ECCS vents and (3) plants without PORVs. **Transient overpressure challenges with a stuck open PSV** Transient challenges are typically computed using thermal hydraulic codes using either realistic assumptions or conservatively biased design basis analyses. For plants using design basis assumptions transient frequency challenges are likely to be overstated. This may have a marginal conservative impact on RICT calculation **Spurious Opening of a PORV** This event is only possible for plants in Categories 1 and 2 above. Spurious challenges are based on industry data. The impact of fire is typically not included. A small impact on the RICT calculation is noted by not considering fire induced PORV openings. **Total Loss of Feedwater Events** This event results from loss of all main and auxiliary feedwater. This event may be mitigated by either restoration of feedwater in a 1 hour time frame or timely initiation of feed and bleed cooling. Plants with larger PORVs or

	PRA Sources of Model Uncertainty Induced LOCA events	
Key Model Feature/Assumption	**Sources of Uncertainty**	**Impact of Uncertainty**
		vents can delay F&B cooing for a considerable time and hence this success path is strongly dependent on equipment availability. While plants with smaller PORVs require prompt operator action and failure is driven by both human factors and equipment availability. The primary uncertainty associated with event success is the modeling of human actions. Some uncertainty is also involved with the number of PORVs /HPSIs required for success. CE plants typically base success criteria on best estimate or design basis thermal hydraulic codes. In this instance over crediting success of F&B will increase importance of HPSIs (reduce RICT) and AFW. And vice versa. **Station Blackouts** These events result in loss of inventory without makeup. The primary cause for core damage is the inability to provide power to available equipment. Uncertainties associated with these events will not have a significant impact on HPSI maintenance RICT.

Question 21

Please provide a discussion, as necessary, explaining in more detail the HPSI LOCA success criteria at the various CEOG plants listed in Table 6.3-3 (page 6-12). For example, it is noted that HPSI hot leg injection is required for St Lucie Unit 2 but no exact criteria are mentioned. Are the HPSI LOCA success criteria assumed to be the same for all break sizes and locations? Please discuss the robustness of the assumed success criteria and the degree of conservatism of some assumptions (e.g., hot leg injection alignment time).

Response: 21

Selection of success criteria is plant dependent and reflects both modeling assumptions and consequences of physical plant layout. LOCA success criteria are dependent on break size. In a very general sense, equipment requirements for the various break categories are presented in Table 21-1. Success criteria contained Table 6.3-3 of the topical reports are not the full set of LOCA success criteria, but rather refer to what capabilities of the HPSI system are required to have to ensure that the HPSI portion of the Table 21-1 success criteria met. The level of conservatism within the LOCA analysis varies.

As shown in the table below, LOCA success criteria are a function of break size. This is clearly demonstrated by the LOCA thermal-hydraulic response at each break range. The impact of location is somewhat more subtle and mainly influences the number of injection pathways required for successful event mitigation. Too few pathways could reduce the injection flow sufficiently to create a core damage condition. In general, hot side breaks require fewer injection flowpaths that cold side breaks, since when the break is situated in the hot leg all the injected flow delivered to the cold leg will pass through the core.

Most plants rely on HPSI system for the primary means of hot side/cold side injection. However, hot side/cold side injection is not required for mitigation of small and medium LOCAs. For most CE PWRs, hot leg injection success requires the HPSI system to be operating and injecting via an intact hot leg injection line.

Table 21-1
Example LOCA Component Success Criteria

LOCA Range	AFW	Component needed for success HPSI	LPSI	SIT
SBLOCA	✓	✓		
MBLOCA		✓		
LBLOCA			✓	✓
LT cooling hotside/coldside injection		Plant specific	Plant specific	
LT cooling SDC*			✓	
Feed and Bleed		✓		

* Alternative heat removal via RWST refill and SI>

Question 22

Terminology used in the discussion on incremental risk (page 6-13) appears confusing. For example terms, such as "incremental risk," "incremental CDP value, " "incremental CDP beyond the frontstop," and "ICDP associated with the maintenance," are used almost interchangeably. When do each of these incremental risks begin to accumulate? What guidance applies to each of these incremental risks? Please clarify and revise accordingly to include consistent and precise terminology.

Response: 22

The wording is unclear. The following points should be made and the report will be changed accordingly.

> The "incremental risk of the configuration" is the ICDP measured from the zero maintenance baseline and includes consideration of the outage of the TS SSC and all other concurrent outages and is measured from the first entry into the TS and accumulates until the RMTS is exited.
>
> "Incremental CDP value" is a non specific term that represents ICDP.
>
> The "incremental risk beyond the frontstop" is the ICDP associated the risk of the TS SSC outage as measured from the frontstop to the time the TS with the flexible AOT is exited.
>
> "ICDP associated with the maintenance" refers to the risk associated with maintaining the component in question from the time the frontstop is passed until the RMTS is exited. In this particular context the incremental risk refers to the risk contribution of that component only.

Aggregated risks (that is annual risks to be compared with RG 1.174) accumulate once the frontstop is past. For each associated TS entry, the configuration risks for use in maintenance rule planning accumulate upon entry into the TS action statement.

Question 23

On page 6-13 it is stated: *"....the model utilizes a risk increment of 1.0E-06. This value is selected for illustration. Risks of this level are very small...."* Please explain why this value is selected for illustration purposes, only. What criteria will be used to determine how much is acceptable to go beyond the frontstop? When does this incremental risk begin to accumulate? If this incremental risk represents the incremental CDP beyond the frontstop (i.e., counting from entry into the extended AOT/CT), as it appears from statements elsewhere in the text, then a risk increment of 1.0E-6 is not necessarily "very small." Furthermore, this quantity should not be confused with the "configuration" or "maintenance" incremental risk which is used in the Maintenance Rule guidance. Please discuss and clarify accordingly.

Response: 23

Plant configurations with ICDPs > 1.0E-6 would not be entered for "planned" maintenance. Therefore, this risk can be interpreted as the maximum expected risk for the various HPSI system maintenance states.

The maintenance ICDP value discussed above is the risk associated with the maintenance configuration(s) that result from the time the RMTS is entered to the time TS is exited. This includes all time before and beyond the frontstop. The details of the process to be used for determining the RICT maintenance material is summarized in Response RAI 1 and is presented in the RMTS Guidelines.

For planned maintenance, it is the intent of the RMTS process to be consistent with the plants' maintenance rule implementation.

For emergent work, it is expected that the plant will adhere to maintenance rule practices. As emergent events may accumulate unexpected risks, it is desired that the risk be carefully controlled. Despite the fact that emergent risks could be allowed to accumulate up to a total of 1.0E-5 (per maintenance rule), the topical report recommends that the utility attempt to limit incremental risks beyond the frontstop to an order of magnitude lower. Note, the pilot plant uses more stringent criteria than is discussed in this report.

The overall use of the flexible AOT is governed by RG 1.174 for small changes. That is the yearly impact of utilizing the flexible AOT should result in an aggregate ICDP (over all usages beyond the frontstop) < 1.0E-5.

Question 24

On page 6-15 it is stated: *"This conditional CDF was assessed for PM only. .....For emergent repairs .....it is expected that the common cause failure probability would increase for a CM condition."* Since CCFs are major contributors to risk, it would be very insightful to investigate how the time to reach the ICDP value of 1.0E-06 changes when an emergent condition is assumed in some of the example risk assessments provided in Section 6.3 of the topical report. This investigation would: (1) demonstrate the plant's capability to implement the Initiative 4b approach to conditions involving CM and (2) would provide insights that could be used in the development of guidance (i.e., would provide input to the RMTS guide). Please discuss.

Response: 24

An example of emergent failure analysis has been performed by the pilot plant. An apparent failure occurred during testing of a high pressure safety injection pump. As the cause of the failure was initially unknown a risk assessment was performed which characterized the failure time for the ICDP of the plant configuration to reach various target thresholds. Two conditions to be compared are: (a) the ICDP when the failure is an entirely random event, and (b) the ICDP when the failure is due to a common cause event with a common cause factor of ~ 0.1. In this analyses the risk was established by setting the failure probability of the affected HPSI pump to True and change the common cause failure probability of the HPSI pumps from its nominal value to the value of the common cause failure parameter. (This is consistent with the plant's CAFTA representation.) Results of the evaluation are summarized below:

	Time for ICDP to Reach	
	Hours	**Days**
Failure	10^{-7}	10^{-6}
Random	282.6	117
Common Cause ($\beta = 0.1$)	10	4.16

Note that the presence of a common cause factor significantly affects the available RICT. In this instance RICT is reduced by a factor of about 30.

Question 25

25. On page 6-17 it is stated: *"For plants with rigidly aligned HPSI asymmetries (e.g., Fort Calhoun), the single HPSI pump train was assumed failed, as the likelihood of two inoperable HPSI pumps on the other train was considered remote."* Please explain what is meant by "rigidly aligned HPSI asymmetries" and the point this statement is making.

Response: 25

FCS has 3 HPSI pumps. Vital bus B supports HPSI pump SI-2B and vital bus A supports HPSI pumps SI-2A and SI-2C. Unlike many more recent designs the 3rd HPSI (SI-2C) is not a true swing, as it is powered by vital bus A. While alignment to vital bus B is physically possible, procedure and guidance for cross train connector is not provided. Therefore, SI-2C is not credited as a spare pump for SI-2B.

Question 26

26. **On page 6-17 it is stated: *"In general, the results confirm the conservative nature of the 3 day front stop AOT."* Also, in the footnote it is stated: *"Note that a typical front stop AOT is generally related to a 5.0E-07 CDP, however the current HPSI AOTs are actually based on system reliability assessments (See Reference 24)."* Based on what criteria the results are conservative? Please explain how the statement in the footnote support the statement regarding the conservative nature of the results.**

<u>Response: 26</u>

The results of the HPSI analyses suggest that very few HPSI component inoperabilities will result in limiting AOTs less than the current 3 days. Plants with standard PORVs indicate that unavailability of a HPSI train for 3 days would have ICDPs < 5 x 1.0E-7. Only plants that strongly rely on HPSI for feed and bleed due to unique PORV sizing (i.e. St. Lucie Units 1 and 2 and Palisades) indicate potential times to ICDPs of 5 x 10E-7 (very small risk levels) to be reached within 2 to 3 days.

Question 27

The discussion on HPSI train inoperability due to unavailability of HPSI auto start (page 6-18) does not clearly state how this failure is modeled in the PRA. More detailed explanation of what was done is needed. For example, it is stated that the "failure to start" basic event was set to "true" without stating how recovery was modeled for the various LOCA sizes. Also, the staff notes that this case is a clear example where PRA modeling assumptions (e.g., break frequencies and manual recovery probabilities) can drive the results. The staff believes that the understanding of important assumptions made in the pilot risk assessments, and their risk impact, is needed to ensure that appropriate guidance will be developed for implementing RMTS Initiative 4b. Please discuss.

Response: 27

Results for HPSI system unavailability due to auto-start failure was included in the Topical report to illustrate that recovery from auto-start may be credited for certain non-LOCA transients. For these transients, the implied assumption is that there would be adequate time for the operator to restore the affected HPSI pump to operability. Transient analyses have demonstrated that there would be adequate time (~ 20 minutes) to recover from auto-start failure for Feed and Bleed transient. Analyses have also demonstrated that there would be adequate time to credit auto-start for steam generator tube ruptures and the lower range of small break LOCAs. The results previously provided in the Topical report vary from plant-to-plant primarily because of differences in plant designs, modeling assumptions, and the affected HPSI pump arrangement.

Updated results for the pilot plant will be provided later. Updated results, which credit the recovery of HPSI pump auto-start, will be provided for other plants with Combustion Engineering NSSS designed PWR at the time of their specific submittal.

Question 28

The inoperability of one HPSI train, due to inability to operate in the emergency sump recirculation mode, is discussed on page 6-19. It is stated: *"This failure increases the likelihood of core damage events initiated by large and medium LOCAs."* Please explain the basis for not considering the more frequent small LOCAs and transient-induced LOCAs (as is the case in the ongoing resolution of GSI-191 for PWRs).

Response: 28

The small LOCAs and transients are not excluded. The comment was a general one. The success for a small LOCA sequence does not rely on the need for recirculation from the ECCS sump as small LOCAs can be mitigated in the long term via use of the shutdown cooling system. This is a consequence of how small LOCAs are defined in the PRA. As long as the containment sprays do not actuate, the time required to empty the RWST for a small LOCA event is relatively long.

It should be noted that resolution of GSI-191 indicates that LOCAs in the PRA small break range (less than approximately 2 inches in diameter) will not challenge the operability of the containment sump.

It should also be noted that the importance of the HPSI is maximized by assuming ECCS sump operability. This is a direct consequence of the fact that LOCAs that proceed to core damage due to sump inoperability (clogging etc.) will do so regardless of the availability of the HPSI.

Question 29

The discussion on HPSI train inoperability, due to the unavailability of a mini-flow line (page 6-19), does not clearly state how this failure is modeled in the PRA for each of the CEOG plants. More detailed explanation of what was done is needed. It is stated that the risk analysis assumed that the mini-flow capability was disabled (e.g. closed mini-flow valve). However, not enough information is presented on how the capability of the HPSI pump to perform its function was modeled. Several "generic" statements are made without providing adequate explanation about their applicability or basis. For example, it is stated: *"This time is sufficiently long so as to significantly limit the range of small LOCAs for which HPSI failure would occur."* The staff finds that such statements do not provide adequate information to determine whether the unavailability of a HPSI mini-flow line was properly modeled in the risk assessments discussed in the CEOG topical report. The staff believes that the understanding of important modeling assumptions made in the pilot risk assessments is needed to develop appropriate guidance for implementing RMTS Initiative 4b. Please discuss.

Response: 29

Summary information is provided in tables contained in Section 6 of the topical report. Table 6.3-1 presents the mini-flow modeling assumptions. Table 5.5-1 presents the shutoff heads for the various HPSI designs. The mini-flow line provides a small HPSI flow relief path to the RWST when the HPSI pumps operate against a higher pressure sink. The mini-flow must open during injection to ensure that the HPSI pumps are not operated in a dead-headed manner. The mini-flow line must also close during recirculation to avoid inventory being pumped back into the RWST. The mini-flow lines are normally operated in open position. The unavailability of the line maybe due a transfer to close or maintenance activities that require mini-flow line isolation.

Question 29 continued

The significance of this valve is affected by design and modeling assumptions. The RCS pressure at which dead-headed operation occurs is plant specific and varies from 1170 psig to 1900 psig (see Table 5.1-1 of the topical report). Mini-flow operability is a concern for very small LOCAs where the time of operation above these pressures may be long (> tens of minutes, see Table below). Thus, isolation of mini-flow during injection will cause HPSI failure in a fraction of the small LOCAs that would otherwise be mitigated. As the small LOCA spectrum results in these conditions is expected to be relatively narrow, the fraction of the small LOCA spectrum that would be affected by this failure varies from 0 to less than 0.1.

PRA models for the mini-flow vary among utilities. Simplified models map the unavailability of mini-flow to the failure of the HPSI pumps to inject for all small LOCAs. More realistic assessment utilizes thermal hydraulic analyses to estimate the fraction of the small LOCA spectrum (if any) that is affected. The table below illustrates the impact of break size on the time of HPSI operation above the shutoff head. Note that for longer duration events, inventory makeup may also be provided via the charging system. Also note that Palo Verde does not require mini-flow for HPSI. In the Palo Verde design the HPSI shutoff head is above the SIAS setpoint; therefore, it is assumed that if HPSI is actuated, the backpressure is low enough that flow will go to the RCS.

Time to 1200 psia Injection
(CEN-114-P: Review of Small Break Transients in Combustion Engineering Nuclear Steam Supply Systems)

Break Area	**Effective Diameter**	**Time to HPSI Injection**
Ft^2	inches	Minutes
0.1**	4.28	0.95
0.02**	1.92	1.52
0.0093*	1.31	3.17
0.0005**	0.30	61.67

* Nominal Stuck open PORV
** Cold leg break LOCA

Question 30

The HPSI inoperability, due to degraded pump performance, is discussed on pages 6-19 and 6-20. It is stated that the assessments of degraded pump performance were performed using a Realistic LOCA Evaluation Model and that *"... analyses indicate that reductions in HPSI pump injection flows on the order of 80 percent full capacity will still avoid a core damage condition."* How much confidence do we have in this "realistic" model? Please discuss.

Response: 30

Reduction in HPSI pump injection flows referred to above reduce RCS delivery to approximately 80% full capacity. The realistic model is based on a tool used for design analyses (see Response 17). The reduced flow requirements is primarily a result of the use of the realistic decay heat curve (with 2σ uncertainty). The analysis performed for a spectrum of LOCA sizes varying from $0.01ft^2$ to $1ft^2$. HPSI injection was reduced to reflect the delivered flow associated with a one and two injection of four leg(s) unavailable. The primary purpose of the HPSI pump is to supply make up inventory boil-off to the core. A 20% reduction in the design flow is generally compensated for by removal of an approximately equal amount of conservatism from the design basis decay heat model.

Question 31

The HPSI inoperability, due to failure of HPSI pump room cooling, is discussed on page 6-20. It is stated: *".... the loss may cause a failure of the associated HPSI pump(s) while operating in the recirculation mode"* and *"None of the plants requires HPSI pump cooling for successful HPSI performance while in the injection mode."* What are the bases for these assumptions? How was this failure modeled in the PRA? Please discuss.

Response: 31

This assumption varies among utilities within the CE fleet.

Fluid from the emergency sump is saturated with temperatures between 250 and 300 F. As a result of the transport of high temperature fluid, operation of HPSI pumps motors could be damaged. At Fort Calhoun Station, the high pressure safety injection, low pressure safety injection, and containment spray pumps are installed in two separate rooms. Four pumps are in one room, four pumps are in the other room. During the injection phase, the HPSI is delivering low temperature water (typically < 120 F) to the RCS. Room heat-up calculations have been performed to confirm that pump operability limits will not be violated. While the pumps are exposed to higher temperature liquid the room heat load is significantly reduced when recirculation actuation signal trips the low pressure safety injection pumps, and when the operators reduce the number of operating containment spray pumps per the emergency operating procedures. The rooms are large, and analysis has concluded that the pumps can run for many hours without ventilation.

Plant specific variations at Palo Verde result in pumps assigned increased failure probabilities for selected pumps when room cooling fails. Palo Verde does not differentiate between failure in the injection and recirculation modes.

Question 32

On page 6-25, third paragraph, it is stated that the results of the impact of simultaneous equipment inoperabilities in the presence of a low risk HPSI condition are presented in Figures 6.3-8 through 6.3-14. Please provide more detailed description of the assumed outages. For example, what is the concurrent maintenance for PVNGS (Figure 6.3-15) which shows maintenance conditions with train A and train B outage? Please clarify.

Response: 32

The intent of the examples with concurrent outages is to demonstrate a representative realistic scenario. Several cases were run assuming a single HPSI injection valve became non-functional while scheduled maintenance was in progress on opposite train systems, such as HVAC, EDG, or AFW. A and B maintenance conditions are typical of normal minor preventative maintenance, typically conducted at Palo Verde.

Question 33

On page 6-25 (bottom) it is stated: *"In this particular example, while the change in risk is notable, the practical risk increment for the flexible AOT is negligible (See Figure 6.3-16). Similar conclusions may be drawn from the Fort Calhoun comparison (See Figure 6.3-8)."* It appears that there are inconsistencies between these two figures (which are related to Fort Calhoun). For example, Figure 6.3-8 shows that the time to reach ICDP of 1.0E-6 when an SI line valve is inoperable, concurrently with the opposite EDG, is about one day. However, Figure 6.3-16 shows that this same time is almost 200 days! Also, Figure 6.3-16 shows that it takes more than 2,000 days of operation with one SI header valve and one motor-driven AFW pump out of service to reach an ICDP value of 1.0E-6. Please explain these two Figures and revise accordingly.

Response: 33

The presentation of the material was confusing. The figure was intended to illustrate that the risk of the multiple maintenance situations was not due to the unavailability of an SI injection path. The examples selected showed that the contribution of the risk of the maintenance activity configuration was in fact from the component that was not subject to the Flexible AOT restrictions. The two figures actually tracked different conditions. Figure 6.3-8 of the topical report shows the time required for the configuration (all components considered) to reach a CDP of 1.0E-6 assuming simultaneous equal duration outages. Figure 6.3-16 of the topical report illustrates the risk contribution of the **HPSI SI line** unavailability alone in the presence of other components OOS. Figure 6.3-16 core damage probability is obtained by taking the CDF of the initial maintenance configuration with one SI line OOS and subtracted the CDF associated with the initial maintenance configuration associated with all OOS components except HPSI. The net risk CDF contribution attributed to the SI line was very small and is reflected in very large "time" metrics. These metrics will not be used to manage risk. The overall point was to demonstrate that the amplification effect associated with having many components OOS can be modeled and the effect for some HPSI maintenance conditions can still be quite small.

Question 34

The information provided in Table 6.3-5 (page 6-26) indicates that not all CEOG plants performed all risk assessments (actually Calvert Cliffs and Millstone 2 have not performed any). The missing risk assessments are needed if the industry is requesting staff approval for the proposed HPSI AOT/CT extensions for all CEOG plants. Please explain.

Response: 34

These plants have provided supplemental data but have not currently performed analyses. This task will proceed as a pilot application, additional analyses from CCNPP and MP2 will not be provided at this time.

Question 35

The contribution from fire risk is discussed on page 6-31. Table 6.3-6 reports results which show that the time to reach 1.0E-6 ICDP can be significantly shorter when fire risk is considered in some cases (e.g., SI injection and AFW pump). This does not seem to agree with the industry's conclusion that HPSI train OOS risk is not expected to impact fire-induced core damage results. Furthermore, the results of Table 6.3-6 are specific to Palo Verde Nuclear Generating Station (PVNGS), a plant that cannot use HPSI for feed and bleed (i.e., no PORVs). The fire risk impact for plants that take credit for HPSI to perform feed and bleed may be considerably higher. Also, it is stated: *".....availability of safe shutdown paths will......obviate the need for HPSI mitigation during and following a fire."* This statement needs to be followed by licensee commitment to ensure the availability of safe shutdowns systems, such as EDGs and AFW, when a HPSI train is declared inoperable for maintenance. Please discuss.

<u>Response: 35</u>

The treatment of the impact of fire scenarios on planning of HPSI maintenance will vary among the participating utilities. At least three CEOG member utilities have full scope fire PRAs (see RAI 7). These plants may directly utilize fire PRA results to estimate the impact of fire on RICT.

Alternate methods for addressing the impact of fire scenarios on maintenance can be based on using fire insights. In this approach, results of fire PRA/FIVE assessments would be used to screen low risk areas and focus attention on risk significant fire areas. Risk significant areas would be those for which a fire would challenge systems or trains that have increased risk importance if one train of HPSI is made inoperable. Appropriate risk management actions would be developed, such as providing additional protection for those systems or trains.

Use of these alternate methods would also include, as appropriate: (1) contingency actions to control combustibles, and ensure that fire mitigation capability is available in the risk significant area(s) identified, (2) reduced thresholds for operator action, and (3) actions to protect risk significant equipment needed for safe shutdown. Such guidance would be captured in plant specific procedures.

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Question 36

Seismic risks are discussed on page 6-32. It is stated: *"For other initiators, provided safe shutdown paths are protected for any PWR, the presence or absence of the HPSI will not have a significant impact on plant risk."* This statement needs to be followed by licensee commitment to ensure the availability of safe shutdowns systems, such as EDGs and AFW, when a HPSI train is declared inoperable for maintenance. Please discuss.

Response: 36

The seismic influence on HPSI maintenance decisions will be considered. Several member utilities have seismic PRAs (see RAI 7). Many others such as St. Lucie Units 1 and 2 and Waterford Unit 3 are situated in low seismic zones. For these plants the impact of plant configuration, including seismic events, can be considered directly via contemporaneous PRA assessment, bounding assessments or readily ignored.

In the pilot analysis an alternate approach is used. All plants are designed to withstand a safe shutdown Earthquake. The pilot plant is designed for a design basis earthquake of 0.17g. However, at ground accelerations greater than about 0.1 g the site may be susceptible to a loss of offsite power. The frequency of such events is estimated based on EPRI seismic hazard curves to be less than 7×10^{-5}/year. At this g level the HCLF value of ceramic insulators (See Reference) is 0.05. Thus, for a typical one week maintenance configuration, the impact of a seismic event on HPSI maintenance is less than the likelihood that a seismic event causes a LOOP. The probability of a seismic induced LOOP is then

$$7 \times 1.0E\text{-}5/\text{year} \times 0.05 \times 7\ \text{days}/(365\ \text{days/year}) = 6.7 \times 1.0E\text{-}8$$

This level of risk is considered negligible. Seismically induced LOCAs are not significant as the plant is designed to withstand ground accelerations up to 0.17 g. Even if a 0.1 g acceleration were to produce a small LOCA, the contribution of the event to the small LOCA core damage frequency would be less than 1%.

Seismic Frequency: 7 x 1.0E-5/year
Estimated piping fragility: 0.05
Small Break LOCA Frequency: 0.0068 per year (used in PRA analysis)

$$\text{Contribution of Seismic LOCAs} = \frac{7 \times 1.0E\text{-}5/\text{year} \times 0.05}{0.0068} = 0.05\ \%$$

Reference

TSTF-372, Revision 4, "Addition of LOC 3.0.8, Inoperability of Snubbers," April 23, 2004.

Question 37

Typical administrative actions that can be taken when a HPSI train is declared inoperable and the repair time is longer than the frontstop AOT/CT are discussed on page 6-36. The language used in describing these administrative actions does not imply a strong commitment that plants will develop and implement such controls. The staff believes that a commitment should be made to develop guidance for each of the four administrative control categories discussed on page 6-36 as part of the justification of the proposed flexible HPSI AOT/CT extensions. Please discuss.

Response: 37

The utilities securing the flexible AOT extension will commit to implement the controls associated with the RMTS guidelines as summarized in Question 1. This document provides guidance for consideration of common cause issues during emergent failures and treatment of contingency actions. With respect to the HPSI AOT in particular, plants guidance beyond frontstop operation:

1. Concurrent AFW unavailability should be avoided.

2. Concurrent maintenance on inoperable ECCS should be avoided when beyond the frontstop AOT.

Question 38

On page 6-37, a brief comment on defense-in-depth is made. It is stated: *"Additional guidance to critically evaluate simultaneous outages of the AFW and HPSI trains further enhances defense-in-depth by ensuring the potential challenges to core cooling are adequately controlled."* This statement implies that guidance will be available to critically evaluate simultaneous outages of AFW and HPSI trains. However, no commitment has been made to require the development of such guidance. Please discuss.

<u>Response: 38</u>

Plant implementing the flexible AOT will utilize guidance contained in the RMTS guidance document. The RMTS guidance document provides sufficient guidance for evaluating risk of multiple system/component outages. Risk assessments of multiple component outages will consider impact of the out of service components and maintenance activities on external and internal event generated risks. Such evaluations will be performed in a timely manner using peer review internal events PRAs. External events may be considered as discussed in Response to RAIs 35 and 36.

Question 39

On page 7-3 it is stated: ***"As discussed previously, HPSI subsystem inoperabilities are expected to have a negligible impact on LERF. Therefore, LERF need only be assessed during periods of equipment inoperabilities that are important to LERF that may be OOS during the HPSI extended AOT/CT period."*** **The staff believes that guidance is required to ensure that the increase in LERF (when equipment important to LERF is out of service) is assessed and considered in the decisionmaking process when a HPSI AOT/CT extension is considered. Also, please comment on the adequacy of the PRA models the various CEOG plants will be using to calculate LERF increases. Will they be detailed assessments and/or bounding-type calculations?**

Response: 39

Implementation guidance for the HPSI flexible AOT extension will include LERF considerations. The primary LERF impacts results from a LOCA in the presence of an unisolated containment or increases in the frequency for an ISLOCA event. Provided containment integrity is maintained the incremental LERF contribution resulting from loss of containment isolation is at least one order of magnitude less than the CDF impact. While availability of a HPSI will alter the timing of an ISLOCA event, the PRA model assumes that availability of a HPSI will not terminate an ISLOCA since over time the RWST will deplete and inventory will not be available to ensure that they are covered. This modeling approach will tend to have results to de-value HPSIs importance. Models that would include RWST refill would show a small HPSI dependency.

Regardless, plants will evaluate ICLERPs to confirm or update the RICT calculation. The specific details of the plant's LERF model vary. Plants' models are either extensions of Level 2 PRA models which are based on detailed models, or reflect more conservative implementations of methods such as NUREG/CR-6595. As LERF challenges are tied to containment bypass and loss of containment isolation sequences, the direct impact of HPSI maintenance and availability on LERF is small. For the most part LERF assessments will reflect simplified bounding assessments.

Question 40

On page 7-4 it is stated: *"Explicit risk management actions (e.g., Mode Change, including shutdown and compensatory measures)..........may be developed and documented in advance for anticipated combinations of equipment with more significant risk impacts."* The staff expects that an explicit plant shutdown strategy based on clear decision criteria should be developed as part of the RMTS Guide. Also, the RMTS Guide should require that each plant adopting flexible AOTs/CTs (Initiative 4b) identify anticipated combinations of equipment outages with significant risk impacts and develop appropriate risk management guidance. Please discuss.

Response: 40

When plant is operating beyond the frontstop of an extended flexible AOT, and the maintenance risk exceeds the limiting RICT the plant will consider the TS Action Statement to be NOT MET and the appropriate required actions will be followed. These actions may include plant shutdown. The RICT will be exceeded when the ICDP of a maintenance configuration cannot be maintained below an incremental core damage probability of 1 x 1.0E-5 over a zero maintenance baseline or the instantaneous risk CDF of 1 x 1.0E-3/year. (See also Response for RAI 1.)

Question 41

On page 7-5 it is stated: ***"Furthermore, flexibility to utilize longer AOTs/CTs can potentially avoid higher risk system outages which result from situations that drive the plant to complete more comprehensive maintenance activities to minimize system outage times and meet performance goals."*** **Please clarify and provide example(s).**

Response: 41

Using a flexible AOT, maintenance can be spread out over a longer duration with increased operational efficiency. This will result in fewer entries to the LCO, and minimize maintenance error (e.g., tagout errors) due to multiple entries into the same TS. The benefit of this will vary among utilities based on maintenance practice, and compliance with performance indicators.

Question 42

On page B-5 it is stated: ***"Furthermore unlike the TS, the Maintenance Rule is silent on identification of plant conditions requiring plant shutdown.............This alternative establishes flexible AOTs controlled by the Maintenance Rule, and shutdown/mode change actions established from a risk assessment process."*** **It is not clear in the report how the proposed process for shutting the plant down differs from the Maintenance Rule process. For example, on page B-7 it is stated:** ***"The risk assessment process will focus on the entire maintenance evolution and will utilize the quantitative action thresholds of Section 11.3.7.2 of Reference B8."*** **These "action thresholds" do not provide a strategy and clear criteria for initiating a plant shutdown. Please explain how the proposed process is any different than the Maintenance Rule in identifying plant conditions that require plant shutdown.**

Response: 42

See Comment in response to RAIs 1 and 40.

Question 43

On the bottom of page B-5 it is stated: *"However, it is envisioned that, once fully implemented, the maintenance related actions for non-TS SSCs will also follow the same risk assessment process."* Please provide a more detailed discussion to clarify this statement regarding non-TS SSCs.

Response: 43

This item does not specifically refer to the HPSI submittal. It is a general statement to highlight that all components in the PRA will be assessed quantitatively with respect to its impact on plant risk. This process will ensure that risk significant non-safety equipment will be considered in estimating proposed risk of component unavailability. This process is consistent with the RMTS.

Question 44

On page B-6 it is stated: "*....A quantitative/qualitative risk assessment will provide the basis for continued plant operation....."* Please explain how a qualitative risk assessment will be used to determine the AOT/CT extension intervals. Guidance, and/or requirements for guidance, is needed for the qualitative risk assessments. Also, statements, such as *"The timing of the plant shutdown will reflect plant cumulative risks, the likelihood of repair, and transition and shutdown considerations,"* are vague and does not provide a clear strategy and criteria for shutting the plant down. Please discuss.

Response: 44

The RICT will be computed as discussed in the RMTS Guidance Document. The calculation will include a quantitative ICDP and ILERP determinations based on the Level 1 PRA, External Events (seismic, fire, as appropriate) and LERF. Qualitative assessments will be used to screen out those external events contributors that are considered to have small or negligible impact on the RICT calculation. The other external events will be used to establish quantitative RICT assessments. These assessments will use realistic or bounding approximations to external event risks. (See response to RAIs 35 and 36.)

Question 45

On page B-8 it is stated that "Planned maintenance beyond the frontstop AOT/CT should be infrequent....." Please explain what effective controls are proposed so that this statement will come true. For example, a requirement to base the flexible AOT/CT extension for planned maintenance on an ICDP value of 1.0E-6. Please discuss.

Response: 45

Maintenance beyond the frontstop will be tracked and documented. This information will be captured on annual reports and reviewed in order to establish the effectiveness of the plant maintenance rule program. This review will include an assessment of the risk (estimated CDF and LERF) incurred while operating beyond the front stop. Also included in this review will be the duration of the activity (including time beyond front stop), and concurrent TS and non-TS equipment outages and relevant compensatory measures. This information will be used to confirm or adjust maintenance practices.

With respect to the HPSI Flexible TS, operation beyond the frontstop is expected to arise primarily as a result of an emergent condition. Such emergent conditions may arise as a result of discovery of a component/subcomponent failure or, following a recent repair, but most likely an unexpected failure in that component's acceptance test.

As the flexible AOT expands in scope to other CE PWR systems (not requested at this time) planned outages of low risk equipment requiring operation beyond a TS frontstop may be recommended in order to: (a) repair low risk components whose parts are not readily available and (b) perform consolidated maintenance on SSCs. Item b refers to the situation where preventive component maintenance requires more time than is traditionally allotted in the frontstop duration. Such situations are currently handled via multiple outages on a single component with more focused maintenance activities. These shorter outages incur the same overhead as a longer more comprehensive outage, e.g., hanging tags, clearing tags, acceptance testing setup. Therefore, use of the flexible AOT will allow the net time spent on such maintenance activities to be reduced, as compared to several shorter outages to accomplish the same scope of work.

Question 46

On page B-11, two *"initiative 4b enhancements"* are mentioned. The first is the *"identification of, and timely response to, emergent High Risk conditions."* The second is the *"Implementation of a formal Risk-Informed Decision Process for plant shutdown/mode change."* The staff believes that these two "enhancements" need to be further developed, analyzed, characterized and explained and then used to identify criteria and requirements and to develop guidance (both generic and plant-specific) to implement initiative 4b. The same is true for the various ideas, considerations, attributes, comments and suggestions discussed in Appendix B of the topical report. Please discuss.

Response: 46

The items discussed above will be further discussed in the RMTS and associated implementation guidance in this initiative. Additional details on the shutdown process are contained within the scope of the RMTS guidelines. Activities to identify and respond to emergent risk conditions may be addressed via a combination of pre-analysis and contemporaneous on-line risk assessments, including generation of component risk rankings during the HPSI system (or other high value system) maintenance evolutions.

Question 47

The level of documentation required for an Initiative 4b risk assessment must be described; the documentation must be adequate for inspectors to verify the assumptions and results of the CE Pilot CRMP process.

Response: 47

Use of the flexible AOT shall be documented. The documentation shall include the following information.

1. Reason for initial entry into TS
2. Reason for extended operation beyond the frontstop
3. Estimated CDF and [LERF] upon entry
4. Concurrent component outages
5. Actual CDP and LERP
6. Time of entry into the "beyond" front stop
7. Time of exit of TS action statement
8. Resolution/Treatment of Potential Common Cause Conditions [for emergent failures only] via Operability Determination Process
9. Compensatory measures implemented by the plant to manage risk of the associated outage
10. Post Maintenance Review

Question 48

CE-TSTF-424 (Table 6.3-3): Table 6.3-3 of WCAP-15773 lists the HPSI system LOCA success criteria in terms of number of the available HPSI systems and intact SI lines. Discuss the bases used to determine the success criteria and justify that they provide a sufficient HPSI capacity assumed in the LOCA analysis.

Response: 48

In accordance with the intent of the ASME standard to provide more realistic PRAs for use in RI decision making, the CEOG has funded tasks to establish realistic success criteria for LOCA. These activities involved the use of the "CE FLASH-4AS Small break LOCA Realistic Evaluation Model (REM)" to determine the significance of various ECCS equipment sets in determining success criteria. CE FLASH-4AS has been reviewed by NRC in specific design basis licensing applications. The realistic success criteria effort used existing design basis CEFLASH-4AS models and modified the inputs to reflect more realistic fuel power shapes, availability of fewer mitigating components and consideration of the potential of reduced injection capabilities (reflecting failure of injection lines). Results of these analyses spanned the small, medium and lower end of large breaks (up to $1ft^2$).

Question 49

CE-TSTF-424: On page 1, Section 2, of the proposed change, it is stated that "...[c]ontingency action or compensatory actions or compensatory measures may be required to support the acceptable result of risk assessment." CE Owner Group should consider to add a matrix that lists the specific contingency measures and compensatory actions for extending AOT beyond the front stop for each system (such as HPSI) or components in appropriate documents with acceptable justification, and to provide them for the staff to review.

<u>Response: 49</u>

A general process for developing compensatory measures and contingency actions will be developed. Pre-established contingency actions will be provided, as appropriate, on a plants specific basis.