

## KHNPDCDRAIsPEm Resource

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**Subject:** APR1400 Design Certification Application RAI 34-7870 (07.01 - Instrumentation and Controls - Introduction)  
**Attachments:** APR1400 DC RAI 34 ICE1 7870.pdf; image001.jpg

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Please submit your RAI response to the NRC Document Control Desk.

Thank you,

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## REQUEST FOR ADDITIONAL INFORMATION 34-7870

Issue Date: 06/16/2015

Application Title: APR1400 Design Certification Review – 52-046

Operating Company: Korea Hydro & Nuclear Power Co. Ltd.

Docket No. 52-046

Review Section: 07.01 - Instrumentation and Controls - Introduction

Application Section:

### QUESTIONS

07.01-1

Clarify the relationships among Analytical Limit (AL), Allowable Value (AV), Trip Setpoint (TSP), and Draft TSP.

10 CFR 50.36(c)(1)(ii)(A) states, in part, “Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded.” Technical Report (TeR) APR1400-Z-J-NR-14005-P, Rev.0, “Setpoint Methodology for Plant Protection System,” describes the setpoint methodology applied to the Plant Protection System (PPS) and Diverse Protection System (DPS) for the APR1400 and states conformance to BTP 7-12, Regulatory Guide 1.105 - Rev.3, and Regulatory Issue Summary 2006-17. Sections 2.1 and 2.5.3 of the TeR state, “The allowable value (AV) is less conservative than the TSP by the amount of the PPS cabinet periodic test error.” However, Figure 1 of the technical report, shows the difference between AV and TSP to be more than just the PPS Cabinet Periodic Test Error. Section 2.3.2.6 of the TeR states, “PPS Cabinet Periodic Test Error for APR1400 is not applicable since the processor module error and measurement test error are negligible.” If PPS Cabinet Periodic Test Error has no error, then Figure 1 implies that the AV and Draft TSP are equivalent? Also, would the upper limit of the Periodic Test Error Band be equivalent to the AV? Clarify the inconsistencies in the description of the relationships between the variables described above, and include appropriate modifications to the FSAR.

07.01-2

Discuss the as-left limit and as-found limit of the five-point calibration (0%, 25%, 50%, 75%, 100% of the range) of the instrument transmitter and how these limits relate to the TSP, as-left limit, and as-found limit.

10 CFR 50.36(c)(1)(ii)(A) states, in part, “Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded.” TeR APR1400-Z-J-NR-14005-P, Rev.0, “Setpoint Methodology for Plant Protection System,” describes the setpoint methodology applied to the PPS and DPS for the APR1400 and states conformance to BTP 7-12, Regulatory Guide 1.105, Rev.3, and Regulatory Issue Summary 2006-17. In Figure 1 of the TeR depicts the relationship among the Calibration Error Band (as-left limit), Periodic Test Error Band (as-found limit), and the Trip Setpoint. The staff requests applicant to discuss the as-left limit and as-found limit of the five-point calibration (0%, 25%, 50%, 75%, 100% of the range) of the instrument transmitter, and how these limits relate to the TSP, as-left limit, and as-found limit as shown in Figure 1. Staff requests applicant to update the FSAR accordingly.

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07.01-3

Describe how the change in measured TSP will be verified to be within predefined limits as described in Regulatory Issue Summary 2006-17, "NRC Staff Position on the Requirements of 10 CFR 50.36, "Technical Specifications," Regarding Limiting Safety System Settings During Periodic Testing and Calibration of Instrument Channels".

10 CFR 50.36(c)(1)(ii)(A) states, in part, "Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded." Technical Report APR1400-Z-J-NR-14005-P, Rev.0, "Setpoint Methodology for Plant Protection System," describes the setpoint methodology applied to the PPS and DPS for the APR1400 and states conformance to BTP 7-12, Regulatory Guide 1.105, Rev.3, and Regulatory Issue Summary 2006-17. Regulatory Issue Summary 2006-17, states, in part, "...the NRC staff expects licensees to verify during testing or calibration that the change in the measured TSP since the last test or calibration is within predefined limits (double-sided acceptance criteria band) and to take appropriate actions if the change is outside these limits." It is not clear how the APR1400 Setpoint Methodology addresses this RIS. The staff request applicant to address the guidance in the RIS and document in the FSAR the appropriate actions when change is outside the double-sided acceptance criteria.

07.01-4

Describe how the offset between the final TSP and the AV is determined.

10 CFR 50.36(c)(1)(ii)(A) states, in part, "Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded." TeR APR1400-Z-J-NR-14005-P, Rev.0, "Setpoint Methodology for Plant Protection System," describes the setpoint methodology applied to the PPS and DPS for the APR1400 and states conformance to BTP 7-12, Regulatory Guide 1.105, Rev.3, and Regulatory Issue Summary 2006-17. Section 2.1 of the TeR states, "The final TSP is a more conservative value than the AV by the offset that is determined as a greater value than the PPS cabinet periodic test error to reduce the possibility of a licensee event report." Describe how this offset is determined and to update the FSAR. Figure 1 used the term "margin." Is this the same as "offset?" Clarify the relationship between these two terms.

07.01-5

Identify the Limiting Safety System Setting (LSSS) for the APR1400.

10 CFR 50.36(c)(1)(ii)(A) states, in part, "Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded." TeR APR1400-Z-J-NR-14005-P, Rev.0, "Setpoint Methodology for Plant Protection System," describes the setpoint methodology applied to the PPS and DPS for the APR1400 and states conformance to Regulatory Guide 1.105, Rev.3, BTP 7-12, and Regulatory Issue Summary (RIS) 2006-17. Section 2.5.1 of the TeR states, "The LSSS may be TSP, AV, or both according to Reference 4.1." Reference 4.1 is ANSI/ISA-S67.04-1994, "Setpoints for Nuclear Safety-Related Instrumentation", which states "Depending on the methodology, the LSSS may be the allowable value, the trip setpoint, or both." It is not clear to the staff what is the LSSS is for the APR1400. While the guidance allows flexibility in choosing the LSSS, a determination should be made in the application. Therefore, clearly define the LSSS for the APR1400 and update the FSAR accordingly.

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07.01-6

Provide consistent use of setpoint terminology.

10 CFR 50.36(c)(1)(ii)(A) states, in part, "Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded." TeR APR1400-Z-J-NR-14005-P, Rev.0, describes the setpoint methodology applied to the PPS and DPS for the APR1400 and states conformance to Regulatory Guide 1.105, Rev.3, BTP 7-12, and Regulatory Issue Summary 2006-17. Section 5 of the TeR defines the setpoint-related terminology used. For clarity, staff requests applicant to cite the source, if relevant, for the definitions. For example, "Analytical Limit (AL), Limit of a measured or calculated variable established by the safety analysis to ensure that a safety limit is not exceeded. (ANSI/ISA S67.04-1994)." Appendix A of the TeR, "Pressurizer Pressure – High Trip Setpoint Calculation," Section VI, "TRIP SETPOINT, ALLOWABLE VALUE, PRETRIP SETPOINT," uses the terms Trip Setpoint, Allowable Value, and Final Trip Setpoint. It is not clear if "Trip Setpoint" is referring to the "Draft Setpoint" in Figure 1 of the technical report. Staff requests applicant to use consistent terminology between the technical report and its appendices. Also, the Staff requests applicant to unambiguously state how the terms (e.g., AV, NTSP, As-Left Tolerance [ALT], As-Found Tolerance [AFT]) used in Tier 2, Chapter 16, Section 5.5.19, "Setpoint Control Program" (SCP), correspond to the terms used in the setpoint methodology technical report (e.g., AV, TSP, Calibration Error Band [as-left limit], Periodic Test Error Band [as-found limit]). Provide consistent use of terminology and update the FSAR accordingly.

07.01-7

Clarify what is meant by "previous errors" in TeR APR1400-Z-J-NR-14005-P, Rev.0, "Setpoint Methodology for Plant Protection System."

10 CFR 50.36(c)(1)(ii)(A) states, in part, "Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded." TeR APR1400-Z-J-NR-14005-P, Rev.0, describes the setpoint methodology applied to the plant protection system and diverse protection system for the APR1400, and states conformance to Regulatory Guide 1.105, Rev.3, BTP 7-12, and Regulatory Issue Summary (RIS) 2006-17. Section 2.3.2.1 of the TeR states, "As with the previous errors, the measurement channel calibration errors is determined from tests and from the information supplied by the manufacturer." Staff requests applicant to describe what is meant by "previous errors" and to update the FSAR accordingly.

07.01-8

Describe how surveillance testing and maintenance are used to determine setpoints.

10 CFR 50.36(c)(1)(ii)(A) states, in part, "Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded." TeR APR1400-Z-J-NR-14005-P, Rev.0, "Setpoint Methodology for Plant Protection System," describes the setpoint methodology applied to the plant protection system and diverse protection system for the APR1400, and states conformance to Regulatory Guide 1.105, Rev.3, BTP 7-12, and Regulatory Issue Summary (RIS) 2006-17. APR1400 FSAR, Tier 1, Section 2.5.1.1, Item

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10, states, "Accuracy, response time testing, surveillance testing, and maintenance are applied to determine setpoints for variables of RT and ESF initiation." It is not clear to the staff how surveillance testing and maintenance are used to determine setpoints as described in the TeR. Describe how surveillance testing and maintenance are used to determine setpoints and update the FSAR accordingly.

07.01-9

Describe when reset setpoints would be used for reactor trip functions and the basis for manually changing the setpoint value. Also, describe how the new fixed value setpoint is determined and how is this new setpoint is consistent with the more restrictive setpoint.

10 CFR 50.36(c)(1)(ii)(A) states, in part, "Limiting safety system settings for nuclear reactors are settings for automatic protective devices related to those variables having significant safety functions. Where a limiting safety system setting is specified for a variable on which a safety limit has been placed, the setting must be so chosen that automatic protective action will correct the abnormal situation before a safety limit is exceeded." 10 CFR 50.55a(h)(3) requires safety systems to meet the requirements of IEEE Std 603-1991. IEEE Std 603-1991, Clause 6.8.2, states, in part, "Where it is necessary to provide multiple setpoints for adequate protection for a particular mode of operation or set of operating conditions, the design shall provide positive means of ensuring that the more restrictive setpoint is used when required. The devices used to prevent improper use of less restrictive setpoints shall be part of the sense and command features."

TeR APR1400-Z-J-NR-14005-P, Rev.0, "Setpoint Methodology for Plant Protection System," describes the setpoint methodology applied to the plant protection system and diverse protection system for the APR1400, and states conformance to Regulatory Guide 1.105, Rev.3, BTP 7-12, and Regulatory Issue Summary (RIS) 2006-17. TeR APR1400-Z-J-NR-14001-P, Rev. 0, "Safety I&C System," Section 4.2.1, states, in part, "The PPS ... receives manually entered inputs for limited operator intervention in the automatic RT [reactor trip] and ESF [engineered safety features] actuation such as an operating bypass and setpoint reset," and Section 4.2.1.1, states, in part, that low pressurizer pressure and low steam generator pressure reactor trips have manual reset setpoints. APR1400 FSAR, Tier 2, Chapter 7, Page 7.2-11, states, in part, "The design permits manually initiated automatic decrementing of the setpoint. Decrementing of the setpoint can be initiated by setpoint reset switches on the safety console and remote shutdown console (RSC). When the signal decreases, the setpoint resets itself to a fixed value less than the actual input signal that exists at that time."

Describe when the reset setpoints would be used for these reactor trip functions and the basis for manually changing the setpoint value. In addition, describe how the new "fixed value" setpoint is determined, and how is this new setpoint is consistent with "the more restrictive setpoint" discussed in IEEE Std 603-1991, Clause 6.8.2. Tier 2, Chapter 7, Section 7.2.3.4, states "Restrictive setpoints are not used for the RPS." It is not clear to the staff if the more restrictive setpoint is used. Clarify and describe the use of reset setpoints, fixed value setpoints, and more restrictive setpoints in the APR1400 design and update the FSAR accordingly.

