OPEN ITEMS 16.4.6

09/16/2009

US-APWR Design Certification

Mitsubishi Heavy Industries

Docket No. 52-021

SRP Section: 16.4.6 Instrumentation Technical Specifications Branch

[**Open Item 16-1784/172**] This question is related to RAI 16-1784/172.

In RAI-SRP16-CTSB-1784/172, the staff requested an explanation regarding the methodologies for obtaining allocations for signal conditioning and actuation logic response times for Reactor Trip System (RTS) Instrumentation. The APWR Bases discussion for SR 3.3.1.13, RTS RESPONSE TIME, states that the allocations for signal conditioning and actuation logic response times may be obtained from the same methodologies used to determine sensor allocation response times. The comparable Bases discussion for SR 3.3.1.16 in NUREG-1431, defines the methods for obtaining allocations for sensor response times distinctly from the methods for obtaining allocations for signal conditioning and actuation logic response times. The Bases for SR 3.3.1.16 also cites two topical reports, one that provides the basis and methodology for using allocated sensor response times (WCAP-13632-P-A), and one that provides the basis and methodology for using allocated signal conditioning and actuation logic response times (WCAP-14036-P). For the US-APWR, the applicant maintains that the same methods are used for obtaining response time allocations for all three portions of the system. The staff questions the applicant's position regarding response time allocations for RTS Instrumentation on the basis that 1) all technical references associated with the Standard Technical Specifications (STS) appear to have been removed without providing comparable replacement references, and 2) differences in the methods used by the US-APWR and STS have not been clearly delineated. In a teleconference meeting on May 26, 2009, the applicant acknowledged the staff's concerns and indicated that response time allocation issues would be appropriately addressed in a Technical Report scheduled for issuance in September 2009. This issue is identified as Open Item OI-SRP16-CTSB-1784/172.

[**Open Item 16-1784/174**] This question is related to RAI 16-1784/174.

In RAI-SRP16-CTSB-1784/174, the staff requested a justification for why the information associated with dynamic transfer functions in the NUREG-1431 Bases discussion for SR 3.3.1.16, REACTOR TRIP SYSTEM (RTS) RESPONSE TIME, was excluded from the comparable Bases discussion for SR 3.3.1.13 in the APWR Bases. The applicant states that Reactor Trip Breakers (RTBs) and Resistance Temperature Detectors (RTDs) are known to have aging or wear-out mechanisms that can impact response time and thus require response time measurement. Response times for other components can be affected by random failures or calibration discrepancies, which can be detected by other testing and calibration methods required by other surveillances. Consequently, response time testing is provided for RTBs and RTDs, but not for other Protection and Safety Monitoring System (PSMS) components, including digital components of the PSMS which implement dynamic transfer functions. The applicant therefore concludes that the discussion of response time testing for dynamic transfer functions is not applicable to the digital PSMS. The staff questions the applicant's position regarding the applicability of response time testing for dynamic transfer functions on the basis of insufficient information associated with other testing, calibration methods, and surveillance requirement specifics for digital PSMS instrumentation that includes dynamic transfer functions. It is not clear from the response that the justification provided warrants exclusion of the Standard Technical Specification (STS) discussion on dynamic transfer functions from the APWR Bases. In a teleconference meeting on May 26, 2009, the applicant acknowledged the staff's concerns and agreed to review the issue. This issue is identified as Open Item OI-SRP16-CTSB-1784/174.

[**Open Item 16-1784/186**] This question is related to RAI 16-1784/186.

In RAI-SRP16-CTSB-1784/186, the staff requested an explanation regarding the methodologies for obtaining allocations for signal conditioning and actuation logic response times for Engineered Safety Features Actuation System (ESFAS) Instrumentation. The APWR Bases discussion for SR 3.3.2.8, ESFAS RESPONSE TIMES, states that the allocations for signal conditioning and actuation logic response times may be obtained from the same methodologies used to determine sensor allocation response times. The comparable Bases discussion for SR 3.3.2.10 in NUREG-1431, defines the methods for obtaining allocations for sensor response times distinctly from the methods for obtaining allocations for signal conditioning and actuation logic response times. The Bases for SR 3.3.2.10 also cites two topical reports, one that provides the basis and methodology for using allocated sensor response times (WCAP-13632-P-A), and one that provides the basis and methodology for using allocated signal conditioning and actuation logic response times (WCAP-14036-P). For the US-APWR, the applicant maintains that the same methods are used for obtaining response time allocations for all three portions of the system. The staff questions the applicant's position regarding response time allocations for ESFAS Instrumentation on the basis that 1) all technical references associated with the Standard Technical Specifications (STS) appear to have been removed without providing comparable replacement references, and 2) differences in the methods used by the US-APWR and STS have not been clearly delineated. In a teleconference meeting on May 26, 2009, the applicant acknowledged the staff's concerns and indicated that response time allocation issues would be appropriately addressed in a Technical Report scheduled for issuance in September 2009. This issue is identified as Open Item OI-SRP16-CTSB-1784/186.

[**Open Item 16-1784/188**] This question is related to RAI 16-1784/188.

In RAI-SRP16-CTSB-1784/188, the staff requested a justification for why the information associated with dynamic transfer functions in the NUREG-1431 Bases discussion for SR 3.3.2.10, ENGINEERED SAFETY FEATURES ACTUATION SYSTEM (ESFAS) RESPONSE TIMES, was excluded from the comparable Bases discussion for SR 3.3.2.8 in the APWR Bases. The applicant states that Reactor Trip Breakers (RTBs) and Resistance Temperature Detectors (RTDs) are known to have aging or wear-out mechanisms that can impact response time and thus require response time measurement. Response times for other components can be affected by random failures or calibration discrepancies, which can be detected by other testing and calibration methods required by other surveillances. Consequently, response time testing is provided for RTBs and RTDs, but not for other Protection and Safety Monitoring System (PSMS) components, including digital components of the PSMS which implement dynamic transfer functions. The applicant therefore concludes that the discussion of response time testing for dynamic transfer functions is not applicable to the digital PSMS. The staff questions the applicant's position regarding the applicability of response time testing for dynamic transfer functions on the basis of insufficient information associated with other testing, calibration methods, and surveillance requirement specifics for digital PSMS instrumentation that includes dynamic transfer functions. It is not clear from the response that the justification provided warrants exclusion of the Standard Technical Specification (STS) discussion on dynamic transfer functions from the APWR Bases. In a teleconference meeting on May 26, 2009, the applicant acknowledged the staff's concerns and agreed to review the issue. This issue is identified as Open Item OI-SRP16-CTSB-1784/188.

[**Open Item 16-1784/192**] This question is related to RAI 16-1784/192.

In RAI-SRP16-CTSB-1784/192, the staff requested a justification for why Condition F of LCO 3.3.3 in NUREG-1431 was not included in LCO 3.3.3 of the US-APWR GTS, as a Referenced Condition in Table 3.3.3-1 for "Reactor Vessel Water Level" and "Containment High Range Area Radiation" Post Accident Monitoring (PAM) Instrumentation. Condition F of NUREG-1431, Rev 3.1, requires the unit to "initiate action in accordance with Specification 5.6.5," which is a 14-day report. NUREG-1431 Bases B 3.3.3 for Condition F states that an alternate means of monitoring Reactor Vessel Level and Containment Area Radiation have been developed and tested for the reference unit, and that the alternate means may be temporarily installed if the normal PAM channel cannot be restored to OPERABLE status within the allotted time. If these alternate means are used, the Required Action is not to shut down the unit but rather to follow the directions of Specification 5.6.5 in the Administrative Controls of the Technical Specifications. The applicant concludes that Condition F of NUREG-1431 can be applied to both Reactor Vessel Water Level monitoring and Containment High Range Area Radiation monitoring in the APWR GTS, since they consider Pressurizer Level an alternate method of monitoring for Reactor Vessel Water Level and Containment Pressure an alternate method of monitoring for Containment High Range Area Radiation. The staff questions the applicant's position regarding the applicability of Condition F to LCO 3.3.3 of the APWR GTS, on the basis that an analysis has not been provided that 1) describes the degree to which the alternate instrumentation is equivalent to the installed PAM channels, and 2) justifies the areas in which they are not equivalent. In a teleconference meeting on May 13, 2009, the applicant acknowledged the staff's concerns and gave consideration to the development of an equivalency analysis. This issue is identified as Open Item OI-SRP16-CTSB-1784/192.

[**Open Item 16-1769/209**] This question is related to RAI 16-1769/209.

In RAI-SRP16-CTSB-1769/209, the staff requested an explanation for why the US-APWR GTS, Table 3.3.1-1, High Power Range Neutron Flux Rate, Positive and Negative Rate Function Allowable Values do not include Time Constants. This is a deviation from NUREG-1431. The applicant states that Allowable Values are not provided because Time Constants are digital values set in the application software and that there is no drift or adjustments for these Time Constants. The staff was unable to make a conclusive determination regarding exclusion of the Time Constants on the basis of the information provided. In a teleconference meeting on May 13, 2009, at the staff's request, the applicant agreed to review and substantiate their position. This issue has been identified as Open Item OI-SRP16-CTSB-1769/209.

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[**Open Item 16-1769/220**] This question is related to RAI 16-1769/220.

In RAI-SRP16-CTSB-1769/220, the staff requested a technical justification for: 1) specifying Reactor Trip System (RTS) Instrumentation Allowable Values in terms of “Channel Uncertainty Allowances” instead of specific values with inequality signs, and 2) expressing RTS Allowable Value units for various functions 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. The applicant states there is no setpoint drift for functions whose digital trip setpoint values reside within the Protection and Safety Monitoring System (PSMS) software, and that the only potential setpoint error is related to analog instrument loop uncertainties (i.e. Sensor reference accuracy, Sensor measuring and test equipment uncertainty, Sensor drift, Digital controller uncertainty). The applicant therefore concludes that the digital function Allowable Value in Table 3.3.1-1 is a maximum deviation, or two-sided OPERABILITY limit defined in terms that are pertinent to the five calibration setpoints 0%, 25%, 50%, 75% and 100% of the instrument range that can be measured during CHANNEL CALIBRATION. This approach deviates from the established convention for Allowable Values included in Standard Technical Specifications (STS) and all Tech Specs issued for operating plants. It is important to maintain consistency regarding Allowable Value convention from a human factors standpoint in order to promote uniform operations through standard operational practices and the avoidance of potential ambiguities that may result from a two-sided OPERABILITY limit. The staff finds that the response does not provide the requisite technical justification to warrant deviation from the STS. In addition, the applicant did not address the staff’s request regarding Allowable Value units as described in Item 2. These issues have been identified as Open Item OI-SRP16-CTSB-1769/220.

[**Open Item 16-1769/228**] This question is related to RAI 16-1769/228.

In RAI-SRP16-CTSB-1769/228, the staff requested an explanation regarding inconsistencies between the US-APWR GTS and the WOG STS in the BACKGROUND section of the Reactor Trip System Instrumentation Bases (B 3.3.1). The inconsistencies identified are directly associated with the issue described in RAI-SRP16-CTSB-1769/220 in which the applicant considers the digital function Allowable Value in Table 3.3.1-1 to be a maximum deviation, or two-sided OPERABILITY limit defined in terms that are pertinent to the five calibration setpoints 0%, 25%, 50%, 75% and 100% of the instrument range. Determinations regarding the referenced inconsistencies are dependent upon the resolution of Open Item OI-SRP16-CTSB-1769/220. These determinations have been identified as Open Item OI-SRP16-CTSB-1769/228.

[**Open Item 16-1769/230**] This question is related to RAI 16-1769/230.

In RAI-SRP16-CTSB-1769/230, the staff requested a technical justification explaining how the CHANNEL OPERATIONAL TEST (COT) surveillance requirement (SR 3.3.1.7) specified for Reactor Trip System (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 in Table 3.3.1-1, ensures that those functions are adequately tested. 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. The applicant states that for the digital system, the continuous self-testing along with the software integrity confirmation (COT in US-APWR GTS) covers the confirmation of the setpoint and the bistable the same as in the conventional analog system (COT in WOG STS). The staff was unable to make a conclusive determination regarding the capability of the COT to adequately test the referenced functions, on the basis of the information provided and the revised definition in the US-APWR GTS. This issue has been identified as Open Item OI-SRP16-CTSB-1769/230.

[**Open Item 16-1769/231**] This question is related to RAI 16-1769/231.

In RAI-SRP16-CTSB-1769/231, the staff requested a technical justification explaining how the ACTUATION LOGIC TEST (ALT) surveillance requirement (SR 3.3.1.5) specified for Reactor Trip System (RTS) Functions 14, 15.b, and 18 in Table 3.3.1-1, ensures that those functions are adequately tested. 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. The applicant’s response was to see the answer to RAI 167-1769, Question 16-230, which states that for the digital system, the continuous self-testing along with the software integrity confirmation (ALT in US-APWR GTS) covers the confirmation of the voting logic and automatic actuation signals the same as in the conventional analog system (ALT in WOG STS). The staff was unable to make a conclusive determination regarding the capability of the ALT to adequately test the referenced functions, on the basis of the information provided and the revised definition in the US-APWR GTS. This issue has been identified as Open Item OI-SRP16-CTSB-1769/231.

[**Open Item 16-1769/232**] This question is related to RAI 16-1769/232.

In RAI-SRP16-CTSB-1769/232, the staff requested a technical justification explaining how the CHANNEL CALIBRATION surveillance requirement (SR 3.3.1.9, SR 3.3.1.10, SR 3.3.1.11) for Reactor Trip System (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 in Table 3.3.1-1, ensures that those functions are adequately tested. 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. The applicant states that for both analog and binary measurements, the CHANNEL CALIBRATION confirms the accuracy of the channel from sensor to digital Visual Display Unit (VDU) readout as described in Topical Report, “Safety I&C System Description and Design Process,” MUAP-07004 Section 4.4.2. The staff was unable to make a conclusive determination regarding the capability of the CHANNEL CALIBRATION to adequately test the referenced functions, on the basis of the information provided and the revised definition in the US-APWR GTS. This issue has been identified as Open Item OI-SRP16-CTSB-1769/232.

[**Open Item 16-1769/233**] This question is related to RAI 16-1769/233.

In RAI-SRP16-CTSB-1769/233, the staff requested a technical justification explaining how the TRIP ACTUATING DEVICE OPERATIONAL TEST (TADOT) surveillance requirement (SR 3.3.1.4, SR 3.3.1.12) for Reactor Trip System (RTS) Functions 1, 13.a, 13.b, and 17 in Table 3.3.1-1, ensures that those functions are adequately tested. 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. The applicant states there are two types of binary devices – those that have no drift potential and those that do have drift potential. The operability of devices that have drift potential is confirmed through CHANNEL CALIBRATION and/or RESPONSE TIME TESTING. The operability of devices that have no drift potential is confirmed through TADOT. The CHANNEL CALIBRATION confirms the accuracy of the device’s binary state change with regard to its setpoint requirement and the RESPONSE TIME TEST confirms the accuracy of the devices state change with regard to its timing requirement. The TADOT confirms only the state change operability (i.e. there is no setpoint or timing accuracy information needed). The staff was unable to make a conclusive determination regarding the capability of the TADOT to adequately test the referenced functions, on the basis of the information provided and the revised definition in the US-APWR GTS. This issue has been identified as Open Item OI-SRP16-CTSB-1769/233.

[**Open Item 16-1769/238**] This question is related to RAI 16-1769/238.

In RAI-SRP16-CTSB-1769/238, the staff requested an explanation regarding an inconsistency between the US-APWR GTS and the WOG STS in the APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY section of the Reactor Trip System Instrumentation Bases (B 3.3.1). The inconsistency identified is directly associated with the issue described in RAI-SRP16-CTSB-1769/220 in which the applicant considers the digital function Allowable Value in Table 3.3.1-1 to be a maximum deviation, or two-sided OPERABILITY limit defined in terms that are pertinent to the five calibration setpoints 0%, 25%, 50%, 75% and 100% of the instrument range. Determination regarding the referenced inconsistency is dependent upon the resolution of Open Item OI-SRP16-CTSB-1769/220. This determination has been identified as Open Item OI-SRP16-CTSB-1769/238.

[**Open Item 16-1769/241**] This question is related to RAI 16-1769/241.

In RAI-SRP16-CTSB-1769/241, the staff requested an explanation for why the US-APWR GTS, Table 3.3.2-1, Function 1.e, 4.d (1), and 4.d (2) Allowable Values do not include Time Constants used in the lead/lag controller. This is a deviation from NUREG-1431. The applicant states that Allowable Values are not provided because Time Constants are digital values set in the application software and that there is no drift or adjustments for these Time Constants. The staff was unable to make a conclusive determination regarding exclusion of the Time Constants on the basis of the information provided. In a teleconference meeting on May 13, 2009, at the staff's request, the applicant agreed to review and substantiate their position. This issue has been identified as Open Item OI-SRP16-CTSB-1769/241.

[**Open Item 16-1769/242**] This question is related to RAI 16-1769/242.

In RAI-SRP16-CTSB-1769/242, the staff requested a technical justification for: 1) specifying Engineered Safety Feature Actuation System (ESFAS) Instrumentation Allowable Values in terms of "Channel Uncertainty Allowances" instead of specific values with inequality signs, and 2) expressing ESFAS Allowable Value units 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 ESFAS Trip Setpoint units 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. The applicant's response was to see the answer to RAI 1769, Question 16-220. The staff finds that the response to Question 16-220 does not provide the requisite technical justification to warrant deviation from the Standard Technical Specifications (STS). In addition, the applicant did not address the staff's request regarding ESFAS Allowable Value and Trip Setpoint units as described in Item 2. These issues have been identified as Open Item OI-SRP16-CTSB-1769/242.

[**Open Item 16-1769/270**] This question is related to RAI 16-1769/270.

In RAI-SRP16-CTSB-1769/270, the staff requested a technical justification explaining how the CHANNEL OPERATIONAL TEST (COT) surveillance requirement (SR 3.3.2.3) specified for Engineered Safety Feature Actuation System (ESFAS) Instrumentation 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) in Table 3.3.2-1, ensures that those functions are adequately tested. 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. The applicant's response was to see the answer to RAI 167-1769, Question 16-230, which states that for the digital system, the continuous self-testing along with the software integrity confirmation (COT in US-APWR GTS) covers the confirmation of the setpoint and the bistable the same as in the conventional analog system (COT in WOG STS). The staff was unable to make a conclusive determination regarding the capability of the COT to adequately test the referenced functions, on the basis of the information provided and the revised definition in the US-APWR GTS. This issue has been identified as Open Item OI-SRP16-CTSB-1769/270.

[**Open Item 16-1769/271**] This question is related to the applicant's response to RAI 16-1769/271.

In RAI-SRP16-CTSB-1769/271, the staff requested a technical justification explaining how the ACTUATION LOGIC TEST (ALT) surveillance requirement (SR 3.3.2.2) specified for Engineered Safety Feature Actuation System (ESFAS) Instrumentation 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 in Table 3.3.2-1, ensures that those functions are adequately tested. 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. The applicant's response was to see the answer to RAI 167-1769, Question 16-230, which states that for the digital system, the continuous self-testing along with the software integrity confirmation (ALT in US-APWR GTS) covers the confirmation of the voting logic and automatic actuation signals the same as in the conventional analog system (ALT in WOG STS). The staff was unable to make a conclusive determination regarding the capability of the ALT to adequately test the referenced functions, on the basis of the information provided and the revised definition in the US-APWR GTS. This issue has been identified as Open Item OI-SRP16-CTSB-1769/271.

[**Open Item 16-1769/272**] This question is related to RAI 16-1769/272.

In RAI-SRP16-CTSB-1769/272, the staff requested a technical justification explaining how the CHANNEL CALIBRATION surveillance requirement (SR 3.3.2.7) for Engineered Safety Feature Actuation System (ESFAS) Instrumentation 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) in Table 3.3.2-1, ensures that those functions are adequately tested. 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. The applicant's response was to see the answer to RAI 167-1769, Question 16-232, which states that for both analog and binary measurements, the CHANNEL CALIBRATION confirms the accuracy of the channel from sensor to digital Visual Display Unit (VDU) readout as described in Topical Report, "Safety I&C System Description and Design Process," MUAP-07004 Section 4.4.2. The staff was unable to make a conclusive determination regarding the capability of the CHANNEL CALIBRATION to adequately test the referenced functions, on the basis of the information provided and the revised definition in the US-APWR GTS. This issue has been identified as Open Item OI-SRP16-CTSB-1769/272.

[**Open Item 16-1769/273**] This question is related to RAI 16-1769/273.

In RAI-SRP16-CTSB-1769/273, the staff requested a technical justification explaining how the TRIP ACTUATING DEVICE OPERATIONAL TEST (TADOT) surveillance requirement (SR 3.3.2.4, SR 3.3.2.5, SR 3.3.2.6, SR 3.3.2.9) for Engineered Safety Feature Actuation System (ESFAS) Instrumentation 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 in Table 3.3.2-1, ensures that those functions are adequately tested. 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. The applicant's response was to see the answer to RAI 167-1769, Question 16-233, which states that there are two types of binary devices – those that have no drift potential and those that do have drift potential. The operability of devices that have drift potential is confirmed through CHANNEL CALIBRATION and/or RESPONSE TIME TESTING. The operability of devices that have no drift potential is confirmed through TADOT. The CHANNEL CALIBRATION confirms the accuracy of the device's binary state change with regard to its setpoint requirement and the RESPONSE TIME TEST confirms the accuracy of the devices state change with regard to its timing requirement. The TADOT confirms only the state change operability (i.e. there is no setpoint or timing accuracy information needed). The staff was unable to make a conclusive determination regarding the capability of the TADOT to adequately test the referenced functions, on the basis of the information provided and the revised definition in the US-APWR GTS. This issue has been identified as Open Item OI-SRP16-CTSB-1769/273.

[**Open Item 16-1769/274**] This question is related to RAI 16-1769/274.

In RAI-SRP16-CTSB-1769/274, the staff requested an explanation regarding inconsistencies between the US-APWR GTS and the WOG STS in the BACKGROUND section of the Engineered Safety Feature Actuation System Instrumentation Bases (B 3.3.2). The inconsistencies identified are directly associated with the issue described in RAI-SRP16-CTSB-1769/242 in which the applicant considers the digital function Allowable Value in Table 3.3.2-1 to be a maximum deviation, or two-sided OPERABILITY limit defined in terms that are pertinent to the five calibration setpoints 0%, 25%, 50%, 75% and 100% of the instrument range. Determinations regarding the referenced inconsistencies are dependent upon the resolution of Open Item OI-SRP16-CTSB-1769/242. These determinations have been identified as Open Item OI-SRP16-CTSB-1769/274.

[**Open Item 16-1769/275**] This question is related to RAI 16-1769/275.

In RAI-SRP16-CTSB-1769/275, the staff requested an explanation regarding an inconsistency between the US-APWR GTS and the WOG STS in the APPLICABLE SAFETY ANALYSES, LCO, and APPLICABILITY section of the Engineered Safety Feature Actuation System Instrumentation Bases (B 3.3.2). The inconsistency identified is directly associated with the issue described in RAI-SRP16-CTSB-1769/242 in which the applicant considers the digital function Allowable Value in Table 3.3.2-1 to be a maximum deviation, or two-sided OPERABILITY limit defined in terms that are pertinent to the five calibration setpoints 0%, 25%, 50%, 75% and 100% of the instrument range. Determination regarding the referenced inconsistency is dependent upon the resolution of Open Item OI-SRP16-CTSB-1769/242. This determination has been identified as Open Item OI-SRP16-CTSB-1769/275.

OPEN ITEMS 16.4.6

[**Open Item 16-1769/282**] This question is related to RAI 16-1769/282.

In RAI-SRP16-CTSB-1769/282, the staff requested an explanation regarding the implementation of Condition C in LCO 3.3.3 for Post Accident Monitoring (PAM) Functions 2, 3, 10 and 16 in Table 3.3.3-1. Condition C states “One or more Functions with two required channels inoperable.” 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 “2 per loop” and “2 per steam generator” in the “Required Channels” column. The applicant states that since there are four loops and four steam generators, there are four required channels for each of these parameters. Reactor Coolant System (RCS) Cold Leg Temperature Wide Range (Function 2) is used in conjunction with RCS Hot Leg Temperature Wide Range (Function 3) to verify unit conditions necessary to establish natural circulation in the RCS. RCS Hot Leg Temperature Wide Range and RCS Cold Leg Temperature Wide Range of the same train form a pair PAM function. Similarly, Steam Generator Water Level Wide Range (Function 10) and Emergency Feedwater Flow (Function 16) of the same train make up a pair PAM function as well. Revisions include the addition of a NOTE to Table 3.3.3-1 describing the pair PAM functions and dedicated NOTES to Conditions A and C providing implementation guidance with respect to Functions 2, 3, 10 and 16. The staff questions the applicant’s position regarding pair PAM functions on the basis of what appears to be a change of intent regarding implementation of the functional concept within the confines of LCO 3.3.3, and the introduction of potential ambiguities. In a teleconference meeting on May 13, 2009, the applicant acknowledged the staff’s concerns and agreed to reexamine their approach. This issue is identified as Open Item OI-SRP16-CTSB-1769/282.

[**Open Item 16-1769/284**] This question is related to RAI 16-1769/284.

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.

OPEN ITEMS 16.4.6

[**Open Item 16-1769/290**] This question is related to RAI 16-1769/290.

In RAI-SRP16-CTSB-1769/290, the staff requested a technical justification explaining how the TRIP ACTUATING DEVICE OPERATIONAL TEST (TADOT) surveillance requirement (SR 3.3.5.2) for the LOP Class 1E GTG Start Instrumentation Functions, ensures that the undervoltage (UV) relays are adequately tested. 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. Under the WOG STS, undervoltage relay trip setpoints are checked and any necessary adjustments made every 31 days during performance of a TADOT. For the APWR GTS, the undervoltage relay is confirmed to actuate for gross loss of voltage conditions every 31 days during performance of a TADOT, and undervoltage relay trip setpoints/time delays are verified and any necessary adjustments made every 24-months during performance of a CHANNEL CALIBRATION. The applicant states that TADOT SR 3.3.5.2 confirms UV relay operation with reasonable accuracy based on technician judgment and that 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 Setpoint and Allowable Value. The staff was unable to make a conclusive determination regarding the capability of the TADOT to adequately test the LOP undervoltage relays, on the basis of the information provided and the revised definition in the US-APWR GTS. This issue has been identified as Open Item OI-SRP16-CTSB-1769/290.