## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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| **RAI NO.:** | **NO. 167-1769 REVISION 0** |
| **SRP SECTION:** | **16 - TECHNICAL SPECIFICATIONS** |
| **APPLICATION SECTION:** | **16** |
| **DATE OF RAI ISSUE:** | **2/3/2009** |

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**QUESTION NO.: 16-205**

LCO 3.3.1, RTS Instrumentation

Provide the additional information and any changes necessary to explain why the NOTE in Condition F only applies to High Power Range Neutron Flux instrumentation.

The APWR GTS, Condition F, Required Action, NOTE, states that “[f]or High Power Range Neutron Flux channels only, the inoperable channel may be bypassed for up to 12 hours for surveillance testing of other channels.” Condition F applies to the following reactor trip functions: Power Range Neutron Flux (Low Setpoint), Overtemperature ∆T, Overpower ∆T, Power Range Neutron Flux Positive Rate, Power Range Neutron Flux Negative Rate, High Pressurizer Pressure, and Low SG Water Level. It is unclear why the NOTE only applies to the High Power Range Neutron Flux channels. The APWR Bases, ACTIONS, F.1 and F.2, page B 3.3.1-34 (second paragraph), references the NOTE but does not discuss its applicability. The comparable NOTE in Condition E of the WOG STS does not place any restrictions on the reactor trip functions.

Determine applicability of the NOTE and correct any potential discrepancies that may exist. Include any discussions necessary to ensure a clear understanding of the NOTE’s relevance to each of the reactor trip functions associated with Condition F.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS and Bases.

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**ANSWER:**

For Overtemperature ΔT, Overpower ΔT, High Pressurizer Pressure, and Low SG Water Level there are only 3 required channels, and these channels are shared with the control system. Normally with three operable channels, the signal selection algorithm (SSA) can prevent erroneous control system operations. Therefore three channels are sufficient to provide a plant trip and meet the single failure criterion. DCD Rev. 4 will be revised to clarify that a bypass of a required channel is not allowed for these channels, because when there are less than three operable channels, the SSA cannot prevent erroneous control system operation due to an input failure. If a failure were to occur in one of the two remaining control channels, a plant transient could occur that would require a plant trip, but a plant trip would not occur with only one remaining operable channel.

In DCD Rev. 0 thru Rev. 3, the inapplicability of the bypass note was considered the only distinction for the functions with shared channels (and only 3 required channels) in CONDITION F. However, MHI has now concluded that the shared channels (with only 3 required channels) also require different completion times and actions. Therefore, in DCD Rev. 4 the functions with shared channels (and only 3 required channels) will be moved to new Condition U. Power Range Neutron Flux (low setpoint), Power Range Neutron Flux Positive Rate and Power Range Neutron Flux Negative Rate will remain in Condition F; although these are shared channels, they have 4 required channels.

Condition U will prohibit a channel bypass for testing, as originally in Condition F. In addition, Condition U will require the inoperable channel be placed in trip within 1 hour; this ensures that if a plant transient is caused by an additional failure in one of the two remaining shared channels, the protection system can generate a trip with only one channel. During this configuration the protection system will function to protect the plant, but it does not meet the single failure criterion. Therefore, Condition U will also require that 3 required channels be restored to operable status with 72 hours.

This same change is applicable to the functions with shared channels in CONDITION L, which will be moved to new CONDITION W in DCD Rev. 4, and the functions with shared channels in LCO 3.3.2 CONDITION D, which will be moved to a new CONDITION M in DCD Rev. 4. (The conditions in LCO 3.3.2 will be re-ordered in DCD Rev. 4, due to the addition of the new conditions. Refer to the response to RAI 16-267.)

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-206**

LCO 3.3.1, RTS Instrumentation

Provide the additional information and any changes necessary to explain the exclusion of NOTE related information associated with surveillance testing, from Conditions E, F and L of the APWR GTS and Bases.

The APWR GTS, Conditions E, F and L, Required Action Sections, exclude REVIEWER'S NOTE information contained in corresponding sections D, E, K, and N of the WOG STS. The REVIEWER'S NOTE states that "[t]he below Note should be used for plants with installed bypass test capability: One channel may be bypassed for up to 12 hours for surveillance testing." APWR channel instrumentation bypass test capabilities are not well understood. It appears that the NOTE may be relevant. Determine whether or not the NOTE is applicable and correct any potential discrepancies in the APWR GTS and Bases. Include any discussions necessary to ensure a clear understanding of APWR instrumentation bypass test capabilities with respect to surveillance testing.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS and Bases.

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**ANSWER:**

<u>Condition E</u>

For the Power Range Neutron Flux (High Setpoint) Function the Bases 3.3.1 in DCD Rev. 1 included a Note to allow bypassing an inoperable channel for 12 hours to allow "routine surveillance testing of other channels". A separate sentence allowed bypassing an inoperable channel for 12 hours to allow "setpoint adjustment of other channels". The Bases was not consistent with the LCO 3.3.1, where the Note stated "for surveillance testing and setpoint adjustment of other channels".

In response to this RAI, the Bases 3.3.1 in DCD Rev. 2 added an additional Note to allow an additional 12 hour bypass "for surveillance testing and setpoint adjustment"; this Note was not limited to inoperable channels. The LCO 3.3.1 in DCD Rev. 2 was also modified to remove the restriction of the original Note to only inoperable channels. These same changes, including two bypass Notes within the Bases, were retained in DCD Rev. 3.

However, having two Notes in the Bases was incorrect, because in the WOG STS the original Note was intended for plants without bypass test capability and the alternate Note was intended for plants with bypass test capability. This was denoted in the WOG STS Bases through bracketed text of the first Note and in the WOG STS LCO through bracketed text of both Notes. Since the US-APWR has bypass test capability, in the US-APWR GTS the new Note in the Bases should have replaced the original Note (i.e., there should not be two Notes).

The difference is that for plants without bypass test capability, testing causes a channel to be tripped. Since the inoperable channel must be put in trip within 72 hours, a surveillance test of another channel would cause a plant trip. Therefore, the inoperable channel must be bypassed to avoid a spurious plant trip. But for plants with bypass test capability, the channel being tested can be bypassed; this prevents any spurious trip signals from that channel during testing. So even if an inoperable channel has been put in trip for this LCO action, there will not be a spurious plant trip during testing of another channel.

Therefore, the new Note that was added to Rev. 2 allows a channel to be bypassed for testing and for setpoint adjustments. Bypassing for setpoint adjustments also prevents inadvertent trip signals, which would otherwise cause a spurious plant trip if another channel is in trip for this LCO action.

To resolve the issue of two Notes, the Bases 3.3.1 in DCD Rev. 4 will have only one Note which allows a 12 hour bypass for “surveillance testing, or setpoint adjustments”. In this sentence the “and” will be changed to “or”, because the bypass is allowed for either condition. This same “and” to “or” change will be made to the Note in the LCO.

In DCD Rev. 4 the word “routine” will be deleted from the Note for consistency with the LCO; the LCO does not have “routine”. Deleting “routine” allows the testing and adjustments to occur for maintenance that may be required at non-routine intervals. This same change will be made to all Conditions that contain a similar bypass Note.

In addition, the Note in DCD Rev. 4 Bases and LCO 3.3.1 will allow bypassing one channel “provided the other three channels are OPERABLE, or two channels are OPERABLE and one is placed in the trip condition”. This additional provision is needed for the US-APWR because these channels are shared with the control systems. With either configuration and one required channel bypassed, the system can provide protection for all anomalies, including anomalies that may be caused by a shared channel failure, but it cannot also sustain a single failure.

<u>Condition F</u>
The explanation above is also applicable to the Power Range Neutron Flux (Low Setpoint) Function of Condition F; DCD Rev. 4 will have only one Note with the same restrictions described above.

However, in DCD Rev. 4 the other Functions in Condition F have been moved to Condition U, because MHI has determined that there must be different required actions and that a bypass is not permitted. Although all of these Functions are shared with the control systems, the difference is that Power Range Neutron Flux has 4 required channels, but the other Functions in Condition F have only 3 required channels. DCD Rev. 4 will explain that with one channel inoperable or bypassed, the two remaining channels are not sufficient to detect anomalies that may be caused by a shared channel failure. Therefore a bypass of one of these channels is not permitted.

<u>Condition L</u>
For Condition L the original incorrect Note for plants without bypass test capability was replaced with the correct Note for plants with bypass test capability in DCD Rev. 2; this same correction was

maintained in DCD Rev. 3. This Note correctly restricted the bypass to Functions with channels that are not shared with the control systems.

However, in DCD Rev. 4 the Functions in Condition L with channels that are shared by the control systems have been moved to Condition W, because MHI has determined that there must be different required actions. Condition W retains the bypass restriction that was in Condition L, in DCD Rev. 2 and 3. DCD Rev. 4 will explain that for the Functions in Condition W bypass of a required channel is not allowed because there are only three required channels and these channels are also used for control. If a failure were to occur in one of the two remaining control channels, a plant transient could occur that would require a plant trip, but a plant trip would not occur with only one remaining OPERABLE channel.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

# RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

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**Mitsubishi Heavy Industries**

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**QUESTION NO.: 16-224**

LCO 3.3.1, RTS Instrumentation

Provide the additional information and any changes necessary to explain, clarify, and correct potential inconsistencies associated with Condition C in the APWR GTS and Bases.

The APWR GTS, Condition C, states “[o]ne required Manual Reactor Trip channel inoperable.” Condition C appears to have incorrectly referenced the word “channel” as opposed to the word “train” based on the following:

- Required Action C.1 states “[r]estore three trains to OPERABLE status.”
- APWR Bases, ACTIONS, Section C, page B 3.3.1-30 (fourth paragraph), states “[t]his action addresses the train orientation for these functions.”
- The APWR GTS, Table 3.3.1-1, Manual Reactor Trip Initiation, Required Channels, specifies “3 trains” in all applicable Modes.

Determine the appropriate reference and make any necessary corrections to the APWR GTS and Bases. Include any discussions necessary to ensure a clear understanding of “train” versus “channel” inoperability.

Condition C in the APWR GTS and Bases applies only to the Manual Reactor Trip Function in Modes 3, 4, or 5 with the Rod Control System capable of rod withdrawal or one or more rods not fully inserted. The APWR Bases, ACTIONS, Section C, page B 3.3.1-30 (fourth paragraph), states “[t]his action addresses the train orientation for these functions.” It appears that the Bases statement reference to “functions” should be singular instead of plural, and the bulleted “Manual Reactor Trip” reference deleted. Determine the validity of the references and make any necessary corrections to the APWR Bases.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS and Bases.

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**ANSWER:**

In DCD Rev. 2, Condition C was changed to “One required Manual Reactor Trip train inoperable”. For the Manual Reactor Trip function, “train” is consistently used in the GTS Bases ACTIONS Conditions B and C, and in the GTS Table 3.3.1-1 Manual Reactor Trip Initiation Required Channels.

In DCD Rev. 4, the Bases, ACTIONS, Condition C will be changed to “This action addresses the train orientation for this Function. With one required train inoperable, the inoperable train must be restored to OPERABLE status within 72 hours.” The change from “one” to “this” is an editorial correction. The addition of “required” is for consistency with other Conditions, where “required” is used for Functions that have more channels/trains available than are required. In addition, the bulleted “Manual Reactor Trip” will be deleted to be consistent with the Bases, ACTIONS, Condition B.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2017**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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**QUESTION NO.: 16-225**

LCO 3.3.1, RTS Instrumentation

Provide the additional information and any changes necessary to explain and correct discrepancies associated with the Turbine Inlet Pressure P-13 interlock, in the APWR GTS and Bases.

The APWR GTS, Table 3.3.1-1, Turbine Inlet Pressure P-13, specifies four Required Channels. The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO and APPLICABILITY, Turbine Inlet Pressure P-13, page B 3.3.1-27 (third paragraph), states that "[t]he LCO requires three channels of Turbine Inlet Pressure, P-13 interlock to be OPERABLE in MODE 1." Determine the required number of Operable channels and make any necessary corrections to the APWR GTS and Bases.

The APWR GTS, Table 3.3.1-1, Turbine Inlet Pressure P-13, specifies units of Rated Thermal Power (RTP). The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO and APPLICABILITY, Turbine Inlet Pressure P-13, page B 3.3.1-27 (second paragraph), states that "[t]he Turbine Inlet Pressure, P-13 interlock is actuated when the pressure in the first stage of the high pressure turbine is greater than approximately 10 percent of the rated full power pressure." The WOG STS, Table 3.3.1-1 specifies units of Percent Turbine Power for the Turbine Impulse Pressure P-13 interlock. It appears that the units should be in Percent Turbine Power. Determine the proper units for the Turbine Inlet Pressure P-13 interlock and make any necessary corrections to the APWR GTS and Bases.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS and Bases.

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**ANSWER:**

The correct number of required channels for Turbine Inlet Pressure P-13 is three. The description in GTS, Table 3.3.1-1 was revised from 4 required channels to 3 required channels at DCD Rev. 2.

All Nominal Trip Setpoints and Allowable Values were removed from Table 3.3.1-1 in DCD Rev. 3, due to incorporation of the Setpoint Control Program administrative technical specifications. Therefore, there is no longer a discrepancy between the GTS and the Bases with regard to the units for the Turbine Inlet Pressure P-13 interlock. In DCD Rev. 4 a reference will be added to a document established by the Setpoint Control Program which will establish and maintain Nominal Trip Setpoints and Allowable Values.

The actuation of the Turbine Inlet Pressure P-13 Interlock at “10% of the rated full power pressure” is correct. These are the same units used in the WOG STS Basis. This was incorrectly changed to “10% of the turbine power” in DCD Rev. 2. It will be changed back to “10% of the rated full power pressure” in DCD Rev. 4, which is consistent with the WOG STS Bases.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-236**

LCO 3.3.1, RTS Instrumentation

Provide the additional information and any changes necessary to explain and correct potential discrepancies associated with the Overtemperature $\Delta T$ and Overpower $\Delta T$ protection setpoint equations in the APWR DCD and GTS.

The APWR GTS, Table 3.3.1-1, and the APWR DCD, Section 7.2.1.4.3, Overtemperature $\Delta T$ and Overpower $\Delta T$ Function protection setpoint equations do not include either the $\Delta T_Q$ term or the T-average $1/(1+T_6S)$ Laplace Transform term specified in the same equations for Overtemperature $\Delta T$ and Overpower $\Delta T$ in the WOG STS, Table 3.3.1-1. Determine whether or not the two terms are applicable to the Overtemperature $\Delta T$ and Overpower $\Delta T$ protection setpoint equations and make any necessary corrections to the APWR GTS and DCD. Include any discussions necessary to ensure a clear understanding of the algorithm with respect to each term.

The additional information is needed to ensure the accuracy and completeness of the APWR Bases and DCD.

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**ANSWER:**

In response to this RAI, MHI committed to revise equations for both $\Delta T$ functions to include terms necessary for unit consistency. However, the associated markup changes for the Overpower $\Delta T$ equation were not incorporated into Table 3.3.1-1, Note 2, in DCD Rev. 2. The associated markup changes for the Overpower $\Delta T$ equation were included in DCD Rev. 3. In addition, since DCD Rev.3 has been revised to reflect Option (3) of DC/COL-ISG-08, “Establish a PTS Section 5.5 or 5.6 Administrative Controls Program or Report”, the Allowable Values were eliminated from Notes 1&2 in DCD Rev. 3.

DCD Chapter 15 Technical Report, MUAP-11014 “Over Temperature $\Delta T$ and Over Power $\Delta T$ Reactor Trip Functions and Setpoint Determination Process”, issued in June 2011, describes the following information, and Section 7.2.1.4.3 of DCD Chapter 7 will be revised to refer to this Technical Report.

(1) Design basis of ΔT equation, including the purpose of the lead-lag processing
(2) Differences between the US-APWR equation and the corresponding equation in NUREG 1431, Table 3.3.1-1, Notes 1&2

In addition, DCD Chapter 16 will be revised as follows:

(1) Table 3.3.1-1, Notes 1&2 will be deleted.
(2) An explanation that the cycle dependent variables for this function are specified in the COLR will be added to Item 6 Overtemperature ΔT and Item 7 Overpower ΔT in APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY in B 3.3.1.
(3) The following clarification will be made to Bases Section 3.3.1 for the description of Item 6 Overtemperature ΔT:

> The reactor trip occurs if ~~indicated~~measured loop ΔT exceeds the lower setpoint of the DNB protection limit setpoint and the core exit boiling limit setpoint.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-249**

LCO 3.3.2, ESFAS Instrumentation

Provide the additional information and any changes necessary to explain and correct a potential discrepancy associated with the Main Feedwater Isolation - High-High Steam Generator Water Level Function (5B.c) in the APWR GTS, Table 3.3.2-1.

The APWR GTS, Table 3.3.2-1, Main Feedwater Isolation - High-High Steam Generator Water Level Function (5B.c), actuates a trip of all Main Feedwater (MFW) Pumps, closure of all MFW Isolation Valves, and closure of all Steam Generator Water Filling Control Valves upon deactivation of Pressurizer Pressure Interlock P-11. Below the P11 interlock these isolation actuations may be manually bypassed. The APWR GTS, Table 3.3.2-1, does not specify a footnote for mode three of Function 5B.c indicating that the specific equipment referenced is capable of being automatically actuated above P-11 after having been manually bypassed below the interlock (similar to footnote (a) for Functions 1.d, 1.e, 4.d(1) and footnote (f) for Function 4.d(2)). A review of the APWR DCD, Functional Logic Diagram, Figure 7.2-2 (sheet 10 of 21), and APWR DCD, Section 7.3.1.5.8.2 and Table 7.2-4, confirms the details associated with operating bypass Interlock P-11 relative to Function 5B.c.

Determine whether or not an additional footnote is warranted for Function 5B.c and make any necessary corrections to the APWR GTS, Table 3.3.2-1. If a new footnote is incorporated, include any discussions necessary to ensure a clear understanding of footnote applicability and intent in the Bases.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS and Bases.

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**ANSWER:**

DCD Rev. 4 will be revised to explain that for Main Feedwater Isolation - High-High Steam Generator Water Level, the sub-function for trip of all MFW pumps and closure of the MFIVs and SGWFCVs is not required in MODE 3 below the P-11 (Pressurizer Pressure) interlock. Therefore this sub-function may be manually bypassed below the P-11 interlock, as described in APWR DCD

Figure 7.2-2 (sheet 10 of 21), Section 7.3.1.5.8.2, and Table 7.2-4 (sheet 2 of 3). This description will be added to the Basis and as a footnote in Table 3.3.2-1 for Main Feedwater Isolation - High-High Steam Generator Water Level in DCD Rev. 4.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

**1/27/2012**

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**QUESTION NO.: 16-250**

LCO 3.3.2, ESFAS Instrumentation

Provide the additional information and any changes necessary to explain and correct potential discrepancies associated with footnote (a) in the APWR GTS, Table 3.3.2-1.

Two separate and distinct reference comments have been assigned to footnote (a) in the APWR GTS, Table 3.3.2-1. Footnote (a) as it applies to Functions 1.d, 1.e, and 4.d(1), states “above the P-11 (Pressurizer Pressure) interlock.” Footnote (a) as it applies to Functions 13.a, 13.b, 13.c(1), 13.c(2), and 13.c(3), states “during movement of irradiated fuel assemblies within containment.” Footnotes within the same Tech Spec Table should remain dedicated in order to avoid confusion and potential misinterpretation by Operations personnel. Determine appropriate footnote designations and make the necessary corrections.

The APWR GTS, Table 3.3.2-1, page 3.3.2-20, specifies footnote (a) in Mode 4 for each of the Main Control Room Isolation Functions. The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, page B 3.3.2-21, fifth paragraph, states that “the MCR Isolation Functions must be OPERABLE in MODES 1, 2, 3, 4, and during movement of irradiated fuel assemblies.” There is a potential that the movement of irradiated fuel assemblies could occur outside of Modes 1 through 4. It appears that footnote (a) should actually be applied as a separate Mode Condition similar to the presentation in the WOG STS, LCO 3.3.7, Control Room Emergency Filtration (CREFS) Actuation Instrumentation, Table 3.3.7-1. Determine the proper placement of the footnote and make any necessary changes.

The APWR GTS, Table 3.3.2-1, page 3.3.2-20, does not specify footnote (a) as a Mode Condition for any of the Containment Purge Isolation Functions. The WOG STS however, specifies footnote (a) as an applicable Mode for each of the Containment Purge and Exhaust Isolation Functions in LCO 3.3.6, Table 3.3.6-1 (Note that LCO 3.3.6 is actually part of LCO 3.3.2 in the APWR GTS). It appears that footnote (a) may be applicable to the Containment Purge Isolation Functions as a separate Mode Condition, considering that the potential exists for an accident that could release significant fission product radioactivity into the containment in Conditions other than Modes 1 through 4. Determine if footnote (a) should be applied to the Containment Purge Isolation Function and explain the deviation from the WOG STS. Make any necessary corrections to the APWR GTS, Table 3.3.2-1. If a new footnote is incorporated, include any discussions necessary to ensure a clear understanding of footnote applicability and intent in the Bases.

The additional information is needed to ensure the accuracy, completeness, and integrity of the

APWR GTS.

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**ANSWER:**

The footnote (a) for the functions 13.a, 13.b, 13.c(1), 13.c(2) and 13.c(3) in Table 3.3.2-1 has a different meaning from that of footnote (a) for the functions 1.d, 1.e and 4.d(1). Thus, in order to avoid confusion, footnote (a) for the functions 13.a, 13.b, 13.c(1), 13.c(2) and 13.c(3) was revised as footnote (k) in DCD Rev. 2. In addition, in DCD Rev. 3 note (k) was revised from “During movement of irradiated fuel assemblies within containment” to “During movement of irradiated fuel assemblies”. This change was made to encompass all conditions of irradiated fuel movement regardless of its location..

The main control room isolation function in Table 3.3.2-1 had a footnote (a) for MODE 4 in DCD Rev.1 (changed to footnote (k) in DCD Rev.2, as explained above). However, since the intent of the footnote was to show that the applicable modes or other specified conditions corresponds to MODEs 1 to 4 plus the condition described by footnote (k), the position of the footnote was intended to be changed in DCD Rev. 2 to denote a completely separate (MODE independent) condition. However, the footnote designation was incorrectly placed in a superscript position. This will be corrected in DCD Rev. 4. In addition, in DCD Rev.4, footnote (k) will be relabeled for consistency with sequential labeling of all footnotes.

The US-APWR fuel handling accident (FHA) analysis takes into consideration an FHA in the state where the containment is not isolated. The Bases in DCD Rev. 4 will be revised to clarify that for this case, where the FHA occurs without the containment being isolated, the doses at the exclusion area boundary, at the low population zone outer boundary and in the main control room are maintained within acceptable limits. Therefore, it is not necessary to have the containment purge isolation function other than in MODEs 1 to 4. This is described in FSAR Sections 15.7.4.1, 15.7.4.2.1.5, and 15.7.4.3 of DCD Rev.3.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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| **RAI NO.:** | **NO. 167-1769 REVISION 0** |
| **SRP SECTION:** | **16 - TECHNICAL SPECIFICATIONS** |
| **APPLICATION SECTION:** | **16** |
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**QUESTION NO.: 16-252**

LCO 3.3.2, ESFAS Instrumentation

Provide the additional information and any changes necessary to explain and correct potential discrepancies associated with the Main Feedwater Isolation Function in the APWR Bases.

The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, 5B, Main Feedwater Isolation, page B 3.3.2-22 (last paragraph), states that “[t]he Function is actuated when the level in any SG exceeds the high setpoint, …” It appears that the Bases statement should actually specify “High-High” setpoint as opposed to just “High” setpoint, on the basis that the remaining references to Function 5B.c in the APWR GTS, Bases and DCD all cite “High-High Steam Generator Water Level.” Determine the correct setpoint description and make any necessary corrections to the APWR Bases.

The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, 5B, Main Feedwater Isolation, page B 3.3.2-23 (first full paragraph), states that “[t]his Function is actuated by High-High SG Water Level or by an ECCS Actuation signal.” The Bases statement does not include the fact that the Function is also actuated by Manual Initiation. Explain the apparent omission and make any necessary corrections to the APWR Bases.

The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, 5B.c, Main Feedwater Isolation - High-High Steam Generator Water Level (P-14), page B 3.3.2-23 (last underlined subsection title), implies that there is a P-14 interlock signal that is an integral part of the isolation logic associated with this function. The Bases discussion does not provide any information regarding interlocks. It appears, based on a review of the APWR DCD, including Functional Logic Diagram Figure 7.2-2 (sheet 12 of 21) and Sections 7.3.1.5.8 and 7.3.1.6.3, that the P-14 interlock does not exist and that the P-11 interlock is actually part of the Main Feedwater Isolation - High-High Steam Generator Water Level Logic. Validate the interlock logic associated with Function 5B.c and make any necessary corrections to the APWR Bases. Provide the changes needed to ensure that all relevant interlock information is clearly described in the Bases.

The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, 5B.b, Main Feedwater Isolation - Actuation Logic and Actuation Outputs, page B 3.3.2-23, second paragraph from the bottom, does not provide any information regarding Mode applicability or the conditional requirements established in accordance with footnote (i) in Table 3.3.2-1 of the APWR GTS. This information is relevant and needs to be included in the APWR Bases. Provide the missing Bases information.

The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, 5B.d, Main Feedwater Isolation - ECCS Actuation, page B 3.3.2-24, third paragraph, states that “except when all MFIVs, MFRVs, and associated bypass valves are closed when the MFW System is in operation.” The reference to Steam Generator Water Filling Control Valves (SGWFCVs) in the APWR GTS, Table 3.3.2-1, footnote (i), appears to have been omitted from the Bases statement. It is unclear why the SGWFCVs have not been included in the Bases discussion. Also, the information contained in this paragraph is applicable to Main Feedwater Isolation Functions 5B.a, 5B.b, and 5B.c. As such, the paragraph should stand-alone, independent of Section 5B.d. The comparable paragraph in the WOG Bases, page B 3.3.2-28, has been formatted as a stand-alone paragraph. Explain the apparent omission of the SGWFCVs, determine if the paragraph should be relocated, and make any necessary corrections to the APWR Bases.

The additional information is needed to ensure the accuracy and completeness of the APWR Bases.

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**ANSWER:**

Main feedwater isolation is actuated when SG water level exceeds High-High Steam Generator Water Level setpoint. As a result, the APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, 5B was revised from High setpoint to High-High setpoint at DCD Rev. 2.

The APWR Bases was revised to describe manual main feedwater isolation because main feedwater isolation can be also actuated by manual initiation at DCD Rev. 2.

Similar to the response discussing P-14 for Question 16-218, main feedwater isolation by High-High Steam Generator Water Level has been previously called the P-14 interlock. For the US-APWR, DCD Chapter 7 does not use the phrase P-14 for main feedwater isolation by High-High Steam Generator Water Level because High-High Steam Generator Water Level is one of the signals that activates main feedwater isolation function. For consistency, the phrase P-14 was deleted in GTS and Bases at DCD Rev. 2.

Mode applicability of all Main Feedwater Isolation Functions is addressed in the last paragraph below.

The main feedwater isolation function isolates all MFIVs, MFRVs, MFBRVs and SGWFCVs. Therefore, MFBRVs and SGWFCVs were added to the description in APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, 5B.d for consistency at DCD Rev. 2. In addition, the discussion of mode applicability will be moved to the end of this section, in DCD Rev. 4. This will define that all Main Feedwater Isolation functions must be OPERABLE in MODES 1, 2 and 3, except the sub-function of the MFW Isolation on High-High Steam Generator Water Level, which trips the MFW pumps and closes the MFIVs and SGWFCVs which must be OPERABLE in MODES 1 and 2, and in MODE 3 above the P-11 setpoint.

Footnotes (i) and (j) and related descriptions in Rev.2 and 3 of the DCD, which exclude applicability when these valves are closed, will be removed from LCO 3.3.2 Table 3.3.2-1, and the Bases in DCD Rev. 4. These Functions are applicable in these modes, regardless of valve position, because the Functions are credited to mitigate spurious valve opening from Operational VDUs.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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**QUESTION NO.: 16-253**

LCO 3.3.2, ESFAS Instrumentation

Provide the additional information and any changes necessary to explain, clarify and correct potential discrepancies identified in the Emergency Feedwater Actuation Function Sections of the APWR Bases.

The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, 6.e, Emergency Feedwater Actuation - Loss of Offsite Power, page B 3.3.2-26 (third paragraph), states that “[t]he LCO requires two OPERABLE undervoltage devices on each Class 1E bus corresponding to each OPERABLE EFW train.” The APWR GTS, Table 3.3.2-1, 6.e, LOOP Signal, Required Channels, specifies “3 per bus for each EFW train.” An apparent conflict exists between Table 3.3.2-1 and the Bases regarding the Required Number of Operable channels. The APWR DCD, Section 7.3.1.1 (page 7.3-2), states that “[e]ach ESFAS train monitors three under voltage inputs, using 2-out-3 logic, to detect a loss of power condition for its respective train, and generates a LOOP signal.” This would tend to imply that three Operable channels are probably required in order ensure adequate redundancy and enhanced reliability. Determine the required number of Operable channels and make any necessary corrections.

The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, 6.e, Emergency Feedwater Actuation - Loss of Offsite Power, page B 3.3.2-26 (third paragraph), states that “[l]oss of power to a Class 1E bus will actuate its respective EFW train to ensure that at least two SGs contain enough water to serve as the heat sink for reactor decay heat and sensible heat removal following the reactor trip.” This statement is somewhat confusing considering that the APWR Emergency Feedwater Actuation System “has four trains, with two motor driven pumps and two turbine driven pumps” as stated in the last paragraph on page B 3.3.2-24 of the Bases. Loss of power to a single Class 1E bus whose pump is motor driven pump will not result in successful actuation of that bus’s EFW train as indicated above. The comparable statement in the WOG Bases, page B 3.3.2-30 (third paragraph), states that “[l]oss of power to either service bus will start the turbine driven AFW pumps …” It appears that the APWR Bases statement on page B 3.3.2-26 is accurate for the Class 1E bus whose pump is turbine driven, and at least partially accurate for a complete Loss of Offsite Power in which all of the Class 1E buses are completely de-energized (i.e. turbine driven pumps will be started, ensuring enough water for two SGs

minimum). Provide the necessary clarification and ensure that the information is clearly stated in the APWR Bases.
The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, page B 3.3.2-26 (last paragraph), states that "[f]unctions 6.a through 6.d must be OPERABLE in MODES 1, 2, and 3 to ensure that the SGs remain the heat sink for the reactor." The comparable statement in the WOG Bases, page B 3.3.2-30 (last paragraph), states that "[f]unctions 6.a through 6.e must be OPERABLE in MODES 1, 2, and 3 to ensure that the SGs remain the heat sink for the reactor." The APWR GTS, Table 3.3.2-1, specifies MODES 1, 2, and 3 for Function 6.e as well. It appears that the Bases statement should incorporate functional references 6.a through 6.e. Determine the correct information and make any necessary corrections to the APWR Bases.

The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, page B 3.3.2-27, 6.f, Emergency Feedwater Action - Trip of All Main Feedwater Pumps, page B 3.3.2-27 (second paragraph), states that "[i]n MODES 3, 4, and 5, the RCPs and MFW pumps may be normally shut down, and thus neither pump trip is indicative of a condition requiring automatic EFW initiation." Neither the APWR DCD or the APWR GTS specify an Emergency Feedwater Actuation on RCP Undervoltage. It appears that the reference to RCPs in the Bases statement may be invalid. Determine the correct information and make any necessary corrections to the APWR Bases.

Correct the following typographical/editorial errors identified in the Emergency Feedwater Actuation Function Sections of the APWR Bases:

- Page B 3.3.2-26, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, Second Paragraph: The phrase "ensure that at least two SG contains enough water," should read "ensure that at least two SGs contain enough water..."
- Page B 3.3.2-27, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, Second Paragraph: The phrase "[t]his ensures that at least two SG is provided with water," should read "[t]his ensures that at least two SGs are provided with water..."
- Page B 3.3.2-27, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, Subsection "f" Underlined Function Description: The word "Action" should be "Actuation".

The additional information is needed to ensure the accuracy and completeness of the APWR Bases.

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**ANSWER:**

As described in DCD Chapter 7, Section 7.3.1.1, each ESFAS train monitors three under voltage inputs, using 2-out-of-3 voting logic, to detect a loss of power condition for its respective train, and generates a LOOP signal. Therefore, the number of available channels is three. As a result, the required number of operable channels was revised to three in Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, 6.e at DCD Rev. 2.

The US-APWR is designed with four Class 1E bus trains. Each Class 1E bus has three undervoltage devices that detect a LOOP in a two out of three configuration. A unique LOOP signal is generated for each Class 1E bus. This unique LOOP signal will only actuate one EFW train. The LOOP signal will result in the successful actuation of the associated train of EFW, regardless of whether the train has a motor or turbine driven pump (although the pump start may be delayed as described in Note 2 of Figure 7.2-2 (sheet 7 of 21)). In the case of a complete LOOP, the four Class 1E busses would each generate separate LOOP signals (four total), which would actuate all four EFW trains. The description of "at least two SGs" in Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, 6.e, Emergency Feedwater Actuation – Loss of Offsite Power, page B 3.3.2-26 is for the assumption of a feedwater line break accident where EFW flow does not enter the SG of the broken loop and the assumed single failure is the loss of one other EFWS train, resulting in only two SGs receiving cooling water. For a LOOP without the additional assumption of a feedwater line break, all four EFW trains would be actuated and thus all four SGs would receive cooling water. The description on page B 3.3.2-26 was revised for clarity at DCD Rev. 2.

The description in the last paragraph on page B 3.3.2-26 of Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, that refers to “6.a through 6.d” in DCD Rev.1 was a typographical mistake and was revised at DCD Rev. 2.

The description in the second paragraph on page B 3.3.2-27 of Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, Emergency Feedwater Action – Trip of All Main Feedwater Pumps, that refers to “RCPs” in DCD Rev.1, was a typographical mistake and was revised at DCD Rev. 2.

According to the indicated typographical/editorial errors in the first and third bullets in the question (SGs and Actuation), the descriptions for Functions 6.e and 6.f in Bases were corrected in DCD Rev. 2. The additional typographical error in the second paragraph of Function 6.f indicated in the second bullets in the question, will be corrected in DCD Rev. 4 (i.e., “SG is” changed to “SGs are”).

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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**QUESTION NO.: 16-267**

LCO 3.3.2, ESFAS Instrumentation

Provide the additional information and any changes necessary to explain, clarify, and correct potential discrepancies associated with Condition N in the APWR GTS and Bases.

The APWR GTS, Condition N, Required Action N.1.2, states "enter applicable Conditions and Required Actions for one CREFS train made inoperable by inoperable CREFS actuation instrumentation." The APWR Bases, ACTIONS, Condition N, page B 3.3.2-48 (first paragraph), states that "condition N applies to the failure of two MCR Isolation Actuation Logic and Actuation Output trains, two Main Control Room Radiation channels, or two Manual Initiation trains." It is unclear how Required Action N.1.2 can provide direction for the inoperability of only one CREF train, when entry into Condition N would seem to imply that there is a potential for two CREF trains to be inoperable as a direct result of the inoperability of two Main Control Room Isolation trains. Explain how inoperable Main Control Room Isolation train instrumentation impacts CREF train OPERABILITY. Validate Required Action N.1.2 and make any necessary changes.

The APWR GTS, Condition N, Required Action N.2, NOTE, states that "this alternative is not available for failure of the Automatic Actuation Logic and Actuation Outputs." The APWR Bases, ACTIONS, Section N, page B 3.3.2-48 (second paragraph), states "the Required Actions are modified by a Note that excludes this alternative for failure of the Actuation Logic and Actuation Outputs, since failure of this Function affects normal and emergency modes." The referenced Note is not included in the WOG STS, LCO 3.3.7, Condition B, Required Action B.2. It is unclear why the Note would apply to the failure of Function 13.b in the APWR GTS and not apply to failure of the comparable "Automatic Actuation Logic and Actuation Relays" Function in Table 3.3.7-1 of the WOG STS. Clarify the Note, explain the deviation from the WOG STS, and make any necessary changes. Include any discussions necessary to ensure a clear understanding of the Note's intent and ensure that the information is clearly stated in the Bases.

The APWR GTS, Condition N, Required Action N.2, NOTE, states "failure of the Automatic Actuation Logic and Actuation Outputs." The APWR Bases, ACTIONS, Section N, page B 3.3.2-48 (second paragraph), states "failure of the Actuation Logic and Actuation Outputs…" It appears that the qualifier "Automatic" should either be included in the Bases reference to "Actuation Logic and Actuation Outputs" or be removed from the Note in order to ensure accuracy and consistency between the two. Validate the Bases statement and make any necessary changes.

The APWR GTS, Condition N, Required Action N.2, Note placement and width are incorrect. Reformat the Note in accordance with the Tech Spec Writers Guide TSF-GG-05-01, Section 2.1.4.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS and Bases.

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**ANSWER:**

DCD Rev. 2 was revised to clarify that MCR Isolation actuates Main Control Room HVAC System (MCRVS) which consist of two 100% trains (A and D) of subsystem Main Control Room Emergency Filtration System (MCREFS) and four 50% trains of subsystem Main Control Room Air Temperature Control System (MCRATCS), as described in DCD Chapter 16, LCO 3.7.10. However, the actions for inoperable measurement channels versus inoperable Actuation Logic and Actuation Outputs trains remained confusing. Therefore, in DCD Rev. 4 the conditions will be revised (1) to clearly distinguish the Required Actions for inoperable measurement channels from inoperable Actuation Logic and Actuation Outputs trains, (2) to distinguish Required Actions for inoperability of one channel/train from two channels/trains, and (3) to distinguish the affect of inoperable channels/trans on MCREFS and/or MCRATCS. For all conditions the Required Actions allow the MCR Isolation Function to operate with 100% capacity, but without compliance to the single failure criterion, for 7 days; within 7 days, the MCR Isolation Function is required to operate with 100% capacity with compliance to the single failure criterion by restoring inoperable equipment or placing one or more trains in the emergency mode. If the inoperable equipment leaves the MCR Isolation Function with less than 100% capacity, there is an additional immediate action to restore 100% capacity (without single failure compliance) by placing one or more trains in the emergency mode.

The note in DCD Rev. 1 Condition N that states “this alternative is not available for failure of the Automatic Actuation Logic and Actuation Outputs” was deleted in DCD Rev. 2 because MHI determined that the emergency mode can be achieved using manual actions, even when the Actuation Logic and Actuation Outputs is inoperable. This will be clarified in DCD Rev. 4. A note is not required because Rev. 4 provides separate conditions for measurement channels and Actuation Logic and Actuation Outputs trains.

The discrepancy in Condition N in the use of “Automatic” actuation logic and actuation outputs, was eliminated in DCD Rev. 2 with the deletion of the note, as explained above.

The discrepancy in the Note placement and width for Condition N, Required Action N.2 were not corrected in DCD Rev. 2 or Rev. 3. Although Rev. 4 will not contain these same notes, other notes are included. The placement and width of all notes will be corrected in DCD Rev. 4.

In addition, in DCD Rev. 4 the Basis will be revised to clarify the meaning of “emergency mode”. For all plants this clarification will accommodate the potential for spurious signals from non-safety operational VDUs. The clarification will include bracketed text that can be applied to plants with or without toxic gas protection.

It is also noted that due to the split of MCR Isolation conditions for measurement channels and Actuation Logic and Actuation Outputs trains, the MCR Isolation Functions which were covered by Conditions M, N, O, and P in DCD Revision 1 thru 3, will be covered by Conditions U, V, W, X, Y, Z and AA in DCD Rev. 4.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

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**QUESTION NO.: 16-281**

LCO 3.3.3, PAM Instrumentation

Provide the additional information and any changes necessary to regarding the application of NOTE 1 in the ACTIONS Section of the APWR GTS and Bases.

The APWR GTS, ACTIONS, NOTE 1, states "lco 3.0.4 not applicable." The APWR Bases, ACTIONS, page B 3.3.3-8 (next to last paragraph), states that "this exception is acceptable due to the passive function of the instruments, the operator's ability to respond to an accident using alternate instruments and methods, and low probability of an event requiring these instruments." This Note is not included in the ACTIONS Section of the WOG STS. It is unclear why the requirements of LCO 3.0.4 regarding Mode change restrictions would not be the same for both the APWR GTS and the WOG STS. The APWR Bases discussion does not provide adequate justification for the exclusion of LCO 3.0.4. Determine whether or not the Note is valid, provide a justification, and make any necessary corrections.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS and Bases.

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**ANSWER:**

The inclusion of this note was an error. The note was deleted from the GTS in DCD Rev. 2. However, neither Rev. 2 nor Rev. 3 deleted the description of this note from the Bases. The description of this note will be deleted from the Bases in DCD Rev. 4.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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**QUESTION NO.: 16-289**

LCO 3.3.5, LOP Class 1E GTG Start Instrumentation

Provide the additional information and any changes necessary to explain and correct a potential discrepancy associated with Condition B of the APWR GTS.

The APWR GTS, ACTIONS, Condition B, page 3.3.5-1, states “one or more Functions with two channels per required bus inoperable.” The APWR Bases, ACTIONS, B.1, page B 3.3.5-4 (first paragraph), states that “condition B applies when more than one loss of voltage or more than one degraded voltage channel per required Class 1E 6.9 kV bus are inoperable.” A potential conflict exists between Condition B and the Bases statement when three channels per bus are inoperable. Required Action B.1, which states “restore all but one channel per bus to OPERABLE status,” is applicable with two or three inoperable channels, whereas Condition B is not. It appears that Condition B should actually read “one or more Functions with two or more channels per required bus inoperable,” similar to the comparable statement in Condition B of the WOG STS, page 3.3.5-1. Validate the Condition statement and make any necessary corrections.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS.

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**ANSWER:**

The US-APWR Bases, first paragraph of ACTIONS B.1 was changed as follows in DCD Rev. 2:

> “Condition B applies when two or more loss of voltage or two or more degraded voltage channel per required Class 1E 6.9 kV bus are inoperable.”

Condition A and Condition B of the GTS were also changed as follows at DCD Rev. 2:

> Condition A: One or more Functions with one or more channels per required bus inoperable

> Condition B: One or more Functions with two or more channels per required bus inoperable

However, this resulted in an error in Condition A, because Condition A is applicable only when there is only one channel inoperable (not one or more) in one or more functions. DCD Rev. 4 will be revised to correct this error.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

# RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

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**QUESTION NO.: 16-297**

3.3 Instrumentation, General Comment

Provide the additional information and changes necessary to enhance the APWR Bases, REFERENCES, for INSTRUMENTATION Sections B 3.3.1, B 3.3.2, B 3.3.3, B 3.3.4, B 3.3.5, B 3.3.6. Acceptable guidance on the inclusion of references can be found in TSTF-GG-05-01, "Writer's Guide for Plant-Specific Improved Technical Specifications," Section 4.2.8.

In the APWR Bases, B 3.3.1, REFERENCES, page B 3.3.1-51, insert "FSAR," before "Chapter 7" for Reference 2, and replace "Chapter 7" by "Section (7.x.y)" to identify the specific location of the item referred to in the FSAR.

In the APWR Bases, B 3.3.1, REFERENCES, page B 3.3.1-51, insert "FSAR," before "Chapter 15" for Reference 3, and replace "Chapter 15" by "Section (15.x.y)" to identify the specific location of the item referred to in the FSAR.

In the APWR Bases, B 3.3.1, REFERENCES, page B 3.3.1-51, insert "FSAR," before "Chapter 6" for Reference 9, and replace "Chapter 6" by "Section (6.x.y)" to identify the specific location of the item referred to in the FSAR.

In the APWR Bases, B 3.3.2, REFERENCES, page B 3.3.2-57, insert "FSAR," before "Chapter 7" for Reference 2, and replace "Chapter 7" by "Section (7.x.y)" to identify the specific location of the item referred to in the FSAR.

In the APWR Bases, B 3.3.2, REFERENCES, page B 3.3.2-57, insert "FSAR," before "Chapter 15" for Reference 3, and replace "Chapter 15" by "Section (15.x.y)" to identify the specific location of the item referred to in the FSAR.

In the APWR Bases, B 3.3.2, REFERENCES, page B 3.3.2-57, insert "FSAR," before "Chapter 8" for Reference 8, and replace "Chapter 8" by "Section (8.x.y)" to identify the specific location of the item referred to in the FSAR.

In the APWR Bases, B 3.3.2, REFERENCES, page B 3.3.2-57, insert "FSAR," before "Chapter 6" for Reference 10, and replace "Chapter 6" by "Section (6.x.y)" to identify the specific location of the item referred to in the FSAR.

In the APWR Bases, B 3.3.3, REFERENCES, page B 3.3.3-12, insert "FSAR," before "Chapter 7" for Reference 4, and replace "Chapter 7" by "Section (7.x.y)" to identify the specific location of the item referred to in the FSAR.

In the APWR Bases, B 3.3.4, REFERENCES, page B 3.3.4-4, insert "FSAR," before "Chapter 7" for Reference 4, and replace "Chapter 7" by "Section (7.x.y)" to identify the specific location of the item referred to in the FSAR.

In the APWR Bases, B 3.3.5, REFERENCES, page B 3.3.5-7, insert "FSAR," before "Chapter 8" for Reference 1, and replace "Chapter 8" by "Section (8.x.y)" to identify the specific location of the item referred to in the FSAR.

In the APWR Bases, B 3.3.6, REFERENCES, page B 3.3.6-12, insert "FSAR," before "Chapter 7" for Reference 3, and replace "Chapter 7" by "Section (7.x.y)" to identify the specific location of the item referred to in the FSAR.

The additional information is needed to ensure the accuracy and completeness of the APWR Bases.

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**ANSWER:**

As for Reference 2 on page B3.3.1-51, this reference was detailed to incorporate the comments in QUESTION No. 16-297 at DCD Rev. 2 (FSAR Section 7.2).

As for Reference 3 on page B3.3.1-51, "FSAR" was inserted before "Chapter 15" in DCD Rev. 2. However, the specific section of Chapter 15 was not added, because this refers to all of Chapter 15, not to a specific section.

As for Reference 9 on page B3.3.1-51, this reference was detailed to incorporate the comments in QUESTION No. 16-297 at Rev. 2 (FSAR Section 6.2.1).

As for Reference 2 on page B3.3.2-57, this reference was detailed to incorporate the comments in QUESTION No. 16-297 at Rev. 2 (FSAR Section 7.3.1). At the DCD Rev. 4, this reference will be changed to “FSAR Section 7.3.”

As for Reference 3 on page B3.3.2-57, "FSAR" was inserted before "Chapter 15" in DCD Rev. 2. However, the specific section of Chapter 15 was not added, because this refers to all of Chapter 15, not to a specific section.

As for Reference 8 on page B3.3.2-57, this reference was detailed to incorporate the comments in QUESTION No. 16-297 at DCD Rev. 2 (FSAR Section 8.3.1). It is noted that the amended response to this RAI, dated July 3, 2009, stated that Reference 8 was not necessary and would be deleted from the References Section of Bases B 3.3.2. However, this was incorrect; DCD Rev. 2 has been updated as stated above. At the DCD Rev. 4 this Reference 8 for FSAR Section 8.3.1 will be removed and newly added the reference for MUAP-09021-P, Revision 2, “Response Time of Safety I&C System.”

As for Reference 10 on page B3.3.2-57, this reference was deleted from the text on page B 3.3.2-5 and from the reference list in DCD Rev. 2, because Chapter 6 has nothing to do with description in fourth paragraph of page B3.3.2-5.

As for Reference 4 in page B3.3.3-12, this reference was detailed to incorporate the comments in QUESTION No. 16-297 at DCD Rev. 2 (FSAR Section 7.5).

As for Reference 4 in page B3.3.4-4, this reference was detailed to incorporate the comments in QUESTION No. 16-297 at DCD Rev. 2 (FSAR Section 7.4.1).

As for Reference 1 in page B3.3.5-7, this reference was detailed to incorporate the comments in

QUESTION No. 16-297 at DCD Rev. 2 (FSAR Section 8.3.1).

As for Reference 3 in page B3.3.6-12, this reference was detailed to incorporate the comments in QUESTION No. 16-297 at DCD Rev. 2 (FSAR Section 7.8).

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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| **RAI NO.:** | **NO. 167-1769 REVISION 0** |
| **SRP SECTION:** | **16 - TECHNICAL SPECIFICATIONS** |
| **APPLICATION SECTION:** | **16** |
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**QUESTION NO.: 16-209**

LCO 3.3.1, RTS Instrumentation

Provide the additional information and any changes necessary to explain and correct potential discrepancies associated with Allowable Value criteria for the High Power Range Neutron Flux Rate Functions.

The APWR GTS, Table 3.3.1-1, High Power Range Neutron Flux Rate, Positive and Negative Rate Functions, page 3.3.1-14, specify their Allowable Values in terms of "[ ] percent RTP," while the associated APWR Trip Setpoints are specified in terms of "[ ] percent RTP with time constant ≥ [ ] sec." The WOG STS, Table 3.3.1-1, Power Range Neutron Flux Rate, High Positive and Negative Rate Functions, page 3.3.1-15, specify the same "[ ] percent RTP with time constant ≥ [ ] sec" criteria for the Nominal Trip Setpoint Values as well as the Allowable Values. Determine the correct Allowable Value criteria and correct any potential discrepancies in the APWR GTS, Table 3.3.1-1. Include any discussions necessary to ensure a clear understanding of the Allowable Value criteria for the High Power Range Neutron Flux Rate Functions.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS.

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**ANSWER:**

Allowable Values (AV) are not included for Time Constants because the Time Constants in the PSMS have no potential for drift. The PSMS MELTAC controllers employ Time Constants that are installed as non-volatile digital values and processed through digital algorithms. Therefore, the time response of all digital PSMS functions has no potential for variation due to time, environmental drift or component aging. PSMS Time Constants are set at the nominal values assumed in the safety analysis. These Time Constant values are confirmed to be unchanged through two diverse tests (1) the continuous automatic self-testing and (2) the periodic surveillance Memory Integrity Check (MIC). Therefore, there is no need to identify Allowable Values for Time Constants in the Technical Specifications.

In Bases Section 3.3.1 of DCD Rev. 4, the section entitled “Allowable Values and RTS Setpoints” will be revised to describe these non-volatile digital settings. The Bases will be modified in DCD Rev. 4 to clarify that digital Time Constant values are confirmed with no tolerance during the continuous automatic self-testing and the MEMORY INTEGRITY CHECK (MIC). The Bases will also be modified in DCD Rev. 4 to clarify that since the Time Constants have no potential for drift, the response time for the digital portion of the PSMS, which includes Time Constants, is allocated rather than tested.

In addition, DCD Chapter 16 Rev.3 has been revised to reflect Option (3) of DC/COL-ISG-08, “Establish a PTS Section 5.5 or 5.6 Administrative Controls Program or Report”. Thus all Time Constants will be under administrative control within the Setpoint Control Program prepared consistent with DCD Chapter 16 Specification 5.5.21. Therefore, in DCD Rev. 3 all Time Constants have been eliminated from Chapter 16 Tables 3.3.1-1 and 3.3.2-1. For the safety functions that employ Time Constants, the appropriate sections of the Bases in DCD Rev. 4 will be modified to state “The Time Constants for this Function are recorded and maintained in a document established by the Setpoint Control Program (SCP)”.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

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**QUESTION NO.: 16-220**

LCO 3.3.1, RTS Instrumentation

Provide a technical justification for specifying Allowable Values in terms of “Channel Uncertainty Allowances” and validate the “Uncertainty Allowance Numbers.” Provide the additional information and any necessary changes to explain, resolve, and correct any potential discrepancies or inconsistencies associated with Allowable Value Units and “Channel Uncertainty Allowances” in the APWR GTS, Table 3.3.1-1.

The APWR GTS, Table 3.3.1-1, specifies Allowable Values in terms of “Channel Uncertainty Allowances” instead of specific values with “inequality” and “equal to” criteria. The only exceptions to this are Turbine Trip Functions 13.a and 13.b. In addition, the Allowable Value units for various functions are expressed as “percent of span” (Functions 5, 8a, 8b, 9, 12a, 12b, 15a, 15d), “percent of rated flow” (Function 10), and “percent rated pump speed” (Function 11), in lieu of units that are function specific. These are deviations from NUREG-1431. Technically justify the use of “Channel Uncertainty Allowances”, validate the Allowable Values, and make any necessary corrections to the APWR GTS, Table 3.3.1-1. Include any discussions necessary to ensure a clear understanding of the differences between the APWR GTS, Table 3.3.1-1, and the WOG STS, Table 3.3.1-1, with respect to Allowable Value presentation.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS.

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**ANSWER:**

Section B.3.3.1 of DCD Chapter 16 Rev. 4 will be revised to explain that for functions whose setpoints are stored as digital values, there is no setpoint drift and therefore no Allowable Value tolerance for the setpoint. Digital setpoint values are confirmed by continuous automatic self-testing and periodic Memory Integrity Check (MIC), which confirms software memory integrity. Therefore, the only potential error in the point at which the safety function actuates is related to analog instrument loop uncertainty. Hence, for digital functions Allowable Values are OPERABILITY limits checked during CHANNEL CALIBRATION. The Allowable Value considers the uncertainty terms and the test methods, as defined in the US-APWR Instrument Setpoint Methodology, MUAP-09022.

As explained in MUAP-09022, Section 5.3.2, RTS Instrumentation Allowable Values, for functions where setpoints are digital values, are expressed in terms of two sided "Channel Uncertainty Allowances" instead of specific values with inequality signs, because the CHANNEL CALIBRATION encompasses all functions of the channel (i.e., trip functions that actuate on both increasing and decreasing value conditions). The AV is established by selecting the most limiting accuracy requirement for all functions. Even though some functions may actuate on only an increasing or decreasing condition, the method of confirming a two sided OPERABILITY limit is maintain for all channels for consistency of maintenance and testing, and thereby avoidance of human error. This standard methodology checks all channels at five calibration settings (0%, 25%, 50%, 75% and 100% of span). Therefore, the AV is normally expressed as a two-sided "% of span". However, AV may also be expressed on other two-sided percentages, such as "% of rated flow" or "% of rated pump speed" to reflect the actual instrument application and test conditions.

In addition, DCD Chapter Rev.3 has been revised to reflect Option (3) of DC/COL-ISG-08, "Establish a PTS Section 5.5 or 5.6 Administrative Controls Program or Report". Thus all Nominal Trip Setpoints and Allowable Values will be under administrative control within the Setpoint Control Program prepared consistent with DCD Chapter 16 Specification 5.5.21. Therefore, in DCD Rev.3 all Nominal Trip Setpoints and Allowable Values have been eliminated from Chapter 16 Tables 3.3.1-1, 3.3.2-1 and 3.3.6-1. The appropriate sections of the Bases in DCD Rev. 4 will be modified to state "The Allowable Value is recorded and maintained in a document established by the Setpoint Control Program (SCP)".

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

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**QUESTION NO.: 16-228**

LCO 3.3.1, RTS Instrumentation

Provide the additional information and any changes necessary to explain and correct potential discrepancies associated with the BACKGROUND section of the APWR Bases.

The APWR Bases, BACKGROUND, page B 3.3.1-2 (bottom paragraph), states that "[t]he Allowable Value specified in Table 3.3.1-1 serves as the LSSS such that a channel is OPERABLE if the channel accuracy is found not to exceed the Allowable Value during CHANNEL CALIBRATION."

In addition, the APWR Bases, BACKGROUND, Allowable Values and RTS Setpoints, page B 3.3.1-5 (bottom paragraph), states that "[t]he Trip Setpoint entered into the digital bistable is more conservative than that specified by the Analytical Limit (LSSS) to account for measurement errors detectable by the CHANNEL CALIBRATION. The Allowable Value serves as the Technical Specification OPERABILITY limit for the purpose of the CHANNEL CALIBRATION."

The APWR Bases statement references to CHANNEL CALIBRATION have replaced references to CHANNEL OPERATIONAL TEST (COT) in corresponding statements of the WOG Bases. The definition for CHANNEL OPERATIONAL TEST in the APWR GTS and WOG STS both state that "[t]he COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy." Neither definition for CHANNEL CALIBRATION in the APWR GTS or the WOG STS discusses setpoints in any way. Determine the correct surveillance reference and make any necessary corrections to the APWR Bases. Include any discussions necessary to ensure a clear understanding of the differences between CHANNEL CALIBRATIONS and CHANNEL OPERATIONAL TESTS with respect to setpoint specifics.

Also, it appears that the accuracy/intent of both APWR Bases statements may have been affected by the following changes made to the original statements in the WOG Bases:

- In the first Bases statement referenced above, "channel accuracy" replaced the word "setpoint" in the WOG Bases, page B 3.3.1-2 (last paragraph). A "setpoint" is a specific number that can be readily compared to an Allowable Value, whereas "channel accuracy" is a measure of closeness or indication of instrumentation performance. Comparisons are typically not drawn between Allowable Values and "channel accuracies."
- In the second Bases statement, "Analytical Limit" replaced the reference to "Allowable Value" in the WOG Bases, page B 3.3.1-6 (first paragraph). An Analytical Limit is the limit

of a process variable at which a safety action is initiated to ensure that a Safety Limit is not exceeded. Every setpoint calculated is set conservatively with respect to the Analytical Limit. The statement should convey that the ESFAS Trip Setpoint entered into the digital bistable is more conservative than the Allowable Value (the OPERABILITY limit) to ensure that OPERABILITY is not inadvertently challenged.

Validate the Bases statements and make any necessary changes.

The additional information is needed to ensure the accuracy, completeness, and consistency of the APWR Bases.

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**ANSWER:**

Section B.3.3.1 of DCD Rev. 4 will be revised to explain that for functions where setpoints are digital values, there is no setpoint drift and therefore no allowable value tolerance for the setpoint. Digital setpoint values are confirmed by continuous automatic self-testing and periodic MEMORY INTEGRTY CHECK (MIC), which confirms software integrity. Therefore, the only potential error in the point at which the safety function actuates is related to analog instrument loop uncertainty. Hence, for digital functions Allowable Values are OPERABILITY limits checked during CHANNEL CALIBRATION instead of COT.

It is noted that in the US-APWR DCD Chapter 16 Rev. 4, COT will be replaced by MEMORY INTEGRITY CHECK (MIC) to confirm the software memory integrity which includes Nominal Trip Setpoints. (Refer to the response to RAI 16-230 for the replacing of COT by MIC).

The Allowable Value considers the uncertainty terms and the test methods, as defined in the US-APWR Instrument Setpoint Methodology, MUAP-09022. As explained in MUAP-09022, Section 5.3.2, RTS Instrumentation Allowable Values for functions where setpoints are digital values are expressed in terms of two sided “Channel Uncertainty Allowances” instead of specific values with inequality signs, because the CHANNEL CALIBRATION encompasses all functions of the channel (i.e., trip functions that actuate on both increasing and decreasing value conditions). The AV is established by selecting the most limiting accuracy requirement for all functions of the channel. Even though some functions may actuate on only an increasing or decreasing condition, the method of confirming a two sided OPERABILITY limit is maintained for all channels for consistency of maintenance and testing, and thereby avoidance of human error.

Since the US-APWR AV, for functions where setpoints are digital values, is applied to the “channel accuracy” confirmed during CHANNEL CALIBRATION, it is not appropriate to correlate the AV to the Nominal Trip Setpoint in the Bases description. Although the AV could be correlated to the Nominal Trip Setpoint for functions where the setpoint is within a binary sensor, the same section of the Bases applies to all PSMS setpoints (i.e., both digital setpoints and binary sensor setpoints). Therefore, in DCD Rev. 4, the appropriate Sections of the Bases will be revised to clarify that the Nominal Trip Setpoint entered into the digital bistable or binary sensor is more conservative than that specified by the Analytical Limit, and the Nominal Trip Setpoint accounts for measurement errors detectable by the CHANNEL CALIBRATION and other unmeasurable errors (such as the effects of anticipated environmental conditions), which are both considered in the Allowable Value for CHANNEL CALIBRATION.

In addition, DCD Chapter 16 Rev. 3 has been revised to reflect Option (3) of DC/COL-ISG-08, “Establish a PTS Section 5.5 or 5.6 Administrative Controls Program or Report”. Thus all Nominal Trip Setpoints and Allowable Values will be under administrative control within the Setpoint Control Program prepared consistent with DCD Chapter 16 Specification 5.5.21. Therefore, in DCD Rev. 3 all Nominal Trip Setpoints and Allowable Values have been eliminated from Chapter 16 Tables 3.3.1-1, 3.3.2-1 and 3.3.6-1. The appropriate sections of the Bases in DCD Rev. 4 will be modified to state “The Allowable Value is recorded and maintained in a document established by the Setpoint Control Program (SCP)”.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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**SRP SECTION:** **16 - TECHNICAL SPECIFICATIONS**

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**QUESTION NO.: 16-230**

LCO 3.3.1, RTS Instrumentation

Provide a technical justification that explains how the CHANNEL OPERATIONAL TEST (COT) surveillance requirement specified for Reactor Trip System (RTS) Functions in Table 3.3.1-1, ensures that those functions are adequately tested.

The APWR GTS, Table 3.3.1-1, specifies the performance of a CHANNEL OPERATIONAL TEST surveillance requirement in accordance with SR 3.3.1.7 for RTS Functions 2.a, 2.b, 3.a, 3.b, 4, 5, 6, 7, 8.a, 8.b, 9, 10, 11, 12.a, 12.b, 15.a, 15.c, and 15.d. The Channel Operational Test as originally defined in NUREG -1431, has been revised under the APWR GTS to accommodate aspects of the fully digital MELTAC I&C platform design.

The APWR GTS Channel Operational Test for the Protection and Safety Monitoring System (PSMS), consists of a software memory integrity check. This is an adaptation of the NUREG-1431 definition, which is a verification of channel device operability based on the injection of a simulated or actual signal into the channel as close to the sensor as practicable, including the adjustment of setpoints required for operability. It is unclear how the performance of a software memory integrity check is equivalent to verifying the operability of all devices in the channel required for channel operability, and the adjustment of setpoints. Does a software memory integrity check satisfy the same or similar requirements for digital equipment that a Channel Operational Test is required to satisfy for analog equipment? Are the two functionally equivalent?

Provide a technical justification that explains how a software memory integrity check satisfies the requirements of a Channel Operational Test for each of the above referenced RTS Functions. Include any discussions necessary to ensure a clear understanding of Channel Operational Test criteria and how that criteria applies to the digital Protection and Safety Monitoring System.

The technical justification is needed to ensure that Reactor Trip Functions are being properly surveilled under the MELTEC digital I&C platform design, and that Channel Operational Test criteria can be applied to digital, as well as analog equipment.

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**ANSWER:**

In the conventional analog system, the CHANNEL CALIBRATION checks the function operability from the instrument up to the input of the analog signal processing electronics. The COT checks the analog signal processing electronics. The ACTUATION LOGIC TEST checks the binary electronics. The COT overlaps with the CHANNEL CALIBRATION by signal injection at the input to the analog signal processing electronics. The ACTUATION LOGIC TEST overlaps with the TADOT at the actuation output.

In the digital PSMS, the CHANNEL CALIBRATION checks the function operability from the instrument through all digital processing up to the digital VDU. Similarly, the TADOT checks the operability from the digital VDU (or conventional switches) through the digital processing to the final actuated devices. The same digital processing required for the CHANNEL CALIBRATION and TADOT are also required for the automated trip function at the required setpoint. However, there is additional digital processing for the automated trip function that is not required for the CHANNEL CALIBRATION or TADOT, such as the inter-division digital data communication to perform voting logic. All digital processing, including this additional digital processing, is continuously self-tested. The continuous automatic self-testing overlaps with the CHANNEL CALIBRATION and TADOT.

In addition to checking specific PSMS functions, the CHANNEL CALIBRATION and TADOT manually confirm that the digital processing within the PSMS is being performed correctly. These test confirm that every PSMS controller can execute program memory instructions for both the basic and the application software. The MEMORY INTEGRITY CHECK (MIC) provides a diverse bit-by-bit check of the entire software memory of the PSMS controllers, including the memory that controls all continuous automatic self-testing, the memory that controls the automated trip logic functions, and the memory that contains all setpoints, time delays and time constants. Through this overlap of the continuous automatic self-testing and manual surveillance testing, including the MIC, the CHANNEL CALIBRATION and the TADOT, all safety functions of the PSMS are completely tested. As stated in MUAP-07004, “This test confirms the functional integrity of PSMS software applications without the need to perform functional logic tests”.

For the digital system, the continuous automatic self-testing and the diverse MIC cover the confirmation of the setpoint and the bistable the same as in the conventional analog system (COT in WOG STS).

Similarly, for the digital system the continuous automatic self-testing and the diverse MIC cover the confirmation of the voting logic and automatic actuation signals the same as in the conventional analog system (ACTUATION LOGIC TEST in WOG STS).

As defined in the STS definition, the function of the COT in the STS is to verify OPERABILITY of all devices in the channel required for channel OPERABILITY. As defined in the STS definition, the function of the ACTUATION LOGIC TEST is a verification of required output logic for a given combination of input signals in conjunction with each possible interlock logic state required for operability of a logic circuit.

The Surveillance Requirements section of the Bases in DCD Rev. 4 will be revised to explain that for the PSMS RTS Instrumentation, the complete operability check from the measurement channel input device to the reactor trip breaker is performed by the combination of the continuous automatic self-testing for the digital devices (the RPS and digital communication interfaces), the continuous automatic CHANNEL CHECK, the CHANNEL CALIBRATION, the MIC (for RPS) and the TADOT. The CHANNEL CALIBRATION, the MIC and the TADOT, which are manual tests, overlap with the continuous automatic self-testing and confirm the functioning of those automatic tests.

For the PSMS the continuous automatic self-testing is described in “Safety I&C System Description and Design Process,“ MUAP-07004 Section 4.3 and “Safety System Digital Platform -MELTAC-,“ MUAP-07005 Section 4.1.5. The MIC is described in “Safety I&C System Description and Design Process,” MUAP-07004 Section 4.4.1 and “Safety System Digital Platform

-MELTAC-," MUAP-07005 Section 4.1.4.1.c.

It is noted that in Rev. 4 of the DCD the MIC will replace the COT and ACTUATION LOGIC TEST from DCD Rev. 3. The MIC is the same diverse software memory integrity test as previously described for COT and ACTUATION LOGIC TEST. This change will be made to avoid confusion with COT and ACTUATION LOGIC TEST, which were originally defined in the WOG STS for analog systems. Therefore, in Rev. 4 of the DCD COT will replace COT-Analog and ACTUATION LOGIC TEST will replace ACTUATION LOGIC TEST – Analog. In Rev. 4 of the DCD COT and ACTUATION LOGIC TEST will apply only to the analog DAS, which is comparable to analog systems in the WOG STS.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

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**QUESTION NO.: 16-231**

LCO 3.3.1, RTS Instrumentation

Provide a technical justification that explains how the ACTUATION LOGIC TEST surveillance requirement specified for Reactor Trip System (RTS) Functions in Table 3.3.1-1, ensures that those functions are adequately tested.

The APWR GTS, Table 3.3.1-1, specifies performance of an ACTUATION LOGIC TEST surveillance requirement in accordance with SR 3.3.1.5 for RTS Functions 14, 15.b, and 18. The Actuation Logic Test as originally defined in NUREG -1431, has been revised under the APWR GTS to accommodate aspects of the fully digital MELTAC I&C platform design.

The APWR GTS Actuation Logic Test for the Protection and Safety Monitoring System (PSMS) consists of a software memory integrity check. This is an adaptation of the NUREG-1431 definition, which is a verification of required output logic for a given combination of input signals in conjunction with each possible interlock logic state required for operability of a logic circuit, including at a minimum, a continuity check of output devices. It is unclear how the performance of a software memory integrity check is equivalent to a comprehensive test of the logic and a continuity check of output devices. Does a software memory integrity check satisfy the same or similar requirements for digital equipment that an Actuation Logic Test is required to satisfy for analog equipment? Are the two functionally equivalent?

Provide a technical justification that explains how a software memory integrity check satisfies the requirements of an Actuation Logic Test for each of the above referenced RTS Functions. Include any discussions necessary to ensure a clear understanding of Actuation Logic Test criteria and how that criteria applies to the digital Protection and Safety Monitoring System.

The technical justification is needed to ensure that Reactor Trip Functions are being properly surveilled under the MELTEC digital I&C platform design, and that Actuation Logic Test criteria can be applied to digital, as well as analog equipment.

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**ANSWER:**
See the answer to No.16-230.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

# RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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**QUESTION NO.: 16-232**

LCO 3.3.1, RTS Instrumentation

Provide a technical justification that explains how the CHANNEL CALIBRATION surveillance requirements specified for Reactor Trip System (RTS) Functions in Table 3.3.1-1, ensure that those functions are adequately tested.

The APWR GTS, Table 3.3.1-1, specifies performance of a CHANNEL CALIBRATION surveillance requirement in accordance with SR 3.3.1.9, SR 3.3.1.10, and SR 3.3.1.11 for RTS Functions 2.a, 2.b, 3.a, 3.b, 4, 5, 6, 7, 8.a, 8.b, 9, 10, 11, 12.a, 12.b, 13.a, 13.b, 15.a, 15.c, and 15.d. The Channel Calibration as originally defined in NUREG -1431, has been revised under the APWR GTS to accommodate aspects of the fully digital MELTAC I&C platform design.

The APWR GTS extends the application of a Channel Calibration to binary measurements. Under this application, a Channel Calibration confirms the accuracy of the channel's state change. This is an adaptation of the NUREG-1431 definition, which consists of an adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter that the channel monitors. It is unclear how confirming the accuracy of a channel's state change meets the intent of the NUREG-1431 definition for a Channel Calibration. Are the two functionally equivalent? Can Channel Calibration criteria be applied to binary measurements?

Provide a technical justification that explains how confirming the accuracy of a channel's state change constitutes performance of a Channel Calibration. Include any discussions necessary to ensure a clear understanding of Channel Calibration criteria as it relates to binary measurements. Describe how analog and binary Channel Calibration surveillance requirements are integrated to ensure that each of the above referenced RTS Functions are adequately tested.

The technical justification is needed to ensure that Reactor Trip Functions are being properly surveilled under the MELTEC digital I&C platform design, and that Channel Calibration criteria can be applied to binary, as well as analog measurements.

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**ANSWER:**

In the GTS, the category of binary measurements is applied to the functions whose setpoints are stored in the binary device itself (i.e. sensor itself). For these functions, sensor output (i.e. binary states) interface to the PSMS binary input module. The category of analog measurements is applied to the functions whose setpoints are stored in the PSMS as the digital values. For these functions, sensor output (i.e. measured value) interface to the PSMS analog input module.

According to the description above, in the GTS the RTS functions “Turbine Trip - Turbine Emergency Trip Oil Pressure” and “Turbine Trip - Main Turbine Stop Valve Position” are categorized as binary measurements.

For both analog and binary measurements CHANNEL CALIBRATION includes “an adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter that the channel monitors.” For both devices, this is accomplished by stimulating the measuring device to represent varying process conditions and then confirming that the output response of the device accurately represents those process conditions. For both devices this confirmation is accomplished by reading the output response of the device on visual display units that are driven by the digital system that processes the measurement value. Therefore, the CHANNEL CALIBRATION confirms the accuracy of the complete processing of the measurement from the sensor through all digital processing.

The only difference between CHANNEL CALIBRATION for analog and binary measurements is as follows: For analog measurements the channel accuracy is checked at five calibration settings corresponding to 0%, 25%, 50%, 75% and 100% of the instrument range. For binary measurements the channel accuracy is checked at the single required automatic actuation setpoint.

For analog measurements multiple accuracy measurements are needed because the channel is used by operators for indication over its entire range, and there are often multiple automatic actuation setpoints. Checking at the same five calibration settings for all analog measurements ensures those setpoints are encompassed, while providing a standard CHANNEL CALIBRATION method for all analog instruments.

Binary measurements are used to alarm and actuate automatic functions only at a single setpoint. Therefore, for binary measurements a single accuracy check is sufficient to ensure the system correctly performs its safety function.

The definition for CHANNEL CALIBRATION will be revised in DCD Rev. 4 to clearly state that confirmation is for the entire channel, from sensor to digital Visual Display Unit (VDU) readout, not just the binary state change. In addition, DCD Rev. 4 will clarify that the digital value read on the VDU originates in the controller that processes the trip, actuation or interlock functions and is the same digital value processed within those safety algorithms. The CHANNEL CALIBRATION overlaps with other surveillance requirements to adequately test the PSMS safety functions. Also, Specification 5.5.21 Setpoint Control Program in DCD Rev. 4 will be revised to clearly define the CHANNEL CALIBRATION for the binary sensors.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

**RAI NO.:** **NO. 167-1769 REVISION 0**

**SRP SECTION:** **16 - TECHNICAL SPECIFICATIONS**

**APPLICATION SECTION:** **16**

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**QUESTION NO.: 16-233**

LCO 3.3.1, RTS Instrumentation

Provide a technical justification that explains how the TRIP ACTUATING DEVICE OPERATIONAL TEST (TADOT) surveillance requirement specified for Reactor Trip System (RTS) Functions in Table 3.3.1-1, ensures that those functions are adequately tested.

The APWR GTS, Table 3.3.1-1, specifies performance of a TRIP ACTUATING DEVICE OPERATIONAL TEST surveillance requirement in accordance with SR 3.3.1.4 and SR 3.3.1.12 for RTS Functions 1, 13.a, 13.b, and 17. The Trip Actuating Device Operational Test as originally defined in NUREG -1431, has been revised under the APWR GTS to accommodate aspects of the fully digital MELTAC I&C platform design.

The APWR GTS Trip Actuating Device Operational Test does not include provisions for adjustment of the trip actuating device so that it actuates at the required setpoint, and is therefore typically applicable only to binary devices that are not subject to drift. This is an adaptation of the NUREG-1431 definition which states that “[t]he TADOT shall include adjustment, as necessary, of the trip actuating device.” It is unclear why the requirement to perform adjustments has been excluded from the TADOT. Has the intent of the surveillance requirement been compromised for certain functions due to the elimination of previously required adjustments? If, as stated in the APWR GTS definition, a TADOT is typically applicable only to binary devices that are not subject to drift, is there a potential for adjustable binary and non-binary trip actuating devices subject to drift, to have their requirements for adjustments overlooked due to being excluded from a surveillance requirement that previously ensured actuation at a required setpoint through periodic adjustment?

Provide a technical justification that explains how a TADOT without provisions for performing adjustments of trip actuating devices, ensures that each of the above referenced RTS Functions are adequately tested and that device operability is not compromised. Include any discussions necessary to ensure a clear understanding of Trip Actuating Device Operational Test criteria and how that criteria applies to RTS trip actuating devices.

The technical justification is needed to ensure that Reactor Trip Functions are being properly surveilled under the MELTEC digital I&C platform design, and that Trip Actuating Device Operational Test criteria is being properly applied.

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**ANSWER:**

The same tests required by NUREG-1431 are also required for the US-APWR. However, for human factors consistency, and thereby to avoid human performance error, TADOT has been limited to binary devices with no drift potential, such as Manual Initiation switches. For these devices, the TADOT confirms only the state change operability (i.e., there is no setpoint or timing accuracy confirmation needed). The TADOT also includes maintenance as necessary, based on manufacture's recommendation, to maintain device reliability.

Binary devices with drift potential are tested by CHANNEL CALIBRATION or RESPONSE TIME tests. The CHANNEL CALIBRATION confirms the accuracy of the device's binary state change with regard to its trip setpoint requirement (i.e., the Allowable Value), as explained in the response to Question 16-232. The RESPONSE TIME test confirms the accuracy of the devices state change with regard to its trip timing requirement. For some binary devices with drift potential, a TADOT is specified in addition to the CHANNEL CALIBRATION and/or RESPONSE TIME test. The TADOT is specified on a more frequent basis than the CHANNEL CALIBRATION or RESPONSE TIME test, to confirm the state change operability of the devices, without checking its state change setpoint or timing accuracy. Checking the setpoint or timing accuracy more frequently than the CHANNEL CALIBRATION or RESPONSE TIME test interval is unnecessary, because the total channel uncertainty, including setpoint and/or timing drift between test intervals, is included in determination of the Nominal Trip Setpoint, the Allowable Value and the response time requirement.

Therefore, although the tests are indentified differently than in NUREG-1431, the same tests are conducted.

The TADOT and RESPONSE TIME definitions will be clarified in DCD Rev. 4 as explained above to address accuracy and adjustments.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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**QUESTION NO.: 16-238**

LCO 3.3.1, RTS Instrumentation

Provide the additional information and any changes necessary to explain and correct a potential discrepancy identified in the APPLICABLE SAFETY ANALYSES, LCO and APPLICABILITY section of the APWR Bases.

The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, page B 3.3.1-7 (bottom paragraph), states that "[a] channel is OPERABLE provided the "as-found" accuracy value does not exceed its associated Allowable Value." The comparable statement in the WOG Bases, page B 3.3.1-8 (bottom paragraph), states that "[a] channel is OPERABLE with a trip setpoint value outside its calibration tolerance band provided the trip setpoint "as-found" value does not exceed its associated Allowable Value …"

it appears that the accuracy/intent of the APWR Bases statement may have been affected by use of the phrase "as-found accuracy value" as opposed to "trip setpoint as-found value" in the WOG Bases. A "setpoint" is a specific number that can be readily compared to an Allowable Value, whereas an "accuracy value" is a measure of closeness or indication of instrumentation performance. Comparisons are typically not drawn between Allowable Values and "accuracy values". Validate the Bases statement and make any necessary changes.

The additional information is needed to ensure the accuracy, completeness, and consistency of the APWR Bases.

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**ANSWER:**

The US-APWR has analog measurements with digital setpoints for most protective functions. However, there are some protective functions that utilize conventional binary measurements with binary setpoints (e.g., Turbine Emergency Trip Oil Pressure). For analog measurements the AV pertains to the calibration settings, not the trip setpoint, as explained in the response to RAI-SRP-16-CTSB-1769/220. For binary measurements the AV pertains to the binary state change, which is the trip setpoint. Therefore this text was revised from the STS to apply to both analog measurements and binary measurement for the US-APWR. However, MHI understands the confusion introduced by discussing "accuracy" within the context of AV. Therefore, the Bases in DCD Rev. 4 will be revised to explain that a channel is OPERABLE provided the "as-found" value, measured during surveillance testing, does not exceed its associated Allowable Value, and provided the “as-left” value is within the specified calibration tolerance at the completion of each CHANNEL CALIBRATION.

This answer is also applied to No.16-275.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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**QUESTION NO.: 16-241**

LCO 3.3.2, ESFAS Instrumentation

Provide the additional information and any changes necessary to explain and correct potential discrepancies associated with footnote (b) in the APWR GTS, Table 3.3.1-2.

The APWR GTS, Table 3.3.1-2, Functions 1.e, 4.d(1) and 4.d(2) , do not specify footnote (b) for the Allowable Values. Footnote (b) is specified for the associated APWR GTS, Trip Setpoints, and also for the Allowable Values and Trip Setpoints of the comparable functions in the WOG STS. In addition, footnote (b) is located inside the brackets of the APWR GTS, Trip Setpoints for each of these functions. Footnote (b) is located outside of the bracketed values for each of the comparable functions in the WOG STS. Determine footnote applicability regarding the Allowable Values and ensure proper footnote placement. Make any necessary changes to the APWR GTS, Table 3.3.1-2.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS.

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**ANSWER:**

Note that this question cites Table 3.3.1-2. However, due to the context of the question, it is clear that the question intends to reference Table 3.3.2-1.

<u>Allowable Value for Time Constants</u>
In the WOG STS footnote (b) is referenced in both columns of Table 3.3.2-1 to define the Time Constant setpoints and Allowable Values. The reference to footnote (b) for the US-APWR GTS Time Constant setpoints is equivalent to the WOG STS reference to footnote (b). However, for the US-APWR there is no Allowable Value for the Time Constant, therefore a reference to footnote (b) from the Allowable Value column of Table 3.3.2-1 would not be appropriate.

This is because for the US-APWR PSMS the Time Constants are stored as digital values. There is no potential for Time Constant drift and therefore no Allowable Value tolerance for the Time Constant. Therefore, in the US-APWR Chapter 16 Rev. 1 footnote (b) was referenced only to define the digital Time Constant setpoint, not the Allowable Value tolerance for that setpoint.

In Bases Section 3.3.2 DCD Rev. 4, the section entitled “Allowable Values and ESFAS Setpoints” will be revised to describe these non-volatile digital settings. The Bases will be modified in DCD Rev. 4 to clarify that digital Time Constant values are confirmed with no tolerance during the continuous automatic self-testing and the MEMORY INTEGRITY CHECK (MIC). The Bases will also be modified in DCD Rev. 4 to clarify that since the Time Constants have no potential for drift, the response time for the digital portion of the PSMS, which includes Time Constants s, is allocated rather than tested.

<u>Bracketed Footnotes</u>
In DCD Rev. 1 the reference to footnote (b) was incorrectly located inside the bracket of the Nominal Trip Setpoint for Function 1.e. The reference to footnotes (b) and (g) for the Nominal Trip Setpoint of Functions 4.d(1) and 4.d(2) were also incorrectly located inside the brackets. The footnotes (b) and (g) for Functions 1.e, 4.d(1) and 4.d(2) were moved outside the bracket of “Nominal Trip Setpoint” in Table 3.3.2-1 of in DCD Rev. 2, because the Time Constant does not depend on the site specific design.

In addition, DCD Chapter 16 Rev.3 has been revised to reflect Option (3) of DC/COL-ISG-08, “Establish a PTS Section 5.5 or 5.6 Administrative Controls Program or Report”. Thus all Time Constants will be under administrative control within the Setpoint Control Program prepared consistent with DCD Chapter 16 Specification 5.5.21. Therefore, in DCD Rev. 3 all Time Constants have been eliminated from Chapter 16 Tables 3.3.1-1 and 3.3.2-1. For the safety functions that employ Time Constants, the appropriate sections of the Bases in DCD Rev. 4 will be modified to state “The Time Constants for this Function are recorded and maintained in a document established by the Setpoint Control Program (SCP)”.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

**RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION**

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**QUESTION NO.: 16-242**

LCO 3.3.2, ESFAS Instrumentation

Provide a technical justification for specifying Allowable Values in terms of “Channel Uncertainty Allowances” and validate the “Uncertainty Allowance Numbers.” Provide the additional information and any changes necessary to explain, resolve, and correct any potential discrepancies or inconsistencies associated with “Channel Uncertainty Allowances” and Allowable Value/Trip Setpoint units in the APWR GTS, Table 3.3.2-1.

The APWR GTS, Table 3.3.2-1, specifies Allowable Values in terms of “Channel Uncertainty Allowances” instead of specific values with “inequality” and “equal to” criteria. In addition, the Allowable Value units are expressed as “percent of span” for Functions 1.c, 1.d, 1.e, 2.c, 4.c, 4.d(1), 4.d(2), 5A.a, 5B.c, 6.c, 6.e, 7.c, 7.d, 8.c, 9.c, 11.b, 12.e, 13.c(1), 13.c(2), 13.c(3), and the Trip Setpoint units are expressed as “percent of span” for Functions 5B.c, 6.c, 7.c, 8.c, 9.c, in lieu of units that are function specific. These are deviations from NUREG-1431. Technically justify the use of “Channel Uncertainty Allowances”, validate the Allowable Values, and determine appropriate units for the referenced function Allowable Values and Trip Setpoints. Make any necessary corrections to the APWR GTS, Table 3.3.2-1. Include any discussions necessary to ensure a clear understanding of the differences between the APWR GTS, Table 3.3.2-1, and the WOG STS, Table 3.3.2-1, with respect to Allowable Value presentation.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS.

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**ANSWER:**

For Allowable Values see the answer to No.16-220 which addresses this same issue for LCO 3.3.1. There are no changes to that response for LCO 3.3.2. Section B.3.3.2 of DCD Chapter 16 Rev. 4 will be revised with the same explanation as Section B.3.3.1.

For the Trip Setpoints associated with Functions 5B.c, 6.c, 7.c, 8.c, 9.c, “percent of span” refers to the span of the transmitters. This is an appropriate unit because the unit is consistent with the unit used in Chapter 7. This is also consistent with the STS, which expresses the setpoint in percent of transmitter span, although the STS does not clearly state this.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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**QUESTION NO.: 16-270**

LCO 3.3.2, ESFAS Instrumentation

Provide a technical justification that explains how the CHANNEL OPERATIONAL TEST (COT) surveillance requirement specified for Engineered Safety Feature Actuation System (ESFAS) Instrumentation Functions in Table 3.3.2-1, ensures that those functions are adequately tested.

The APWR GTS, Table 3.3.2-1, specifies the performance of a CHANNEL OPERATIONAL TEST surveillance requirement in accordance with SR 3.3.2.3 for ESFAS Functions 1.c, 1.d, 1.e, 2.c, 4.c, 4.d(1), 4.d(2), 5A.a, 5B.c, 6.c, 7.c, 7.d, 8.c, 9.c, 11.b, 12.e, 13.c(1), 13.c(2), and 13.c(3). The Channel Operational Test as originally defined in NUREG -1431, has been revised under the APWR GTS to accommodate aspects of the fully digital MELTAC I&C platform design.

The APWR GTS Channel Operational Test for the Protection and Safety Monitoring System (PSMS), consists of a software memory integrity check. This is an adaptation of the NUREG-1431 definition, which is a verification of channel device operability based on the injection of a simulated or actual signal into the channel as close to the sensor as practicable, including the adjustment of setpoints required for operability. It is unclear how the performance of a software memory integrity check is equivalent to verifying the operability of all devices in the channel required for channel operability, and the adjustment of setpoints. Does a software memory integrity check satisfy the same or similar requirements for digital equipment that a Channel Operational Test is required to satisfy for analog equipment? Are the two functionally equivalent?

Provide a technical justification that explains how a software memory integrity check satisfies the requirements of a Channel Operational Test for each of the above referenced ESFAS Functions. Include any discussions necessary to ensure a clear understanding of Channel Operational Test criteria and how that criteria applies to the digital Protection and Safety Monitoring System.

The technical justification is needed to ensure that ESFAS Instrumentation Functions are being properly surveilled under the MELTEC digital I&C platform design, and that Channel Operational Test criteria can be applied to digital, as well as analog equipment.

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**ANSWER:**

See answer to No.16-230. However the following paragraph is modified from the response to No. 16-230 for LCO 3.3.1, to accommodate LCO 3.3.2, ESFAS Instrumentation:

> The Surveillance Requirements section of the Bases in DCD Rev. 4 will be revised to explain that for the PSMS ESFAS Instrumentation, the complete operability check from the measurement channel input device to the SLS output device is performed by the combination of the continuous automatic self-testing for the digital devices (S-VDU processors, RPS, ESFAS, SLS and digital communication interfaces), the continuous automatic CHANNEL CHECK, the CHANNEL CALIBRATION, the MIC (for S-VDU processors, RPS, ESFAS and SLS), and the TADOT. The CHANNEL CALIBRATION, the MIC, and the TADOT, which are manual tests, overlap with the continuous automatic self-testing and confirm the functioning of the continuous automatic self-testing.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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**QUESTION NO.: 16-271**

LCO 3.3.2, ESFAS Instrumentation

Provide a technical justification that explains how the ACTUATION LOGIC TEST surveillance requirement specified for Engineered Safety Feature Actuation System (ESFAS) Instrumentation Functions in Table 3.3.2-1, ensures that those functions are adequately tested.

The APWR GTS, Table 3.3.2-1, specifies performance of an ACTUATION LOGIC TEST surveillance requirement in accordance with SR 3.3.2.2 for ESFAS Functions 1.b, 2.b, 3.a(2), 3.b(2), 4.b, 5B.b, 6.b, 7.b, 8.b, 9.a, 12.c, and 13.b. The Actuation Logic Test as originally defined in NUREG -1431, has been revised under the APWR GTS to accommodate aspects of the fully digital MELTAC I&C platform design.

The APWR GTS Actuation Logic Test for the Protection and Safety Monitoring System (PSMS), consists of a software memory integrity check. This is an adaptation of the NUREG-1431 definition, which is a verification of required output logic for a given combination of input signals in conjunction with each possible interlock logic state required for operability of a logic circuit, including at a minimum, a continuity check of output devices. It is unclear how the performance of a software memory integrity check is equivalent to a comprehensive test of the logic and a continuity check of output devices. Does a software memory integrity check satisfy the same or similar requirements for digital equipment that an Actuation Logic Test is required to satisfy for analog equipment? Are the two functionally equivalent?

Provide a technical justification that explains how a software memory integrity check satisfies the requirements of an Actuation Logic Test for each of the above referenced ESFAS Functions. Include any discussions necessary to ensure a clear understanding of Actuation Logic Test criteria and how that criteria applies to the digital Protection and Safety Monitoring System.

The technical justification is needed to ensure that ESFAS Instrumentation Functions are being properly surveilled under the MELTEC digital I&C platform design, and that Actuation Logic Test criteria can be applied to digital, as well as analog equipment.

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**ANSWER:**

See the answer to No. 16-230. However the following paragraph is modified from the response to No. 16-230 for LCO 3.3.1, to accommodate LCO 3.3.2, ESFAS Instrumentation:

> The Surveillance Requirements section of the Bases in DCD Rev. 4 will be revised to explain that for the PSMS ESFAS Instrumentation, the complete operability check from the measurement channel input device to the SLS output device is performed by the combination of the continuous automatic self-testing for the digital devices (S-VDU processors, RPS, ESFAS, SLS and digital communication interfaces), the continuous automatic CHANNEL CHECK, the CHANNEL CALIBRATION, the MIC (for S-VDU processors, RPS, ESFAS and SLS), and the TADOT. The CHANNEL CALIBRATION, the MIC, and the TADOT, which are manual tests, overlap with the continuous automatic self-testing and confirm the functioning of the continuous automatic self-testing.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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**QUESTION NO.: 16-272**

LCO 3.3.2, ESFAS Instrumentation

Provide a technical justification that explains how the CHANNEL CALIBRATION surveillance requirements specified for Engineered Safety Feature Actuation System (ESFAS) Instrumentation Functions in Table 3.3.2-1, ensure that those functions are adequately tested.

The APWR GTS, Table 3.3.2-1, specifies performance of a CHANNEL CALIBRATION surveillance requirement in accordance with SR 3.3.2.7 for ESFAS Functions 1.c, 1.d, 1.e, 2.c, 4.c, 4.d(1), 4.d(2), 5A.a, 5B.c, 6.c, 6.e, 7.c, 7.d, 8.c, 9.c, 11.b, 13.e, 13.c(1), 13.c(2), and 13.c(3). The Channel Calibration as originally defined in NUREG -1431, has been revised under the APWR GTS to accommodate aspects of the fully digital MELTAC I&C platform design.

The APWR GTS extends the application of a Channel Calibration to binary measurements. Under this application, a Channel Calibration confirms the accuracy of the channel's state change. This is an adaptation of the NUREG-1431 definition, which consists of an adjustment, as necessary, of the channel output such that it responds within the necessary range and accuracy to known values of the parameter that the channel monitors. It is unclear how confirming the accuracy of a channel's state change meets the intent of the NUREG-1431 definition for a Channel Calibration. Are the two functionally equivalent? Can Channel Calibration criteria be applied to binary measurements?

Provide a technical justification that explains how confirming the accuracy of a channel's state change constitutes performance of a Channel Calibration. Include any discussions necessary to ensure a clear understanding of Channel Calibration criteria as it relates to binary measurements. Describe how analog and binary Channel Calibration surveillance requirements are integrated to ensure that each of the above referenced ESFAS Functions are adequately tested.

The technical justification is needed to ensure that ESFAS Instrumentation Functions are being properly surveilled under the MELTEC digital I&C platform design, and that Channel Calibration criteria can be applied to binary, as well as analog measurements.

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**ANSWER:**

See the answer to No.16-232. However the following paragraph is modified from the response to No. 16-232 for LCO 3.3.1, to accommodate LCO 3.3.2, ESFAS Instrumentation:

> According to the description above, in the GTS the ESFAS function “Emergency Feedwater Actuation - LOOP Signal” is categorized as a binary measurement. It is noted that CHANNEL CALIBRATION is not applicable to the ESFAS function “Emergency Feedwater Actuation - Trip of all Main Feedwater Pumps”, because this function uses breaker position sensing device, which are binary devices with no potential for drift; therefore, only a TADOT is applied for this function.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

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**QUESTION NO.: 16-273**

LCO 3.3.2, ESFAS Instrumentation

Provide a technical justification that explains how the TRIP ACTUATING DEVICE OPERATIONAL TEST (TADOT) surveillance requirement specified for Engineered Safety Feature Actuation System (ESFAS) Instrumentation Functions in Table 3.3.2-1, ensures that those functions are adequately tested.

The APWR GTS, Table 3.3.2-1, specifies performance of a TRIP ACTUATING DEVICE OPERATIONAL TEST surveillance requirement in accordance with SR 3.3.2.4, SR 3.3.2.5, SR 3.3.2.6, and SR 3.3.2.9 for ESFAS Functions 1.a, 1.b, 2.a, 2.b, 3.a(1), 3.a(2), 3.b(2), 4.a, 4.b, 5B.a, 5B.b, 6.a, 6.b, 6.e, 6.f, 7.a, 7.b, 8.a, 8.b, 9.a, 11.a, 12.c, 13.a, and 13.b. The Trip Actuating Device Operational Test as originally defined in NUREG -1431, has been revised under the APWR GTS to accommodate aspects of the fully digital MELTAC I&C platform design.

The APWR GTS Trip Actuating Device Operational Test does not include provisions for adjustment of the trip actuating device so that it actuates at the required setpoint, and is therefore typically applicable only to binary devices that are not subject to drift. This is an adaptation of the NUREG-1431 definition which states that “the TADOT shall include adjustment, as necessary, of the trip actuating device.” It is unclear why the requirement to perform adjustments has been excluded from the TADOT. Has the intent of the surveillance requirement been compromised for certain functions due to the elimination of previously required adjustments? If, as stated in the APWR GTS definition, a TADOT is typically applicable only to binary devices that are not subject to drift, is there a potential for adjustable binary and non-binary trip actuating devices subject to drift, to have their requirements for adjustments overlooked due to being excluded from a surveillance requirement that previously ensured actuation at a required setpoint through periodic adjustment?

Provide a technical justification that explains how a TADOT without provisions for performing adjustments of trip actuating devices, ensures that each of the above referenced ESFAS Functions are adequately tested and that device operability is not compromised. Include any discussions necessary to ensure a clear understanding of Trip Actuating Device Operational Test criteria and how that criteria applies to ESFAS trip actuating devices.

The technical justification is needed to ensure that ESFAS Instrumentation Functions are being properly surveilled under the MELTEC digital I&C platform design, and that Trip Actuating Device Operational Test criteria is being properly applied.

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**ANSWER:**

See the answer to No. 16-233, which address this issue for LCO 3.3.1. There are no changes to that response for LCO 3.3.2. Section B 3.3.2 of DCD Chapter 16 Rev. 4 will be revised with same explanation as Section B 3.3.1.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-274**

LCO 3.3.2, ESFAS Instrumentation

Provide the additional information and any changes necessary to explain and correct potential discrepancies associated with the BACKGROUND section of the APWR Bases.

The APWR Bases, BACKGROUND, page B 3.3.2-1 (bottom paragraph), states that "the Allowable Value is considered a limiting value such that a channel is OPERABLE if the channel accuracy is found not to exceed the Allowable Value during CHANNEL CALIBRATION."

In addition, the APWR Bases, BACKGROUND, Allowable Values and ESFAS Setpoints, page B 3.3.2-3 (bottom paragraph), states that "the ESFAS Trip Setpoint entered into the digital bistable is more conservative than that specified by the Analytical Limit to account for measurement errors detectable by the CHANNEL CALIBRATION. The Allowable Value serves as the Technical Specification OPERABILITY limit for the purpose of the CHANNEL CALIBRATION."

The APWR Bases statement references to CHANNEL CALIBRATION have replaced references to CHANNEL OPERATIONAL TEST (COT) in corresponding statements of the WOG Bases. The definition for CHANNEL OPERATIONAL TEST in the APWR GTS and WOG STS both state that "the COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for channel OPERABILITY such that the setpoints are within the necessary range and accuracy." Neither definition for CHANNEL CALIBRATION in the APWR GTS or the WOG STS discusses setpoints in any way. Determine the correct surveillance reference and make any necessary corrections to the APWR Bases. Include any discussions necessary to ensure a clear understanding of the differences between CHANNEL CALIBRATIONS and CHANNEL OPERATIONAL TESTS with respect to setpoint specifics.

Also, it appears that the accuracy/intent of both APWR Bases statements may have been affected by the following changes made to the original statements in the WOG Bases:

. • In the first Bases statement referenced above, "channel accuracy" replaced the word "setpoint" in the WOG Bases, page B 3.3.2-1 (bottom paragraph). A "setpoint" is a specific number that can be readily compared to an Allowable Value, whereas "channel accuracy" is a measure of closeness or indication of instrumentation performance. Comparisons are typically not drawn between Allowable Values and "channel accuracies."

. • In the second Bases statement, "Analytical Limit" replaced the reference to "Allowable Value" in the WOG Bases, page B 3.3.2-3 (third paragraph). An Analytical Limit is the limit of a process variable at which a safety action is initiated to ensure that a Safety Limit is not exceeded. Every setpoint calculated is set conservatively with respect to the Analytical Limit. The statement should convey that the ESFAS Trip Setpoint entered into the digital bistable is more conservative than the Allowable Value (the OPERABILITY limit) to ensure that OPERABILITY is not inadvertently challenged.

Validate the Bases statements and make any necessary changes.

The additional information is needed to ensure the accuracy, completeness, and consistency of the APWR Bases.

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**ANSWER:**

See the answer to No.16-228 which addresses this same issue for LCO 3.3.1 RTS Instrumentation. There are no changes to that response for LCO 3.3.2. Section B.3.3.2 of DCD Chapter 16 Rev. 4 will be revised with the same explanation as Section B.3.3.1.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

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**QUESTION NO.: 16-275**
LCO 3.3.2, ESFAS Instrumentation

Provide the additional information and any changes necessary to explain and correct a potential discrepancy identified in the APPLICABLE SAFETY ANALYSES, LCO and APPLICABILITY section of the APWR Bases.

The APWR Bases, APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY, page B 3.3.2-5 (bottom paragraph), states that "a channel is OPERABLE provided the "as-found" accuracy value does not exceed its associated Allowable Value." The comparable statement in the WOG Bases, page B 3.3.2-6 (first paragraph), states that "a channel is OPERABLE with a trip setpoint value outside its calibration tolerance band provided the trip setpoint "as-found" value does not exceed its associated Allowable Value …"

it appears that the accuracy/intent of the APWR Bases statement may have been affected by use of the phrase "as-found accuracy value" as opposed to "trip setpoint as-found value" in the WOG Bases. A "setpoint" is a specific number that can be readily compared to an Allowable Value, whereas an "accuracy value" is a measure of closeness or indication of instrumentation performance. Comparisons are typically not drawn between Allowable Values and "accuracy values". Validate the Bases statement and make any necessary changes.

The additional information is needed to ensure the accuracy, completeness, and consistency of the APWR Bases.

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**ANSWER:**

See the answer to No.16-238 which addresses this same issue for LCO 3.3.1. There are no changes to that response for LCO 3.3.2. Section B.3.3.2 of DCD Chapter 16 Rev.4 will be revised with the same explanation as Section B.3.3.1.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

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**QUESTION NO.: 16-282**

LCO 3.3.3, PAM Instrumentation

Provide the additional information necessary to clarify and explain how CONDITION C is to be implemented with respect to PAM Functions 2, 3, 10 and 16 in the APWR GTS, Table 3.3.3-1.

The APWR GTS, LCO 3.3.3, Condition “C” states that with “One or more Functions with two required channels inoperable,” perform Required Action C.1 to “Restore one channel to OPERABLE status” within 7 days. The APWR GTS, Table 3.3.3-1, “Required Channels” column, only specifies “1 per loop” for Functions 2 and 3, and “1 per steam generator” for Functions 10 and 16. Comparable functions in the WOG STS, Table 3.3.3-1, specify either “2 per loop” or “2 per steam generator” in the “Required Channels” column. It is unclear how to implement Condition C (two required channels inoperable) when the “Required Channels” column for the referenced functions only specifies “1 per loop” or ”1 per steam generator.” Explain how to implement Condition C for Table 3.3.3-1 Functions whose “Required Channels” are less than two, and ensure that this information is included in the Bases discussion.

The additional information is needed to ensure the accuracy and completeness of the APWR GTS and Bases.

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**ANSWER:**

One channel per loop or steam generator was based on using paired variables for these functions per Note (d) of Table 3.3.3-1 and the NOTE for Required Actions B.1 and C.1 as added in DCD Rev.2. However, MHI will eliminate all description of paired PAM functions for Steam Generator Water level (Wide Range), Emergency Feedwater Flow, RCS Hot Leg Temperature (Wide Range) and RCS Cold Leg Temperature (Wide Range) from Technical Specification LCO 3.3.3 in DCD Rev. 4, because this is not consistent with the emergency procedure guidelines. The requirement for “Steam Generator Water Level (Wide Range) 1 per steam generator” (4 total required) and “Emergency Feedwater Flow 1 per steam generator” (4 total required) will remain, with no additional notes.

In addition, the Bases of DCD Rev. 4 will be updated to explain that for Steam Generator Water Level (Wide Range) and Emergency Feedwater Flow, if the break is in one of the instrumented SGs and there is a single failure affecting the instrumentation in another SG, the instrumentations in the remaining two SGs provide sufficient indication of heat sink availability; two SGs are required for sensible heat removal.

Also, the Bases of DCD Rev. 4 will be updated to explain that for RCS Hot Leg Temperature (Wide Range) and RCS Cold Leg Temperature (Wide Range) the LCO will be revised to require 3 channels each, with no additional notes. Only three channels are required for each parameter because if the break is in one of the instrumented loops, the instrumentation in either remaining instrumented loop (i.e., RCS Hot Leg Temperature or RCS Cold Leg Temperature) provides sufficient indication of core cooling, and the Emergency Operating Procedure (EOP) operator action threshold points can be confirmed by the RCS Hot Leg Temperature instrumentation in either remaining instrumented loop. Therefore, with only 3 required channels for each parameter (each monitoring any three loops), a single failure affecting one or both instruments (i.e., RCS Hot leg Temperature/RCS Cold Leg Temperature) in any intact loop can be accommodated.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

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**QUESTION NO.: 16-290**

LCO 3.3.5, LOP Class 1E GTG Start Instrumentation

Provide a technical justification that explains how the TRIP ACTUATING DEVICE OPERATIONAL TEST (TADOT) surveillance requirement specified for the LOP Class 1E GTG Start Instrumentation, ensures that the undervoltage relays are adequately tested.

The APWR GTS, SURVEILLANCE REQUIREMENTS, specifies performance of a TRIP ACTUATING DEVICE OPERATIONAL TEST surveillance requirement in accordance with SR 3.3.5.2 for the LOP undervoltage relays. The Trip Actuating Device Operational Test as originally defined in NUREG -1431, has been revised under the APWR GTS to accommodate aspects of the fully digital MELTAC I&C platform design.

The APWR GTS Trip Actuating Device Operational Test does not include provisions for adjustment of the trip actuating device so that it actuates at the required setpoint. This is a change from the NUREG-1431 definition which states that "the TADOT shall include adjustment, as necessary, of the trip actuating device." The TADOT specified in accordance with SR 3.3.5.2 for both the APWR GTS and WOG STS, has a 31-day Surveillance Frequency.

The WOG Bases, SURVEILLANCE REQUIREMENTS, SR 3.3.5.2, page B 3.3.5-6 (first paragraph), states that "for these tests, the relay trip setpoints are verified and adjusted as necessary." The APWR Bases, SURVEILLANCE REQUIREMENTS, SR 3.3.5.2, page B 3.3.5-5 (third paragraph), states that "for these tests, the undervoltage relay is confirmed to actuate for gross loss of voltage conditions. Undervoltage trip setpoints and time delays are verified during CHANNEL CALIBRATION, SR 3.3.5.3." APWR SR

3.3.5.3 has a 24-month Frequency. Under the WOG STS, undervoltage relay trip setpoints are checked and any necessary adjustments made every 31 days during performance of a TADOT. Under the APWR GTS, undervoltage relay trip setpoints are verified and any necessary adjustments made every 24 months during performance of a CHANNEL CALIBRATION. Has the surveillance requirement for verifying undervoltage relay trip setpoints and making the necessary adjustments every 31-days been compromised by extending the surveillance interval to 24 months?

Provide a technical justification that explains how a 24-month CHANNEL CALIBRATION that incorporates surveillance requirements previously specified under a 31-day TADOT, provides adequate assurance that the LOP undervoltage trip relays are being properly surveilled

The technical justification is needed to ensure that LOP Class 1E GTG Start Instrumentation is being adequately tested under the MELTEC digital I&C platform design.

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**ANSWER:**

For the WOG STS, confirmation of the Nominal Trip Setpoints and Allowable Values are specified for SR 3.3.5.3 CHANNEL CALIBRATION at every 18 months. The US-APWR provides the same requirement for CHANNEL CALIBRATION at every 24 months. The WOG SR 3.3.5.2 TADOT confirms the UV relays operability at 31 days, with adjustment, as necessary, so that the relay actuates “at the required setpoint within the necessary accuracy”. The TADOT for the US-APWR also confirms the UV relays operability at 31 days, with maintenance as necessary, based on manufacturer’s recommendation, to maintain device reliability. Therefore, with regard to confirming relay operability and ensuring reliability, the SRs are equivalent. The only difference is the frequency at which the setpoint accuracy is confirmed. For the US-APWR checking the setpoint accuracy more frequently than 24 months is unnecessary, because the total channel uncertainty, including setpoint drift over the 24 month calibration interval, is included in determination of the Nominal Trip Setpoint and the Allowable Value, as defined in MUAP-09022. This clarification to distinguish the testing and adjustment during CHANNEL CALIBRATION to confirm and ensure setpoint accuracy, versus the maintenance during TADOT to ensure reliability will be reflected in DCD Rev. 4.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

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**QUESTION NO.: 16-160**

LCO 3.3.1, RTS Instrumentation (16.3.3.1-04)

Justify the initial completion time of 72 hours in the US-APWR TS LCO 3.3.1, ACTIONS B.1, B.2, C.1, C.2.1, and C.2.2. NUREG-1431, Rev 3.1, TS LCO BASES establishes 48 hours as reasonable.

No basis is provided for increasing the “reasonable” completion time from 48 hours to 72 hours other than listing the variety of means available to initiate a Manual reactor trip. Justify the completion time of 72 hours.

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**ANSWER:**

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 72 hour completion times in Conditions B and C, as follows.

The Completion Time of 72 hours is justified because two trains are adequate to perform the safety function, and there are three automatic actuation trains and two other Manual Reactor Trip trains OPERABLE. In addition, the Completion Time considers that the manual Reactor Trip function, for the inoperable Manual Reactor Trip train, can be actuated from the Safety VDU for that train. Therefore, the ability to initiate a manual Reactor Trip through safety related equipment remains functional in all three required trains.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Completion Times. Any differences between the Completion Timesin the GTS compared to the Completion Timesevaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-161**

LCO 3.3.1, RTS Instrumentation (16.3.3.1-05)

Justify the NOTE allowing an inoperable channel in the bypassed condition for up to 12 hours while performing routine surveillance testing of the other channels based on operating experience in the US-APWR TS LCO 3.3.1 BASES, ACTIONS E.1.1, E.1.2, E.2.1, E.2.2, E.3, F.1 and F.2. For these ACTIONS, NUREG-1431, Rev 3.1, establishes the 12-hour bypass limit based on an approved topical report, WCAP-14333-P-A, Rev 1, October 1998. MHI did not provide a comparable analysis.

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**ANSWER:**

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 12 hour bypass times in Conditions E and F, as follows.

The Bypass Time of 12 hours is justified because the remaining OPERABLE channels are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

The Bypass Time of 12 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Bypass Times. Any differences between the Bypass Times in the GTS compared to the Bypass Timesevaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

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**QUESTION NO.: 16-162**

LCO 3.3.1, RTS Instrumentation 16.3.3.1-06)

Justify the Note that describes US-APWR TS LCO 3.3.1 Required Actions L.1 and L.2 in the BASES section. No explanation of the Note appears in the BASES section.

Required Actions L.1 and L.2 are preceded by a Note that allows an inoperable channel to be bypassed for up to 12 hours for surveillance testing of other channels except for Pressurizer Pressure, Pressurizer Level, and SG Water Level. NUREG-1431, Rev 3.1, justifies the 12-hour bypass allowance based on an approved topical report, WCAP- 14333-P-A, Rev 1, October 1998 (WOG STS Page B 3.3.1-42, 3rd paragraph).

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**ANSWER:**

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 12 hour bypass times in Conditions L, as follows.

The Bypass Time of 12 hours is justified because the remaining OPERABLE channels are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE channels have continuous automatic self-testing. In addition, the two remaining OPERABLE channels have continuous automatic CHANNEL CHECKS, except for Turbine Trip – Turbine Emergency Trip Oil Pressure; this additional justification is not needed for Turbine Trip – Turbine Emergency Trip Oil Pressure, because this is an anticipated function that is not credited in the safety analysis.

The Bypass Time of 12 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Bypass Times. Any differences between the Bypass Times in the GTS compared to the Bypass Times evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

It is noted that in DCD Rev. 2, the words “the inoperable channel may be bypassed for up to 12 hours for surveillance testing of other channels” was changed to “one channel may be bypassed for up to 12 hours for surveillance testing”. This change was maintained in DCD Rev. 3. However, MHI has now determined that additional bypass restrictions are necessary, so in DCD Rev 4 this note will be change to “One required channel may be bypassed for up to 12 hours for surveillance testing, provided the other required channels are OPERABLE or placed in the trip condition.” This additional provision ensures that when a required channel is bypassed, the system can provide protection for all anomalies, but it cannot also sustain a single failure.

Also, in DCD Rev. 0 thru Rev. 3, the inapplicability of the bypass note was considered the only distinction for the functions with shared channels in CONDITION L (i.e., Pressurizer Pressure, Pressurizer Level, and SG Water Level). However, MHI has now concluded that the shared channels also require different completion times and actions. Therefore, in DCD Rev. 4 the functions with shared channels (i.e., Pressurizer Pressure, Pressurizer Level, and SG Water Level) will be moved to new Condition W.

Condition W will prohibit a channel bypass for testing, as originally in Condition L. In addition, Condition W will require the inoperable channel be placed in trip condition within 1 hour; this ensures that if a plant transient is caused by an additional failure in one of the two remaining shared channels, the protection system can generate a trip with only one channel. During this configuration the protection system will function to protect the plant, but it does not meet the single failure criterion. Therefore, Condition W will also require that 3 required channels be restored to operability in 72 hours.

The US-APWR Basis will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 72 hour Completion times in Conditions W, as follows.

The Completion Time of 1 hour to place the failed channel in the trip condition in Condition W is based on operating experience and the minimum amount of time allowed for manual operator actions.

The Completion Time of 72 hours to restore the inoperable channel is justified because the two remaining OPERABLE channels are adequate to perform the safety function. In addition, the two remaining OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Completion Times. Any differences between the Completion Times in the GTS compared to the Completion Times evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

This same change is applicable to the functions with shared channels (and only 3 required channels) in CONDITION F, which will be moved to new CONDITION U in DCD Rev. 4, and the functions with shared channels in 3.3.2 CONDITION D, which will be moved and separated to a new CONDITION M in DCD Rev. 4 .

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

**RAI NO.:** **NO. 166-1784 REVISION 0**

**SRP SECTION:** **16 - TECHNICAL SPECIFICATIONS**

**APPLICATION SECTION:** **16**

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**QUESTION NO.: 16-163**

LCO 3.3.1, RTS Instrumentation (16.3.3.1-08)

In the US-APWR TS LCO 3.3.1 BASES, ACTIONS E.1.1, E.1.2, E.2.1, E.2.2, E.3, F.1, F.2, L.1, and L.2, justify a completion time of 72 hours for the automatic self-testing and automatic CHANNEL CHECKS. NUREG-1431, Rev 3.1, establishes the 72-hour completion time for the comparable BASES, ACTIONS D.1.1, D.1.2, D.2.1, D.2.2, D.3, E.1, E.2, K.1, and K.2 based on an approved topical report, WCAP-14333-P-A, Rev 1, October 1998. MHI did not provide a comparable analysis.

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**ANSWER:**

MHI believes the words in this question “for the automatic self-testing and automatic CHANNEL CHECKS” were intended to be “for the Required Action”.

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 72 hour completion time in Condition E, F and L, as follows

<u>Conditions E and F</u>

The Completion Time of 72 hours to place the inoperable channel in the tripped condition is justified because the three remaining OPERABLE channels are adequate to perform the safety function. In addition, the Completion Time considers that the three remaining OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS. In addition, with the remaining three OPERABLE channels, the SSA within the PCMS ensures the control systems can withstand an input failure to the control system without causing erroneous control system operation, which would otherwise require the protection function actuation.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

<u>Condition L</u>

The Completion Time of 72 hours to place the inoperable channel in the tripped condition is justified because the two remaining OPERABLE channels are adequate to perform the safety function. In addition, the Completion Time considers that the two remaining OPERABLE channels have continuous automatic self-testing. In addition, the two remaining OPERABLE channels have continuous automatic CHANNEL CHECKS, except for Turbine Trip – Turbine Emergency Trip Oil Pressure; this additional justification is not needed for Turbine Trip – Turbine Emergency Trip Oil Pressure, because this is an anticipatory function that is not credited in the safety analysis.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Completion Times. Any differences between the Completion Times in the GTS compared to the Completion Times evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

It is noted that in DCD Rev. 0 thru Rev. 3, the inapplicability of the bypass note was considered the only distinction for the functions in CONDITION L with channels that are shared between the PSMS and PCMS (i.e., Pressurizer Pressure, Pressurizer Water Level, and SG Water Level). However, MHI has now concluded that the shared channels also require different Required Actions and Completion Times. Therefore, in DCD Revision 4 the functions with shared channels (i.e., Pressurizer Pressure, Pressurizer Water Level, and SG Water Level) will be moved to new Condition W.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

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**QUESTION NO.: 16-164**

LCO 3.3.1, RTS Instrumentation (16.3.3.1-09)

Justify a completion time of 24 hours in the US-APWR TS LCO 3.3.1 BASES, ACTIONS N.1 and N.2 on page B 3.3.1-38. NUREG-1431, Rev 3.1, establishes the 24-hour completion time based on a topical report, WCAP-15376, Rev 0, October 2000 (WOG STS Page B 3.3.1-46, last paragraph).

No basis is provided for the US-APWR completion time of 24 hours other than identifying that two remaining OPERABLE trains are available and that there is a low probability of an event during this interval. Describe how the completion time of 24 hours was established.

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**ANSWER:**

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 24 hour completion times in Conditions N, as follows.

The Completion Time of 24 hours is justified because the two remaining OPERABLE trains are adequate to perform the safety function.

The Completion Time of 24 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Completion Times. Any differences between the Completion Times in the GTS compared to the Completion Times evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-166**

LCO 3.3.1, RTS Instrumentation (16.3.3.1-11)

Justify the STAGGERED TEST BASIS frequency of 62 days with each RTB tested every 248 days, and each trip methodology ultimately tested every 744 days in the US-APWR TS LCO 3.3.1 BASES, SR 3.3.1.4 on page B 3.3.1-45. NUREG-1431, Rev 3.1, establishes the 62-day frequency based on a topical report, WCAP-15376, Rev 0, October 2000 (WOG STS Page B 3.3.1-53, top paragraph). MHI did not provide a comparable analysis.

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**ANSWER:**

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 62 days with each RTB tested every 248 days, and each trip method ultimately tested every 744 days, as follows.

The Surveillance Frequency of every 62 days is justified based on industry experience. The test frequency also considers the added reliability of the US-APWR RTB configuration, which includes redundant RTBs within each train and the overall two-out-of-four train configuration. Since each test actuates each RTB to its required trip state, the STAGGERED TEST BASIS results in each RTB being tested every 248 days, and each tripping method being tested every 744 days.

The STAGGERED TEST BASES frequency of 62 days, with each RTB tested every 248 days, and each trip method ultimately tested every 744 days is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Surveillance Frequencies. Any differences between the Surveillance Frequencies in the GTS compared to the Surveillance Frequencies evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA result.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

# RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

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**QUESTION NO.: 16-167**

LCO 3.3.1, RTS Instrumentation (16.3.3.1-12)

Justify the STAGGERED TEST BASIS frequency of 24 months based on the expected reliability of the Protection and Safety Monitoring System in the US-APWR TS LCO 3.3.1, SR 3.3.1.5 on page B 3.3.1-45. NUREG-1431, Rev 3.1, establishes a 92-day STAGGERED TEST BASIS frequency based on a topical report, WCAP-15376, Rev 0, October 2000 (WOG STS Page B 3.3.1-53).

SR 3.3.1.5, in the BASES of the US-APWR, indicates that the Reactor Trip System (RTS) is self-tested on a continuous basis, from the digital side of all input modules to the digital side of all output modules, and that the frequency of 24 months is justified based on the reliability of the Protection and Safety Monitoring System. The basis for this improved reliability claim should be briefly summarized and the detailed reliability analysis referenced. A comparison of the Protection and Safety Monitoring System reliability with that of a similar system in a standard plant should be made in order to justify the increased surveillance interval. Furthermore, NUREG 1431, Rev 3.1, indicates that an Actuation Logic Test should include “a continuity check of output devices.” It is not clear that the self-testing performed in the US-APWR is equivalent to this and extends to the “output devices.” US-APWR BASES SR 3.3.1.5 indicates that this testing extends to the “digital side of all output modules.”

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**ANSWER:**

In DCD Rev. 4 SR 3.3.1.5, which was an ACTUATION LOGIC TEST, will be replaced by a MEMORY INTEGRITY CHECK (MIC) and renumbered as SR 3.3.1.6. The MIC is a diverse check of the PSMS software memory integrity, consistent with the Setpoint Control Program (SCP), to ensure there is no change to the internal memory of the PSMS that would impact its functional operation, including digital Nominal Trip Setpoints, Time Constants, or the continuous automatic self-testing function. For LCO 3.3.1 a MIC is performed for the RPS, which implements the RTS Instrumentation Functions.

The MIC and continuous automatic self-testing function are equivalent to the ACTUATION LOGIC TEST of the STS, which the exception of “a continuity check of output devices”, which is confirmed during the TADOT. All three of these tests (i.e., MIC, continuous automatic self-testing, and ACTUATION LOGIC TEST) check for any changes, such as random hardware failures and logic change errors, that would effect the actuation logic functions. The continuous automatic self-testing in the PSMS assures these changes are immediately detected.

For the RTS, the complete operability of all output devices, including the “continuity check of output devices”, is included in the TADOT for the RTBs. When an RTB’s Shunt Trip or Undervoltage device is tested, the corresponding continuity between the output device and the RTB device is also tested. The TADOT overlaps with continuous self-testing and the MIC. The TADOT frequency for the RTBs ensures the continuity check of each output device is conducted every 744 days. This test frequency is justified by the MTBF (Mean Time Between Failures) reliability of the PSMS output device, the redundancy between Shunt Trip and UV trip mechanisms and the 8 breaker 2-out-of-4 configuration of the RTBs.

The STAGGERED TEST frequency is not applied for the MIC. The MIC is conducted for each PSMS train every 24 months.

The Bases will be revised in DCD Revision 4 to provide a deterministic and probabilistic justification for the Frequency of 24 months, as follows.

The Surveillance Frequency of 24 months is justified because the software memory integrity is checked by the continuous automatic self-testing.

The MIC Frequency of 24 months is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Surveillance Frequencies. Any differences between the Surveillance Frequencies in the GTS compared to the Surveillance Frequencies evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-168**

LCO 3.3.1, RTS Instrumentation (16.3.3.1-13)

Justify the frequency of 24 months based on the expected reliability of the Protection and Safety Monitoring System in the US-APWR TS LCO 3.3.1, SR 3.3.1.7. NUREG-1431, Rev 3.1, establishes a 184-day frequency based on an approved topical report, WCAP-10271-P-A, Supplement 1, May 1986 (WOG STS Page B 3.3.1-54, last paragraph). MHI did not provide a comparable analysis.

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**ANSWER:**

In DCD Rev. 4 SR 3.3.1.7, which was a CHANNEL OPERATIONAL TEST (COT), will be replaced by a MEMORY INTEGRITY CHECK (MIC) and it will be combined with previous SR 3.3.1.5: ACTUATION LOGIC TEST to be re-numbered as SR 3.3.1.6. The MIC is a diverse check of the PSMS software memory integrity, consistent with the Setpoint Control Program (SCP), to ensure there is no change to the internal memory of the PSMS that would impact its functional operation, including digital Nominal Trip Setpoints, Time Constants or the continuous automatic self-testing function. For LCO 3.3.1 a MIC is performed for the RPS, which implements the RTS Instrumentation Function.

The MIC and continuous automatic self-testing function are equivalent to the COT of the STS. All three of these tests (i.e., MIC, continuous automatic self-testing, and COT) check for changes, such as random hardware failures and setting errors, that would effect the Nominal Trip Setpoints or trip algorithms. The continuous automatic self-testing in the PSMS assures these changes are immediately detected.

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the Frequency of 24 months, as follows.

The Frequency of 24 months is justified because the software memory integrity is checked by the continuous automatic self-testing function.

The MIC Frequency of 24 months is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19 (Ref. 10).

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Surveillance Frequencies. Any differences between the Surveillance Frequencies in the GTS compared to the Surveillance Frequencies evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-172**

LCO 3.3.1, RTS Instrumentation (16.3.3.1-18)

Clarify the addition of “signal conditioning and actuation logic” to the phrase “Allocations for sensor, signal conditioning and actuation logic response times may be obtained from:” in the discussion of SR 3.3.1.13 on page B 3.3.1-50. The comparable phrase in the discussion of SR 3.3.1.16 on page 3.3.1-60 in NUREG-1431, Rev 3.1 does not contain “signal conditioning and actuation logic.

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**ANSWER:**

The surveillance requirements for response time testing in DCD Rev. 4 will clarify that Technical Report MUAP-09021, “Response Time of Safety I&C System” provides the basis and methodology for using allocated sensor, signal conditioning and actuation logic response times in the overall verification of the protection system channel response time.

The response time for the digital portion of the PSMS is determined one time by analysis and confirmed one time in the factory test. Therefore, for PSMS digital functions, including actuation logic, response time tests are not required; instead, a response time allocation may be applied.

The response time for PSMS MELTAC input signal conditioning, can be affected by random failures or degradation, which can be detected by CHANNEL CALIBRATION. Section 4.6 of MUAP-07005, “Safety System Digital Platform -MELTAC-” describes the basis for crediting CHANNEL CALIBRATION for detecting PSMS signal conditioning response time degradation. Therefore, for PSMS input signal conditioning, response time tests are not required; instead, a response time allocation may be applied.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on Technical / Topical Reports.

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**QUESTION NO.: 16-174**

LCO 3.3.1, RTS Instrumentation (16.3.3.1-20)

Justify the exclusion of the NUREG-1431, Rev 3.1 Bases discussion associated with dynamic transfer functions in the US-APWR BASES discussion regarding SR 3.3.1.13 on page B 3.3.1-49. The NUREG-1431, Rev 3.1 BASES discussion regarding the comparable SR 3.3.1.16 on page B 3.3.1-59 includes a discussion of dynamic transfer functions.

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**ANSWER:**

The surveillance requirement for response time testing in DCD Rev. 4 Bases Section 3.3.1 will clarify that the PSMS MELTAC controllers employ dynamic transfer functions with Time Constants that are installed as digital values and processed through digital algorithms. Therefore, the time response of all digital PSMS functions has no potential for variation due to time, environmental drift or component aging. PSMS Time Constants are set at the nominal values assumed in the safety analysis. The combination of continuous automatic self-testing and MIC confirms the integrity of the dynamic transfer functions, Time Constants and actuation logic functions. The response time for the digital portion of the PSMS is determined one time by analysis and confirmed one time in the factory test. Therefore, for PSMS digital functions, including Functions with dynamic transfer functions with Time Constants, response time tests are not required; instead, a response time allocation may be applied.

The surveillance requirement for response time testing in DCD Rev. 4 Bases Sections 3.3.1 will also clarify that MUAP-09021-P, "Response Time of Safety I&C System", provides the basis and methodology for using allocated sensor, signal processing and actuation logic response times in the overall verification of the protection system channel response time.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on Technical / Topical Reports.

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**QUESTION NO.: 16-177**

LCO 3.3.2, ESFAS Instrumentation (16.3.3.2-04)

Justify the initial completion time of 72 hours in the US-APWR TS LCO 3.3.2, ACTIONS B.1 and B.2. NUREG-1431, Rev 3.1, establishes 48 hours as reasonable.

No basis is provided for increasing the “reasonable” completion time from 48 hours to 72 hours other than identifying that the remaining OPERABLE trains provide protection for each function and that there is a low probability of an event during this interval. Describe the method for establishing the completion time of 72 hours.

---

**ANSWER:**

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 72 hour completion times in Conditions B, as follows.

The Completion Time of 72 hours is justified because (1) for ECCS two trains are adequate to perform the safety function and there are three automatic actuation trains and two other Manual Initiation trains OPERABLE, (2) for Containment Spray three trains are adequate to perform the safety function and there are four automatic actuation trains and three other Manual Initiation trains OPERABLE, or (3) for Containment Phase A Isolation one train is adequate to perform the safety function and there are two automatic actuation trains and one other Manual Initiation train OPERABLE. The Completion Time also considers that all trains of ECCS can be initiated by the Manual Initiation Function from the two remaining trains, and Containment Spray can be initiated by the Manual Initiation Function from any two of the remaining three trains.

In addition, the Completion Time considers that each train of all Functions can be manually initiated from the Safety VDU for that train. Therefore, manual initiation through safety related equipment remains functional in all trains.

DCD Chapter19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Completion Times. Any differences between the Completion Times in the GTS compared to the Completion Times evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-178**

LCO 3.3.2, ESFAS Instrumentation (16.3.3.2-05)

Justify that sufficient OPERABLE trains and the low probability of an event occurring during this interval validate a completion time of 24 hours in the US-APWR, LCO 3.3.2 BASES, ACTIONS C.1, C.2.1, and C.2.2 on page B 3.3.2-40, and LCO 3.3.2 BASES, ACTIONS Q.1 and Q.2 on page B 3.3.2-49. NUREG-1431, Rev 3.1, establishes the 24-hour completion time based on an approved topical report, WCAP-14333-P-A, Rev 1, October 1998 (WOG STS Page B 3.3.2-39). MHI did not provide a comparable analysis. Note: Condition C of LCO 3.3.2 in NUREG-1431 appears to have been split into Conditions C and Q/R of LCO 3.3.2 in the APWR GTS.

Also, the APWR Bases, ACTIONS, C.1, C.2.1, and C.2.2, page B 3.3.2-41 (second paragraph), and the APWR Bases, ACTIONS, Q.1 [and Q.2], page B 3.3.2-49 (third paragraph), do not reference the specific reliability analysis assumption applicable to their respective REQUIRED ACTION NOTES. Both Bases statements merely state that "this allowance is based on the reliability analysis assumption that 4 hours is the average time required to perform train surveillance." The WOG Bases, ACTIONS, C.1, C.2.1, and C.2.2, page B 3.3.2-40 (second paragraph), specifically reference the reliability analysis assumption of WCAP-1027-P-4 as the basis of the 4 hour average time required to perform the train surveillance. Provide the specific reliability analysis assumption upon which the 4 hour average time in the APWR is based.

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**ANSWER:**

Conditions C and Q Completion Times
The Bases will be revised in DCD Revision 4 to provide a deterministic and probabilistic justification for the 24 hours completion times in Conditions C and Q, as follows.

The Completion Time of 24 hours is justified because the remaining OPERABLE train(s) are adequate to perform the safety function. In addition, the Completion Time considers that the remaining OPERABLE train(s) each have continuous automatic self-testing.

The Completion Time of 24 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Completion Times. Any differences between the Completion Times in the GTS compared to the Completion Times evaluated in the base US-APWR PRA are justified in

“Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B in DCD Rev.4.Conditions C and Q REQUIRED ACTION NOTES

The Bases will be revised in DCD Revision 4 to provide a deterministic and probabilistic justification for the 4 hour bypass for surveillance testing in Conditions C and Q, as follows.

The Bypass Time of 4 hours is justified because the remaining OPERABLE train(s) are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE train(s) have continuous automatic self-testing.

The Bypass Time of 4 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Bypass Times. Any differences between the Bypass Times in the GTS compared to the Bypass Times evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

Also, in DCD Rev. 4 the REQUIRED ACTION NOTES will be clarified to distinguish cases where there are and are not additional spare trains, as follows:

For Condition C, which applies to Functions that have no spare trains, the note allows one train to be bypassed for up to 4 hours “provided the other train(s) are OPERABLE”. For Containment Isolation – Phase A Isolation “train” is applicable, because there are only two trains and two are required. For Containment Isolation – Phase B Isolation “trains” is applicable because there are four trains and four are required.

For Condition Q, which applies to Functions that have spare trains, the note allows one required train to be bypassed for up to 4 hours “provided the other required trains are OPERABLE”. The words “required trains” are applicable to ECCS Actuation and Containment Spray, because both Functions have 4 trains, but only 3 trains are required. Therefore, the spare train does not need to be OPERABLE to allow one of the required trains to be temporarily bypassed.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

**RAI NO.:** **NO. 166-1784 REVISION 0**

**SRP SECTION:** **16 - TECHNICAL SPECIFICATIONS**

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**QUESTION NO.: 16-179**

LCO 3.3.2, ESFAS Instrumentation (16.3.3.2-06)

Justify the NOTE allowing an inoperable channel in the bypassed condition for up to 12 hours while performing routine surveillance testing of the other channels in the USAPWR TS LCO 3.3.2 BASES, ACTIONS D.1, D.2.1, and D.2.2 on page B 3.3.2-42.
NUREG-1431, Rev 3.1, establishes the 12-hour bypass limit based on an approved topical report, WCAP-14333-P-A, Rev 1, October 1998 (WOG STS Page B 3.3.2-41). MHI did not provide a comparable analysis.

The US-APWR BASES indicates that ACTIONS D.1, D.2.1, and D.2.2 apply to numerous functions listed on page B 3.3.2-41. The REQUIRED ACTION NOTE is limited to "Containment Pressure" and "Main Steam Line Pressure." The justification for the Note should include a discussion concerning the limitation of applicable functions.

Also, explain not applying the Reviewers Note associated with NUREG-1431, Rev 3.1, TS LCO 3.3.2, Required Actions D.1, D.2.1, D.2.2, E.1, E.2.1, and E.2.2 to the USAPWR TS LCO 3.3.2, Required Actions D.1, D.2.1, D.2.2, E.1, E.2.1, and E.2.2.

The NOTE referred to by the REVIEWER'S NOTE states that "one channel may be bypassed for up to 12 hours for surveillance testing" for plants with installed bypass test capability. The absence of this NOTE would seem to imply that the APWR does not have installed bypass test capability.

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**ANSWER:**

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the12 hour bypass times in Condition D, as follows.

The Bypass Time of 12 hours is justified because the remaining two OPERABLE channels are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining two OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

The Bypass Time of 12 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Bypass Times. Any differences between the Bypass Times in the GTS compared to the Bypass Times evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

Applicability of the REQUIRED ACTION NOTE

In DCD Rev. 1 the REQUIRED ACTION NOTE allowing a 12 hour bypass was limited to the Containment Pressure function and the Main Steam Line Pressure function because these two functions have no interaction between the PSMS and the PCMS. If a channel is bypassed, a single failure in one of the remaining two channels will prevent protective action for postulated accidents, but it will not result in a plant transient that would require protective action. Therefore, a temporary 12 hour bypass is permitted. Two channels of other functions that are shared between PSMS and PCMS cannot be bypassed, because with only two operable channels the signal selector function in the PCMS can not distinguish a single failure. Therefore, a single failure could result in a plant transient (initiated by the PCMS) that would require protective action. But that same single failure would prevent protection from the PSMS.

In DCD Rev. 2 the NOTE allowing a 12 hour bypass was incorrectly changed to allow a 12 hour bypass for all Functions in Condition D, even those Functions that have shared channels for control. This error was maintained in DCD Rev. 3. This error will be corrected in DCD Rev 4. In addition, MHI has now determined that the Main Steam Line Pressure function also has channels that are shared with the control systems, and that all Functions with shared channels (and only 3 required channels) must have different Required Actions and Completion Times. Therefore, in DCD Rev. 4 Condition D will be limited to High Containment Pressure and High-High Containment Pressure. The other Functions with shared channels that were in Condition D will be moved to Condition M. DCD Rev. 4 will explain that bypass of a required channel is not allowed because there are only three required channels and these channels are also used for control. If a failure were to occur in one of the two remaining control channels, a plant transient could occur that would require a plant trip, but a plant trip would not occur with only one remaining OPERABLE channel.

Applicability of the REVIEWER'S NOTE

Condition D

In DCD Rev. 1 the REQUIRED ACTION NOTE discussed above limited the 12 hour bypass to an inoperable channel to allow testing other channels. This note was incorrect because it applies only to plants without bypass test capability. In response to this RAI, DCD Rev. 2 correctly replaced this note with the text identified in the REVIEWER'S NOTE of the WOG STS, which allows bypassing a channel "for surveillance testing" for plants with installed bypass test capability. This note is applicable to the US-APWR, which has installed bypass test capability. This correction was also maintained in DCD Rev. 3.

However, DCD Rev. 4 will clarify that this bypass is allowed provided the other required channels are OPERABLE or one channel is OPERABLE and the other is placed in the trip condition. This additional provision ensures the remaining operable channels provide plant protection, although a single failure cannot be accommodated during this temporary bypass condition.

Condition E

In DCD Rev. 1, 2 and 3 there was no bypass allowed for Containment Spray - High-3 Containment Pressure, and Containment Phase B Isolation - High-3 Containment Pressure.

However, in DCD Rev. 4, the Required Actions will be modified by a Note that allows placing one channel in bypass for up to 12 hours while performing routine surveillance testing, provided the other required channels are OPERABLE. The additional provision included for Condition D, that allows a bypass if one channel is OPERABLE and the other is placed in the trip condition, is not allowed for these Functions because putting a channel in trip would lead to spurious Containment Spray initiation with a single failure.

DCD Rev. 4 will explain that the 12 hour time limit is justified based on continuous automatic self-testing and continuous automatic CHANNEL CHECKS for the remaining OPERABLE channels. DCD Rev. 4 will also explain that the 12 hour bypass is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

**1/27/2012**

**US-APWR Design Certification**

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**QUESTION NO.: 16-180**

LCO 3.3.2, ESFAS Instrumentation (16.3.3.2-07)

Justify the nature of these Functions, the available redundancy, and the low probability of an event occurring during this interval validate a completion time of 72 hours in the US-APWR TS LCO 3.3.2 BASES, ACTIONS F.1, F.2.1, and F.2.2 on page B 3.3.2-43.
NUREG-1431, Rev 3.1, establishes a shorter 48-hour completion time based on the same statement (WOG STS Page B 3.3.2-43).

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**ANSWER:**
The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 72 hour completion times in Conditions F, as follows.

For Loss of Offsite Power Function, the Completion Time of 72 hours is justified because the two remaining OPERABLE undervoltage devices for each train of Emergency Feedwater Actuation trains are adequate to perform the safety function. Since the undervoltage devices are dedicated for each of the four Class 1E busses, and two undervoltage devices are adequate to perform the safety function of each bus, the Emergency Feedwater Actuation on Loss of Offsite Power Function continues to meet the single failure criterion (i.e., three trains of Emergency Feedwater will still actuate if there is an additional undervoltage device failure on one bus).

For Manual Initiation Functions, the Completion Time of 72 hours is justified because (1) for Emergency Feedwater Actuation the remaining two trains are adequate to perform the safety function and there are three automatic actuation trains and two other Manual Initiation trains OPERABLE, or (2) for Main Steam Line Isolation, Main Feedwater Isolation, Emergency Feedwater Isolation, CVCS Isolation, and Block Turbine Bypass and Cooldown Valves the remaining train is adequate to perform the safety function and there are two automatic actuation trains and one other Manual Initiation train OPERABLE. The Completion Time also considers that Emergency Feedwater Actuation for all trains can be initiated by the Manual Initiation Function from the two remaining trains.

In addition, the Completion Time for the Manual Initiation Functions considers that all trains can be manually initiated from the Safety VDU for that train. Therefore, the ability to manually initiate those Functions through safety related equipment remains functional in all trains.

For all functions, the Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Completion Times. Any differences between the Completion Times in the GTS compared to the Completion Times evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

P-4 Interlock Function will be moved to the new separate Condition BB because the Completion Time for this function is not extended from NUREG-1431 Rev 3.1, in DCD Rev.4.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-181**

3.3.2, ESFAS Instrumentation (16.3.3.2-08)

Justify the frequency of 24 months based on the expected reliability of the Protection and Safety Monitoring System in the US-APWR TS LCO 3.3.2 BASES, SR 3.3.2.3 on page B 3.3.2-52. NUREG-1431, Rev 3.1, establishes a 184-day frequency for LCO 3.3.2, SR 3.3.2.5, based on topical report, WCAP-15376, Rev 0, October 2000 (WOG STS Page B 3.3.2-50), and a 92-day frequency for LCO 3.3.7, SR 3.3.7.2, based on "the known reliability of the monitoring equipment" and the fact that the Frequency has "been shown to be acceptable through operating experience" (WOG STS Page B 3.3.7-6).

Note that the WOG STS, LCO 3.3.7, has been incorporated into the APWR GTS, LCO 3.3.2. MHI did not provide a comparable analysis.

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**ANSWER:**

In DCD Rev. 4 SR 3.3.2.3, which was a CHANNEL OPERATIONAL TEST (COT), will be replaced by a MEMORY INTEGRITY CHECK (MIC). The MIC is a diverse check of the PSMS software memory integrity, consistent with the Setpoint Control Program (SCP), to ensure there is no change to the internal memory of the PSMS that would impact its functional operation, including digital Nominal Trip Setpoints, Time Constants, Time Delays or the continuous automatic self-testing function. For LCO 3.3.2 a MIC is performed for the Safety VDU processors, RPS, ESFAS, SLS, and COM-2. The MIC encompasses all ESFAS Instrumentation Functions, including MCR Isolation. MCR Isolation includes the Main Control Room Emergency Filtration System (MCREFS) which is equivalent to the Control Room Emergency Filtration System (CREFS) described in WOG STS LCO 3.3.7.

The MIC and continuous automatic self-testing function are equivalent to the COT of the STS. All three of these tests (i.e., MIC, continuous automatic self-testing, and COT) check for changes, such as random hardware failures and setting errors, that would effect the Nominal Trip Setpoints or ESFAS algorithms. The continuous self-testing in the PSMS assures these changes are immediately detected.

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 24 month surveillance frequency for the MIC, as follows:

The Frequency of 24 months is justified because the software memory integrity is checked by the continuous automatic self-testing.

The MIC Frequency of 24 months is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Surveillance Frequencies. Any differences between the Surveillance Frequencies in the GTS compared to the Surveillance Frequencies evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-184**

LCO 3.3.2, ESFAS Instrumentation (16.3.3.2-11)

In the US-APWR TS LCO 3.3.2 BASES, ACTIONS D.1, D.2.1, D.2.2, E.1, E.2.1, E.2.2, and K.1, justify the completion time of 72 hours for the automatic self-testing and automatic CHANNEL CHECKS. NUREG-1431, Rev 3.1, establishes the 72-hour completion time for the comparable BASES, ACTIONS D.1, D.2.1, and D.2.2 based on an approved topical report, WCAP-14333-P-A, Rev 1, October 1998 (WOG STS Page B 3.3.2-41). MHI did not provide a comparable analysis

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**ANSWER:**

MHI assumes the first sentence of this RAI should read:

> In the US-APWR TS LCO 3.3.2 BASES, ACTIONS D.1, D.2.1, D.2.2, E.1, E.2.1, E.2.2, and K.1, justify the completion time of 72 hours <u>based on only</u> automatic self-testing and automatic CHANNEL CHECKS for Conditions D and K, <u>and based on only the low probability of the event, automatic self-testing and automatic CHANNEL CHECKS for Condition E</u>.

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 72 hour completion times in Conditions D, E and K, as follows.

The Completion Time of 72 hours to restore the inoperable channel (or to place it in the trip condition; for Condition D) is justified because the two remaining OPERABLE channels are adequate to perform the safety function. In addition, the Completion Time considers that the two remaining OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Completion Times. Any differences between the Completion Times in the GTS compared to the Completion Times evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

It is noted that in DCD Rev. 4 the Functions in Condition D, with channels that are shared between the PSMS and PCMS, have been moved to Condition M. Condition M has a 1 hour action to place a failed channel in trip, and a 72 hour action to restore all required channels to OPERABLE status. The deterministic and probabilistic justification for the 1 hour and 72 hour completion times in Conditions M is as follows:

The Completion Time of 1 hour to place the failed channel in the trip condition is based on operating experience and the minimum amount of time allowed for manual operator actions.

The Completion Time of 72 hours to restore the inoperable channel is justified because the two remaining OPERABLE channels are adequate to perform the safety function. In addition, the Completion Time considers that the two remaining OPERABLE channels have continuous automatic self-testing and continuous automatic CHANNEL CHECKS.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Completion Times. Any differences between the Completion Times in the GTS compared to the Completion Times evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

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**QUESTION NO.: 16-186**

LCO 3.3.2, ESFAS Instrumentation (16.3.3.2-13)

Clarify the addition of "signal conditioning and actuation logic" to the phrase "Allocations for sensor, signal conditioning and actuation logic response times may be obtained from:" in the discussion of SR 3.3.2.8 on page B 3.3.2-55. The comparable phrase in the discussion of SR 3.3.2.10 on page 3.3.2-53 in NUREG-1431, Rev 3.1 does not contain "signal conditioning and actuation logic."

Also, clarify the reference to "equipment in both trains" in the discussion of SR 3.3.2.8 on page B 3.3.2-55 (second paragraph). The APWR FSAR, Section 7.3.1.1, ESF System Level Logic, page 7.3-2, states that "there are four trains for the ESF system in the USAPWR."

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**ANSWER:**

The surveillance requirements for response time testing in DCD Rev. 4 will clarify that Technical Report MUAP-09021, “Response Time of Safety I&C System” provides the basis and methodology for using allocated sensor, signal conditioning and actuation logic response times in the overall verification of the protection system channel response time.

The response time for the digital portion of the PSMS is determined one time by analysis and confirmed one time in the factory test. Therefore, for PSMS digital functions, including actuation logic, response time tests are not required; instead, a response time allocation may be applied.

The response time for PSMS MELTAC input signal conditioning, can be affected by random failures or degradation, which can be detected by CHANNEL CALIBRATION. Section 4.6 of MUAP-07005, “Safety System Digital Platform -MELTAC-” describes the basis for crediting CHANNEL CALIBRATION for detecting PSMS signal conditioning response time degradation. Therefore, for PSMS input signal conditioning, response time tests are not required; instead, a response time allocation may be applied.

In addition, the description of "equipment in both trains" in the discussion of DCD Chapter 16 Section 3.3.2 Bases SR 3.3.2.8 in DCD Rev.1 was not correct; this description will be revised in DCD Rev. 4 to clarify that the analyses model the overall or total elapsed time, from the point at which the parameter exceeds the analytical limit to the point at which the equipment in the minimum credited train(s) reaches the required functional state (e.g., pumps at rated discharge pressure, valves in full open or closed position).

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on Technical / Topical Reports.

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**QUESTION NO.: 16-188**

LCO 3.3.2, ESFAS Instrumentation (16.3.3.2-15)

Justify the exclusion of the NUREG-1431, Rev 3.1 Bases discussion associated with dynamic transfer functions in the US-APWR BASES discussion regarding SR 3.3.2.8 on page B 3.3.2-55. The NUREG-1431, Rev 3.1 BASES discussion regarding the comparable SR 3.3.2.10 on page B 3.3.2-53 includes a discussion of dynamic transfer functions.

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**ANSWER:**

See the response to No. 16-174 which addresses this same issue for LCO 3.3.1. Section B 3.3.2 of DCD Chapter 16 Rev. 4 will be revised with same explanation as Section B 3.3.1. However, the explanation will also address the Time Delays within actuation logic functions, that exist within the ESFAS and not in the RTS.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical / Topical Reports**

There is no impact on Technical / Topical Reports.

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**QUESTION NO.: 16-189**

LCO 3.3.2, ESFAS Instrumentation (16.3.3.2-16)

Justify the completion time of 24 hours accounts for sufficient OPERABLE trains and the low probability of an event occurring during this interval in the US-APWR, LCO 3.3.2 BASES, ACTIONS G.1, G.2.1 and G.2.2 on page B 3.3.2-44, and LCO 3.3.2 BASES, ACTIONS S.1 and S.2 on page B 3.3.2-50. NUREG-1431, Rev 3.1, establishes the 24-hour completion time based on an approved topical report, WCAP-14333-P-A, Rev 1, October 1998 (WOG STS Page B 3.3.2-44). MHI did not provide a comparable analysis. Note: Condition G of LCO 3.3.2 in NUREG-1431 appears to have been split into Conditions G and S/T of LCO 3.3.2 in the APWR GTS.

Also, the APWR Bases, ACTIONS, G.1, G.2.1, and G.2.2, page B 3.3.2-44 (last paragraph), and the APWR Bases, ACTIONS, S.1 [and S.2], page B 3.3.2-50 (third paragraph), do not reference the specific reliability analysis assumption applicable to their respective REQUIRED ACTION NOTES. Both Bases statements merely state that "this allowance is based on the assumption that 4 hours is the average time required to perform train surveillance." The WOG Bases, ACTIONS, G.1, G.2.1, and G.2.2, page B 3.3.2-44 (second paragraph), specifically reference the reliability analysis assumption of WCAP-1027-P-4 as the basis of the 4 hour average time required to perform the surveillance. Provide the specific reliability analysis assumption upon which the 4 hour average time in the APWR is based.

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**ANSWER:**

<u>Completion Times</u>

The Bases will be revised in DCD Revision 4 to provide a deterministic and probabilistic justification for the 24 hour completion times in Conditions G and S as follows.

The Completion Time of 24 hours is justified because the remaining OPERABLE train is adequate to perform the safety function. In addition, the Completion Time considers that the remaining OPERABLE train has continuous automatic self-testing.

The Completion Time of 24 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Completion Times. Any differences between the Completion Times in the GTS compared to the Completion Times evaluated in the base US-APWR PRA are justified in "Summary of PSMS reliability analysis in PRA", which will be added to DCD Chapter 19 as Appendix B.

It is noted that Condition T is applicable when the Required Action and associated Completion Time for Condition S has not been met. The justification for bringing the unit to MODE 3 within the next 6 hours and MODE 4 within the following 6 hours (12 hours total time) is the same as the equivalent Functions in Condition G of the WOG STS.

REQUIRED ACTION NOTES

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 4 hour bypass times in Conditions G and S as follows.

The Bypass Time of 4 hours is justified because the remaining OPERABLE train is adequate to perform the safety function. In addition, the remaining OPERABLE trains have continuous automatic self-testing.

The Bypass Time of 4 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Bypass Times. Any differences between the Bypass Times in the GTS compared to the Bypass Times evaluated in the base US-APWR PRA are justified in "Summary of PSMS reliability analysis in PRA", which will be added to DCD Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response**.**

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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| **RAI NO.:** | **NO. 166-1784 REVISION 0** |
| **SRP SECTION:** | **16 - TECHNICAL SPECIFICATIONS** |
| **APPLICATION SECTION:** | **16** |
| **DATE OF RAI ISSUE:** | **2/3/2009** |

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**QUESTION NO.: 16-190**

LCO 3.3.2, ESFAS Instrumentation (16.3.3.2-17)

Justify the completion time of 72 hours accounts for sufficient OPERABLE trains, the low probability of an event occurring during this interval, and continuous self-testing on the remaining OPERABLE trains, in the US-APWR, LCO 3.3.2 BASES, ACTIONS J.1 and J.2 on page B 3.3.2-46. Condition J of LCO 3.3.2 in the APWR GTS, applies to the "Actuation Logic and Actuation Outputs" for the "Emergency Feedwater Actuation Function" only, and appears to have originally been part of Condition G of LCO 3.3.2 in NUREG-1431, Rev 3.1. NUREG-1431, Rev 3.1, establishes the 24-hour completion time for Condition G based on an approved topical report, WCAP-14333-P-A, Rev 1, October 1998 (WOG STS Page B 3.3.2-44). MHI did not provide a comparable analysis.

Also, the APWR Bases, ACTIONS, J.1 and J.2, page B 3.3.2-46 (second paragraph), does not reference the specific reliability analysis assumption applicable to the REQUIRED ACTION NOTE of Condition J. The Bases statement merely states that "this allowance is based on the assumption that 4 hours is the average time required to perform channel surveillance." The WOG Bases, ACTIONS, G.1, G.2.1, and G.2.2, page B 3.3.2-44 (second paragraph), specifically reference the reliability analysis assumption of WCAP-1027-P-4 as the basis of the 4 hour average time required to perform the surveillance. Provide the specific reliability analysis assumption upon which the 4 hour average time in the APWR is based.

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**ANSWER:**

Completion Times

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 72 hour completion time in Condition J, as follows.

The Completion Time of 72 hours is justified because the two remaining OPERABLE trains are adequate to perform the safety function. In addition, the Completion Time considers that the two remaining OPERABLE trains each have continuous automatic self-testing.

The Completion Time of 72 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Completion Times. Any differences between the Completion Times in the GTS compared to the Completion Times evaluated in the base US-APWR PRA are justified in "Summary of PSMS reliability analysis in PRA", which will be added to DCD Chapter 19 as Appendix B.

REQUIRED ACTION NOTES

The Bases will be revised in DCD Revision 4 to provide a deterministic and probabilistic justification for the 4 hour Bypass Time in Condition J, as follows.

The Bypass Time of 4 hours is justified because the remaining OPERABLE trains are adequate to perform the safety function. In addition, the Bypass Time considers that the remaining OPERABLE trains have continuous automatic self-testing.

The Bypass Time of 4 hours is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Bypass Times. Any differences between the Bypass Times in the GTS compared to the Bypass Times evaluated in the base US-APWR PRA are justified in "Summary of PSMS reliability analysis in PRA", which will be added to DCD Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA result.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

# RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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|---|---|
| **RAI NO.:** | **NO. 166-1784 REVISION 0** |
| **SRP SECTION:** | **16 - TECHNICAL SPECIFICATIONS** |
| **APPLICATION SECTION:** | **16** |
| **DATE OF RAI ISSUE:** | **2/3/2009** |

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**QUESTION NO.: 16-191**

LCO 3.3.2, ESFAS Instrumentation (16.3.3.2-18)

Justify the STAGGERED TEST BASIS frequency of 92 days based on the expected reliability of the Protection and Safety Monitoring System in the US-APWR TS LCO 3.3.2, SR 3.3.2.2 on page B 3.3.2-52. NUREG-1431, Rev 3.1, establishes a 92-day STAGGERED TEST BASIS frequency based on a topical report, WCAP-15376, Rev 0, October 2000 (WOG STS Page B 3.3.2-49). MHI did not provide a comparable analysis.

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**ANSWER:**

In DCD Rev. 1 there was an error in this SR. SR 3.3.2.2 ACTUATION LOGIC TEST should have been 24 months, which is the same as all other ACTUATION LOGIC TESTS. The frequency for SR 3.3.2.2 was changed to 24 months in DCD Rev. 2. This was maintained in DCD Rev. 3.

In DCD Rev. 4 SR 3.3.2.2, which was an ACTUATION LOGIC TEST, will be replaced by a MEMORY INTEGRITY CHECK (MIC). The MIC is a diverse check of the PSMS software memory integrity, consistent with the Setpoint Control Program (SCP), to ensure there is no change to the internal memory of the PSMS that would impact its functional operation, including digital Nominal Trip Setpoints, Time Constants, Time Delays or the continuous automatic self-test function. For LCO 3.3.2 a MIC is performed for the Safety VDU processors, RPS , ESFAS, SLS and COM-2 , which implement the ESFAS Instrumentation Function.

The MIC and continuous automatic self-testing function are equivalent to the ACTUATION LOGIC TEST of the STS, which the exception of “a continuity check of output devices”, which for the US-APWR GTS is confirmed during the TADOT. All three of these tests (i.e., MIC, continuous automatic self-test, and ACTUATION LOGIC TEST) check for any changes, such as random hardware failures and logic change errors, that would effect the actuation logic functions. The continuous self-testing in the PSMS assures these changes are immediately detected.

For the ESFAS and SLS, the complete operability of all output devices, including the “continuity check of output devices”, is included in the TADOT. The TADOT overlaps with continuous self-testing and the MIC. The TADOT frequency ensures the continuity check of each output device is conducted every 24 months. This test frequency is justified by the Mean Time Between Failures (MTBF) reliability of the PSMS output device, and the redundant train configuration of the PSMS.

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 24 month surveillance frequency for the MIC, as follows:

The Frequency of 24 months is justified because the software memory integrity is checked by the continuous automatic self-testing function.

The MIC Frequency of 24 months is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.

DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Surveillance Frequencies. Any differences between the Surveillance Frequencies in the GTS compared to the Surveillance Frequencies evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to Ch. 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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| **RAI NO.:** | **NO. 166-1784 REVISION 0** |
| **SRP SECTION:** | **16 - TECHNICAL SPECIFICATIONS** |
| **APPLICATION SECTION:** | **16** |
| **DATE OF RAI ISSUE:** | **2/3/2009** |

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**QUESTION NO.: 16-192**

LCO 3.3.3, Post Accident Monitoring (PAM) Instrumentation (16.3.3.3-01)

Justify not applying Condition F (together with its required action(s) and completion time) of LCO 3.3.3 in NUREG 1431, Rev 3.1, to the US-APWR. Condition F (together with its required action(s) and completion time) of LCO 3.3.3 in NUREG 1431, Rev 3.1 and not including it in the US-APWR TS LCO 3.3.3.

Table 3.3.3-1 in NUREG 1431, Rev 3.1, provides a list of key variables for post accident monitoring, along with the number of “Required Channels” (second column) and the “Condition Referenced from Required Action D.1” (third column). The entries for this third column for the variables “Reactor Vessel Water Level” and “Containment Area Radiation (High Range)” differ from the corresponding entries in the US-APWR. It is not clear why the entries for “Reactor Vessel Water Level” and “Containment Area Radiation (High Range)” should be “E” and not “F.” Condition “F” of NUREG 1431, Rev 3.1, requires the unit to immediately “initiate action in accordance with Specification 5.6.5.” This specification states the following:

> When a report is required by Condition B or F of LCO 3.3.3, "Post Accident Monitoring (PAM) Instrumentation," a report shall be submitted within the following 14 days. The report shall outline the preplanned alternate method of monitoring, the cause of the inoperability, and the plans and schedule for restoring the instrumentation channels of the Function to OPERABLE status.

It is not clear why the above action should not be applicable to the US-APWR for “Reactor Vessel Water Level” and “Containment Area Radiation (High Range).”

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**ANSWER:**

The description of Condition F, which had been added in the DCD Rev. 2, and was included in DCD Rev. 3, will be removed from the LCO 3.3.3 and ACTIONS F.1 of B 3.3.3 in the DCD Chapter 16 Rev. 4. For Reactor Vessel Water Level and Containment High Range Area Radiation the US-APWR has no preplanned alternate method of monitoring. Therefore, the reference to Specification 5.6.5 is not applicable.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA result.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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| **RAI NO.:** | **NO. 166-1784 REVISION 0** |
| **SRP SECTION:** | **16 - TECHNICAL SPECIFICATIONS** |
| **APPLICATION SECTION:** | **16** |
| **DATE OF RAI ISSUE:** | **2/3/2009** |

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**QUESTION NO.: 16-194**

LCO 3.3.5, LOP Class 1E GTG Start Instrumentation (16.3.3.5-01)

Justify the frequency of 24 months based on the expected reliability of the Protection and Safety Monitoring System in the US-APWR TS LCO 3.3.5 BASES, SR 3.3.5.4 on page B 3.3.5-6.

The reliability of the Protection and Safety Monitoring System has yet to be established. Provide analysis documentation to substantiate a 24-month Surveillance frequency.

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**ANSWER:**

In DCD Rev. 4 SR 3.3.5.4, which was an ACTUATION LOGIC TEST, will be replaced by a MEMORY INTEGRITY CHECK (MIC). The MIC is a diverse check of the PSMS software memory integrity, consistent with the Setpoint Control Program (SCP), to ensure there is no change to the internal memory in the PSMS that would impact its functional operation, including the Time Delays and continuous automatic self-test function. For LCO 3.3.5 a MIC is performed for the ESFAS and SLS, which implement the LOP Class 1E GTG Start Instrumentation Function.

The MIC and continuous automatic self-testing function are equivalent to the ACTUATION LOGIC TEST of the STS, which the exception of “a continuity check of output devices”, which for the US-APWR GTS is confirmed during the TADOT. All three of these tests (i.e., MIC, continuous automatic self-test, and ACTUATION LOGIC TEST) check for any changes, such as random hardware failures and logic change errors, that would effect the actuation logic functions. The continuous self-testing in the PSMS assures these changes are immediately detected.

For the ESFAS, and for the SLS which provides the GTG actuation logic and GTG control system, the complete OPERABILITY of all output devices, including the “continuity check of output devices”, is included in the TADOT. The TADOT overlaps with continuous self-testing and the MIC. The TADOT frequency ensures the continuity check of each output device is conducted every 24 months. This test frequency is justified by the Mean Time Between Failures (MTBF) reliability of the PSMS output device, and the redundant train configuration of the PSMS.

The Bases will be revised in DCD Rev. 4 to provide a deterministic and probabilistic justification for the 24 month surveillance frequency for the MIC, as follows.

The Frequency of 24 months is justified because the software memory integrity is checked by the continuous automatic self-testing function.

The MIC Frequency of 24 months is also justified in the US-APWR reliability and risk analyses, the summary and result of which are documented in FSAR Chapter 19.
DCD Chapter 19 provides a summary of the US-APWR reliability and risk analysis, which includes consideration of Surveillance Frequencies. Any differences between the Surveillance Frequencies in the GTS compared to the Surveillance Frequencies evaluated in the base US-APWR PRA are justified in “Summary of PSMS reliability analysis in PRA”, which will be added to DCD Chapter 19 as Appendix B.

**Impact on DCD**

Refer to Attachment A for the impact on the DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical / Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

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| **RAI NO.:** | **NO. 463-3746 REVISION 0** |
| **SRP SECTION:** | **16 - TECHNICAL SPECIFICATIONS** |
| **APPLICATION SECTION:** | **16** |
| **DATE OF RAI ISSUE:** | **10/06/2009** |

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**QUESTION NO.: 16-299**

Provide the additional information and update the following RAI response for Post Accident Monitoring (PAM) Instrumentation Tech Spec 3.3.3.

Request for Additional Information No. 167-1769

QUESTIONS for Technical Specification Branch (CTSB)

16-284

In RAI-SRP16-CTSB-1769/284, the staff requested the applicant provide a summary of the analyses to confirm that the list of Post Accident Monitoring (PAM) instrumentation contained in the APWR GTS, Table 3.3.3-1, includes the entire population of instruments required to address the requirements of General Design Criteria (GDC) 13, 19 and 64, the guidance in Revision 4 of Regulatory Guide (RG) 1.97, and the selection criteria included in IEEE Standard 497-2002. Endorsed IEEE Standard 497-2002 provides criteria for selecting PAM instrumentation variables, instead of providing a list of variables to monitor (which was the approach taken in the 1983 Revision 3 of RG 1.97). The discussion of these criteria on page iv of IEEE Standard 497-2002 states “Accident monitoring variable selection must be consistent with the plant specific emergency operating procedures (EOPs) and abnormal operating procedures (AOPs). The variables selected from these procedures need to be the minimum set to assess that safety-related functions are performed and safety systems operate acceptably.” The applicant's response (provided in Chapter 7 Request For Additional Information item 07.05-8), does not describe how it is possible to provide a “complete” PAM Instrumentation Technical Specification prior to COL issuance, when PAM variable selection criteria in RG 1.97, Revision 4, depend on prior development of Emergency Procedure Guidelines (EPGs), EOPs and AOPs (guidelines and procedures which cannot be developed before COL issuance). This issue is identified as Open Item OI-SRP16-CTSB-1769/284 in the U.S. APWR Safety Evaluation Report.

The staff has reviewed its current position, as stated in the STS Reviewer’s Note, regarding which accident monitoring instrumentation should be in technical specifications, in comparison to Regulatory Guide 1.97, “Criteria for Accident Monitoring Instrumentation for Nuclear Power Plants,” Revision 4, June 2008. It is the NRC staff’s position that technical specifications should include (1) all Regulatory Guide 1.97, Revision 4, Type A instruments, and (2) all Regulatory Guide 1.97, Revision 4, Type B and Type C instruments in accordance with the units Regulatory

Guide 1.97 Safety Evaluation Report. Therefore, a COL applicant should include a technical specification that meets this staff position if the applicant references Regulatory Guide 1.97, Revision 4.

Identification of Regulatory Guide 1.97, Revision 4, Type A, Type B, and Type C accident monitoring instrumentation functions depends on development of emergency operating procedures (EOPs) and abnormal operating procedures (AOPs), which is a post-COL activity. Therefore COL applicants implementing Regulatory Guide 1.97, Revision 4, should use guidance from DC/COL-ISG-8, “Necessary Content of Plant-Specific Technical Specifications When a Combined License Is Issued,” December 2008, in order to complete the plant-specific technical specification list of PAM instrumentation functions. This guidance provides three options:

- Option 1 involves the use of plant-specific information. Option 1 appears impracticable for PAM instrumentation technical specifications because the list of Type A, Type B, and Type C PAM instrumentation functions cannot be finalized before COL issuance.

- Option 2 involves the use of useable bounding information. Option 2 may be practical if the COL applicant is able to develop a truly bounding list of Type A, Type B and Type C PAM instrumentation functions to be included in the plant-specific technical specifications. However, if a Regulatory Guide 1.97, Revision 4, analysis considering plant-specific EOPs and AOPs, which are based on the as-built plant, shows that additional PAM instrumentation functions are necessary, then the COL holder would need to request a license amendment to make changes to the plant-specific technical specification PAM instrumentation required functions list. The NRC would need to approve this amendment before the COL holder would be allowed to load fuel.

- Option 3 involves an administrative program to control PAM instrumentation functions. Option 3 would require establishing a plant-specific administrative controls program technical specification that would require using an NRC-approved methodology to determine the required PAM instrumentation functions, and maintaining the list of required PAM instrumentation functions in a specified document with appropriate regulatory controls. Option 3 may be practical because the approved methodology, Regulatory Guide 1.97, Revision 4, is already established. This approach is advantageous because COL holders would not necessarily need to request a license amendment to make changes to the PAM instrumentation required functions list post COL. However, the program technical specification would need to be developed prior to COL issuance.

The applicant is requested to propose changes as described in the attached document.

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**ANSWER:**

The US-APWR DCD and associated Technical Specifications have been developed based on Option 2 described in this RAI and associated supplemental document. A bounding list of Type A, Type B, and Type C instrumentation functions have been defined and reflected in DCD Section 7.5 and in the US-APWR Generic Technical Specifications (GTS) Section 3.3.3. Notwithstanding the US-APWR commitment to RG 1.97 Rev. 4, this bounding list has been developed based on a combination of previous revisions of RG 1.97, Japanese domestic and US operating plant experience and EOPs, and known differences between the US-APWR and current operating PWRs. Because the US-APWR design is very similar to the current US operating plants, there is high confidence that the list is bounding and complete.

Since the list of PAM variables and the selection basis of PAM variables are described in the DCD Chapter 7.5, DCD Chapter 16 Rev. 4, Bases 3.3.3 BACKGROUND will be revised to clarify that DCD Section 7.5 describes the PAM instrumentation, and in particular, the process that was used for determining the bounding list of PAM variables in Table 3.3.3-1.

Section 7.5 of DCD Rev. 4 will clarify that the Type A, B, and C variables/instrument functions are those determined by the application of the NRC-endorsed PAM instrumentation determination process, which is based on supporting the site-specific AOPs and EOPs, as stipulated in RG 1.97 Rev. 4. The PAM variables in Table 7.5-3 are verified upon completion of the EOPs and AOPs.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

There is no impact on the Technical/Topical Reports.

## RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

**1/27/2012**

**US-APWR Design Certification**

**Mitsubishi Heavy Industries**

**Docket No. 52-021**

**RAI NO.:** NO. 590-4753 REVISION 0

**SRP SECTION:** 16 - TECHNICAL SPECIFICATIONS

**APPLICATION SECTION:** 16

**DATE OF RAI ISSUE:** 6/8/2010

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**QUESTION NO.: 16-301**

In Comanche Peak (CP) RAI 91, Question 16-16, the staff requested that Luminant resolve the COL Holder Items identified in Section 3.3 (Instrumentation) of the CP Units 3 and 4 Plant-Specific Technical Specifications (PTS), in accordance with Interim Staff Guidance Document DC/COL-ISG-8, "Necessary Content of Plant-Specific Technical Specifications When a Combined License is Issued." MHI, in cooperation with Luminant, decided on Option (3) of the ISG, and subsequently established a Setpoint Control Program (SCP) Administrative Controls TS in the DCD to resolve the COL Holder Items. In a letter to the NRC dated October 30, 2009, MHI transmitted proposed updates to the DCD to support incorporation of the SCP Specification.

MHI is requested to address the following items (see attached) associated with these proposed updates, which are identified as Enclosure 1 in the referenced letter.

1. On page 1.1-2, the last sentence in the fourth paragraph of the definition for CHANNEL CALIBRATION states "[t]he confirmed setpoint are monitored on the safety VDUs." Clarify the reference to "setpoint." Does "setpoint" refer to the five calibration settings of 0 percent, 25 percent, 50 percent, 75 percent, and 100 percent, or does it refer to the Limiting Safety System Setting (LSSS) values? Also, it appears that "setpoint" should be pluralized.

2. On page 3.1.9-3, Surveillance Requirement (SR) 3.1.9.1 states "[p]erform a CHANNEL CALIBRATION TEST on power range and intermediate range channels per SR 3.3.1.10, and Setpoint Control Program." The word "TEST" does not appear in the defined term for CHANNEL CALIBRATION in GTS Definitions Section 1.1. In addition, the reference to "Setpoint Control Program" does not constitute adequate incorporation of the statement provided in RAI 91, Question 16-16, which reads: "Perform CHANNEL CALIBRATION on each required channel consistent with Specification 5.5.X.X, "Setpoint Control Program (SCP)."

3. It does not appear that CHANNEL CALIBRATION SRs 3.3.1.9, 3.3.1.10, 3.3.1.11, 3.3.2.7, and 3.3.6 have been revised to incorporate the statement provided in RAI 91, Question 16-16, which reads: "Perform CHANNEL CALIBRATION on each required channel consistent with Specification 5.5.X.X, "Setpoint Control Program (SCP)."

4. There is no longer a reference to Table 3.3.1-1, Note 1, in Table 3.3.1-1, Function 6, Overtemperature ΔT on page 3.3.1-15. If Note 1 is to be retained in Table 3.3.1-1, consider

the use of a footnote to link the associated Overtemperature ΔT setpoint derivation information to Function 6.

5. There is no longer a reference to Table 3.3.1-1, Note 2, in Table 3.3.1-1, Function 7, Overpower ΔT on page 3.3.1-16. If Note 2 is to be retained in Table 3.3.1-1, consider the use of a footnote to link the associated Overpower ΔT setpoint derivation information to Function 7.

6. MUAP-09022-P(R0), "US-APWR Instrument Setpoint Methodology," states that the Loss of Power (LOOP) Function is implemented via a conventional analog bistable and that a Channel Operational Test (COT) confirms bistable accuracy. Table 3.3.2-1 on page 3.3.2-17 does not specify a COT SR for Function 6.e, LOOP Signal.

7. SR 3.3.5.3 on page 3.3.5-2 states: "[p]erform CHANNEL CALIBRATION for LOP undervoltage relays in accordance with the SCP with following time delay." The reference to "SCP" does not constitute adequate incorporation of the statement provided in RAI 91, Question 16-16, which reads: "Perform CHANNEL CALIBRATION on each required channel consistent with Specification 5.5.X.X, "Setpoint Control Program (SCP)." Also, it appears that the word "delay" at the end of the sentence should be pluralized.

8. Inconsistencies in SCP Specification terminology exist with respect to the following:

    a. Step 5.5.21.b on page 5.5.20, specifies "As-Found Tolerance (AFT)," whereas step 5.5.21.f on page 5.5-21 specifies "PTAC" (Performance Test Acceptance Criteria).

    b. Step 5.5.21.b on page 5.5.20, specifies "As-Left Tolerance (ALT)," whereas step 5.5.21.f on page 5.5-21 specifies "CT" (Calibration Tolerance).

9. SCP Specification discrepancies associated with step 5.5.21.d on page 5.5-21 exist with respect to the following:

    a. Step 5.5.21.d states: "[f]or each Technical Specification required automatic protection instrumentation function implemented with an analog bistable function, performance of a CHANNEL CALIBRATION surveillance …" MUAP-09022-P(R0), "US-APWR Instrument Setpoint Methodology," states that a Channel Calibration confirms the instrument accuracy over its entire range and that a COT confirms analog bistable accuracy. Determine the correct SR to be specified for analog bistable functions in step 5.5.21.d.

    b. Although the last sentence in 5.5.21.d describes CT limits, there is no guidance, similar to that in step 5.5.X.X.c.2 of the Example SCP Specification provided in CP RAI 120, Question 16-17, that specifically states that the instrument channel trip setting shall be set to a value within the specified CT around the NTSP at the completion of the surveillance.

10. SCP Specification discrepancies associated with step 5.5.21.c on pages 5.5-20 and 5.5-21 exist with respect to the following:

    a. Although the last sentence in 5.5.21.c describes CT limits, there is no guidance, similar to that in step 5.5.X.X.c.2 of the Example SCP Specification provided in CP RAI 120, Question 16-17, that specifically states that the instrument channel calibration settings shall be set to values within the specified CT around each of the five calibration settings (0 percent, 25 percent, 50 percent, 75 percent, and 100 percent) at the completion of the surveillance.

11. Step 5.5.21.e on page 5.5-21 includes provisions for trending and evaluating "As- Found" versus "As-Left" data only for those instrumentation functions implemented via conventional

analog bistables. The SCP Specification must also include provisions for trending and evaluation of “As-Found” versus “As-Left” data at the five calibration settings (0 percent, 25 percent, 50 percent, 75 percent, and 100 percent) for protection functions implemented via digital bistables.

12. SCP Specification discrepancies associated with REVIEWER’S NOTES on page 5.5-22 exist with respect to the following:

    a. Reviewer’s Notes 2 and 3 are written for automatic protection instrumentation functions implemented via analog bistables. The same Note criteria should also apply to the “As-Found” and “As-Left” values at the five calibration settings (0 percent, 25 percent, 50 percent, 75 percent, and 100 percent) for protection instrumentation functions implemented via digital bistables.

    b. Reviewer’s Note 4 states: “[i]f the requirements of 5.5.21.c or 5.5.21.d include an allowance for the as-found value to be compared with the specified calibration setting or NTSP, …” Neither 5.5.21.c or 5.5.21.d include an allowance for the as-found value to be compared to anything other than the specified calibration setting or NTSP. Comparable step 5.5.X.X.c.1 of the Example SCP Specification provided in CP RAI 120, Question 16-17, specifically states: “[t]he as-found value of the instrument channel trip setting shall be compared with the previous as-left value or the specified NTSP.” There are no provisions in GTS SCP Specification steps 5.5.21.c or 5.5.21.d, to compare either the as-found value of the calibration setting or the as-found value of the NTSP, to the “previous asleft” value. Therefore, the criteria delineated in Reviewer’s Notes 4.a, 4.b, and 4.c of the GTS SCP Specification always apply when comparing the as-found value only to the specified calibration setting or NTSP. The first sentence of Reviewer’s Note 4 could be misleading. Clarify the Reviewer’s Note. Also, make any necessary corrections to the first sentence of the third paragraph on Bases page B 3.3.6-13, which states:“[t]he difference between the current “as-found” value and the previous test “as-left” value must be consistent with the drift allowance used in the setpoint methodology.” The referenced Bases statement is not supported by the GTS SCP Specification for the reasons stated above.

13. The adequacy of the word “administered” in the following Bases statements to convey SCP implementation of the Allowable Values (AVs) and Trip Setpoints is questionable. Consider use of the phrase “recorded and maintained in a document established by the Setpoint Control Program (SCP).”

    a. Page B 3.3.1-2, third paragraph, first sentence states: “[t]he Allowable Value administered in the Setpoint Control Program (SCP) serves as the LSSS such that …"

    b. Page B 3.3.1-5, last paragraph (Allowable Values and RTS Setpoints), third sentence states: “… the Trip Setpoints administered in the SCP in the accompanying LCO …”

    c. Page B 3.3.1-6, first sentence of the NOTE states: “[t]he Allowable Value administered in the SCP is the maximum deviation …”

    d. Page B 3.3.2-3, third paragraph (Allowable Values and ESFAS Setpoints), third sentence states: “… the Allowable Values and Trip Setpoints in the SCP in the accompanying LCO …”

    e. Page B 3.3.6-3, second paragraph, second sentence states: “the Allowable Values administered in the SCP in the accompanying LCO …”

14. The last sentence of the third paragraph on page B 3.3.1-47 states: “[t]he CHANNEL CALIBRATION is performed in a manner that is consistent with Section 5.5.21, SCP.” To

promote consistency within the Bases, consider revising the sentence so that it reads: “[t]he CHANNEL CALIBRATION is performed in a manner that is consistent with the methods and assumptions of Section 5.5.21, SCP.”

15. The last sentence of the third paragraph on page B 3.3.2-64 states: “[t]he CHANNEL CALIBRATION is performed in a manner that is consistent with Section 5.5.21, SCP.” To promote consistency within the Bases, consider revising the sentence so that it reads: “[t]he CHANNEL CALIBRATION is performed in a manner that is consistent with the methods and assumptions of Section 5.5.21, SCP.”

16. The first sentence of the third paragraph on page B 3.3.1-2 states: “[t]he Allowable Value administered in the Setpoint Control Program (SCP) serves as the LSSS such that a channel is OPERABLE if the measured accuracy is found not to exceed the Allowable Value during CHANNEL CALIBRATION.” MUAP-09022-P(R0), “US-APWR Instrument Setpoint Methodology,” Section 5.3, states that “[t]he LTSP is an LSSS managed by the plant Technical Specifications.” Provide the additional information and make any necessary changes to resolve apparent inconsistencies associated with the LSSS value.

17. Bases B 3.3 editorial items:

    a. Page B 3.3.1-2, third paragraph, second sentence: the word “setting” should be pluralized.

    b. Page B 3.3.1-9, last paragraph, third sentence reads: “[f]or digital functions Allowable Values are defined in terms pertinent to the channel calibration setpoints.” The word “setpoints” should be changed to “settings.”

    c. Page B 3.3.1-56, third paragraph, first sentence reads: “[t]he Frequency of 24 months is based on the assumption of a 24 month calibration interval in the determination of the magnitude of equipment drift in Section 5.5.21, SCP.” The last part of the sentence should be revised to read “… magnitude of equipment drift in accordance with Section 5.5.21, SCP.”

    d. Page B 3.3.1-57, third paragraph, first sentence reads: “[t]he Frequency is justified by the assumption of a 24 month calibration interval in the determination of the magnitude of equipment drift in Section 5.5.21, SCP.” The last part of the sentence should be revised to read “… magnitude of equipment drift in accordance with Section 5.5.21, SCP.”

    e. Page B 3.3.2-68, next to last paragraph, first sentence reads: “[t]he Frequency of 24 months is based on the assumption of a 24 month calibration interval in the determination of the magnitude of equipment drift in Section 5.5.21, SCP.” The last part of the sentence should be revised to read “… magnitude of equipment drift in accordance with Section 5.5.21, SCP.”

    f. Page B 3.3.2-4, first paragraph, third sentence reads: “[a]ny channel is considered to be properly adjusted when the “as-left” accuracy value is within the established Calibration Tolerance (CT) band in accordance with the methods and assumptions in the SCP.” The word “accuracy” should be deleted from this statement to ensure consistency with SCP Specification Reviewer’s Note 2 which specifies “as-left value” rather than “as-left accuracy value.”

    g. Page B 3.3.6-5, last paragraph, first sentence reads: “[a] channel is OPERABLE provided the “as-found” accuracy value does not exceed its Allowable Value.” The word “accuracy” should be deleted from this statement to ensure consistency with SCP

Specification steps 5.5.21.c and 5.5.21.d which specify “as-found values” rather than “as-found accuracy values.”

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**ANSWER:**

The following answers are numbered in a manner that matches each of the above questions.

1. The term “setpoint” is referring to the five calibration settings. Therefore, in DCD Rev. 3 “calibration setpoints” was changed to “calibration settings”. In addition, in DCD Rev. 4 GTS Definitions the discussion of where the calibration settings are confirmed (i.e., digital VDU) will be inserted prior to any discussion of analog vs. binary measurements, since the VDU method of confirmation is common to both analog and binary measurements.

2. MHI agrees. In DCD Rev. 3 SR 3.1.9.1 on page 3.1.9-3 was replaced with the following sentence:

   “Perform a CHANNEL CALIBRATION on power range and intermediate range channels consistent with SR 3.3.1.10 and Specification 5.5.21, Setpoint Control Program (SCP).”

   However, this change did not completely resolve this issue. To clarify SR 3.1.9.1 is conducted per Channel Calibration of LCO 3.3.1 Surveillance, in DCD Rev 4 the following additional change will be made to the LCO for SR 3.1.9.1:

   “Perform ~~a~~ CHANNEL CALIBRATION on power range and intermediate range channels <u>per SR 3.3.1.9</u>, consistent with ~~SR 3.3.1.10, and~~ Specification 5.5.21, Setpoint Control Program (SCP).”

   And the following change will be made to Bases SR 3.1.9.1:

   “The power range … A CHANNEL CALIBRATION is performed on each power range and intermediate range channel <u>per SR 3.3.1.9, consistent with Specification 5.5.21, Setpoint Control Program (SCP),</u> prior to initiation of the PHYSICS TESTS. This will ensure ...“

   It is noted that in DCD Rev.4 SR 3.3.1.10, which was CHANNEL CALIBRATION, will be renumbered as SR 3.3.1.9 due to the replacing of COT - Digital and ACTUATION LOGIC TEST – Digital by MEMORY INTEGIRITY CHECK (MIC) (Refer to the response to RAI 16-230 for this replacement).

3. MHI agrees. Regarding the reference to SR 3.3.6, it is our belief that the staff meant to list SR 3.3.6.3 instead of SR 3.3.6. In DCD Rev. 3 SRs 3.3.1.9, 3.3.1.10, 3.3.1.11, 3.3.2.7, and 3.3.6.3 were revised to read as follows:

   “Perform a CHANNEL CALIBRATION on each required channel consistent with Specification 5.5.21, Setpoint Control Program (SCP).”

   It is noted that in DCD Rev. 4 “Perform a CHANNEL CALIBRATION” will be changed to “Perform CHANNEL CALIBRATION” for all of these SRs. In addition, in DCD Rev. 4 a note will be added to SR 3.3.6.3 that allows the CHANNEL CALIBRATION conducted for the PSMS in LCO 3.3.1 or 3.3.2 to be credited for DAS.

4. The reference to Note 1 in Table 3.3.1-1, Function 6, was deleted in DCD Rev. 3 when columns 6 and 7 in this table were deleted, due to incorporation of the Setpoint Control Program. This Note is no longer needed because, DCD Rev. 4 will clarify that the Overtemperature ΔT trip Function is calculated for each loop as described in FSAR Section 7.2.1.4.3.1, and the cycle dependent variables for this Function are specified in the COLR.

5. The reference to Note 2 in Table 3.3.1-1, Function 7, was deleted in DCD Rev. 3 when columns 6 and 7 in this table were deleted, due to incorporation of the Setpoint Control Program. This

Note is no longer needed because, DCD Rev. 4 will clarify that the Overpower ΔT trip Function is calculated for each loop as described in FSAR Section 7.2.1.4.3.2, and the cycle dependent variables for this Function are specified in the COLR.

6. MUAP-09022 is incorrect; it will be corrected at the next revision. Please see the response to item 9, below. For the LOP, which is implemented with binary sensors, the AV for the NTSP is confirmed via CHANNEL CALIBRATION.

7. MHI agrees. The first sentence in SR 3.3.5.3 on page 3.3.5-2 was revised in DCD Rev. 3 as follows:

   "Perform CHANNEL CALIBRATION for LOP undervoltage relays ~~in accordance~~ with ~~the SCP~~ Specification 5.5.21, Setpoint Control Program (SCP), with the following time delays:"

   This SR will be changed to SR 3.3.5.2 in DCD Rev.4. This sentence will be changed further in DCD Rev. 4, as follows:

   "Perform CHANNEL CALIBRATION for the following LOP undervoltage relays consistent with Specification 5.5.21, Setpoint Control Program (SCP)."

   The change to add "the following" is to distinguish these relays from other UV relays that may be in the system. The change to delete "with the following time delays" is because the time delays are within the digital processing of the PSMS. Therefore the time delay values are confirmed by continuous automatic self-testing and the diverse MEMORY INTEGRITY CHECK (MIC), described in B 3.3.2; they are not confirmed by CHANNEL CALIBRATION.

8. See below:

   a. "PTAC" is the correct term.

   b. "CT" is the correct term.

      In DCD Rev. 3 the terms "As-Found Tolerance (AFT)" and "As-Left Tolerance (ALT)" in specification 5.5.21.b, were replaced with "Performance Test Acceptance Criteria (PTAC)" and "Calibration Tolerance (CT)", respectively. In DCD Rev. 3 "PTAC" is used consistently in both 5.5.2.1 (b) and (f), and "CT" is used consistently in both 5.5.2.1 (b) and (f).

9. See below:

   In the previous answer, COT – Analog was intended to be for analog bistables; COT was intended to be for digital bistables. In DCD Rev. 4 COT will be changed to MEMORY INTEGRITY CHECK (MIC) and COT – Analog will be changed to COT. Therefore, COT has been revised to MIC and COT – Analog has been revised to COT in the following answers.

   a. MHI agrees. The analog bistable setpoint is confirmed by COT, not by CHANNEL CALIBRATION. In DCD Rev. 3, Step 5.5.21.d was written to apply to both binary sensors and analog bistables, because the accuracy of both devices is confirmed by checking the AV at the Nominal Trip Setpoint. However addressing both devices in the same Step is confusing because binary sensor accuracy is confirmed by CHANNEL CALIBRATION, whereas analog bistable setpoint accuracy is confirmed by COT. Therefore, in DCD Rev. 4 separate Steps are provided for binary sensors and analog bistables.

      Sections 5.3.1 and 5.3.2 of MUAP-09022-P(R1) are incorrect. In Rev. 2, MHI revised section 5.3.1 to clearly define the setpoint methodology for analog bistables, and 5.3.2 was revised to clearly define the setpoint methodology for digital bistables. In addition, a new section 5.3.2.2 with a new Figure 5-7 was added to Rev. 2 to clearly describe the setpoint methodology and surveillance method for binary sensors.

DCD Rev. 4 will clarify that CHANNEL CALIBRATION is applicable to the following functions with binary sensors:

- Section 3.3.1 (Low Turbine Oil Pressure, Function 13.a in Table 3.3.1-1)
- Section 3.3.2 (LOP, Function 6.e in Table 3.3.2-1)
- Section 3.3.5 (LOP)

It is noted that the binary sensors used for the Emergency Feedwater Actuation - Trip of All Main Feedwater Pumps Function have no drift potential. Therefore they are only checked by a TADOT.

DCD Rev. 4 will also clarify that COT is applicable to all DAS automatic actuation functions, since all DAS automatic actuation functions are implemented with analog bistables.

b. MHI agrees. In DCD Rev. 3 the following sentence was inserted after the first sentence of the last paragraph in 5.5.21.d:

“The instrument channel trip setting shall be set or confirmed to be within the specified CT around the NTSP at the completion of each COT-analog surveillance.”

In DCD Rev. 4 the following additional changes will be made:

- “COT-analog” will be changed to “COT” for consistency with the Definitions in Section 1.1, where COT has been changed to MIC and COT-Analog has been changed to COT.
- This statement will be amended to explain that if this condition is not met “the instrument channel shall be immediately declared inoperable”.

10. See below:

a. MHI agrees. In DCD Rev. 3 the following sentence was inserted after the first sentence of the last paragraph in 5.5.21.c:

“The instrument channel calibration settings shall be set or confirmed to be within the specified CT around the five calibration settings (0, 25, 50, 75 and 100 percent) at the completion of each CHANNEL CALIBRATION surveillance.”

In DCD Rev. 4, this statement will be amended to explain that if this condition is not met “the instrument channel shall be immediately declared inoperable”.

11. MHI agrees, but 5.5.21.e should also have more correctly required that trending for analog bistable functions and binary sensors (e.g., pressure switches, UV relays) should trend the difference between the as-found value and the as-left trip setting value or the specified NTSP. In DCD Rev. 3 specification 5.5.21.e was replaced with the following:

“For each Technical Specification required automatic protection instrumentation function implemented with an analog bistable function, the difference between the instrument channel trip setting as-found value and the as-left trip setting value or the specified NTSP shall be trended and evaluated to verify that the instrument channel is functioning in accordance with its design basis.

For each Technical Specification required automatic protection instrumentation function implemented with a binary sensor connected to a digital channel (e.g., pressure switches, UV relays), the difference between the instrument channel trip setting as-found value and the as-left trip setting value or the specified NTSP shall be trended and evaluated to verify that the instrument channel is functioning in accordance with its design basis.

For each Technical Specification required automatic protection instrumentation function implemented with a digital bistable function, the difference between the instrument channel calibration setting (0, 25, 50, 75 and 100 percent) as-found and as-left values shall be trended and evaluated to verify that the instrument channel is functioning in accordance with its design basis."

In DCD Rev. 4 the following additional changes will be made:

- In the first two paragraphs above, the words "as-left trip setting value" will be changed to "as-left value".
- In the last paragraph above "implemented with a digital bistable" will be changed to "implemented with an analog sensor". This is more correct because it is the type of measurement device that determines the CHANNEL CALIBRATION method, not the type of bistable (i.e., the same CHANNEL CALIBRATION method is used for analog measurements that interface to DAS, even though DAS has analog bistables). This change also makes this section consistent with the Definitions in Section 1.1.
- Separate steps will be created for analog sensors, binary sensors and analog bistables. Similarly, there will be separate steps for trending.

12. See below:

    a. MHI agrees. The following sentence was added to Reviewers Note 2 for the as-left value in DCD Rev. 3:

    > "For each Technical Specification required automatic protection instrumentation function implemented with a digital bistable function, the as-left value of the instrument channel calibration of the surveillance with no additional adjustment of the instrument channel."

    It is noted that this note in DCD Rev. 3 contains typographical omissions; it should have been "…the as-left value of the instrument channel calibration setting shall be the value at which the channel was set or left at the completion of the surveillance…"

    It is also noted that in DCD Rev. 3 the same note for the "As-Found" value was not added for digital bistable functions, as requested by the NRC in this RAI.

    However, there is no need to provide dedicated notes for analog sensors, binary sensors and analog bistables, since the note information is the same for all types of channels. Therefore, in DCD Rev. 4 Notes 2 and 3, which define as-left and as-found values, will be changed to be generically applicable to all instrument channels.

    b. This issue was not correctly addressed in DCD Rev. 3.

    MHI agrees that in Rev. 3 there are no provisions to compare the as-found value to the "previous as-left" value, therefore, the criteria delineated in Reviewer's Notes 4.a, 4.b, and 4.c always apply. However, DCD Rev. 4 will be revised to allow the as-found value of the instrument channel to be compared with the specified NTSP (for binary sensors and analog bistables) or with the calibration setting (for analog sensors), or with the previous as-left value. Therefore, Reviewer's Note 4 is applicable. However, in DCD Rev. 4 separate notes will be provided for comparing the as-found value to the NTSP vs. the calibration setting to clearly distinguish the requirements.

    Regarding the third paragraph on Bases page 3.3.6-13, the first sentence, "[t]he difference between the current "as-found" value and the previous test "as-left" value must be consistent with the drift allowance used in the setpoint methodology", was deleted from this paragraph and from all other sections of the Bases where it previously appeared in DCD Rev. 3. DCD Rev. 4 will clarify that CHANNEL CALIBRATION must be performed consistent with the methods and assumptions of Specification 5.5.21, SCP.

13. MHI agrees. In the letter (UAP-HF-09493) to the NRC dated October 30, 2009, where MHI transmitted proposed updates to the DCD to support incorporation of the SCP Specification, each point where the phrase "…administered in…" appears on pages B 3.3.1-2, B 3.3.1-5, B

3.3.1-6, B 3.3.2-3, and B 3.3.6-3 was replaced in DCD Rev.3 with the phrase "…recorded and maintained in a document established by…"

In DCD Rev. 4 "…recorded and maintained in a document established by the SCP" will be applied to the first instance of NTSP, AV, CT and PTAC in each section.

14. MHI agrees. In DCD Rev. 3 the CHANNEL CALIBRATION description was revised as follows:

    "The CHANNEL CALIBRATION is performed in a manner that is consistent with the method and assumptions of Section 5.5.21, Setpoint Control Program (SCP)."

    In DCD Rev. 4 the typo in "method" will be changed to "methods" and "Section" will be changed to "Specification". These changes will be made in all applicable Bases sections.

15. MHI agrees. In DCD Rev. 3 the CHANNEL CALIBRATION description was revised as follows:

    "The CHANNEL CALIBRATION is performed in a manner that is consistent with the methods and assumptions of Section 5.5.21, Setpoint Control Program (SCP)."

    In DCD Rev. 4 "Section" will be changed to "Specification". This change will be made in all applicable Bases sections

16. MHI has changed the LSSS from the LTSP (and the AV) to the NTSP in MUAP-09022-P Rev. 1, as discussed in a meeting with NRO and Tech Spec Branch staff on March 17 and 18, 2010. Accordingly, the last sentence of the second paragraph on page B 3.3.1-2 was deleted in DCD Rev. 3, because the AV is not a component of the LSSS.

    Likewise, in DCD Rev. 3 the first sentence in the third paragraph on page B 3.3.1-2 was replaced with the following sentence, which also reflects the changes described in items 6, 9.a and 13:

    "The Allowable Value recorded and maintained in a document established by the Setpoint Control Program (SCP) demonstrates that a channel is OPERABLE if the measured accuracy is found not to exceed the Allowable Value during CHANNEL CALIBRATION (protection functions implemented with digital bistable functions) or COT (protection functions implemented with analog bistable functions)."

    However, in DCD Rev. 4 this sentence will be revised as follows to replace "measured accuracy" with "as-found value", and to eliminate discussion of COT because there are no protection functions with analog bistables in Section 3.3.1:

    "The Allowable Value, recorded and maintained in a document established by the Setpoint Control Program (SCP), is considered a limiting value such that a channel is OPERABLE if the as-found value does not exceed the Allowable Value during CHANNEL CALIBRATION."

    The same changes have been made to other sections that describe AV for CHANNEL CALIBRATION.

17. See below.

    a. MHI agrees. In DCD Rev. 3 the word "setting" in the second sentence of the third paragraph on page B 3.3.1-2 was replaced with the word "settings."

    b. MHI agrees. In DCD Rev. 3 the word "setpoints" in the third sentence "…pertinent to the channel calibration setpoints" was replaced with the word "settings."

    c. MHI agrees. In DCD Rev. 3 SR 3.3.1.9 the sentence "…magnitude of equipment drift in Section 5.5.21, SCP…" was revised to read "…magnitude of equipment drift in accordance with Section 5.5.21, Setpoint Control Program (SCP)."

d. MHI agrees. In DCD Rev. 3 SR 3.3.1.11 the sentence "…magnitude of equipment drift in Section 5.5.21, SCP…" was revised to read "…magnitude of equipment drift in accordance with Section 5.5.21, Setpoint Control Program (SCP)."

e. MHI agrees. In DCD Rev. 3 SR 3.3.2.7 the sentence "…magnitude of equipment drift in Section 5.5.21, SCP…" was revised to read "…magnitude of equipment drift in accordance with Section 5.5.21, Setpoint Control Program (SCP)."

f. MHI agrees. In DCD Rev. 3 the word "accuracy" was deleted from the sentence of the first paragraph on page B 3.3.2-4. Also, the word "accuracy" was deleted from the third sentence of the first paragraph on page B 3.3.1-6. In DCD Rev. 4 "in the SCP" will be changed to "of the SCP".

g. MHI agrees. In DCD Rev. 3 the word "accuracy" was deleted from the first sentence of the last paragraph on page B 3.3.6-5. In addition, in DCD Rev 4 this sentence will be changed to clarify the applicability of the "as-found" operability constraint to both DAS measurement channels and DAS analog bistables.

   Also, In DCD Rev. 3 the word "accuracy" was deleted from the second sentence of the fifth paragraph on page B 3.3.2-5.

**Impact on DCD**

Refer to Attachment A for the impact on DCD for this response.

**Impact on R-COLA**

There are impacts on the R-COLA to incorporate the DCD change.

**Impact on S-COLA**

There are impacts on the S-COLA to incorporate the DCD change.

**Impact on PRA**

There is no impact on the PRA.

**Impact on Technical/Topical Reports**

MHI had revised sections 5.3.1 and 5.3.2 of MUAP-09022 and added a new section 5.3.2.2 with a new Figure 5-7 in MUAP-09022 Rev. 2.

**5.3.1 Protection Functions via Analog Bistables**

Figure 5-5 illustrates the relationships between the trip setpoints and other parameters for protection functions implemented via conventional analog bistables. This figure illustrates how NTSP is derived, and how PTAC and AV are related to the trip setpoints. The protection functions implemented via analog bistables are associated with the DAS.~~, the reactor trip on a turbine trip (TT) function and the loss of power (LOOP) signal, e.g., under voltage (UV)~~.

**5.3.2 Protection Functions via Digital Bistables**

Figure 5-6 illustrates the relationships between the trip setpoint and other parameters for protection functions implemented via digital bistables. This figure illustrates how the NTSP is derived, and how PTAC and AV are related to the calibration setting. The protection functions implemented via digital bistables in the US-APWR are all those that are not implemented via analog bistables (identified above) and those ~~not~~ originating as binary measurements (identified below).

#### 5.3.2.2 Binary Sensors

Figure 5-7 illustrates the relationships between the trip setpoint and other parameters for protection functions implemented via binary sensors connected to digital PSMS channels. These functions are 1) reactor trip (RT) on turbine trip (TT) via low turbine oil pressure (pressure switch) and 2) Loss of Power (LOP) signal (UV relay).

Binary sensors connected to PSMS are surveilled the same way as analog sensors connected to PSMS, whereby channel calibration confirms the complete channel accuracy in one step for periodic surveillance, with the exception that channel accuracy is checked at the binary sensor trip setting. AV, PTAC and CT limits are therefore applied to the NTSP.

The AV is used during channel calibration to determine operability. The PTAC term is described in Section 5.4. PTAC is used (relative to NTSP) to determine degradation, thus avoiding the use of excessive tolerances as required by Reference 3.2.4 (RIS 2006-17). Plant procedures will reflect this approach (increasing process; invert for decreasing process):

- If the as-found trip value is less than NTSP + PTAC, then the channel is fully operable

- If the as-found trip value is greater than NTSP + PTAC and less than AV, then the channel is operable but degraded, and corrective action is required to restore the channel to within specifications.

- If the as-found trip value is greater than AV, then the channel is inoperable, and corrective action is required, including those actions required by 10 CFR 50.36 when automatic protective devices do not function as required.

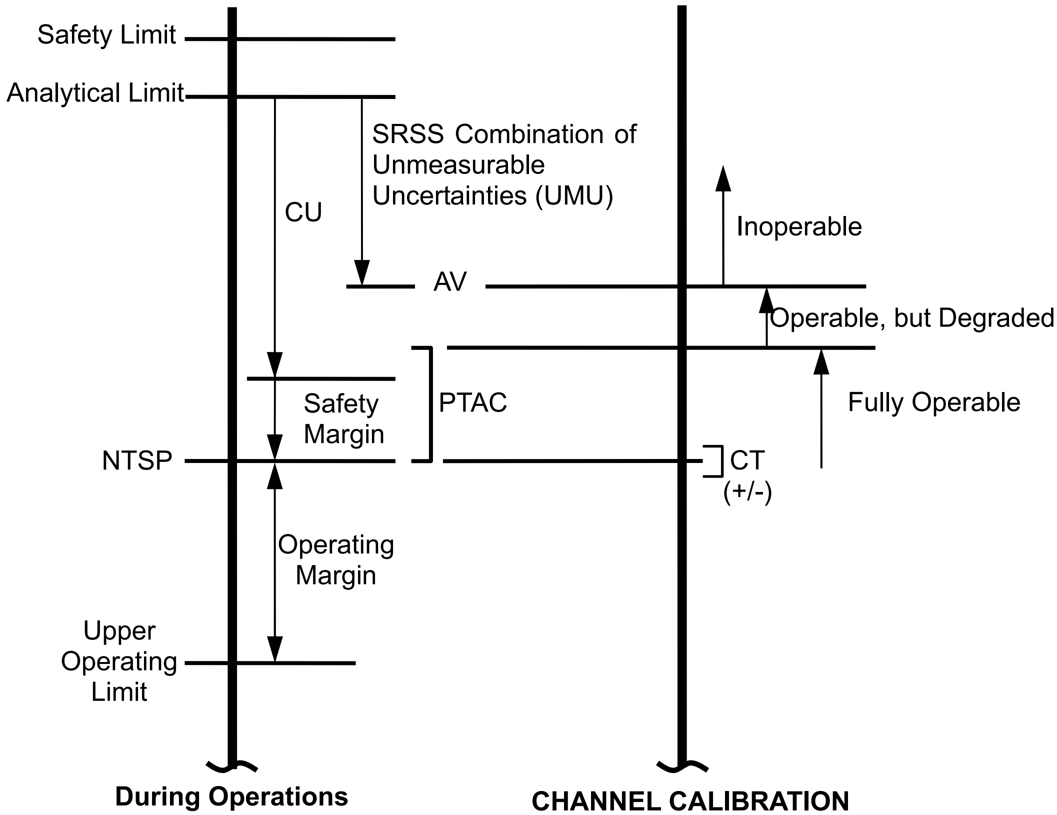


**Figure 5-7 Periodic Surveillance of Protection Functions Implemented via Binary Sensors Connected to PSMS (Increasing Process)**

MHI will revise Section 2.0, 5.3.1, 5.3.2, 5.3.2.2 and 5.4 in MUAP-09022 Rev.3 as follows:

**2.0 DEFINITIONS**

**Channel Calibration**

A channel calibration is the adjustment, as necessary, of the channel measurement devices such that it responds within the necessary range and accuracy to known values of the parameter that the channel monitors.

The performance of a CHANNEL CALIBRATION shall be consistent with DCD Chapter 16, Specification 5.5.21 “Setpoint Control Program”.

Analog Processing Functions:

**Channel Operational Test (COT)**

~~Analog Processing Functions:~~

For analog processing functions, the COT shall be the injection of a simulated or actual signal into the channel as close to the sensor as practicable, at a point of overlap with channel calibration (typically at the rack), to verify operability of all devices in the channel required for channel operability.

For analog processing functions, the COT shall include adjustments, as necessary, of the required alarm, interlock, and trip setpoints required for channel operability such that the setpoints are within the necessary range and accuracy. For indicators the accuracy is confirmed at five calibration settings corresponding to 0%, 25%, 50%, 75% and 100% of the instrument range. For bistables the accuracy is confirmed at the NTSP. The COT may be performed by means of any series of sequential, overlapping, or total channel steps.

The performance of a COT shall be consistent with DCD Chapter 16, Specification 5.5.21 "Setpoint Control Program".

~~Digital Processing Functions:~~ **MEMORY INTEGRITY CHECK (MIC)**

For digital processing functions, the ~~COT~~MIC is a check of the PSMS software memory integrity to ensure there is no change to the software that controls the processing algorithms, setpoints, time constants, time delays and continuous automatic self-test functions.

The PSMS is self-tested on a continuous basis from the digital side of all input modules to the digital side of all output modules. Self-testing also encompasses all data communications within a PSMS train, between PSMS trains and between the PSMS and PCMS. For the PSMS the self-testing is described in ~~Topical~~ Technical Report, "Safety I&C System Description and Design Process," MUAP-07004 Section 4.3 and ~~Topical~~ Technical Report, "Safety System Digital Platform - MELTAC-," MUAP-07005 Section 4.1.5. The software memory integrity test is described in ~~Topical~~ Technical Report, "Safety I&C System Description and Design Process," MUAP-07004 Section 4.4.1 and ~~Topical~~ Technical Report, "Safety System Digital Platform -MELTAC-," MUAP-07005 Section 4.1.4.1.c.

The performance of a MIC shall be consistent with DCD Chapter 16, Specification 5.5.21 "Setpoint Control Program".

**5.3.1 Protection Functions via Analog Bistables**

Surveillance testing and calibration of analog bistable channels is performed in two overlapping steps (i.e., Step 1 – Channel Calibration, Step 2 - COT ~~– Analog~~)

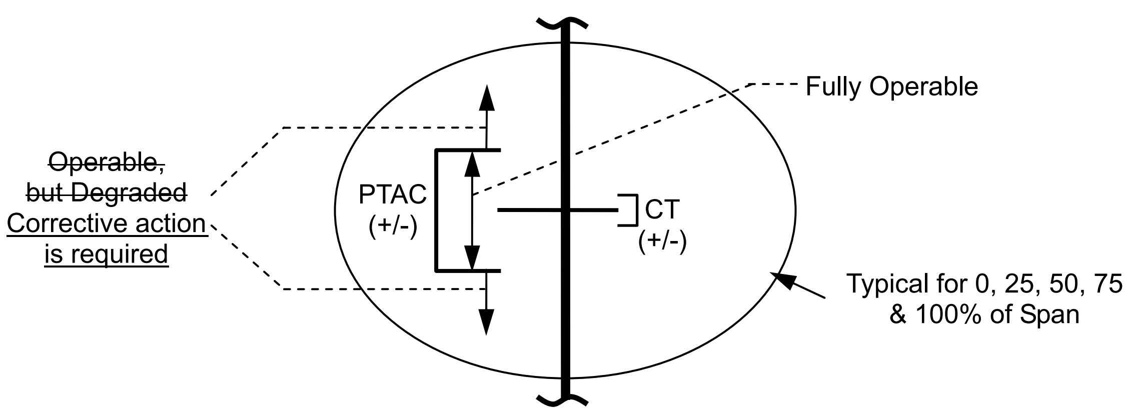


**Figure 5-4 Channel Calibration on Analog Measurements**

COT ~~– Analog~~ (Step 2)

COT ~~– Analog~~ confirms bistable accuracy. CT limits are applied to NTSP. Leaving the NTSP within its CT limits gives the analog bistable room to drift as expected in the determination of

NTSP. COT ~~– Analog~~ for an increasing process trip function is illustrated in Figure 5-5. The Figure 5-5 illustrates the relationships between the NTSP and other parameters for protection functions implemented via conventional analog bistables. This figure illustrates how NTSP is derived, and how PTAC and AV are related to the NTSP.

- If the as-found trip value is greater than NTSP + PTAC and less than AV, ~~then the channel is operable but degraded, and~~ corrective action is required to restore the channel to within specifications.

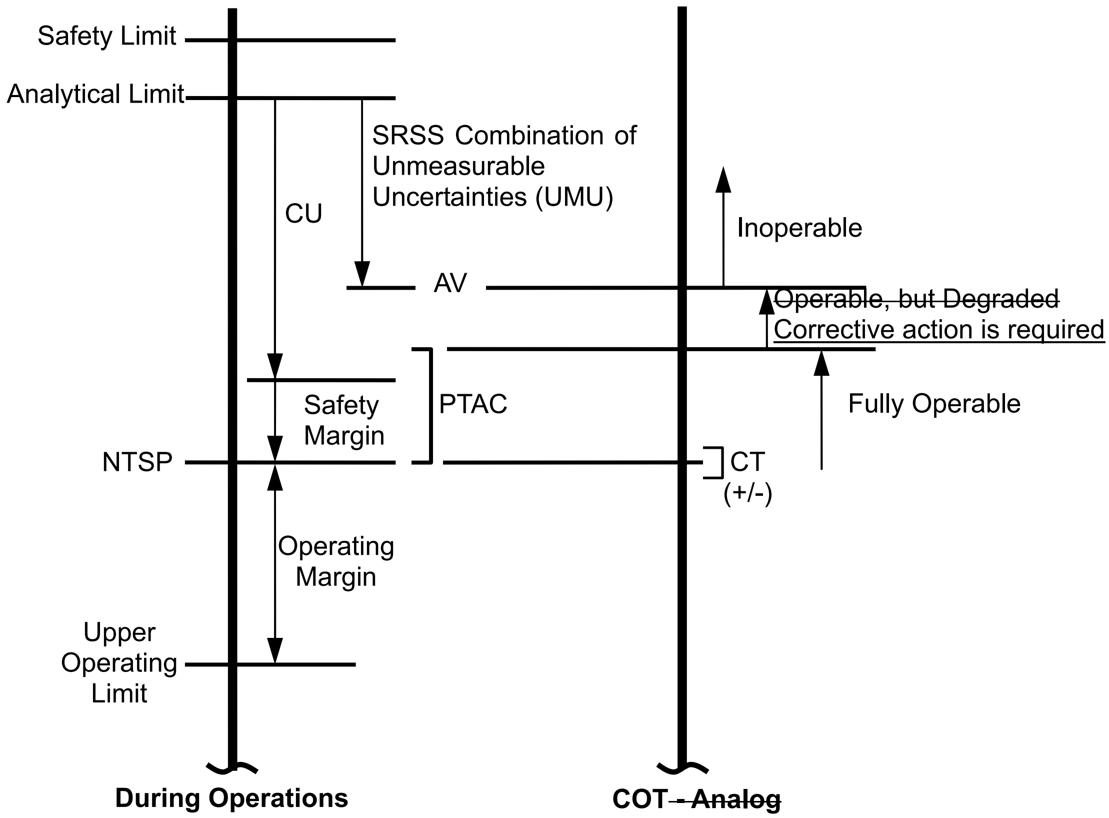


**Figure 5-5 Periodic Surveillance of Protection Function Implemented via Analog Bistables (Increasing Process)**

### 5.3.2 Protection Functions via Digital Bistables

- If any as-found calibration setting value is outside the two-sided limits of (Calibration Setting ± PTAC), but inside the limits of (Calibration Setting ± AV), ~~then the channel is operable but degraded, and~~ corrective action is required to restore the channel to within specifications.

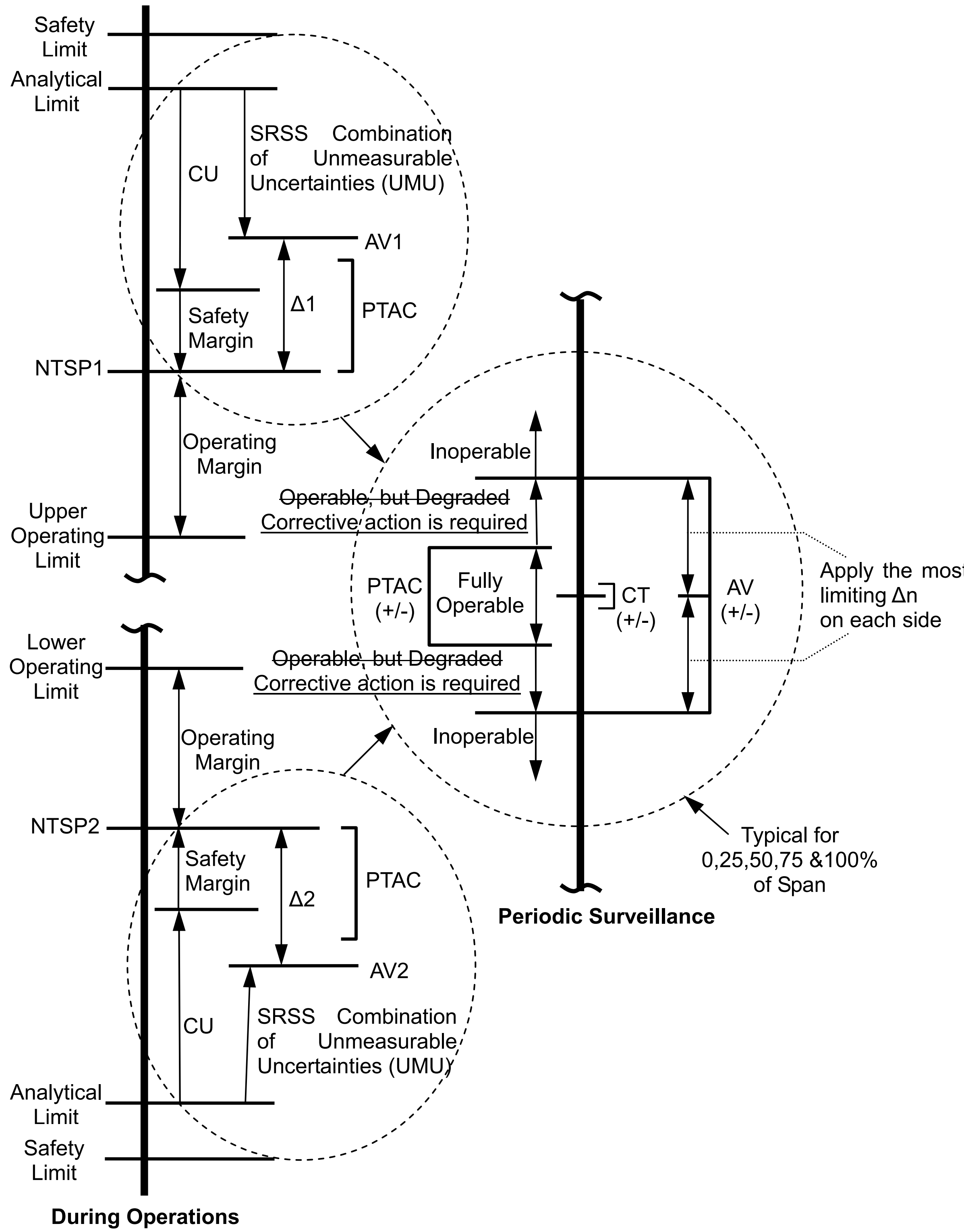


**Figure 5-6 Periodic Surveillance of Protection Functions Implemented via Digital Bistables**

#### 5.3.2.2 Binary Sensors

Figure 5-7 illustrates the relationships between the trip setpoint and other parameters for protection functions implemented via binary sensors with drift potential connected to digital PSMS channels. These functions are 1) reactor trip (RT) on turbine trip (TT) via low turbine oil pressure (pressure switch) and 2) Loss of Power (LOP) signal (UV relay).

It is noted that the binary sensors used for actuation of Emergency Feedwater actuation due to a trip of all Main Feedwater Pumps have no drift potential.

Binary sensors…fully operable

- If the as-found trip value is greater than NTSP + PTAC and less than AV, ~~then the channel is operable but degraded, and~~ corrective action is required to restore the channel to within specifications.

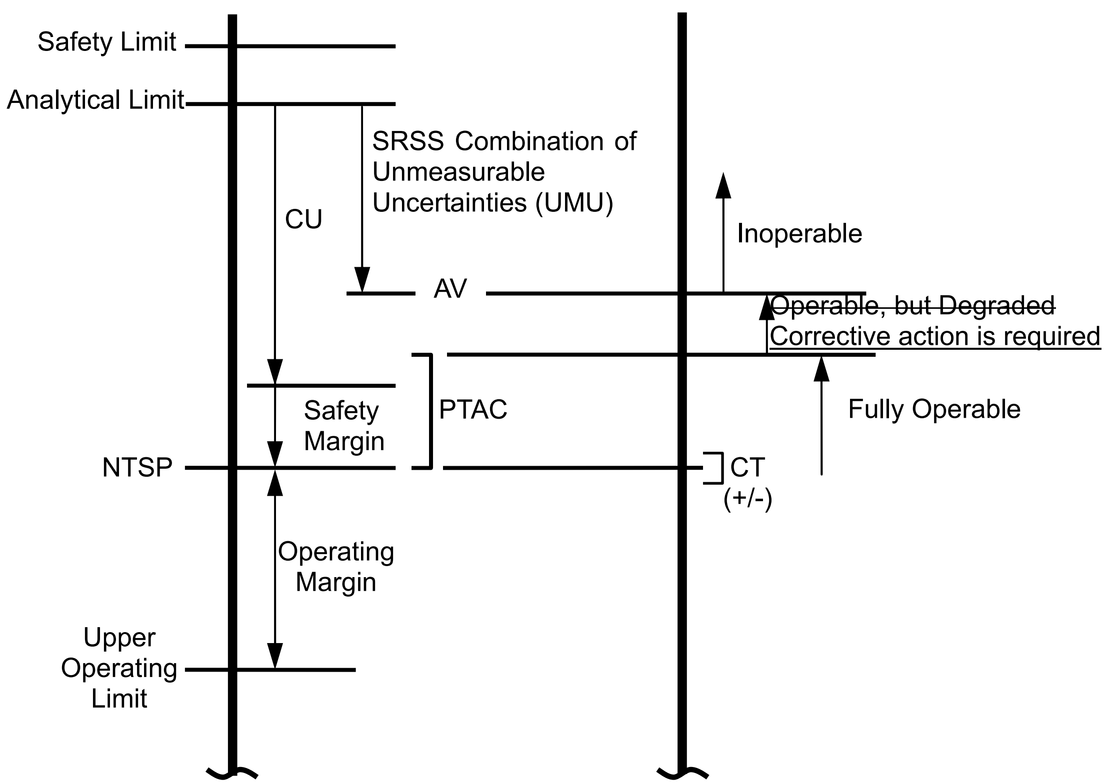


**Figure 5-7 Periodic Surveillance of Protection Functions Implemented via Binary Sensors Connected to PSMS (Increasing Process)**

### 5.4 Performance Test Acceptance Criteria for Digital Channels

For calculated functions (Over Temperature ΔT, Over Power ΔT, and Tavg function, illustrated in Tables 6-5, 6-6, 6-7 and 6-20), PTAC is applied to each input signal used in the setpoint calculation using the PTACLOOP equations described above. PTAC is not applied to the internal digital calculations, as it is for conventional analog function processing, since there is no uncertainty in these digital calculations. This approach is acceptable because the channel calibration test confirms loop accuracy, and the ~~COT~~ MIC confirms the integrity of the digital setpoints, constants and calculations used in the calculated function, in the same manner as for all other digital protection functions. PTAC for DAS functions is described in Section 5.5.2.