REVISED RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

APR1400 Design Certification

Korea Electric Power Corporation / Korea Hydro & Nuclear Power Co., LTD

Docket No. 52-046

RAI No.:	**301-8280**
SRP Section:	**07.01 – Instrumentation and Controls - Introduction**
Application Section:	**07.05**
Date of RAI Issue:	**11/10/2015**

Question No. 07.01-46

Clarify the hot leg temperature and division description in Table 7.5-1, Accident Monitoring Instrumentation Variables," and describe the geometry of the installed hot leg sensors.

10 CFR 50.55a(h) requires compliance to IEEE Std 603-1991. Clause 4.6 of IEEE Std. 603-1991 requires identification of the minimum number and location of sensors for spatially-dependent process variables. Section A.4 of Technical Report APR1400-Z-J-NR-14001-P states “The number and location of the sensors provided to monitor those variables in Item 4 are given in Tables 7.2-3 ["Reactor Protection System Sensors"] and 7.3-4 ["ESFAS Sensors"] of the DCD. The location of precision RTD for measuring RCS hot leg temperature is assigned to measure appropriate coolant transmission effects by temperature difference and temperature distribution of hot leg.” Table 7.2-3 of APR1400 FSAR Tier 2 states there are eight precision RTDs in the hot leg piping which is used by the CPCS for generating high LPD and low DNBR trips. Table 7.5-1 of FSAR Tier 2 states Reactor Coolant Hot Leg Temperature (Wide Range) is a 4 channel, Type B Accident Monitoring Instrumentation Variable, and there are 2 Hot Leg signals per division (QIAS-P). It is not clear to the staff what is meant by "2 Hot Leg signals per division (QIAS-P)" since there are only 2 QIAS-P divisions. Also, provide a diagram of the geometry of the installed hot leg sensors.

Response – (Rev. 1)

In DCD Tier 2, Table 7.5-1, “Reactor Coolant Hot Leg Temperature (Wide Range),” the “Channel Number” column specifies that there are four (4) RTD sensors (example; T-132A, B and T-133A, B) and associated channels for the AMI variable assigned to the RCS hot leg for each steam generator. The four hot leg sensor channels are comprised of two divisions (example; T-132A and 133A for division A and T-132B and 133B for division B). The title “Channel Number” in the fourth column will be changed to “Number of Sensors” in order to provide clarity.

Attachment 1 to this response includes the instrument loop diagrams and a physical location drawing which shows the geometry of the installed hot leg sensors.

The “Ambiguity (Division)” column of Table 7.5-1 specifies that there are “2 Hot Leg signals per division (QIAS-P).” To be consistent with the nomenclature used for other AMI variables, the ambiguity of both the reactor coolant wide range hot leg and cold leg temperatures will be changed to “C, D (PPS OM)”. The changes to Table 7.5-1 are indicated in Attachment 2.

RCS hot leg temperature sensors are used only for CPCS functions of DNBR and LPD trips. ESFAS functions do not use the RCS hot leg temperature sensors. Therefore, no information regarding the RCS hot leg temperature sensors is stated in Table 7.3-4.

The number of sensors for the cold leg temperature and hot leg temperature stated in Table 7.2-3 “Reactor Protection System Sensors” will be clarified to state “4/steam generator” rather than “8.” In addition, the location of temperature sensors will be changed from "Cold leg piping" and "Hot leg piping" to "Cold leg piping connected to steam generators" and "Hot leg piping connected to steam generators" respectively, as indicated in Attachment 3.

Impact on DCD

DCD Tier 2 Tables 7.2-3 and 7.5-1 will be revised as indicated in Attachments 2 and 3.

Impact on PRA

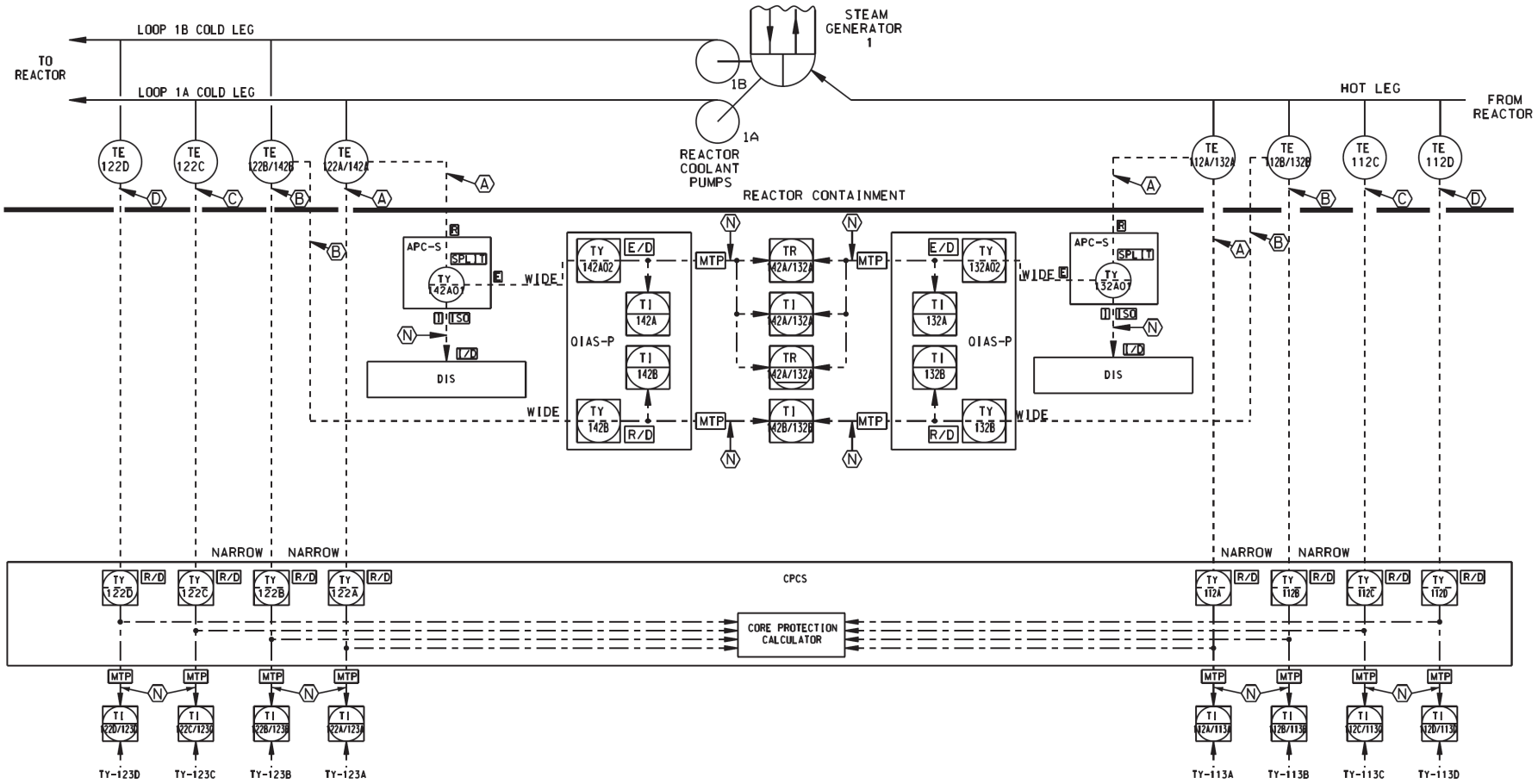
There is no impact on the PRA.

Impact on Technical Specifications

There is no impact on the Technical Specifications.

Impact on Technical/Topical/Environmental Reports

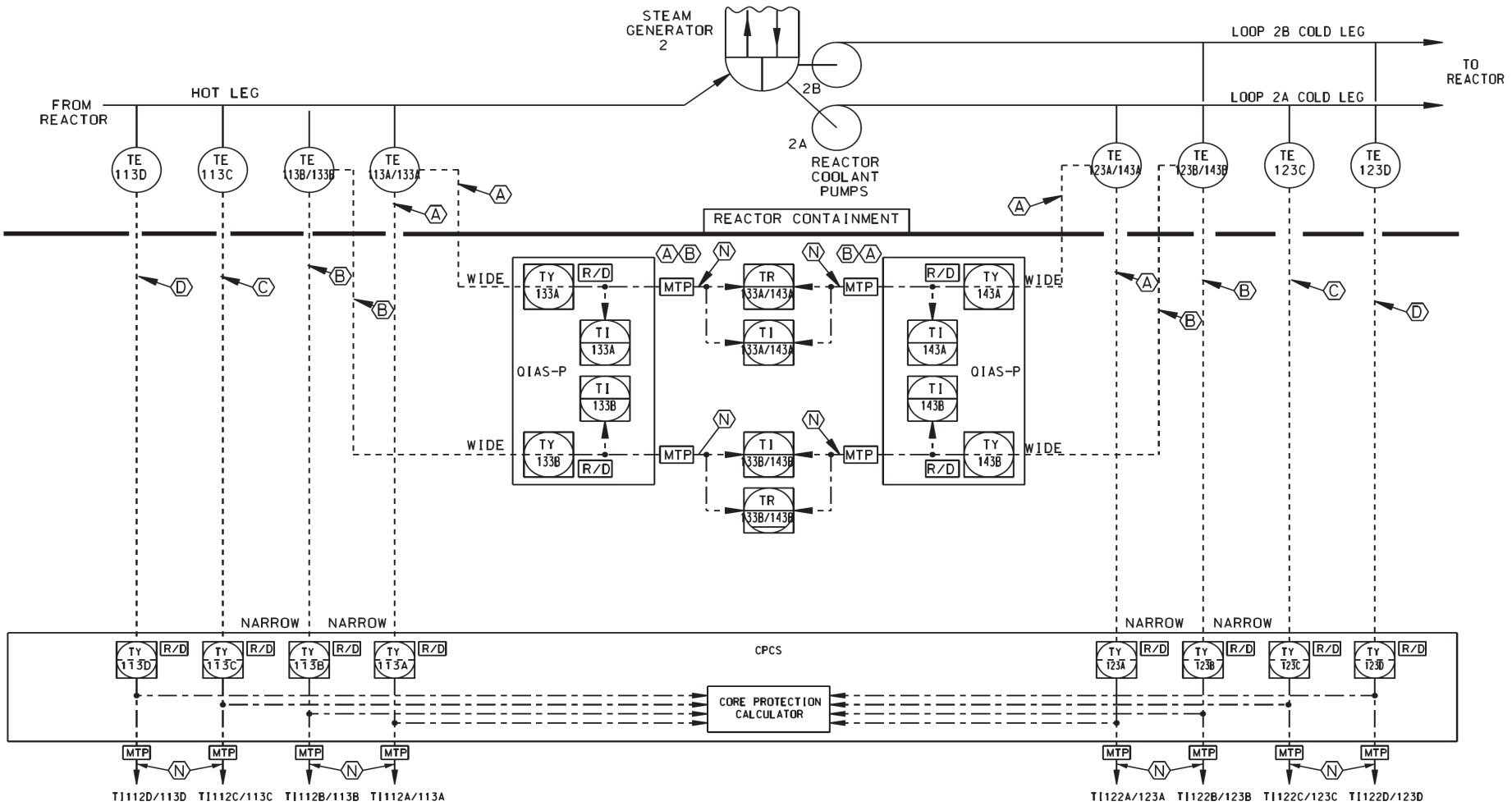
There is no impact on any Technical, Topical, or Environment Report.



2. ALL CIRCUITS ARE CLASS 1E
   EXCEPT AS NOTED.

1. CHANNEL: T-112A~D,122A~D,132A,B,142A,B.

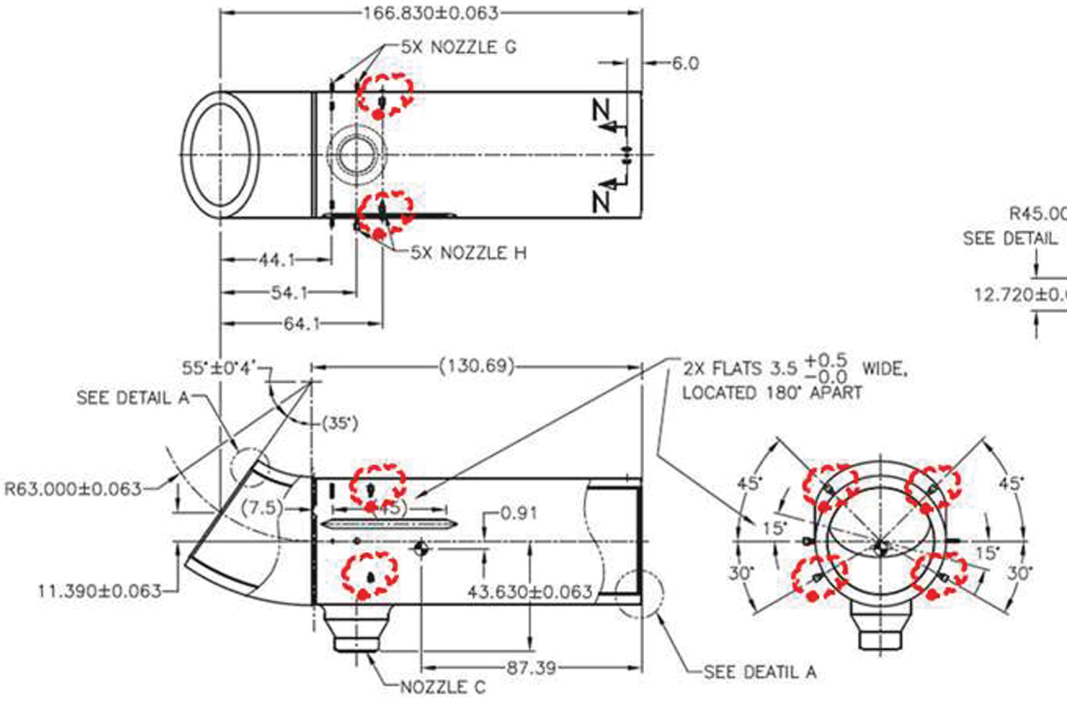
Instrument Loop Diagram for RCS Loop 1 Temperatures



2. ALL CIRCUITS ARE CLASS 1E EXCEPT AS NOTED.

1. CHANNEL: T-113A~D,123A~D,133A,B,143A,B.

Instrument Loop Diagram for RCS Loop 2 Temperatures



P-1 PIPING ASSEMBLY (WT 30913 LBS)

SEE REF DWG NO.2 FOR NOZZLES / SECTIONS DETAILS

Table 7.5-1 (1 of 5)

Accident Monitoring Instrumentation Variables

Number of Sensors

Variable	Range	Monitored Function or System	~~Channel Number~~	Type	Ambiguity (Division)
Pressurizer Pressure (Wide Range)	0 to 210.9 kg/cm^{2}A (0 to 3,000 psia)	Pressurizer	2	B	C,D (PPS OM)
Pressurizer Level	0 to 100 % (0 to 562.15 in)	Pressurizer	2	B	C,D (PPS OM)
Reactor Coolant Hot Leg Temperature (Wide Range)	0 to 400°C (32 to 752 °F)	RCS	4	B	~~2 Hot Leg signals per division (QIAS-P)~~
Reactor Coolant Cold Leg Temperature (Wide Range)	0 to 400°C (32 to 752 °F)	RCS	4	B	~~2 Cold Leg signals per division (QIAS-P)~~
Steam Generator Pressure	0 to 105 kg/cm^{2}A (0 to 1,494 psia)	Steam Generator	2/SG	B	C,D (PPS OM)
Steam Generator Level (Wide Range)	0 to 100 % (0 to 1117.6cm (0 to 440 in tap span)	Steam Generator	2/SG	B	C,D (PPS OM)
Core Exit Temperature	0 to 1260 °C (32 to 2,300 °F)	Inadequate Core Cooling	2	B, C	Validation (QIAS-P)
Degrees of Subcooling	RCS Temp Saturation Margin: -399 to 358.3 °C Upper Head (or CET) Temp Saturation Margin: -1,260 to 368.3 °C RCS (or Upper Head or CET) Press Saturation Margin: -225.5 to 210.9 kg/cm^2	Inadequate Core Cooling	2	B	C,D (PPS OM)
Reactor Vessel Coolant Level	0 to 100 %	RCS	2	B	Validation (QIAS-P)
RCS Pressure (Wide Range)	0 to 281.23 kg/cm^{2}G (0 to 4,000 psig)	RCS	2	B, C	C,D (PPS OM)
IRWST Level	0 to 100 %	IRWST	4	B	C,D (ESCM)

C, D (PPS OM)

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APR1400 DCD TIER 2

Cold leg piping connected to steam generators

Hot leg piping connected to steam generators

Table 7.2-3

Reactor Protection System Sensors

Monitored Variable	Type	Number of Sensors	Location	Receiving System
Neutron flux power	Fission chamber	12	Shield of primary side	ENFMS (for generating VOPT and high Log Power)
Cold leg temperature	Precision RTD	4/steam generator ~~8~~	~~Cold leg piping~~	CPCS (for generating high LPD and low DNBR)
Hot leg temperature	Precision RTD	4/steam generator ~~8~~	~~Hot leg piping~~	CPCS (for generating high LPD and low DNBR)
Pressurizer pressure (narrow range)	Pressure transmitter	4	Pressurizer	PPS, CPCS (for generating high lPD and Low DNBR)
Pressurizer pressure (wide range)	Pressure transmitter	4 (1)	Pressurizer	PPS
CEA positions	Reed switch position transmitter	2/CEA	Control element drive mechanism	CPCS (for generating high LPD and low DNBR)
Reactor coolant pump speed	Proximity sensor	4/pump	Reactor coolant pump	CPCS (for generating high LPD and low DNBR)
Steam generator 1/2 level (narrow range)	Differential pressure transmitter	4/steam generator (1)	Steam generators	PPS
Steam generator 1/2 pressure (wide range)	Differential pressure transmitter	4/steam generator (1)	Steam generators	PPS
Steam generator pressure	Pressure transmitter	4/steam generator (1)	Steam generators	PPS
Containment pressure	Pressure transmitter	4 (1)	Containment structure	PPS
Steam generator 1/2 primary differential pressure	Differential pressure transmitter	4/steam generator	Steam generators	PPS

(1) Common with the engineered safety features actuation system