KHNPDCDRAIsPEm Resource

From: Ciocco, Jeff
Sent: Thursday, November 05, 2015 7:54 AM
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Cc: Harbuck, Craig; Dias, Antonio; Umana, Jessica; Lee, Samuel
Subject: APR1400 Design Certification Application RAI 295-8263 (16 - Technical Specifications)
Attachments: APR1400 DC RAI 295 SPSB 8263.pdf

KHNP,

The attachment contains the subject request for additional information (RAI). This RAI was sent to you in draft form. Your licensing review schedule assumes technically correct and complete responses within 30 days of receipt of RAIs. However, KHNP requests, and we grant, the following response time for the RAI questions. We may adjust the schedule accordingly.

16-109: 30 days
16-110: 90 days
16-111: 90 days
16-112: 90 days
16-113: 30 days
16-114: 90 days
16-115: 90 days
16-116: 45 days
16-117: 90 days
16-118: 90 days
16-119: 90 days
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Please submit your RAI response to the NRC Document Control Desk.

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REQUEST FOR ADDITIONAL INFORMATION 295-8263

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Docket No. 52-046
Review Section: 16 - Technical Specifications
Application Section: 16.3.3 Instrumentation

QUESTIONS

16-109

1. The second and third paragraphs of the "LCO" section of the Bases for generic TS 3.2.4 matches the STS Bases discussion, but shouldn't because the APR1400 has two CEACs in each CPCS channel for a total of eight CEACs, and not two CEACs shared among all four CPCS channels. The Palo Verde Units 1, 2, and 3 plant-specific TS provide appropriate language for LCO 3.2.4, as follows; note that the generic TS LCO 3.2.4.b, c, and d references to COLR Figures 3.2.4-1, 3.2.4-2, and 3.2.4-3, respectively, have been inserted in *italic* font:

LCO 3.2.4 The DNBR shall maintained by one of the following methods:

a. Core Operating Limit Supervisory System (COLSS) In Service:

   1. Maintaining COLSS calculated core power less than or equal to COLSS calculated core power operating limit based on DNBR when at least one Control Element Assembly Calculator (CEAC) is OPERABLE in each OPERABLE Core Protection Calculator (CPC) channel; or

   2. Maintaining COLSS calculated core power less than or equal to COLSS calculated core power operating limit based on DNBR decreased by the allowance specified in *Figure 3.2.4-1 of* the COLR when the CEAC requirements of LCO 3.2.4.a.1 are not met.

b. COLSS Out of Service:

   1. Operating within the region of acceptable operation *of Figure 3.2.4-2* specified in the COLR using any OPERABLE Core Protection Calculator (CPC) channel when at least one Control Element Assembly Calculator (CEAC) is OPERABLE in each OPERABLE CPC channel; or

   2. Operating within the region of acceptable operation *of Figure 3.2.4-3* specified in the COLR using any OPERABLE CPC channel (with both CEACs inoperable) when the CEAC requirements of LCO 3.2.4.b.1 are not met.

The Bases for LCO 3.2.4 should be revised as indicated in the following markup to be consistent with the above:

> With the COLSS in service and ~~one or both~~ **at least one** of the control element assembly calculator**s** (CEAC**s**) OPERABLE **in each OPERABLE CPC channel**, the DNBR will be maintained by ensuring that the core power calculated by the COLSS is equal to or less than the permissible core power operating limit based on DNBR calculated by the COLSS. In the event that the COLSS is in service but neither of the two CEACs is OPERABLE **in each OPERABLE CPC channel**, the DNBR is maintained by ensuring that the core power calculated by the COLSS is equal to or less than a reduced value of the permissible core power operating limit calculated by the COLSS. In this condition, the calculated operating limit must be reduced by the allowance specified in the COLR as shown in Figure 3.2.4-1.
>
> In instances for which the COLSS is out of service and ~~either one or both~~ **at least one** of the CEACs ~~are~~ **is** OPERABLE **in each OPERABLE CPC channel**, the DNBR is maintained by operating within the acceptable region specified in the COLR as shown in Figure 3.2.4-2, in the COLR, and using any OPERABLE CPC channel. Alternatively, when the COLSS is out of service and neither of the two CEACs is OPERABLE, the DNBR is maintained by operating within the acceptable region specified in the COLR for this condition as shown in Figure 3.2.4-3, in the COLR, and using any OPERABLE CPC channel **with two inoperable CEACs**.

The applicant is requested to revise LCO 3.2.4 and Bases to be consistent with the above.

2. Provide a draft of the COLR to demonstrate that the COLR figures are accurately referenced in generic TS LCO 3.2.4.

The requested changes and information are intended to ensure that the TS accurately reflect the APR1400 design.

16-110

The applicant is requested to consider the following suggested clarifications and corrections to the “Background” section of the Bases for generic TS 3.3.1:

1. Though the acronym (RPS) “Reactor Protection System” is defined in the subsection title, the STS convention is to also define it when the phrase is first used in the subsection. Replace “The RPS” in the first sentence with “The Reactor Protection System (RPS)”; also append SAFDL with a lower case letter s, since it is a singular acronym.

2. The beginning of the third paragraph on Page B 3.3.1-1 omits the following generally-applicable text which is included the STS. The applicant is requested to insert this passage, and revise the the existing sentences consistent with the indicated markup:

   > Technical Specifications are required by 10 CFR 50.36 **(Reference 7)** to include LSSS for variables that have significant safety functions. LSSS are defined by the regulation as “Where a LSSS is specified for a variable on which a safety limit has been placed, the setting must be chosen so that automatic protective actions will correct the abnormal situation before a Safety Limit (SL) is exceeded.” The Analytical Limit is the limit of the process variable at which a safety action is initiated, as established by the safety analysis, to ensure that a SL is not exceeded. Any automatic protective action that occurs on reaching the Analytical Limit therefore ensures that the SL is not exceeded. However, in practice, the actual settings for automatic protection channels must be chosen to be more conservative than the Analytical Limit to account for channel uncertainties related to the setting at which the automatic protective action would actually occur. <<*Begin markup*>> ~~The LSSS for variable of the significant safety functions is required by 10 CFR 50.36 (Reference 7).~~ The LSSS~~,~~ **values are** identified and maintained in **a document required by Specification 5.5.19,** ~~the setpoint control program~~ **Setpoint Control Program** (SCP), which specifies that the changes to LSSS values (and related limits) shall be controlled by 10 CFR 50.59 **and the NRC-approved setpoint methodology referenced in Specification 5.5.19 (the SCP).** In ~~in~~ conjunction with the LCOs, the LSSS establish~~es~~ the threshold**s** for protection system **actuation** ~~action~~ to prevent exceeding acceptable limits during design basis events (DBEs).

   In the next (fourth) paragraph, in list item ‘a’ change ‘safety limit’ to ‘Safety Limit’ and in item ‘c’ change ‘reactor coolant system (RCS)’ to just ‘RCS.’

3. Following the fifth paragraph, the STS includes a Reviewer’s Note. The applicant is requested to describe how the calculated trip setpoints described in the proposed setpoint methodology TeR (allowable value, draft trip setpoint, final trip setpoint, calibration tolerance, and periodic test acceptance criteria) are consistent with the guidance in the Reviewer’s Note and the quantities described in the Note (limiting trip setpoint, nominal trip setpoint) or required by the SCP (allowable value, nominal trip setpoint, as-left tolerance, and as-found tolerance).

4. Following the Reviewer’s Note, on page B 3.3.1-2, the Bases omits the following generally-applicable text which is included in STS B 3.3.1B, and would precede the fourth paragraph that begins, "During AOOs . . ." on generic TS page B 3.3.1-1. See STS pages B 3.3.1B-2 and B 3.3.1B-3. The applicant is requested to insert this passage:

   > The [Limiting Trip Setpoint (LTSP)] specified in the SCP is a predetermined setting for a protective channel chosen to ensure automatic actuation prior to the process variable reaching the Analytical Limit and thus ensuring that the SL would not be exceeded. As such, the [LTSP] accounts for uncertainties in setting the channel (e.g., calibration), uncertainties in how the channel might actually perform (e.g., repeatability), changes in the point of action of the channel over time (e.g., drift during surveillance intervals), and any other factors which may influence its actual performance (e.g., harsh accident environments). In this manner, the [LTSP] ensures that SLs are not exceeded. As such, the [LTSP] meets the definition of a LSSS (Ref. 1).
   >
   > Technical Specifications contain values related to the OPERABILITY of equipment required for safe operation of the facility. OPERABLE is defined in Technical Specifications as "...being capable of

performing its safety function(s)." Relying solely on the [LTSP] to define OPERABILITY in Technical Specifications would be an overly restrictive requirement if it were applied as an OPERABILITY limit for the "as-found" value of a protection channel setting during a Surveillance. This would result in Technical Specification compliance problems, as well as reports and corrective actions required by the rule which are not necessary to ensure safety. For example, an automatic protection channel device with a setting that has been found to be different from the [LTSP] due to some drift of the setting may still be OPERABLE because drift is to be expected. This expected drift would have been specifically accounted for in the setpoint methodology for calculating the [LTSP] and thus the automatic protective action would still have ensured that the SL would not be exceeded with the "as-found" setting of the protection channel. Therefore, the channel would still be OPERABLE because it would have performed its safety function and the only corrective action required would be to reset the channel within the established as-left tolerance around the [LTSP] to account for further drift during the next surveillance interval.

Note that, although the channel is OPERABLE under these circumstances, the trip setpoint must be left adjusted to a value within the as-left tolerance, in accordance with uncertainty assumptions stated in the referenced setpoint methodology (as-left criteria), and confirmed to be operating within the statistical allowances of the uncertainty terms assigned (as-found criteria).

However, there is also some point beyond which the channel may not be able to perform its function due to, for example, greater than expected drift. This value needs to be specified in the Technical Specifications in order to define OPERABILITY of the channels and is designated as the Allowable Value.

If the actual setting (as-found setpoint) of the channel is found to be conservative with respect to the Allowable Value but is beyond the as-found tolerance band, the channel is OPERABLE, but degraded. The degraded condition will be further evaluated during performance of the SR. This evaluation will consist of resetting the channel setpoint to the [Nominal Trip Setpoint (NTSP)] (within the allowed tolerance), and evaluating the channel response. If the channel is functioning as required and is expected to pass the next surveillance, then the channel is OPERABLE and can be restored to service at the completion of the surveillance. After the surveillance is completed, the channel as-found condition will be entered into the Corrective Action Program for further evaluation.

The applicant should replace the items in square brackets with terms that are consistent with the terms in the SCP and omit the brackets.

16-111

The proposed ACTIONS Table and SR Table and Table 3.3.5-1 for generic TS 3.3.5 contains the following differences from STS 3.3.5B that do not appear to be justified or self consistent. The applicant is requested to conform to the STS phrasing and provisions, and suggested consistency changes, or justify the difference:

1. Suggest inserting “automatic” before “operating bypass removal channel” in Required Action C.2.2.
2. Completion Time for generic TS 3.3.5 Required Actions A.2 and C.2.2 should match STS (“Prior to entering MODE 2 following next MODE 5 entry”);
3. Condition B should match STS and include “automatic ESFAS” before “trip channels inoperable.”
4. The Required Action Note in Condition E and Condition F should say “Functions” instead of “function.”
5. The Note in the Required Action column of Condition B, that states “LCO 3.0.4 is not applicable” with the unit in Condition B, is unnecessary, since the ACTIONS will permit operation to continue indefinitely with one automatic ESFAS trip channel in trip and one automatic ESFAS trip channel in bypass for affected RPS Function(s).
6. The logical connector between Required Actions C.2.1 and C.2.2 should align with the period before the last digit of the labels C.2.1 and C.2.2;
7. The Note in the Required Action column of Condition D, that states “LCO 3.0.4 is not applicable” with the unit in Condition D, is unnecessary, since the ACTIONS will permit operation to continue indefinitely with bypass removal channels disabled, or one affected automatic ESFAS trip channel in trip and one affected trip channel in bypass for affected RPS Function(s).
8. Required Actions C.1 and D.1, which say “Disable [automatic operating] bypass [removal] channel(s).” are unclear. Since the function being disabled is to automatically remove the bypass and enable the associated ESFAS trip channel, unbypassing the ESFAS trip channel would need to be done manually before reaching the reset setting. The applicant is requested to clarify the meaning of these action requirements.

9. In generic TS SR 3.3.5.2 and SR 3.3.5.3, insert “the” before “Setpoint Control Program.” In SR 3.3.5.3 insert “associated automatic operating” before “bypass removal function.”

10. In generic TS Table 3.3.5-1 in the second column heading (APPLICABLE MODES or OTHER SPECIFIED CONDITIONS), “or” should be “OR”; also, the Applicability should be stated for each ESFAS trip instrument Function (trip signal from each bistable processor), and not for the ESFAS signal from coincidence logic, and processed through initiation logic and actuation logic, which is covered by LCO 3.3.6.

11. Justify not including Mode 4 in the Applicability of generic TS Table 3.3.5-1 Functions 3a, Containment Isolation Actuation Signal (CIAS) on Containment Pressure ─ High and 3b, CIAS on Pressurizer Pressure ─ Low; else add Mode 4 and revise the Required Action Notes for ACTIONS E and F and associated Bases discussions accordingly.

12. The Required Action Notes for ACTIONS E and F should appear above Required Action E.1 and F.1, respectively, and span the width of the Required Action column. (See Writer’s Guide Section 5.1.8.) Alternatively, these Notes may be moved to the Condition column to be in line with the Condition letter and should span the width of the Condition statement.

16-112

The applicant is requested to consider the following suggested clarifications and corrections to the “Background” section of the Bases for generic TS 3.3.5:

1. On page B 3.3.5-4, second paragraph under the heading “<u>ESFAS Logic</u>”, the fourth sentence should end with the phrase “coincidence logic state” not “coincidence logic**s** state.” The applicant is requested to remove the letter “s” from “logics” for clarity, or otherwise revise the sentence to clarify the intended meaning.

2. On page B 3.3.5-5, the applicant is requested to revise the first two paragraphs consistent with the following suggested markup by the staff:

   > The actuation logic in each channel of ESF-CCS takes part in **actuating the equipment of the** corresponding ESF~~AS~~ train. Each ESF**AS** Function has individual actuation logic in each channel of **the** ESF-CCS.
   >
   > The initiation logic performs the ~~logical “OR” of~~ **selective 2-out-of-4 logic (logical "OR"; channel A or C <u>AND</u> channel B or D; but not channels A and C <u>OR</u> channels B and D)** on the LCL outputs for each ESFAS **Function, to generate the ESF actuation** signal ~~and sends the ESFAS signal~~ to **the** ESF-CCS **component control logic.**

3. On page B 3.3.5-5, the third paragraph uses the phrase “serial data link for group and loop controllers.” A word search of DCD Chapter 16 found no other instances of the use of the terms “group controller(s)” and “loop controller(s).”

   Staff understands that, for <u>each</u> channel (Division A, B, C, or D) of an ESFAS Function, the Engineered Safety Features Component Control System (ESF-CCS) includes:

   - Two redundant Group Controllers (GC1 and GC2) that independently perform the “initiation logic” function─the “selective 2-out-of-4 logic” processing of the coincidence logic output signals received from the Local Coincidence Logic (LCL) processors in all four Plant Protection System (PPS) channels. For example, for ESFAS Division A, the coincidence logic trip signals received from the four PPS channels are labeled A1, B1, C1, and D1, and for ESFAS Division B, they are labeled A2, B2, C2, and D2. The selective 2-out-of-4 logic in Division A is “A1 or C1 <u>AND</u> B1 or D1”; and in Division B, it is “A2 or C2 <u>AND</u> B2 or D2.”

   - A Loop Controller (LC), with a primary and a backup processor module (PM1 and PM2), that processes the GC1 and GC2 ESF actuation signals, respectively, with the ESF component control logic to generate and send component control signals to the component interface module (CIM) of each actuated device in the respective ESF train.

   a. The applicant is requested to verify the accuracy of the above description of the LCL for coincidence logic, the GC for initiation logic, and the LC for actuation logic; the actuation logic is apparently considered by Table 3.3.6-1 to include the ESFAS Division’s component control logic.

   b. The applicant is requested to describe the functions and purposes of the equipment listed in the subject paragraph by expanding the subject Bases paragraph, which confusingly states:

      > The ESF-CCS comprises power supply, manual switch, latching logic and serial data link for group and loop controllers.

4. The fourth paragraph on page B 3.3.5-5 is confusing and appears to be inaccurate. It states:

Each ESFAS Function has sub groups and each sub group is in charge of one- or more ESFAS Functions. The initiation and actuation logics to the sub groups are identified in LCO 3.3.6.

The "ESFAS function sub groups" do not appear to be listed or defined in any kind of detail anywhere in the DCD, the Safety I&C TeR, or the Bases for generic TS 3.3.6. Therefore, the applicant is requested to (1) add this information to the APR1400 DC application; and (2) revise the above paragraph so it is accurate, clear, and informative regarding ESFAS function sub groups.

5. The applicant is requested to revise the fifth paragraph on page B 3.3.5-5 for clarity beginning with the fourth sentence, consistent with the following markup:

Bypassing the same parameter in more than one channel is restricted by ~~the~~ administrative procedure. The coincidence logic becomes 2-out-of-3 coincidence logic. ~~All-bypass~~ **The all-bypass** function for bypassing all parameters in ~~the~~ **an ESFAS** channel is interlocked in **the** LCL algorithm to prevent simultaneous bypass of more than one channel. The all-bypass **function** interlock is implemented ~~based on~~ **with an** analog circuit ~~through~~ **and** hardwired cable between **the** LCLs in all channels. The purpose of **the** all-bypass function is to support testing and maintenance of **the** BP**,** whereas the trip channel bypass is used ~~against~~ **in case of** sensor failure.

6. The applicant is requested to revise the seventh paragraph on page B 3.3.5-5 for clarity, consistent with the following markup:

An enabled operating ~~Operating~~ bypass **function does not block** ~~protects~~ the output of trip and alarm signals from **the** bistable processor **to the IPS and QIAS-N**. The Pressurizer Pressure – Low input to the SIAS shares an operating bypass with the Pressurizer Pressure – Low reactor trip.

16-113

Proposed generic TS Subsection 3.3.14, "Boron Dilution Alarms," appears to reference generic TS 3.1.12 of CE System 80+ DCD Chapter 16 because the STS has no such LCO. In the following questions, the 'reference TS' means the generic TS in CE System 80+ DCD Chapter 16. The NRC staff noted the following deficiencies needing correction:

1. The LCO statement uses the name "startup channel high neutron flux alarms." Though this is consistent with the reference TS, the broader term of "Boron Dilution Alarm System (BDAS)" is not used. For example, the LCO could be stated, "Two Boron Dilution Alarm System (BDAS) channels shall be OPERABLE." Likewise, Condition A could be stated as "One BDAS channel inoperable." And Condition B could be stated as "Two BDAS channels inoperable." Also "BDAS channels" is used in the "Applicable Safety Analyses" section of the Bases for generic TS 3.3.14. The applicant is requested to consider using 'BDAS channel' instead of 'startup channel high neutron flux alarm.'

   Related to this is the use of "startup range monitor (SRM)" as a synonym for "startup channel" in APR1400 generic TS 3.9.2. The applicant is requested to use the same title for the startup range neutron flux instrumentation channels across all of the generic TS. Following are examples of some of the various titles used:

   - startup range .... Note to SR 3.3.14.1
   - startup range monitors (SRMs) .... LCO 3.9.2 and the "Background" section of the Bases for generic TS 3.9.2, "Nuclear Instrumentation"
   - source range channels .... "SRs" section of Bases for generic TS 3.9.2, Bases for SR 3.9.2.1

- excore startup channels .... “Applicability” section of Bases for generic TS 3.3.14
- source range neutron flux monitoring .... “Applicability” section of Bases for generic TS 3.3.14
- startup channel neutron flux indications .... “Background” section of Bases for generic TS 3.3.14
- startup range neutron flux monitoring .... “Applicability” section of Bases for generic TS 3.3.13, “Logarithmic Power Monitoring Channels”
- startup range nuclear monitoring channels... “Applicability” section of Bases for generic TS 3.3.13, “Logarithmic Power Monitoring Channels”

2. A part of the Applicability statement is presented in a Note. This is an inappropriate use of a Note. •The applicant is requested to revise the Applicability statement format and content to match the following:

APPLICABILITY: MODE 3 within 1 hour after the neutron flux is within the startup range following a reactor shutdown, *[note that there should be no blank line here, and the next line should be indented 1.5 inches - this is a limitation of the eRAI text formatting tools]*

MODES 4, and 5.

3. The Applicability also does not include Mode 6. The “Background” and “Applicability” sections of the Bases for generic TS 3.3.14 and the “Background” and “Applicability” sections of the Bases for generic TS 3.9.2 indicate that LCO 3.9.2 requires two BDAS channels to be operable in Mode 6, as well as the two associated “startup range monitor (SRM)” channels. The “Background” section of the Bases for generic TS 3.9.2 begins with the following sentence (*emphasis added*) (Staff suggests that the applicant insert “the” as indicated to correct the sentence’s grammar.):

> The installed startup range monitors (SRMs) *and boron dilution alarm system* are used during refueling operations to monitor **the** core reactivity condition.

However, LCO 3.9.2 just states “Two startup range monitors (SRMs) shall be OPERABLE.” If the intent of the generic TS is to also require two channels of the Boron Dilution Alarm System (BDAS) to be operable in Mode 6, then LCO 3.9.2 should explicitly say so. Otherwise, the Applicability of generic TS 3.3.14 should include Mode 6. The applicant is requested to revise LCO 3.9.2 to state (added text is in bold type, removed text is lined out):

LCO 3.9.2 Two startup range **neutron flux** monitor~~s~~ (SRM~~s~~) **channels and two Boron Dilution Alarm System high startup range neutron flux alarm (BDAS) channels** shall be OPERABLE.

Associated with this requested change, the applicant is requested to revise generic TS 3.9.2 Actions A and B to say:

> A. One SRM channel inoperable. <u>OR</u> One BDAS channel inoperable. | A.1 Suspend positive reactivity additions. | Immediately <u>AND</u> A.2 Suspend operations that would cause introduction of coolant into the RCS with boron concentration less than required to meet the boron concentration of LCO 3.9.1. | Immediately
>
> B. Two SRM channels inoperable. <u>OR</u> Two BDAS channels inoperable. | B.1 Initiate action to restore one SRM channel and one BDAS channel to OPERABLE status. | Immediately <u>AND</u> B.2 Perform SR 3.9.1.1. | Once per 12 hours.

In addition, the applicant is requested to make necessary and appropriate changes to the Bases for generic TS 3.9.2.n addition, the applicant is requested to make necessary and appropriate changes to the Bases for generic TS 3.9.2.

If the APR1400 design has more than two SRM channels or BDAS channels that could be used to satisfy LCO 3.3.14 and LCO 3.9.2, then the applicant is requested to insert the word "required" in the Conditions and Required Actions, as appropriate.

4. The "Applicable Safety Analyses" section of the Bases for generic TS 3.1.2, "SDM – T_{cold} ≤ 99 °C (210 °F)," beginning with third paragraph, states (*emphasis added*):

> An inadvertent boron dilution is a moderate Frequency incident as defined in Reference 2. The core is initially subcritical with all CEAs inserted. *A* chemical and volume control system (*CVCS*) *malfunction occurs which causes unborated water to be pumped to the RCS via one charging pump*.
>
> The reactivity change rate associated with boron concentration changes due to inadvertent dilution is within the capabilities of operator recognition and control. *The high neutron flux alarm on the startup channel instrumentation will alert the operator of the boron dilution with a minimum of 30 minutes remaining before the core becomes critical*.

APR1400 DCD Tier 2 Chapter 15, Rev. 0, Section 15.4.6.1, "Identification of Causes and Frequency Classification," says:

> NUREG-0800, Subsection 15.4.6, states if operator action is required to terminate the transient, the following minimum time intervals must be available between the time an alarm announces an unplanned moderator dilution and the time shutdown margin is lost: (1) during refueling: 30 minutes, or (2) during startup, cold shutdown, hot shutdown, hot standby, and power operation: 15 minutes. However, in this analysis, the operator action time of 30 minutes is conservatively assumed for all operation modes (Modes 1 through 6).
>
> Analysis of the inadvertent decrease in reactor coolant boron concentration event initiated during each of the six operational modes defined in the Technical Specifications is performed. These analyses show that Mode 4 (hot shutdown) results in the least time available for detection and termination of the event as shown in Table 15.4.6-1.

The applicant is requested to explain why assuming an operator has 30 minutes after receiving a BDAS alarm before a loss of SDM and criticality occurs is more conservative than assuming 15 minutes in Mode 4.

DCD Section 15.4.6.2, "Sequence of Events and Systems Operation," paragraph e, describes indications and/or alarms available to alert the operators that the inadvertent decrease in reactor coolant boron concentration event is occurring in Mode 6 (*emphasis added*):

> e. In Mode 6, with the reactor upper head removed and the CEAs fully withdrawn, the coolant is maintained at a boron concentration of at least 2,150 ppm before entering this mode. In this condition, deboration is prohibited. The *neutron flux alarm on the startup flux channel* or the reactor makeup water flow alarm (backup only) provides indication of any inadvertent decrease in reactor coolant boron concentration event. *In Mode 6, this event is prevented by administrative controls that isolate the RCS from the potential source of unborated water. The associated valve in the CVCS is locked closed during Mode 6 to block the flow paths that could allow unborated makeup to reach the RCS.*

DCD Section 15.4.6.2 goes on to say,

> For Modes 3, 4, 5, and 6, operation time is calculated from event initiation to loss of shutdown margin. For these modes, 30 minutes is conservatively subtracted from this time to determine the latest allowable time for alarm actuation. In these modes, it is calculated that at 30 minutes prior to loss of shutdown [margin], the source range monitoring (SRM) ratio exceeds its setpoint. An operator response time of at least 30 minutes is demonstrated.
>
> The operator can identify a boron dilution through a *neutron flux alarm on the startup flux channel*, reactor makeup flow rate, [reactor coolant] sampling, or boric acid flow rate. The operator turns off the charging pump in order to stop further boron dilution.

DCD Section 15.4.6.3.3, "Results" (limiting dilution event in Mode 4) says:

> Using the above conservative parameters in Equation (15.4-3), the minimum possible time interval to dilute from 6.5 %Δρ subcritical to criticality is 72.8 minutes. Utilizing only the *redundant, qualified neutron flux alarm*, this time period will provide reasonable assurance of detection of an inadvertent decrease in reactor coolant boron concentration event at least 30 minutes prior to criticality.

The applicant is requested to explain why in Mode 6, the generic TS do not include an LCO that requires the isolation (e.g., locked closed CVCS makeup valve) of the RCS from unborated water sources, which is described as an "administrative control" in the above DCD passages, to preclude an RCS boron dilution event in Mode 6. Such an LCO is included in TS for other PWR designs.

5. In the Required Action column of the Actions table of generic TS 3.3.14, the applicant is requested to place the Note inline with associated Required Action A.1, not above it, and inline with associated Required Action B.1, not above it.

   In addition, the applicant is requested to correct the vertical spacing of logical connectors in the required action column compared to the completion times in the adjacent column in generic TS 3.3.14 Actions A and B – that is, ensure the logical connector occurs after one blank line below the end of the completion time of the preceding Required Action.

   The applicant is requested to provide the time intervals referred to by the Completion time for Required Actions A.1 and B.1 (“At the monitoring Frequency specified in the COLR”).

6. The title of the SRs table should be vertically separated three blank lines below the end of the Actions table, in generic TS 3.3.14.

7. The applicant is requested to explain why SR 3.3.14.2 (Channel Functional Test) with a Frequency of “Total shutdown period 31 days” and SR 3.3.14.3 (Channel Calibration) with an 18 month Frequency are proposed, while the CE System 80+ DCD generic TS 3.1.12 specifies no Channel Functional Test, but does specify SR 3.1.12.2 (Channel Calibration) with a Frequency of “Every 31 days of cumulative operation during shutdown”; staff notes that the Bases for SR 3.3.14.2 quotes the Frequency as “31 days of cumulative operation during shutdown.”

8. The applicant is requested to explain why generic TS SR 3.3.14.1 (Channel Check) includes a surveillance column Note, which says “Not required to be performed until 1 hour after neutron flux is within the startup range” instead of the additional Frequency of CE System 80+ DCD generic TS SR 3.1.12.1 (Channel Check), which states:

   When initially setting setpoints at the following times:

   a. One hour after a reactor trip

   b. After a controlled reactor shutdown: Within 1 hour after the neutron flux is within the startup range in MODE 3.

   The Bases for SR 3.3.14.1 second and third sentences say (**emphasis added**)

   > ... A CHANNEL CHECK is normally a comparison of the parameter indicated on one channel to **a similar parameter** on other channels. It is based upon the assumption that instrument channels monitoring **the same parameter** should read approximately the same value. ...

   The applicant is requested to replace the phrase ‘a similar parameter’ with the phrase ‘the same parameter.’

   The applicant is requested to revise the second sentence of the fourth paragraph of the Bases for SR 3.3.14.1, as indicated:

   > Since the probability of two random failures in redundant channels in any **12 hour** period is extremely low, CHANNEL CHECK minimizes

the chance of **a** loss of **a** protective **alarm** function due to **a** failure of redundant channels.

The applicant is requested to revise the first paragraph of Bases for SR 3.3.14.3, as indicated:

SR 3.3.14.3 is the performance of a CHANNEL CALIBRATION. A CHANNEL CALIBRATION is performed every 18 months. The Surveillance is a complete check and ~~re~~adjustment of the excore startup channel from the **neutron flux detector** input through to the BDAS **alarm in the MCR**. The Surveillance verifies that the channel responds to a measured parameter within the necessary range and accuracy. CHANNEL CALIBRATION leaves the channel adjusted to account for instrument drift between successive calibrations to ensure that the channel remains **OPERABLE**~~operational~~. This SR is an extension of the SR 3.9.2.2 for the **startup range neutron flux monitor (SRM)** nuclear instrumentation CHANNEL CALIBRATION listed here because of its Applicability in MODES 3, 4 and 5.

16-114

The proposed ACTIONS Table and SR Table and Table 3.3.6-1 for generic TS 3.3.6 contain the following differences from STS 3.3.6B that do not appear to be justified or self consistent. The applicant is requested to conform to the STS phrasing and provisions, and suggested consistency changes, or justify the difference:

1. Justify not including Mode 4 in the Applicability of generic TS Table 3.3.6-1 Functions 3a, Containment Isolation Actuation Signal (CIAS) Coincidence Logic, and 3b, CIAS Initiation Logic; else add Mode 4 and revise the Required Action Notes for ACTIONS E and F and associated Bases discussions accordingly.
2. The Required Action Notes for ACTIONS E and F should appear above Required Action E.1 and F.1, respectively, and span the width of the Required Action column. (See Writer's Guide Section 5.1.8.) Alternatively, these Notes may be moved to the Condition column to be in line with the Condition letter designator and should span the width of the Condition statement. In addition, neither Note includes Function 2, Containment Spray Actuation Signal, and Function 7, Diverse Manual ESF Actuation Signal (Switch on MCR Safety Console). The applicant is requested to explain this omission, or correct the error. Finally, staff suggest clarifying Conditions E and F to say:

   E. Required Action and associated Completion Time **of Condition A, B, or C** not met.

   F. Required Action and associated Completion Time **of Condition A, B, C, or D** not met.
3. The applicant is requested to explain the following concerning the Diverse Manual ESF Actuation Signal Function:
   a. Why does LCO 3.3.6 not explicitly refer to Diverse Manual ESF Actuation Signal channels, Functions 7a through 7f? The "LCO" section of the Bases for generic TS 3.3.6

says "This LCO requires two channels of safety injection, containment spray, auxiliary feedwater, and one channel for each main steam isolation valve and one channel for containment isolation to be OPERABLE in MODES 1, 2, 3, and 4." But LCO 3.3.6 says, "Four channels of ESFAS Coincidence Logic, four channels of ESFAS Initiation Logic, four channels of Actuation Logic, and four channels of Manual Trip shall be OPERABLE for each Function in Table 3.3.6-1." The applicant is requested to consider revising Table 3.3.6-1 to include a "REQUIRED CHANNELS" column, and to revise LCO 3.3.6 to say: "The ESFAS Coincidence Logic, Initiation Logic, Actuation Logic, Manual Trip, and Diverse Manual ESF Actuation channels required for each Function in Table 3.3.6-1 shall be OPERABLE."

b. The last sentence of the Bases for Required Action D.1 needs clarification, and should say: "If the inoperable **Diverse Manual ESF Actuation** channel is not restored to OPERABLE status within 72 hours, ~~it~~ **Condition F** is entered ~~to the Condition F~~.

c. The applicant is requested to make the following corrections or justify the currently proposed text: Condition D should say: "One or more **Diverse Manual ESF Actuation** Functions with one ~~Diverse Manual ESF Actuation Channels~~ channel inoperable." Required Action D.1 should say: "Restore channel~~s~~ to OPERABLE ~~S~~status." because separate condition entry is *apparently* allowed by the ACTIONS Table Note, for each Diverse Manual ESF Actuation Function. So, the ACTIONS Table Note should say: "Separate Condition entry is allowed for each ESFAS Function **and for each Diverse Manual ESF Actuation Function**.

d. Since only one Diverse Manual ESF Actuation channel is provided for each main steam isolation valve and only one Diverse Manual ESF Actuation channel is provided for containment isolation, the proposed rationale (in the Bases for Action D of generic TS 3.3.6) for the proposed 72 hour Completion Time to restore an inoperable channel to operable status is not acceptable for these two Diverse Manual ESF Actuation Functions. The applicant is requested to propose and justify a more restrictive restoration action Completion Time for these two Diverse Manual ESF Actuation Functions.

4. The applicant is requested to revise as indicated the first sentence of the Bases for Required Actions E.1 and E.2, and for Required Actions F.1 and F.2 of generic TS 3.3.6 to say "If ~~the~~ **any** Required Action~~s~~ and associated Completion Time~~s for the~~ **of** Condition **A, B,** [**or C**] [**C, or D**] cannot be met, the plant must be brought to a MODE in which the LCO does not apply." Also, these Bases paragraphs should address the Required Action Note (or Condition Note if the Note is moved) and state which of the six sets of ESFAS Logic and Manual Trip Functions apply to each Action (E or F) and why; also, the Bases for Action F should say why only Action F applies to Functions 7a through 7f, Diverse Manual ESF Actuation Functions a. Safety Injection; b. Containment Spray; c. Auxiliary Feedwater (SG #1); d. Auxiliary Feedwater (SG #2); e. Main Steam Isolation per MSIV; and f. Containment Isolation.

5. For consistency in terminology, the applicant is requested to revise the surveillance column Note for SR 3.3.6.1, as indicated by the markup, to say: "Testing of Actuation Logic shall include the verification of proper operation of each actuation **circuit** ~~signal~~." Also for clarity, the applicant is requested to revise the surveillance column Notes for SR 3.3.6.2, as indicated by the markup, to say:

-------------------------------NOTE**S**-----------------------------

1. Components exempt from testing during operation shall be tested once every 18 month**s** (MODE 6) or in MODE 5 if not tested ~~until~~ **within** the previous 62 days.

2. Subgroup of Actuation Logic channel A, C and B, D shall be tested on a staggered basis.

16-115

The applicant is requested to consider the following suggested clarifications and corrections to the Bases for generic TS 3.3.6; please explain and correct any errors in the suggested changes:

1. Generic TS SR 3.3.6.2 verifies that each subgroup can actuate ESFAS equipment when actuational output of each subgroup is generated; surveillance column Note 2 says "Subgroup of Actuation Logic channel A, C and B, D shall be tested on a staggered basis." The "Background" section of the Bases for generic TS 3.3.6 does not describe in any detail the ESFAS Actuation Logic subgroups and trip legs so that the Required Actions and Surveillance Requirements may be understood. Suggest inserting into the SR 3.3.6.2 Bases discussion consistent with the following information describing the ESF-CCS actuation logic from TeR APR1400-Z-J-NR-14001-P, Rev.0:

   > For each ESF actuation function, each group of outputs is divided into subgroups. Outputs within a subgroup are tested concurrently and are selectively arranged so that concurrent actuation does not adversely affect plant operations. (Page 60, Section 4.4.3, last paragraph, **TS**)
   >
   > The ESFAS initiation signals from the PPS are sent to separate ESF-CCS cabinets. Each cabinet contains the actuation logic for only one division; therefore, a failure in one cabinet cannot affect the circuitry and actuated equipment of the other divisions. (Page A9)
   >
   > Single failures of the actuation (or control) logic will cause, at worst, only a failure of a component, group of components, or one entire redundant train; actuation of the remaining redundant division is sufficient for the protective action. (Page A10)

   In the above TeR quotations, when the word "division" means either electrical power Division I or Division II, or Actuation Logic division (A, B, C, or D), staff requests applicant to so indicate to improve the clarity of the discussion in the TeR, and in the Bases for generic TS 3.3.6.

2. In order for NRC staff to verify the TeR quotations in item 1 above, for each ESFAS subgroup ("subgroup for Actuation signal of each Actuation Logic channel"), the applicant is requested to provide, in response to this question, a list of components (motor, air, and solenoid operated valves, pumps, dampers, and fans) by equipment designator and name, for all six NSSS ESFAS Functions, and all three BOP ESFAS Functions. For each component indicate (a) the supporting electrical power division (also indicate whether dc or ac power), (b) the associated safety train (A, B, C, or D), and the associated ESFAS Actuation Logic division. For each containment penetration flow path, indicate which

isolation valve is inside and which isolation valve is outside containment. Also indicate the same information, where applicable, for the pressurizer power operated safety relief valves, the steam generator atmospheric steam dump valves and block valves, the CVCS isolation valves, the SCS valves, the steam generator blowdown system isolation valves, and the RCS leak detection system instrumentation, and the post accident monitoring instrumentation (AMI) for Type A, B, and C parameters.

3. The “Actions” section of the Bases for generic TS 3.3.6, uses the term ‘trip leg’ in the discussion of Required Actions B.1 and B.2. The CE System 80+ DCD Chapter 16, Section 1.1 defines “trip leg” as follows:

    A TRIP LEG is defined as the "logical or" combination of channel states which represent half of a Selective two-out-of-four Logic function. When both TRIP LEGS of a Selective two-out-of-four Logic function assume a true state, the output of the Selective two-out-of-four Logic function assumes a true state (e.g., in a Selective two-out-of-four Logic [(A "or" C) "and" (B "or" D) = N]; the term (A "or" C) is a TRIP LEG, the term (B "or" D) is a TRIP LEG, and N is the output).

   In the CE System 80+ DCD, the generic TS use the term TRIP LEG in the “Background” and “Actions” sections of the Bases for TS 3.3.4, RPS Logic and Trip Initiation, and in the “Actions” section of the Bases for TS 3.3.6, ESFAS Logic and Manual Initiation. The applicant is requested to discuss what is meant by an ESFAS “trip leg” in the “Background” section of the Bases on page B 3.3.5-4 and page B 3.3.6-3.

4. In the “Background” section of the Bases for TS 3.3.5 and TS 3.3.6,

   a. First paragraph, replace reactor coolant system with Reactor Coolant System.

   b. On pages B 3.3.5-1 and B 3.3.6-1, apply STS ordered list format convention to list of ESFAS functions; that is, end each item with a comma except end last item with a period, and append “and” to the next to last item. Note that this may be considered a global comment for all ordered lists in the “Background” section of each generic TS Subsection Bases.

   c. Fourth paragraph on pages B 3.3.5-1 and B 3.3.6-1, the applicant is requested to revise for clarity and for acronym definition and usage consistency, as indicated in the following markup; please explain and correct any errors in the suggested changes:

      The ~~engineered safety features (ESF) system~~ **Engineered Safety Features (ESF) Actuation System (ESFAS)** consists of four channels of sensors, **auxiliary process cabinets – safety (**APC-S**)** ~~cabinets~~, the ESF**AS signal** ~~initiation~~ **generation** portion of the **Plant Protection System (**PPS**)** cabinets and **the ESF Component Control System (**ESF-CCS**)**.

   d. On pages B 3.3.5-1 & 2, and page B 3.3.6-2, the applicant is requested to revise the following three paragraphs for clarity as indicated by the following markup; please explain and correct any errors in the suggested changes::

      The devices and circuitry that generate the above ESFAS signals are grouped into the following interconnected parts. These parts are: ~~The ESFAS function is performed through the below portions in the ESF system.~~

      ~~a.~~ • Measurement channels**,**

~~b.~~• Bistable logic **processor channels,**

~~c.~~• ESFAS logic **channels**:

- Coincidence Logic**,**
- Initiation Logic **(trip paths), and**
- Actuation Logic**.**

[For B 3.3.6] This LCO addresses **the** ESFAS logic **channels**. Bistable logic **processor channels** and measurement channel**s** are addressed in . . .

[For B 3.3.5] This LCO addresses measurement channels and bistable logic **processor channels**. **ESFAS logic** ~~Logic is~~ **channels**~~. and~~ are addressed in . . .

[For B 3.3.6] The role**s** of the measurement channel**s** and bistable logic **processor channels** ~~is~~ **are** described in LCO 3.3.5. The role of the ESFAS logic is described below.

[For B 3.3.5] The role of each of these ~~functions~~ **interconnected parts of** ~~in~~ the ESFAS, including the **ESFAS** logic**, which is also described in** ~~of~~ LCO 3.3.6, is discussed below.

e. On pages B 3.3.5-2 & 3, for consistency in terminology, the applicant is requested to revise the heading “Bistable Logics” to “Bistable Logic Processors.”

f. On page B 3.3.6-2, for clarity the applicant is requested to revise the paragraph under the heading “ESFAS Logic” as indicated; please explain and correct any errors in the suggested changes:

The ESFAS logic, consisting of coincidence, initiation and actuation logic, employs a scheme that provides an ESF**AS** actuation **signal from all** ~~of~~ four **PPS** divisions **to the component control logic of all trains of the associated ESF systems** when ~~bistables in~~ any two of the four **bistable logic processor** channels sense **that** the same input parameter **has satisfied the ESFAS Function’s** trip **setpoint on the input parameter**. This **logic scheme** is called a two-out-of-four trip logic.

On page B 3.3.5-4, for clarity the applicant is requested to revise the paragraph under the heading “ESFAS Logic” as indicated:

The ESFAS logic, consisting of **coincidence,** initiation ~~logic channel~~ and actuation logic, employs a scheme that provides an ESF**AS** actuation **signal from all four PPS divisions to the component control logic** of all trains **of the associated ESF systems** when ~~bistables in~~ any two of the four **bistable logic processor** channels **sense that** ~~sensing~~ the same input parameter **has satisfied the ESFAS Function’s** trip **setpoint on the input parameter**. This **logic scheme** is called a two-out-of-four trip logic.

The applicant is requested to compare corresponding paragraphs in the “Background” sections of the Bases for all generic TS Section 3.3 Subsections, and make repeated information consistent in both phrasing and terminology.

g. On pages B 3.3.6-2 and -3, for clarity the applicant is requested to revise the paragraph under the heading "Coincidence Logic" as indicated; please explain and correct any errors in the suggested changes:

> There is one local coincidence logic (LCL) associated with each trip bistable logic of each channel **of a given ESFAS instrument Function**. Each LCL receives four trip signals, one **from the trip** ~~for its associated~~ bistable logic in the **associated** channel and one from each **trip** ~~of the equivalent~~ bistable logic located in the other three channels **of the affected ESFAS instrument Function**. The LCL **also** receives the trip channel bypass status **signal** associated with each of the ~~above mentioned bistables~~**bistable signals**. The function of the LCL is to generate a coincidence logic trip **signal** whenever two or more like bistables are in a tripped condition. ~~The LCL takes into consideration the trip bypass input state when determining the coincidence logics state.~~ **Each LCL automatically changes the state of each of the four coincidence logic channels based on the state of the trip channel bypass Function in each channel. For example, a 2-out-of-4 trip logic goes to 2-out-of-3 if one trip bistable logic channel is bypassed.**
>
> Designating the protection channels as A, B, C, D, with no trip **channel** bypass **signal** present, the LCL will produce a coincidence logic trip signal for any of the following trip inputs: AB, AC, AD, BC, BD, CD, ABC, ABD, ACD, BCD, ABCD. These represent all possible two- or more out-of-four trip combinations of the four protection channels. Should a trip **channel** bypass be present, the logic will provide a coincidence logic trip signal when two or more of the three un-bypassed **trip bistable logic channels** ~~bistables~~ are in a tripped condition.

h. On pages B 3.3.6-3, for clarity the applicant is requested to revise the paragraph under the headings "Initiation Logic," "Actuation Logic," and "Manual Trip," as indicated; please explain and correct any errors in the suggested changes:

> <u>Initiation Logic</u>
>
> The initiation logic is designed to **be** fail-safe. ~~This~~ **Failure of one initiation logic channel** will result in a partial trip (1 of 4) in the two-out-of-four (**one-out-of-two-taken-twice** ESFAS **selective** actuation logic. The partial trip will be alarmed the same as a full ESF**AS** trip and will be indicated by the **Qualified Indication and Alarm System - Safety (**QIAS**-P)** and **the Information Processing System (**IPS**)**; the partial trip cannot be bypassed.
>
> <u>Actuation Logic</u>
>
> The four initiation logic ~~in~~ **signals from** the PPS ~~actuate~~ **are used to generate** a two-out-of-four **selective** logic ~~in~~ **actuation signal in each division of** the ESF-CCS. In the actuation logic, each signal also sets a latch when the two-out-of-four **selective** logic actuates to assure that the **ESF actuation** signal is not automatically reset once it has been ~~initiated~~ **generated**.

Receipt of two ~~engineered safety system~~ **ESFAS** initiation **logic** channel signals will generate the actuation ~~channel~~ **logic division** signals. This is done independently in each ESF-CCS cabinet, generating division A and division B **actuation signals**, and where required **for ESF systems with four trains**, division C and division D **actuation** signals.

Manual Trip

ESFAS Manual ~~ESFAS~~ Trip capability is provided to permit the operator to manually actuate an ESF system when necessary.

Two sets of two push buttons (in the MCR) for each ESF function are provided, and each set actuates **all trains provided for that ESF Function, either two or four.** ~~the ESF of four trains (or two trains).~~ Each manual trip push button signal is **sent** ~~inputted~~ to the actuation logic ~~of~~ **in the** ESF-CCS **cabinets** via **the** control panel multiplexer (CPM). By arranging the push buttons in two sets of two, such that both push buttons in a set must be depressed, it is possible to ensure that manual trip will not be prevented in the event of a single random failure **in the signal path associated with one set of push buttons**.

5. Regarding Diverse Manual ESF Actuation, the applicant is requested to add in the APR1400 generic TS Bases equivalent discussions with the same level of detail as provided in CE System 80+ DCD Chapter 16, since no such discussion are included:
    a. The “Background’ section of the Bases for generic TS 3.3.6, “ESFAS Logic and Manual Initiation,” of the CE System 80+ DCD Chapter 16 includes a discussion of Diverse Manual ESF Actuation. The APR1400 generic TS 3.3.6 Bases “Background” section contains no discussion of ESFAS Function 7, “Diverse Manual ESF Actuation Signal.” The appliocant is requested to add discussion of this function in “Background” section of Bases for generic TS 3.3.6.
    b. The “Applicable Safety Analyses” section of the Bases for generic TS 3.3.6, “ESFAS Logic and Manual Initiation,” of the CE System 80+ DCD Chapter 16 includes a discussion of “Diverse Manual ESF Actuation Interface to ESF Components.” The applicant is requested to add an equivalent discussion of this function in the “Applicable Safety Analyses” section of Bases for generic TS 3.3.6.
    c. The “LCO” section of the Bases for generic TS 3.3.6, “ESFAS Logic and Manual Initiation,” of the CE System 80+ DCD Chapter 16 includes a discussion of “Diverse Manual ESF Actuation Interface to ESF Components.” The applicant is requested to add an equivalent discussion of this function in the “LCO” section of Bases for generic TS 3.3.6.
    d. The “Applicability” section of the Bases for generic TS 3.3.6, “ESFAS Logic and Manual Initiation,” of the CE System 80+ DCD Chapter 16 includes a discussion of “Diverse Manual ESF Actuation Interface to ESF Components.” The applicant is requested to add an equivalent discussion of this function in the “Applicability” section of Bases for generic TS 3.3.6.
6. The applicant is requested to explain why automatic Diverse ESF Actuation Functions are not included in an LCO based on LCO Selection Criterion 4, and why the manual Diverse ESF Actuation Functions are included in LCO 3.3.6 (as in System 80+) instead of in a separate LCO in generic TS Section 3.3.

16-116

According to DCD Tier 2 Section 7.3.1.4 Component Control Logic, on page 7.3-9, the "LC priority logic performs a prioritization between ESF actuation signals and component-level signal from the ESCM and MI switches. The output of the LC priority logic is then inputted to the priority logic in the CIM." The applicant is requested to describe how the priority logic, which is implemented in the LC and the CIM, is considered to be within the scope of generic TS 3.3.6, ESFAS Actuation Logic, for generic TS Table 3.3.6-1 Functions 1c, 2c, 3c, 4c, 5c, and 6c.

16-117

DCD Tier 2 Section 7.3.1.3 Actuation Logic, below the heading "ESFAS Function" beginning on page 7.3-5, makes the following statements:

> The SIAS is also initiated by a loss of power to two PPS divisions. The SIAS also actuates the EDG.
>
> The CSAS is also initiated by a loss of power to two PPS divisions.
>
> The CIAS is also initiated by a loss of power to two PPS divisions.
>
> The MSIS is also initiated by a loss of power to two PPS divisions.
>
> The AFAS-1 or AFAS-2 is also initiated by a loss of power to two PPS divisions.

ESFAS Functional Logic, as depicted in DCD Figure 7.3-4 SIAS, Figure 7.3-5 CSAS, Figure 7.3-6 CIAS, Figure 7.3-7 MSIS, and Figure 7.3-8 AFAS, does not appear to illustrate the effect of a loss of vital ac power to two PPS divisions on the coincidence logic, initiation logic, and actuation logic for these EFSAS Functions. In addition to an SIAS coincidence logic output signal, the EDG of the associated Class 1E electrical safety train also gets a start signal from the CSAS, AFAS-1, and AFAS-2 coincidence logic output signals, according to Figure 7.3-21 EDG Loading Sequencer – Control logic Diagram. The applicant is requested to:

(1) Describe how loss of (vital ac) electrical power to two PPS divisions generates ESF actuation signals to all ESF trains of equipment;

(2) Describe how loss of (vital ac) electrical power to two PPS divisions would affect an enabled operating bypass, including when the operating bypass is in a denergized PPS division, and when it is in an unaffected PPS division;

(3) Revise the Bases for generic TS subsection 3.3.6 ESFAS Logic and Manual Trip, and DCD Tier 2 Chapters 7 and 8, to explain how a loss of (vital ac) electrical power to two PPS divisions generates ESF actuation signals to all ESF trains of equipment, in terms of the ESFAS Functional Logic design;

(4) Revise the Bases for generic TS subsection 3.3.6 ESFAS Logic and Manual Trip and subsection 3.3.7 EDG ─ LOVS to clarify how SIAS, CSAS, and AFAS signals initiate an EDG start, and that this actuation logic is required by LCO 3.3.6 and tested by a Channel Functional Test surveillance; and

(5) Revise as appropriate the operating bypass discussions in the generic TS Section 3.3 Bases to clarify how an enabled operating bypass is affected when its associated PPS division loses ac electrical power.

16-118

The applicant is requested to consider incorporating the following clarifications to the "Background" section of the Bases for generic TS 3.3.4, to improve the useability of the Bases.

1. On page B 3.3.4-4 under the heading "RTSG" revise the first sentence to be consistent with the STS, as indicated; please identify and correct any errors in the suggested changes:

> The reactor trip switchgear **system (RTSS)** consists of **two sets of four RTSS circuit breakers (RTSGs), RTSS-1 and RTSS-2, connected in series** ~~of eight RTSGs~~ **(i.e., eight RTSS circuit breakers in total), which are operated in four sets (i.e., channels A, B, C, and D) of two RTSS circuit breakers each**. **RTSS-1 contains four RTSS circuit breakers designated A1, B1, C1, and D1 arranged in two parallel trip legs (A1 and B1; C1 and D1) (a trip leg contains two RTSS circuit breakers in series); RTSS-2 contains four RTSS circuit breakers designated A2, B2, C2, and D2 also arranged in two parallel trip legs (A2 and C2; B2 and D2). Opening one RTSS circuit breaker in each trip leg of RTSS-1 or RTSS-2 interrupts power to all control element drive mechanisms (CEDMs)**.
>
> Power input to the **CEDMs by way of** ~~RTSG~~ **RTSS-1 and RTSS-2 and the Digital Rod Control System (DRCS)** comes from two full capacity **motor generator** (MG**)** sets operated in parallel, such that the loss of either MG set does not de-energize the CEDMs. **Power is supplied from the MG sets to the CEDMs via two trip legs (redundant paths) in RTSS-1 and two trip legs in RTSS-2, with RTSS-1 and RTSS-2 connected in series. This arrangment of the eight RTSS circuit breakers ensures that a fault, or the opening of an RTSS-1 circuit breaker in one trip leg (i.e., for testing purposes) coincident with a fault, or the opening of an RTSS-2 circuit breaker in one trip leg will not interrupt power to the CEDMs.** ~~Both trip legs shall be interrupted to drop CEAs.~~ **With two channels in trip for the same RPS Function, at least one RTSS circuit breaker will be opened in both trip legs of either RTSS-1 or RTSS-2.** ~~and two~~ **Two** separate methods for **opening each RTSS circuit breaker are**

> ~~shall be~~ provided, **the undervoltage trip device and the shunt trip device.** ~~because each power is connected to only one of two RTSGs connected in serial.~~ The two **RTSS circuit breakers** ~~RTSGs~~ within a trip leg are actuated by separate **RPS** initiation **logic** circuits. When **electrical power to the** two CEDM power supply buses **is** ~~are~~ lost, all CEAs will fall into the core by gravity. The PPS interfaces with the undervoltage trip device of **the** RTSS **circuit** breakers. The **Diverse Protection System (DPS)** ~~DPS~~ interfaces with the shunt trip device of the RTSS **circuit** breakers. The actuation of either the undervoltage or the shunt trip device interrupts power from the ~~motor generator (~~MG~~)~~ sets to the ~~control element drive mechanisms (~~CEDMs~~)~~.

16-119

In the "Applicable Safety Analyses" section of the Bases for generic TS 3.3.6, under the discussion of AFAS, the second paragraph (page B 3.6.6-5) states

> AFAS maintains a steam generator heat sink during a small LOCA event, steam generator tube rupture event, MSLB, or FWLB event either inside or outside containment.

In the "Applicable Safety Analyses" section of the Bases for STS 3.3.6, under the discussion of Emergency Feedwater Actuation Signal (EFAS), the second paragraph (page B 3.6.6-6) states

> EFAS maintains a steam generator heat sink during a steam generator tube rupture event and a MSLB or FWLB event either inside or outside containment.

- The applicant is requested to explain including "small LOCA event" in the list of events during which the AFAS maintains a SG heat sink, since neither the STS Bases nor Sys 80+ Bases includes this event.

- The applicant is also requested to clarify the paragraph, consistent with the STS, to say:

> AFAS maintains a steam generator heat sink during a small **break** LOCA event, **a** steam generator tube rupture event, **and a** ~~MSLB,~~ **MSLB** or FWLB event either inside or outside **of** containment.

- The applicant is requested to explain why it did not propose to include an additional sentence at the end of the paragraph, which is included in the "Applicable Safety Analyses" section of the Bases for CE System 80+ generic TS 3.3.6, under the discussion of Emergency Feedwater Actuation Signal (EFAS), the second paragraph (page B 3.3-133) that states (emphasis added)

> EFAS maintains a steam generator heat sink during a loss of MFW event, steam generator tube rupture event, MSLB, or FWLB event either inside or outside containment, or any event where

> normal AC power or the MFW system is unavailable. *EFAS is also initiated by a loss of power to two or more measurement channels.*

•The applicant is requested to explain not including “loss of MFW event” or “any event where normal AC power or the MFW system is unavailable” in the list of events during which the AFAS maintains a SG heat sink, since the Sys 80+ Bases paragraph quoted above includes these events, and since the “Applicable Safety Analyses” section of the Bases for generic TS 3.7.5, AFWS, states,

> The AF system mitigates the consequences of any event with a loss of normal feedwater.
>
> The limiting design basis accidents (DBAs) and transients for the AFWS are as follows:
>
> a. Feedwater line break (FWLB)
>
> b. Loss of normal feedwater
>
> In addition, the minimum available AFW flow and system characteristics are serious considerations in the analysis of a small break loss of coolant accident.

16-120

The applicant is requested to correct an error in the “LCO” section of the Bases for generic TS 3.3.6, page B 3.3.6-8, under the discussion of Coincidence Logic for Auxiliary Feedwater Actuation Signal SG #2 (AFAS-2). Paragraph 6.a should say

> This LCO requires ~~six~~ **four** channels of coincidence logic to be OPERABLE in MODES 1, 2, and 3.

16-121

The “Applicability“section of the Bases for generic TS 3.3.6 appears to be inconsistent regarding whether any automatic ESFAS logic functions are required to be operable in Mode 4. The contents of the Applicability section of the Bases for generic TS 3.3.6, STS 3.3.6, and CE System 80+ generic TS 3.3.6 are presented in the following table for comparison:

Applicability Section of Bsaes for:		
APR1400 generic TS 3.3.6	STS 3.3.6	CE System 80+ generic TS 3.3.6
In MODES 1, 2, 3 and **4**, there is sufficient energy in the primary and secondary systems to warrant automatic ESF System responses to:	In MODES 1, 2, and 3 there is sufficient energy in the primary and secondary systems to warrant automatic ESF System responses to:	In MODES 1, 2, and 3, there is sufficient energy in the primary and secondary systems to warrant automatic ESF System responses to:
a. Close the main steam isolation valves to preclude a positive reactivity addition. b. Actuate auxiliary feedwater to preclude the loss of the steam generators as a heat sink (in the event the normal feedwater system is not available). c. Actuate ESF systems to prevent or limit the release of fission product radioactivity to the environment by isolating containment and limiting the containment pressure from exceeding the containment design pressure during a design basis LOCA or MSLB. d. Actuate ESF systems to ensure sufficient borated inventory to permit adequate core cooling and reactivity control during a design basis LOCA or MSLB accident.	• Close the main steam isolation valves to preclude a positive reactivity addition, • Actuate auxiliary feedwater to preclude the loss of the steam generators as a heat sink (in the event the normal feedwater system is not available), • Actuate ESF systems to prevent or limit the release of fission product radioactivity to the environment by isolating containment and limiting the containment pressure from exceeding the containment design pressure during a design basis LOCA or MSLB, and • Actuate ESF systems to ensure sufficient borated inventory to permit adequate core cooling and reactivity control during a design basis LOCA or MSLB accident.	• Close the main steam isolation valves to preclude a positive reactivity addition, • Actuate auxiliary feedwater to preclude the loss of the steam generators as a heat sink (in the event the normal feedwater system is not available), • Actuate ESF systems to prevent or limit the release of fission product radioactivity to the environment by isolating containment and limiting the containment pressure from exceeding the containment design pressure during a design basis LOCA or MSLB, and • Actuate ESF systems to ensure sufficient borated inventory to permit adequate core cooling and reactivity control during a design basis LOCA or MSLB accident.
No text corresponding to Sys 80+	No text corresponding to Sys 80+	All the following ESF functions are required to be operable in these MODES: 1. Safety Injection Actuation – SIAS 2. Containment Spray Actuation - CSAS 3. Containment Isolation - CIAS 4. Main Steam Line Isolation – MSIS 5. Emergency Feedwater - EFAS-1 6. Emergency Feedwater - EFAS-2 7. Diverse Manual ESF Actuation Interface to ESF Components.

Applicability Section of Bsaes for:		
APR1400 generic TS 3.3.6	STS 3.3.6	CE System 80+ generic TS 3.3.6
No text corresponding to Sys 80+	No text corresponding to Sys 80+	For MODE 4 there is sufficient energy and potential in the primary and secondary systems to warrant 1) the automatic actuation of all components to mitigate the consequences of a large break LOCA or Main Steam Line Break (MSLB) and 2) prevent or limit the release of fission product radioactivity to the environment. ESF functions which apply to MODE 4 operation follow: 1. Safety Injection Actuation - SIAS 2. Containment Spray Actuation - CSAS 3. Containment Isolation - CIAS 4. Main Steam Line Isolation – MSIS 5. Diverse Manual ESF Actuation Interface to ESF Components.
In MODES **4,** 5, and 6, automatic actuation of these Functions is not required because adequate time is available to evaluate plant conditions and respond by manually operating the ESF components if required.	In MODES 4, 5, and 6, automatic actuation of these Functions is not required because adequate time is available to evaluate plant conditions and respond by manually operating the ESF components if required.	In MODES 5 and 6 these functions are not required because adequate time is available to evaluate plant conditions and respond by manually operating the ESF components if required. **In most cases, the equipment actuated by these ESFAS functions need not be operable.**
The ESFAS manual trip capability is required in MODE 4 for SIAS, CIAS, CSAS, MSIS and AFAS **even though automatic actuation is not required**. Because of the large number of components actuated by these Functions, ESFAS actuation is simplified by the use of the manual trip push buttons.	ESFAS Manual Trip capability is required in MODE 4 for SIAS, CIAS, CCAS, and RAS even though automatic actuation is not required. Because of the large number of components actuated by these Functions, ESFAS actuation is simplified by the use of the Manual Trip push buttons.	No text corresponding to STS
No text corresponding to STS	CSAS, MSIS, and EFAS have relatively few components, which can be actuated individually if required in MODE 4, and the systems may be disabled or reconfigured, making system level Manual Trip impossible and unnecessary.	No text corresponding to STS
The ESFAS logic must be OPERABLE in the same MODES as the automatic and manual trip. In MODE 4, only the portion of the ESFAS logic responsible for the required manual trip must be OPERABLE.	The ESFAS logic must be OPERABLE in the same MODES as the automatic and Manual Trip. In MODE 4, only the portion of the ESFAS logic responsible for the required Manual Trip must be OPERABLE.	No text corresponding to STS
In MODES 5 and 6, the systems initiated by ESFAS are either reconfigured or disabled for shutdown cooling operation. Accidents in these MODES are slow to develop and would be mitigated by manual operation of individual components.	In MODES 5 and 6, the systems initiated by ESFAS are either reconfigured or disabled for shutdown cooling operation. Accidents in these MODES are slow to develop and would be mitigated by manual operation of individual components.	No text corresponding to STS

REQUEST FOR ADDITIONAL INFORMATION 295-8263

- The applicant is requested to resolve the apparent conflicts in the Bases regarding which automatic ESFAS logic Functions are required to be operable in Mode 4. Generic TS 3.3.6 Table 3.3.6-1 indicates that CIAS and AFAS conicidence logic and initiation logic functions are not required to be operable in Mode 4, but that CIAS and AFAS actuation logic and manual trip functions are required to be operable in Mode 4.

- The applicant is requested to explain why CIAS and AFAS Actuation Logic Function must be operable to support operability of CIAS and AFAS Manual Trip Function in Mode 4.

16-122

The “Surveillance Requirements” section of the Bases for generic TS Section 3.3 needs the following suggested clarifications to be useable. The applicant is requested to consider incorporating the suggested changes, as indicated; please explain and correct any errors in the suggested changes:

1. In the “Surveillance Requirements” section of the Bases for generic TS 3.3.1, 3.3.4, 3.3.4 and 3.3.6, revise first paragraph so the meaning is clear:

    (TS 3.3.1 SR Bases) The OPERABILITY of **the** interface and test processor (ITP) is not ~~limited per~~ **required by** LCO 3.3.1 because **the RPS does not need the** ITP ~~does not~~ **to** perform the safety function of RPS. However, **the** ITP shall **be** maintain**ed** ~~the functional integrity to perform~~ **capable of supporting performance of the** CHANNEL FUNCTIONAL TEST of SRs 3.3.1.7, 3.3.1.10, and 3.3.1.12.

    (TS 3.3.4 SR Bases) The OPERABILITY of the ~~ITP~~ **interface and test processor (ITP)** is not ~~limited per~~ **required by** LCO 3.3.4 because **the RPS does not need the** ITP ~~does not~~ **to** perform the safety function of RPS. However, the ITP shall **be** maintain**ed** ~~the functional integrity to perform~~ **capable of supporting performance of the** CHANNEL FUNCTIONAL TEST of SR**s** 3.3.4.1 and 3.3.4.2.

    (TS 3.3.5 SR Bases) Since the ~~ITP~~ **interface and test processor (ITP) is not needed to** ~~does not~~ perform **any ESFAS** safety ~~related~~ function ~~for ESFAS~~, **the** OPERABILITY **of the ITP is not required by** ~~per~~ LCO 3.3.5 ~~is not required~~. However, the ITP shall **be** maintain**ed** ~~the functional integrity for~~ **capable of supporting performance of** the CHANNEL FUNCTIONAL TEST ~~in~~ **of** SRs 3.3.5.2, 3.3.5.3, and 3.3.5.5.

    (TS 3.3.6 SR bases) Since the ~~ITP~~ **interface and test processor (ITP) is not needed to** ~~does not~~ perform ~~the~~ **any ESFAS** safety ~~related~~ function**s** ~~of ESFAS~~, the OPERABILITY **of the ITP** is not **required** ~~limited~~ by LCO 3.3.6. **However, the** ~~But,~~ ITP ~~must~~ **shall be** maintain**ed** ~~the functional integrity for operation~~ **capable of supporting performance** of **the** CHANNEL FUNCTIONAL TEST **of SR 3.3.6.1**.

    In the above paragraphs, which do not exist in the STS, recommend changing the word “shall” to “must” in the second sentence, since using “shall” is not customary in the Bases.

2. Under the heading “SR 3.3.5.2” in the “Surveillance Requirements” section of the Bases for generic TS 3.3.5, are five paragraphs taken from STS Bases for SR 3.3.5.2, with design-difference related changes. The resulting paragraphs need clarification, such as the suggested changes indicated in the following markup (existing text as proposed is colored black; proposed text identical to STS text is colored green; added text is blue; and proposed text being removed is lined out and colored ~~red~~):

(1st paragraph) A CHANNEL FUNCTIONAL TEST on each channel is performed ~~every 31 days~~ to ensure the entire channel will perform its intended function when needed. The OPERABILITY of each ESFAS instrumentation channel is verified on a 31 day interval with applicable extensions. This Frequency is based on operating experience which shows that ESFAS instrument channels usually pass the CHANNEL FUNCTIONAL TEST when performed on a 31 day Frequency. ~~This test is part of an overlapping test sequence similar to that employed in the RPS.~~

(2nd paragraph) This test is part of an overlapping test sequence similar to that employed in the RPS. This sequence consists of SR~~s~~ 3.3.5.2, SR 3.3.6.1, and SR 3.3.6.2 and tests the entire ESFAS from sensor input to the bistable logic processor ~~input to actuational~~ through the automatic ESF actuation logic (actuational) output of each subgroup. These overlapping tests are described in ~~DCD Tier 2~~ FSAR Section 7.3 (Reference 1).

(3rd paragraph) SR~~s~~ 3.3.5.2 and SR 3.3.6.1 are performed together and in conjunction with ESFAS testing. SR 3.3.6.2 verifies that each subgroup can actuate ESF~~AS~~ equipment when actuational output of each subgroup is generated.

(4th paragraph) These tests verify that the ESFAS is capable of performing its intended function, from sensor input to the bistable logic processor ~~input~~ through the actuational output of each subgroup to the actuated ESF components. SR~~s~~ 3.3.6.1 and SR 3.3.6.2 are described in LCO 3.3.6. SR 3.3.5.2 includes bistable logic processor testing.

(5th paragraph) To assure that the actual trip ~~occurrence by~~ setting in the bistable logic processor is ~~within~~ conservative with respect to the Allowable Value ~~of setpoint~~, a test signal is superimposed on the input in one channel at a time to verify that the bistable *processor* trips within the specified *as-found setting* tolerance around the ~~setpoint~~ *previous as-left setting*[HC1] ~~infected in only one channel at a time~~. This is performed ~~in bypassed status of~~ with the corresponding RPS trip channel placed in trip channel bypass. Setpoint adjustment must be performed ~~consistent with the plant specific setpoint analysis~~ as specified in the Setpoint Control Program.

3. Under the heading "SR 3.3.6.1" in the "Surveillance Requirements" section of the Bases for generic TS 3.3.6, are three paragraphs taken from STS Bases for SR 3.3.6.1, with design-difference related changes. The resulting paragraphs need clarification, such as the suggested changes indicated in the following markup (existing text as proposed is colored black; proposed text identical to STS text is colored green; added text is blue; and proposed text being removed is lined out and colored ~~red~~):

(1st paragraph) A CHANNEL FUNCTIONAL TEST is performed ~~every 31 days~~ to ensure the entire channel will perform its intended function when needed. The ~~operability~~ OPERABILITY of ~~the each channel or~~

~~automatic actuation logic channel~~ each ESFAS Logic channel, ESFAS Manual Trip channel, and Diverse Manual ESF Actuation channel is verified ~~by the operator every 31 days at least to meet the surveillance requirement~~ on a 31 day interval with applicable extensions. This Frequency is based on operating experience which shows that automatic ESF actuation logic channels, ESF manual trip channels, and diverse manual ESF actuation channels usually pass the CHANNEL FUNCTIONAL TEST when performed on a 31 day Frequency.

(2^{nd} paragraph) The CHANNEL FUNCTIONAL TEST is part of an overlapping test sequence similar to that employed in the RPS. This sequence, consisting of SR~~s~~ 3.3.5.2, SR 3.3.6.1, and SR 3.3.6.2 tests the entire ESFAS from sensor input to the bistable logic processor ~~input~~ through the automatic ESF actuation logic (actuational) output of each ~~the actuation of the individual~~ subgroup. These overlapping tests are described in Reference 1. SR~~s~~ 3.3.5.2 and SR 3.3.6.1 are normally performed together and in conjunction with ESFAS testing. When the actuational output signal ~~of each~~ for a subgroup is generated, SR 3.3.6.2 verifies that the ~~actuation ability of~~ ESF components associated ~~actuation signal of the associated~~ with ~~each~~ the subgroup are capable of being actuated by the ESF-CCS.

(3^{rd} paragraph) These tests verify that the ESFAS is capable of performing its intended function, from sensor input to the bistable logic processor ~~input~~ through the actuated components. SR 3.3.5.2 is addressed in LCO 3.3.5. SR 3.3.6.1 includes LCL testing, initiation logic (trip path) testing, and actuation logic testing.

(4^{th} paragraph) <u>Local Coincidence Logic Testing</u>

LCL testing ~~is tested to verify~~ verifies the ~~operability~~ OPERABILITY of the two-out-of-four coincidence logic and trip channel bypass logic.

(5^{th} paragraph) <u>Initiation Logic (Trip Path) Testing</u>

Testing of initiation logic, ~~Initiation logic testing is for Initiation Logic~~ which consists of logical “OR” (selective 2-out-of-4 logic), ~~and~~ is performed after the completion of LCL testing. This testing ~~implements the~~ exercises only one ~~Initiation~~ initiation logic ~~of one~~ channel at a time, which affects only one trip path.

(6^{th} paragraph) <u>Actuation Logic Testing</u>

Actuation logic testing ~~is tested to verify~~ verifies the ~~operability~~ OPERABILITY of the two-out-of-four actuation logic after the completion of initiation logic (trip path) testing. *This test is performed only for one channel and one actuation logic by periodic automatic test.*

a. The applicant is requested to explain and clarify the last sentence of the 6th paragraph.

b. The applicant is requested to explain why the LCL, initiation logic, and actuation logic tests are described in the above Bases discussions as being performed sequentially, without any discussion of overlap.

c. Overall, the Bases descriptions of the ESFAS Actuation Logic are unclear, in large measure to there being no definitive statement of the correspondence to the various parts of an ESFAS Function instrumentation loop, and the various ESFAS instrument and logic functions, and what defines a channel (or division) in an ESFAS instrument function, and in each type of ESFAS logic function. The applicant is requested to review the following corresponence list and correct errors; also provide a concise description of the correspondences between the items in the list.

Sensor and APC-S.. LCO 3.3.5

Bistable Logic Processor in the PPS .... LCO 3.3.5

ESF-CCS Group Controller and local coincidence logic (LCL)......................... LCO 3.3.6

ESF-CCS Local Controller (LC) and initiation logic (selective 2/4) (trip path).... LCO 3.3.6

ESF-CCS Component control logic and actuation logic, subgroups .... LCO 3.3.6

Component Interface Module (CIM) .... LCO on associated component

d. The applicant is requested to list all component groups, subgroups, which ESF-CCS ESFAS Actuation Logic Division is associated with the components in each subgroup, and which subgroups cannot be tested during power operation of the unit, and “must be tested in accordance with the Note to [SR 3.3.6.2].”

e. The applicant is requested to clarify the meaning of the Bases for the Frequency of SR 3.3.6.2, which says

> The 31-day Frequency on a staggered test basis complies with the operating experience and ensures the problems of individual logic signal can be detected within this time frame.

f. Because Table 3.3.6-1 does not list applicable SRs for each ESFAS Logic Function, ESFAS Manual Trip Function, and diverse Manual ESF actuation function, and no Note is provided in the SRs about the applicability of each SR to each Function, it is ambiguous whether SR 3.3.6.1 and SR 3.3.6.2 apply to Function 7. The applicant is requested to clarify this by making appropriate changes to generic TS 3.3.6.

[HC1]This text is from STS Rev 4 page B 3.3.5B-26

16-123

The applicant is requested to revise generic TS 3.3.11, "Accident Monitoring Instrumentation (AMI)," and Bases to conform to RG 1.97, "Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants," Revision 4.

1. The applicant is requested to identify all operator manual actions relied upon or otherwise assumed to occur by the DCD Tier 2 Chapter 15 safety analyses, including

   a. Termination of the limiting boron dilution event in Mode 4; and

   b. Termination of auxiliary feedwater flow to a faulted steam generator during secondary side events in Mode 1, 2, or 3, such as

      - A steam generator tube rupture,
      - An unisolatable main feedwater line break,
      - An unisolatable steam generator blowdown line break,
      - An unisolatable main steam line break, and
      - A stuck open main steam safety valve.

   Any control room indication of a process parameter or other variable needed by the operator, as directed by the emergency operating procedure or the emergency procedure guidlines for the APR1400, to accomplish a "planned manually-controlled action for which no automatic control is privided," (IEEE Std 497-2002, Section 4.1; RG 1.97, Rev. 4, Section C) should be identified as a Type A post accident monitoring (PAM) system variable in DCD Tier 2 Section 7.5.1.1, Table 7.5-1, "AMI Variables," and should be included in generic TS Table 3.3.11-1 as an AMI Function. The NRC staff is not persuaded of the validity of the statement in DCD Section 7.5.1.1 that "There are no AMI Type A variables in APR1400 design."

2. The applicant is requested to conform generic TS 3.3.11 and associated Bases to the list of PAM variables or functions described in DCD Tier 2 Section 7.5.1.1, and Table 7.5-1.

3. The applicant is requested to descibe the process used to determine the list of AMI varriables listed in DCD Tier 2 Table 7.5-1, and what type (B, C, D, or E) each variable is.

4. Please explain what is meant by the column heading "Ambiguity" in last column of Table 7.5-1

5. The Bases for generic TS 3.3.11 often uses the word "channel" in all capital letters by itself. The applicant is requested to make this word all lower case because "CHANNEL" is not a defined term in TS Section 1.1.

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